A report to address the "Terms of Reference" for an application to include *Chilatherina alleni* onto the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.

Chilatherina alleni Price, 1997 , Allen's Rainbowfish



© Photograph Gerald Allen Permission to use photo obtained 9th July 2015.

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the fashion industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that Allen's Rainbowfish *Chilatherina alleni* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin aquarium shop. The statement was to be presented for the prosecution in the witness box by author1 of this report, however the accused offender pleaded guilty.

Disease

Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species

Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat

Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species

Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes

Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

References

Clements, Valentin, Rankin, Baker, Gee, Snellgrove, Sloman (2019) "*The effects of interacting with fish in aquariums on human health and well-being: A systematic review*" published by Institute of Biomedical and Environmental Health Research, School of Health and Life Sciences, University of the West of Scotland, Paisley, United Kingdom.

Cracknell, White, Pahl, Nichols & Depledge. 2016 "*Marine Biota and Psychological Well-Being: A Preliminary Examination of Dose–Response Effects in an Aquarium Setting*" published by Environment and Behavior2016, Vol. 48(10) 1242 –1269© 2015 SAGE Publications

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Price D.S. (1997) *Chilatherina alleni*, a new species of rainbowfish (Melanotaeniidae) from Irian Jaya. Revue française d'Aquariologie 24(3-4): 79-82.

Tappin, Adrian. (2005) "Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011" at: https://rainbowfish.angfaqld.org.au/Alleni.htm

Froese, R. and D. Pauly. Editors. 2021.FishBase. World Wide Web electronic publication. www.fishbase.org, (02/2021) https://www.fishbase.se/summary/Chilatherina-alleni.html



Typical Chilatherina Habitat. © Michael Wagner permission granted (2019)

Terms of Reference

Overview: The rainbowfish genus *Chilatherina* consists of eleven species.

etymology: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane

Named *alleni* in honour of Gerald R. Allen, in recognition of his outstanding contribution to ichthyology and his deep commitment to the study and preservation of the aquatic fauna of New Guinea. Live specimens were collected from the type location near Siriwo Village and introduced into the hobby in 2008. Additional live specimens were collected for the aquarium hobby in 2012 from the Wapoga River.

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Glossolepis* are:

Chilatherina is closely related to Melanotaenia, the largest genus in the family. They differ chiefly with regard to jaw structure. In Chilatherina the lateral portion of the premaxillary is either straight or curved gently in a postero-ventral direction. The lower jaw is generally inferior to the upper jaw and the medial portion of the upper lip is swollen and profusely covered with teeth. In addition, the head tends to be more slender and the snout relatively pointed compared with Melanotaenia. The latter genus by contrast, has a more or less abrupt downward bend in the lateral portion of the premaxillary with less swelling of the medial upper lip and fewer teeth on its surface. Moreover, the jaws are usually about even or the upper jaw is slightly inferior (Le. lower jaw protruding). The external jaw features of Chilatherina and Melanotaenia were illustrated by Allen (1980a).

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299. http://museum.wa.gov.au/sites/default/files/A%20revision%20of%20the%20rainbowfish%20genus%20chilatherina%20(melanotaeniidae).pdf

1. Provide information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane
Species: *Chilatherina alleni*, Price, 1997, Allen's rainbowfish

© Photograph Johannes Graf Chilatherina alleni

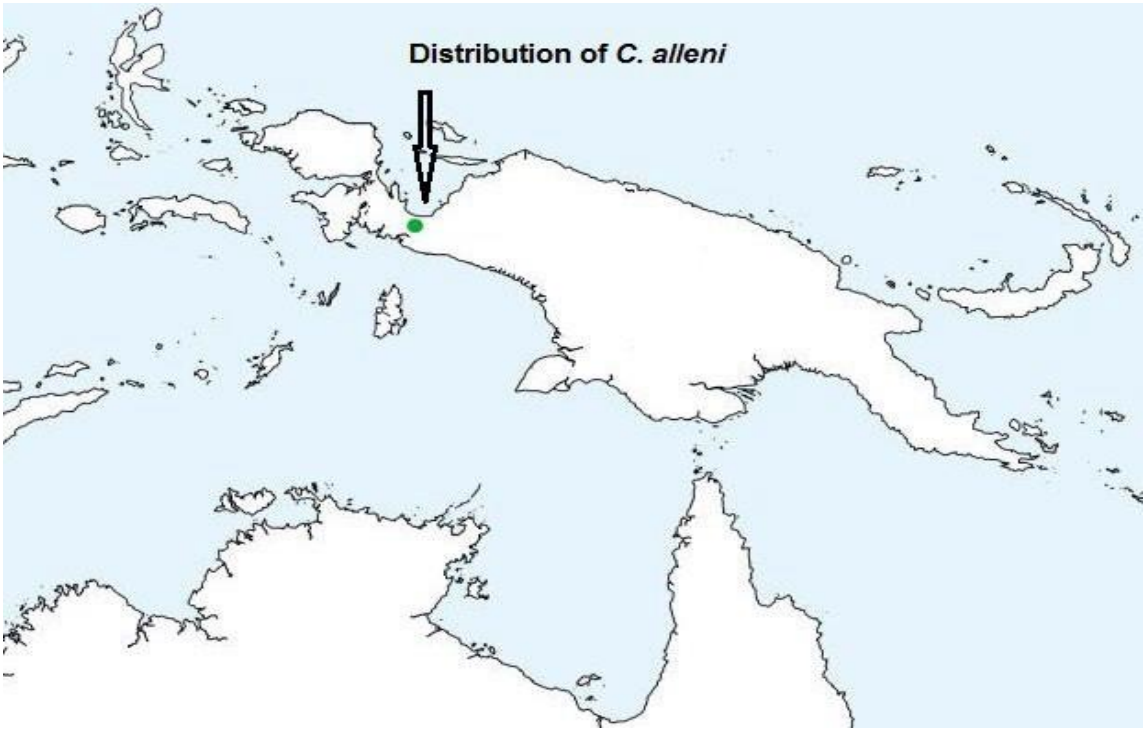


Species Summary

Chilatherina alleni is most similar to *C. fasciata* of the northern New Guinea mainland and *C. pricei* of Yapen Island in Geelvink Bay. It differs greatly from these in colouration. *C. alleni* having a dark mid-lateral stripe and reddish fins in males. It further differs from *C. fasciata* in having a shorter blunter snout with the maxillary reaching to about the level of the anterior edge of the eye (falling well short in *C. fasciata*). It further differs from *C. pricei* in the modal counts of soft anal rays (usually 19–24 in *C. alleni* vs. 24–27 in *C. pricei*), and in the number of cheek scales (16-18 in *C. alleni* vs. 19-23 *C. pricei*). *C. alleni* may reach a maximum size of 10 cm, but are usually less than 7 cm. Males are usually much larger and deeper bodied than females. *C. alleni* have the upper half of the body brownish anteriorly becoming turquoise posteriorly, each horizontal scale row is separated by narrow brown or dull orange stripe. Mid-lateral band dark blue, occupying about two horizontal scales rows, from upper rear corner of eye to base of caudal fin, interrupted on its lower edge by about five, white indentations in area just behind pectoral fin. Lower half of body mainly dark silver, except for intense white stripe with lower margin of dull orange occupying scale row immediately below midlateral band. 4–5 diffused charcoal coloured bars on lower side between level of pelvic fin base and fin origin. The first dorsal fin is light blue; second dorsal and anal fins translucent bluish becoming reddish on margins. Caudal fin translucent reddish. Pectoral and pelvic fins mainly translucent. Females slightly less intense with median fins, mainly translucent to bluish without any red. Besides the colour differences noted above, males are typically deeper bodied than females. In addition, the second dorsal and anal fins short and blunt in females and somewhat elongated and pointed in males. There is a wide variation in colouration of this species depending on habitat. One variety has a reddish back, red fins and bright yellow stripe in the middle of the body. They exhibit an amazing range of colour variation; specimens from the rainforest creeks near Siewa sometimes exhibit a spectacular pattern involving a bright red back and yellow fins.

Distribution & Habitat

Chilatherina alleni were originally collected in 1994 from the Aiborei (Aboge) River, situated in the Derewo River Basin, southeast of Cenderawasih Bay in northern West Papua. They were again collected in 1998 during a Conservation International survey from tributaries of the Wapoga, Tirawiwa and Logari rivers. Habitat consist of slow to moderately flowing tributary streams with gravel, rock, and sandy bottoms; water slightly turbid to clear or darkly stained with log snags and accumulated leaf litter. Water temperature 24–31°C, *p*H 6.0–8.4. This species was common throughout the Wapoga survey area from lowland creeks to mountain streams. Very abundant around Siewa in both small rainforest creeks and the much larger Tirawiwa River.



Remarks

Named "*alleni*" in honour of Gerald R. Allen, in recognition of his outstanding contribution to ichthyology and his deep commitment to the study and preservation of the aquatic fauna of New Guinea.

Specimens originating from the type location near Siriwo Village were introduced into the European hobby in 2009, where they are widely available.

References:

Froese, R. and D. Pauly. Editors. 2021.FishBase. World Wide Web electronic publication. www.fishbase.org, (02/2021)

Price D.S. (1997) *Chilatherina alleni*, a new species of rainbowfish (Melanotaeniidae) from Irian Jaya. Revue française d'Aquariologie 24(3-4): 79-82.

Tappin, Adrian (2005) "Rainbowfishes ~ Their Care & Keeping in Captivity, 2nd Edition - 2011" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

2. Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). For example, is the species listed on CITES Appendix I, II or III, and if so, are there any specific restrictions on the movement of this species? Include information on the conservation value of the species.

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Chilatherina” revealed no results for those entities.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 11 species of Chilatherina listed.

Chilatherina alleni **listed as vulnerable**
https://www.iucnredlist.org/species/169522/147680522

Chilatherina axelrodi **listed as endangered**
https://www.iucnredlist.org/species/4628/147680647

Chilatherina bleheri **listed as endangered**
https://www.iucnredlist.org/species/4629/147680677

Chilatherina bulolo **listed as least concern**
https://www.iucnredlist.org/species/4630/147680735

Chilatherina campsi **listed as least concern**
https://www.iucnredlist.org/species/161079348/161079383

Chilatherina crassispinosa **listed as least concern**
https://www.iucnredlist.org/species/161079519/161079697

Chilatherina fasciata **listed as least concern**
https://www.iucnredlist.org/species/161079834/161080091

Chilatherina lorentzii **listed as near threatened**
https://www.iucnredlist.org/species/161080164/161080249

Chilatherina pagwiensis **listed as endangered**
https://www.iucnredlist.org/species/161080305/161080322

Chilatherina pricei **listed as vulnerable**
https://www.iucnredlist.org/species/161080365/161080369

Chilatherina sentaniensis **listed as critically endangered**
https://www.iucnredlist.org/species/4631/147680762

References

The CITES Species website with lists and search facility accessed on 17 April 2021.
URL http://www.cites.org/eng/disc/species.php

The IUCN Red List search facility locate accessed on 17 April 2021.
URL http://www.iucnredlist.org/details/4630/0

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Price, (1997), records the Holotype of the species as being 88.0 mm standard length, and 14 paratypes as being between 77.4 and 115.0 mm standard length as below, which is also reflected by **Tappin,** (2011)

Holotype. MZB 6234, male, 82.6 mm SL, in a tributary of the Aiborei River of the Siriwo drainage, Irian Jaya (3°38'S, 136oo5'E); collected by Siriwo villagers using a piece of wire mosquito mesh, November, 1994.

Paratypes. MZB 6235, 7 specimens, 56.7-70.6 mm SL, collected with holotype. with holotype; W AM P .31029-001, 5 specimens, 44.1-65.5 mm SL, collected

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Price, D.S, (1997) Chilatherina alleni, a new species of Rainbowfish (Melanotaeniidae) from Irian Jaya, Revue fr. Aquariol., 24 (1997),3-4, 19 Decembre 1997 https://www.researchgate.net/publication/277011492_Chilatherina_alleni_a_new_species_of_Rainbowfish_Melanotaeniidae_from_Irian_Jaya

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.c The natural geographic range.

Chilatherina alleni, is known only from the Siriwo (Aiborei River) and Wapoga river systems of north-western Papua Province, Indonesia. Both systems flow into the eastern edge of Cenderawasih Bay.

References:

Price, D.S, (1997) Chilatherina alleni, a new species of Rainbowfish (Melanotaeniidae) from Irian Jaya, Revue fr. Aquariol., 24 (1997),3-4, 19 Decembre 1997 https://www.researchgate.net/publication/277011492_Chilatherina_alleni_a_new_species_of_Rainbowfish_Melanotaeniidae_from_Irian_Jaya

Boeseman, M. (1963) Notes on the fishes of western New Guinea 1. Zool. Mededelingen, 38(14); 221-242.

3.d Habitat.

Chilatherina alleni was collected from a tributary of the Aiborei (=Aboge) River which is part of the Siriwo drainage. The river is approximately five meters wide, with a maximum depth on about one meter, although most pools which *Chilatherina alleni* tend to favour are no more than 70 cm in depth. The substrate consists of gravel and rocks. The water is cold and clear and swiftly descends from the mountains through the village adjacent to the airstrip. In November 1994 water pH was 7.0.

This is a benthopelagic species that is found in rivers or streams where the substrate consists of gravel and rocks, and the water is cold, clear and fast-flowing. It is also found in rocky pools and backwaters in rainforest habitat. It generally occurs well upstream at elevations above 200m in the Siriwo system and more than 60m in the Wapoga system. This species has a maximum size of about 9 cm SL (G.R. Allen pers. comm. 2019).

In most cases Chilatherina are found in either low-lying riverine floodplain or foothill streams to altitudes of about 500m. However at least one species (*Chilatherina campsi*) frequents streams of the mountainous Central Highlands to about 1500m above sea level.

At least three species (*C. bleheri, C .fasciata, C. sentaniensis*) have lake dwelling populations. In stream habitats *Chilatherina* frequent shallow pools where the flow rate is gentle, however *C .bulolo* is often found in rapid flowing steep gradient creeks. Typically *Chilatherina* prefers sections of the stream or lake-shore which affords maximum exposure to sunlight. (Allen 1991)

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Price, D.S, (1997) Chilatherina alleni, a new species of Rainbowfish (Melanotaeniidae) from Irian Jaya, Revue fr. Aquariol., 24 (1997),3-4, 19 Decembre 1997 https://www.researchgate.net/publication/277011492_Chilatherina_alleni_a_new_species_of_Rainbowfish_Melanotaeniidae_from_Irian_Jaya

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Chilatherina alleni* was not recorded by Price (1997) but the diet of other members of the *Chilatherina* genus are well recorded. All rainbowfishes of the family *Melanotaeniidae* are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.f Social behaviour and groupings

Price described them as very abundant in small pools of the Aiborei (=Aboge) River which is part of the Siriwo drainage They were not schooling but in loose aggregations swimming at all levels in water up to 70cm deep.

Allen (1991) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; "Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac."

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Fishbase: https://www.fishbase.de/summary/chilatherina-alleni.html

Price, D.S, (1997) Chilatherina alleni, a new species of Rainbowfish (Melanotaeniidae) from Irian Jaya, Revuefr. Aquariol., 24 (1997),3-4, 19 Decembre 1997 https://www.researchgate.net/publication/277011492_Chilatherina_alleni_a_new_species_of_Rainbowfish_Melanotaeniidae_from_Irian_Jaya

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylised display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as "dither fish" to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried rainbowfish for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

References:

Fishbase:
https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.i characteristics that may cause harm to humans and other species.

There are no sharp spines, toxins or venom in any member of *the Melanotaeniidae* family.

References:

Fishbase: https://www.fishbase.de/summary/Glossolepis-wanamensis.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4. Provide information on the reproductive biology of the species, including

There are no scientific records of any work done on the reproductive biology of *Chilatherina alleni* but the description *of Chilatherina* by Price, D.R. (1997) states that it is most similar to *C. fasciata* of the northern New Guinea mainland and *C. pricei* of Yapen Island in Geelvink Bay. It differs greatly from these in colouration, C. alleni having a dark mid-lateral stripe and reddish fins in males. It further differs from *C. fasciata* in having a shorter blunter snout with the maxillary reaching to about the level of the anterior edge of the eye (falling well short in *C. fasciata*). It further differs from *C. pricei* in the modal counts of soft anal rays (usually 19-24 in *alleni* vs 24-27 in *pricei*), and in the number of cheek scales (16-18 in alleni vs 19-23). Chilatherina *species are* well known in the aquarium trade and have been kept and bred by the authors since 1983 from stock obtained from Melbourne.

C. axelrodi, C. bleheri, C. bulolo, C. crassispinosa, C. campsi, C. fasciata and *C. sentaniensis* were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Price, D.S, (1997) Chilatherina alleni, a new species of Rainbowfish (Melanotaeniidae) from Irian Jaya, Revue fr. Aquariol., 24 (1997),3-4, 19 Decembre 1997 https://www.researchgate.net/publication/277011492_Chilatherina_alleni_a_new_species_of_Rainbowfish_Melanotaeniidae_from_Irian_Jaya

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Chilatherina alleni* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b How frequently breeding occurs

The authors could find no record or observation for *Chilatherina alleni* but closely related *Chilatherina* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "Rainbowfishes, their care and keeping in captivity" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Chilatherina alleni* but closely related *Chilatherina* species will produce about 40 to 80 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992). There are no naturally occurring *Chilatherina* species in Australia. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species *of Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *Gl. incisus* was hybridized with a *M. praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish "aquarium" strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under "pseudo-scientific" names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and

New Guinea Rainbowfishes Association have a “Code of Conduct” that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by the authors.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

ANGFA “Code of Conduct”
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) “*Rainbowfishes, their care and keeping in captivity*” available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There are no records of *Chilatherina alleni* being hybridised in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Chilatherina* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between *Melanotaenia praecox* and *Glossolepis incisus*, they produced hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family *Melanotaeniidae* was sufficiently close for them all to hybridise. Author 1 called an expert in the field of rainbowfish for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different rainbowfish *Melanotaenia splendida splendida* has been introduced to a different rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

References

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020)

"*Evidence of Interspecific Chromosomal Diversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Chilatherina alleni* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6. https://www.fishbase.de/summary/Chilatherina alleni.html

Froese, R. and D. Pauly. Editors. 2020. FishBase.
World Wide Web electronic publication. www.fishbase.org, version (12/2020). Accessed 17 Apr 2021 https://www.fishbase.de/summary/chilatherina-alleni.html

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

Glossolepis incisus, has been assessed by Patricia Kialola for and on behalf of the Pet Industry Association of Australia. *Glossolepis leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005)
https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator; https://www.baphiq.gov.tw/public/Data/910614193571.pdf
, or
http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of *Chilatherina alleni* into the Australian environment should it be released or escape effective human control. Author 1 contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with *Chilatherina alleni* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020.

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Chilatherina alleni is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment score attached as appendix B. There are few places where a large population is near a suitable aquatic environment for this species. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

7c. ability to find shelter

Allen (1979), describes rainbowfish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Price, D.S, (1997) Chilatherina alleni, a new species of Rainbowfish (Melanotaeniidae) from Irian Jaya, Revue fr. Aquariol., 24 (1997),3-4, 19 Decembre 1997 https://www.researchgate.net/publication/277011492_Chilatherina_alleni_a_new_species_of_Rainbowfish_Melanotaeniidae_from_Irian_Jaya

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7d. rate of reproducing

Chilatherina alleni is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been here, and popular, for more than 40 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using the Climatch v2.0 for PC process indicates a score of 3 for *Chilatherina alleni* indicating the species has a very low chance of survival in Australian water ways. Attached as appendix A.

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Chilatherina alleni* were to escape effective control is where the likelihood of accidental or intentional release is greatest. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging.

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to a natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Chilatherina alleni* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution. It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats. *Chilatherina* have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020 Available at: https://climatch.cp1.agriculture.gov.au/

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

It would appear that Chilatherina alleni is only found in a few small areas in West Papua. The IUCN list it as vulnerable in the wild due to introductions of feral species such as tilapia and others. There are mining concessions in part of the distribution area of this species (Siriwo River) and associated human settlements also represent a threat. Allen mentions a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Chilatherina alleni* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Chilatherina alleni* is similar to and is most closely related to *C. fasciata* and *C. pricei* and other members of the *Chilatherina* genus the behaviour will be similar. Aquarium observations worldwide of *Chilatherina alleni* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

References:

Aqua-fish.net – since 2005 - https://en.aqua-fish.net/fish/allens-rainbowfish

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8.b Probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Chilatherina alleni* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 82 mm (Price 1997).

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Price, D.S, (1997) Chilatherina alleni, a new species of Rainbowfish (Melanotaeniidae) from Irian Jaya, Revue fr. Aquariol., 24 (1997),3-4, 19 Decembre 1997 https://www.researchgate.net/publication/277011492_Chilatherina_alleni_a_new_species_of_Rainbowfish_Melanotaeniidae_from_Irian_Jaya

8.c Habitat and local environmental conditions

Chilatherina alleni are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Chilatherina* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Chilatherina alleni* (Fishbase records diseases in other *Chilatherina* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is

no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. located at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Chilatherina,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

References :

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Hardy-Smith P., Jones R. and Kailola P. (2007) *"Scientific review of the biosecurity risks associated with the importation of rainbowfish for ornamental purposes"* - Prepared for Biosecurity Australia by Panaquatic® Health Solutions Pty Ltd

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

Kahn, S.A., Wilson, P.W., Pereira, R.P., Hayder, H. and Gerrity, S.E. 1999. *Import Risk analysis on live ornamental finfish*. Canberra: Australian Quarantine and Inspection Service. 172 p.

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *C. axelrodi, C. bleheri, C. campsi and C. fasciata* have been kept and bred here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Chilatherina alleni* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from German breeders and then from commercial facilities to which these captive bred stocks are distributed.

Chilatherina alleni poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp*. (Glossolepis. incisus,* and *glossolepis leggetti)* currently permitted for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for “fresh” wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008) [online] Available at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf [Accessed 17 April 2021].

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Chilatherina alleni* will be used in the live fish ornamental aquarium display trade. *Chilatherina alleni* are to be added to the live import list to legitimise the use of *Chilatherina (axelrodi, bleheri, bulolo, campsi, crassispinosa and fasciata)* have been in Australia prior to 1983, two species of Glossolepis, *Glossolepis incisus* and *Glossolepis leggetti* appear on the 'List of Specimens Suitable for Live Import' under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act. Rainbowfish of the genus *Glossolepis* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960’s.

If *Chilatherina alleni is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

References:

Biosecurity Australia. (2009) " **BIOSECURITY AUSTRALIA ADVICE 2009/30 EXTENSION OF POLICY TO INCLUDE THE IMPORTATION OF RED RAINBOWFISH FOR ORNAMENTAL PURPOSES".** Published by the Australian Government, available at: http://www.daff.gov.au/SiteCollectionDocuments/ba/memos/2009/2009-30.pdf Downloaded 17 Jul 2015.

Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11.a The containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

Reference:

Biosecurity Act 2015 as in force 25 march 2020, Accessed 24 march 2021, available at: https://www.legislation.gov.au/Details/C2020C00127

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Chilatherina* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Chilatherina alleni* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Chilatherina alleni* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture Water, and the Environment. Australian Government Department of Agriculture Water, and the Environment, conditions for importing live ornamental fish into Australia available on the world wide web at universal resource locator - http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

References :

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Aquagreen Aquarium and Pond Keepers Code of Conduct – available at URL - https://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008) [online] Available at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf [Accessed 17 April 2021].

Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

12. Provide information on all other Commonwealth, state and territory legislative controls on the species.

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species, there are no references or instances of *Chilatherina* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Chilatherina alleni* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on

Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow *Chilatherina alleni* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows *Chilatherina alleni* is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-freshwater/list-of-noxious-fish , and shows no *Chilatherina* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called “Restricted Matter” comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. *Chilatherina alleni* is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 and can be accessed https://www.daf.qld.gov.au/__data/assets/pdf_file/0008/1398842/prohibited-restricted-invasive-fish.pdf , and there are no *Chilatherina* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Chilatherina alleni* is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at,

http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Chilatherina* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Chilatherina* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. *Chilatherina alleni* is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish , and shows no *Chilatherina* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. *Chilatherina alleni* does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *chilatherina* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp (*Cyprinus carpio*) mosquito fish (*Gambusia* spp.) Didymo a freshwater algae (*Didymosphenia geminata*) and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *chilatherina* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is 'reckless' about whether the animal is a prohibited animal and is also 'reckless' about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at

https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-Animals-Declaration-ACCESS-3.pdf . There are no *Chilatherina* species listed.

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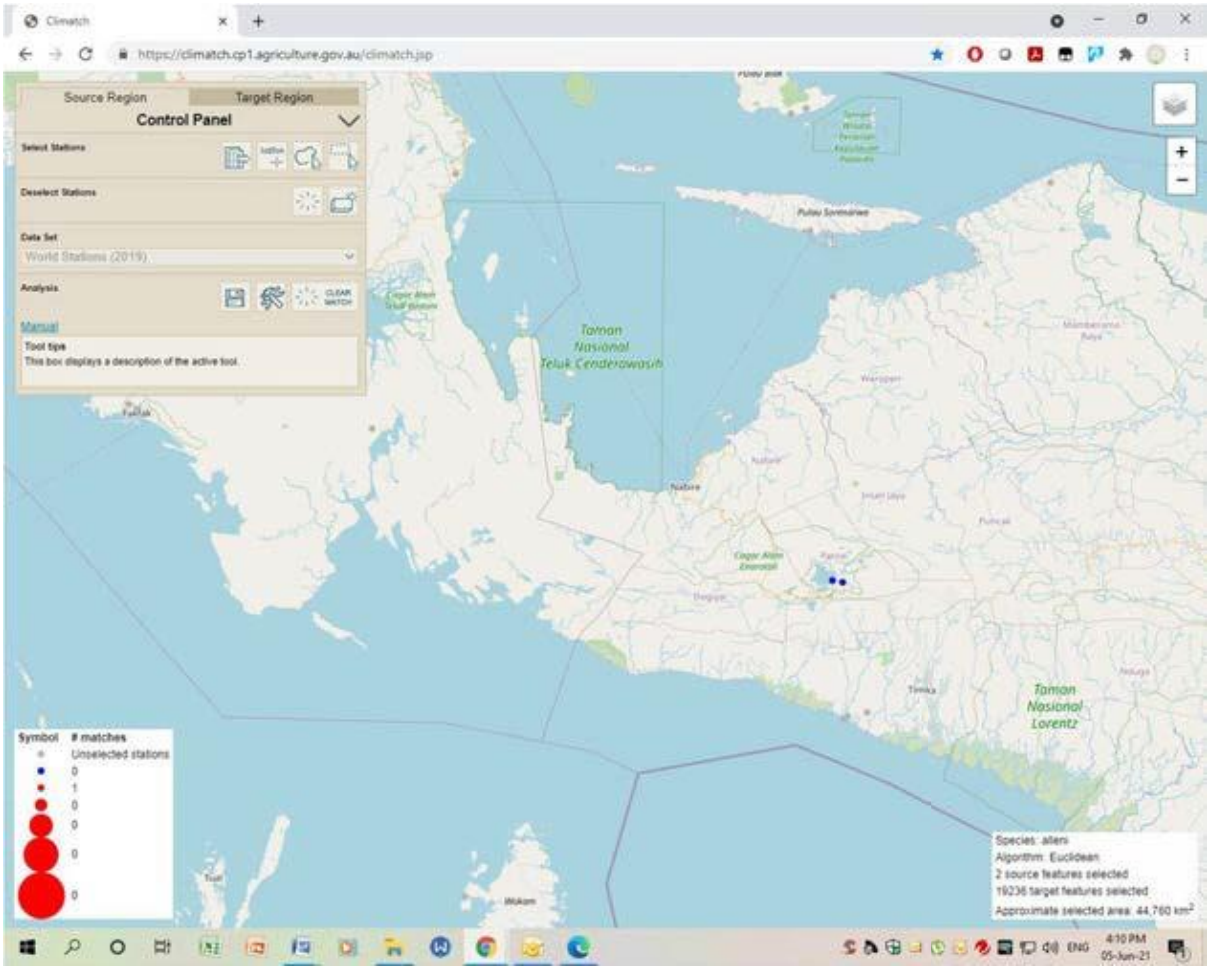
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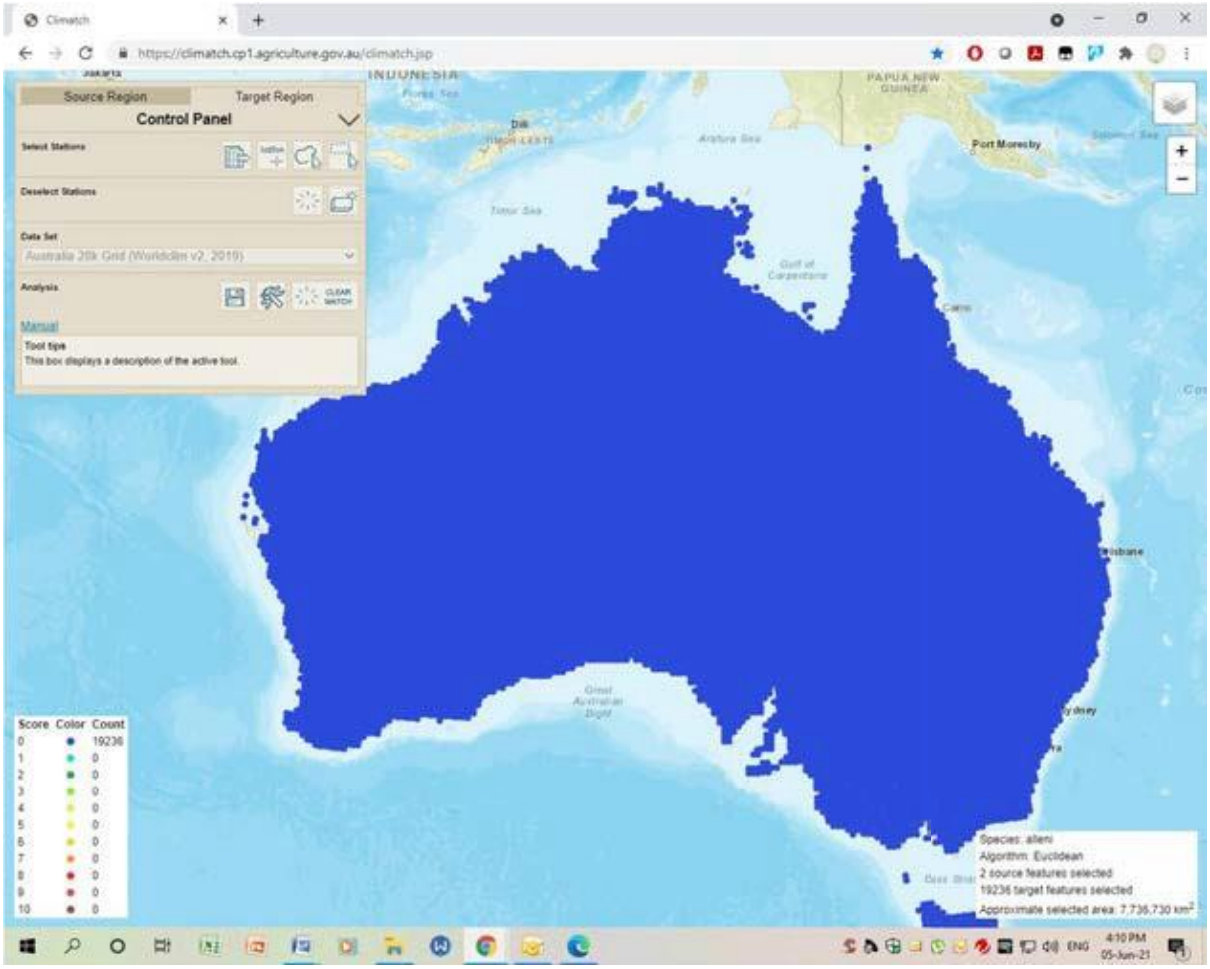
Weber, M. Professor at the University of Amsterdam, and **De Beaufort, L. F**. (1922) The fishes of the Indo-Australian Archipelago. iv heteromi, solenichthyes, synentognathi, percesoces, labyrinthici, microcvprini - - Leiden E. J. Brill Ltd.

Whitley G.P. (1938) Descriptions of some New Guinea fishes. Records of the Australian Museum 20(3): 223-233.

Whitley, G.P. (1957). Fishes from inland New Guinea. *Records of the Australian Museum* 24(3): 23-30.

APPENDIX A – calculation of climate from *Chilatherina alleni* distribution climate to Australian Climate.





References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

APPENDIX B

Bomford and Glover 2004 risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment model for import and keeping of exotic freshwater and Estuarine Fish" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004

Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were done to provide a score against the provisions in the assessment process.(accessed 6th June 2021.)

BOMFORD ASSESSMENT

SPECIES: Chilatherina alleni

Score A. Climate Match (0-8)

Number of squares within 60% of the mean: (No. 5)	0
Number of squares within 50% of the mean: (No. 6)	0
Number of squares within 40% of the mean: (No. 7)	0
Number of squares within 30% of the mean: (No. 8)	0
Number of squares within 20% of the mean: (No. 9)	0
Number of squares within 10% of the mean: (No. 10)	0

Total = <4
Score: 1 (Ref: fishbase.org, PC CLIMATE)

Score B, Overseas Range

Number of 1° x 1° grids in which species occurs overseas.
No. of squares : <4
Score: 0 (Ref: fishbase.org, googleearth.com)

Score C, Establishment

Locations of establishment incidence: nil - never introduced
Score: 1 (Ref: fishbase.org)

Score D, Introduction Success

Percentage of Introduction events that have been successful
Introductions nil
Successful: nil
Score: 1 (Ref: fishbase.org)

Score E, Taxa risk

Genus: Chilatherina
Introductions: 0
Successful: 0
Score: 0 (Ref: fishbase.org / M. Bomford)

Family:	Melanotaeniidae (Rainbowfishes)	
Introductions:	5	
Successful:	0	unknown
Score:	**0**	(Ref: fishbase.org / M. Bomford)

Total: 3 (VERY LOW)

The score of 3 according to the assessment model gives the fish a moderate chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

Bomford, Mary (2006) "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia

Bomford, Mary and Glover, Julie (June 2004) "*Risk assessment model for the import and keeping of exotic freshwater and estuarine finfish*", A report produced by the Bureau of Rural Sciences for The Department of Environment and Heritage.

Phelong, P.C. (1996b) "Climex: a system to predict the distribution of an organism based on climate preferences". Available at: http://www.agric.wa.gov.au

A report to address the “Terms of Reference” for an application to include *Chilatherina axelrodi* onto the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.

Chilatherina axelrodi



Chilatherina axelrodi - © Neil Armstrong permission granted (2000)

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that Axelrod's Rainbowfish *Chilatherina axelrodi* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented for the prosecutor in the witness box by the author of this report, however the accused offender pleaded guilty.

Disease

Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species

Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat

Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species

Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes

Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

References

Allen, G.R. 1979. *Chilatherina axelrodi*, a new species of rainbowfish (Melanotaeniidae) from Papua New Guinea. *Tropical Fish Hobbyist* 28(5): 48-49, 52-55.

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Clements, Valentin, Rankin, Baker, Gee, Snellgrove, Sloman (2019) "*The effects of interacting with fish in aquariums on human health and well-being: A systematic review*" published by Institute of Biomedical and Environmental Health Research, School of Health and Life Sciences, University of the West of Scotland, Paisley, United Kingdom.

Cracknell, White, Pahl, Nichols & Depledge. 2016 "*Marine Biota and Psychological Well-Being: A Preliminary Examination of Dose–Response Effects in an Aquarium Setting*" published by Environment and Behavior2016, Vol. 48(10) 1242 –1269© 2015 SAGE Publications

Froese, R. and D. Pauly. Editors. 2021.FishBase. World Wide Web electronic publication. www.fishbase.org, (02/2021) https://www.fishbase.se/summary/Chilatherina-axelrodi.html

Tappin, Adrian. (2005) "Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011" at: https://rainbowfish.angfaqld.org.au/Axelrodi.htm

Terms of Reference

Overview: The rainbowfish genus *Chilatherina* consists of eleven species.

etymology: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Glossolepis* are:

Chilatherina is closely related to Melanotaenia, the largest genus in the family. They differ chiefly with regard to jaw structure. In Chilatherina the lateral portion of the premaxillary is either straight or curved gently in a postero-ventral direction. The lower jaw is generally inferior to the upper jaw and the medial portion of the upper lip is swollen and profusely covered with teeth (Fig. 3). In addition, the head tends to be more slender and the snout relatively pointed compared with Melanotaenia. The latter genus by contrast, has a more or less abrupt downward bend in the lateral portion of the premaxillary with less swelling of the medial upper lip and fewer teeth on its surface. Moreover, the jaws are usually about even or the upper jaw is slightly inferior (Le. lower jaw protruding). The external jaw features of Chilatherina and Melanotaenia were illustrated by Allen (1980a).

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299. http://museum.wa.gov.au/sites/default/files/A%20REVISION%20OF%20THE%20RAINBOWFISH%20GENUS%20CHILATHERINA%20(MELANOTAENIIDAE).pdf



Typical Chilatherina habitat © Michael Wagner permission granted (2019)

1. Provide information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane
Species: *Chilatherina axelrodi*, Axelrod's rainbowfish



Chilatherina axelrodi - © Neil Armstrong permission granted (2000)

Species Summary

Chilatherina axelrodi males have a body colour of bluish-grey to greenish-brown on the upper half of the body and silver-grey or whitish on the lower half. There is a about 10 short bars along the middle of side (approximately every two scales) that finally merge with a more or less solid blackish stripe along the middle of caudal peduncle. There are about 6-10 faint dusky bars on lower side of the body, those on side of abdomen are particularly evident. The upper half of the body has a number of bluish stripes while the lower half has a number of faint yellow stripes, bordering each longitudinal scale row. The dorsal, anal and pelvis fins

are yellowish, other fins translucent. Females are an overall silvery colour and rather plain compared to the males. Males are more brightly coloured, larger, and much deeper bodied than females. Males may reach a maximum size of 10 cm, with females usually less than 8 cm SL. Spawning usually occurs from October to January, with females producing between 50 and 150 eggs, spawning over a period of several days.

Distribution & Habitat

Chilatherina axelrodi were first collected in 1979 from Yungkiri Creek, a tributary of the Pual River (formerly Nemayer or Neumayer River), in the Bewani Mountains of Papua New Guinea. This location is about 40 kilometres inland from the north-coast town of Vanimo, which is close to the West Papuan border. Vanimo is a relatively recent township; it was established as a patrol post and then abandoned and reoccupied several times during the Australian administration. Only after the Sepik district was divided into east and west in 1967, Vanimo became the capital of what was then the West Sepik District and today is the Sandaun Province. Sandaun Province is the north-westernmost province of Papua New Guinea. It covers an area of 36,300 km².

Chilatherina axelrodi were found around sub-surface vegetation, submerged logs and branches in a small, narrow slow flowing rainforest stream. The water at the collection site was slightly turbid and a temperature of 28°C and pH 7.8 were recorded. Other rainbowfishes found in the stream included *C. crassispinosa* and *Melanotaenia affinis*. *C. fasciata* and *C. lorentzi* have also been collected from the Paul River.

Remarks

A number of live specimens were collected by Gerald Allen, Brian Parkinson and Peter Neusinger in September 1979, but unfortunately they all died soon after arriving in Australia. However, Gerry Allen returned in 1982 and together with Heiko Bleher they collected more live specimens, which were later bred and distributed in the hobby. In 1983 further live specimens were collected by Barry Crockford and returned to Australia. A rather attractive species, still in the hobby here in Australia, and are widely available in Europe and North America. The species was named in honour of Herbert R. Axelrod who provided funding for the first collecting expedition.

References:

Allen G.R. (1980) *Chilatherina axelrodi*, A New Species of Rainbowfish (Melanotaeniidae) From Papua New Guinea. Tropical Fish Hobbyist 28 (5): 48-55.

Allen G.R. (1981) A revision of the rainbowfish genus *Chilatherina* (Melanotaeniidae). Record of the Western Australian Museum 9(3): 279-299.

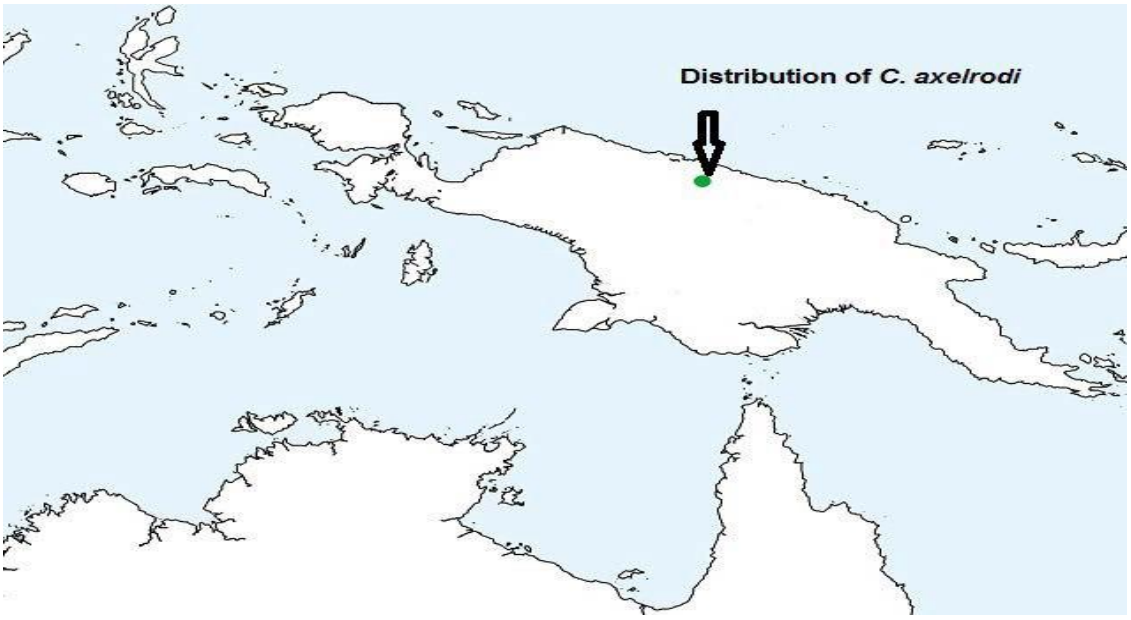
Froese, R. and D. Pauly. Editors. 2021.FishBase. World Wide Web electronic publication. www.fishbase.org, (02/2021) https://www.fishbase.de/summary/chilatherina-axelrodi.html

Tappin, Adrian (2005) “Rainbowfishes ~ Their Care & Keeping in Captivity 2nd Edition - 2011” at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Chilatherina axelrodi



Chilatherina axelrodi - © Gary Lange permission granted (2017)



Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). For example, is the species listed on CITES Appendix I, II or III, and if so, are there any specific restrictions on the movement of this species? Include information on the conservation value of the species.

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Chilatherina” revealed no results for those entities.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 11 species of Chilatherina listed.

Chilatherina alleni **listed as vulnerable**
https://www.iucnredlist.org/species/169522/147680522

Chilatherina axelrodi **listed as endangered**
https://www.iucnredlist.org/species/4628/147680647

Chilatherina bleheri **listed as endangered**
https://www.iucnredlist.org/species/4629/147680677

Chilatherina bulolo **listed as least concern**
https://www.iucnredlist.org/species/4630/147680735

Chilatherina campsi **listed as least concern**
https://www.iucnredlist.org/species/161079348/161079383

Chilatherina crassispinosa **listed as least concern**
https://www.iucnredlist.org/species/161079519/161079697

Chilatherina fasciata **listed as least concern**
https://www.iucnredlist.org/species/161079834/161080091

Chilatherina lorentzii **listed as near threatened**
https://www.iucnredlist.org/species/161080164/161080249

Chilatherina pagwiensis **listed as endangered**
https://www.iucnredlist.org/species/161080305/161080322

Chilatherina pricei **listed as vulnerable**
https://www.iucnredlist.org/species/161080365/161080369

Chilatherina sentaniensis **listed as critically endangered**
https://www.iucnredlist.org/species/4631/147680762

References

The CITES Species website with lists and search facility accessed on 17 April 2021.
URL http://www.cites.org/eng/disc/species.php

The IUCN Red List search facility locate accessed on 17 April 2021.
URL http://www.iucnredlist.org/details/4630/0

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Allen G.R. (1980), records the Holotype of the species as being 81.1 mm standard length, and 49 paratypes as being between 35.4 and 85.3 mm standard length as below, which is also reflected by **Tappin, A.R.,** (2011)

Holotype. WAM P26739-001, 81.1 mm SL, Yungkiri stream, a tributary of the Pual River (formerly Nemayer or Neumayer River), in the Bewani Mountains of Papua New Guinea. This location is about 6 kilometres north of Bewani on Vanimo road. 2º58 S, 141º 08 E

Paratypes , 49 specimens, 56.7-70.6 mm SL, collected with holotype. with holotype; WAM P .26739-002,

References:

Allen G.R. (1980) *Chilatherina axelrodi*, A New Species of Rainbowfish (Melanotaeniidae) From Papua New Guinea. Tropical Fish Hobbyist 28 (5): 48-55.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.c The natural geographic range.

This species is known only from Yungkiri Stream near Bewani in north-west Papua New Guinea, although it may occur in other similar streams in the Pual (Nemayer) River system 2º58 S, 141º 08 E

References:

Allen G.R. (1980) *Chilatherina axelrodi*, A New Species of Rainbowfish (Melanotaeniidae) From Papua New Guinea. Tropical Fish Hobbyist 28 (5): 48-55.

Boeseman, M. (1963) Notes on the fishes of western New Guinea 1. Zool. Mededelingen, 38(14); 221-242.

The IUCN Red List search facility locate accessed on 17 April 2021.
URL http://www.iucnredlist.org/details/4630/0

Tappin, Adrian. (2005) "Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011" at: https://rainbowfish.angfaqld.org.au/Alleni.htm

3.d Habitat.

Chilatherina axelrodi type specimens were collected from a small flowing stream in rainforest habitat about 37km inland from the coastal town of Vanimo and approximately 14km due east of the Indonesian border. Most of the types were taken from 2 relatively large, slow flowing pools measuring about 3 x 10m with a maximum depth of 1.5m. Although situated in rainforest the stream bed was relatively open and exposed to sunlight, which is typical of *Chilatherina* streams. The water was slightly turbid and a temperature of 25.8 and pH of 7.8 were recorded. This species is assessed as Endangered. It has an area of occupancy (AOO) of 40-60 km^2 and occurs in a single location based on the threats of invasive species and developments (e.g. logging and oil palm). These are also causing continuing decline in habitat. Major threats are Development, including logging and oil palm plantations, threaten the species. Invasive species are also present in the system

This is a benthopelagic species that is found in streams where or pools the substrate consists of gravel and rocks, and the water is cold, clear and fast-flowing. It is also found in rocky pools and backwaters in rainforest habitat. This species has a maximum size of about 9 cm

In most cases Chilatherina are found in either low-lying riverine floodplain or foothill streams to altitudes of about 500m. However at least one species (*C. campsi*) frequents streams of the mountainous Central Highlands to about 1500m above sea level.

At least three species (*C. bleheri, C. fasciata, C. sentaniensis*) have lake dwelling populations. In stream habitats *Chilatherina* frequent shallow pools where the flow rate is gentle, however *C. bulolo* is often found in rapid flowing steep gradient creeks. Typically *Chilatherina* prefers sections of the stream or lake-shore which affords maximum exposure to sunlight. (Allen 1991) Other rainbowfishes found in the stream included *C. crassispinosa* and *Melanotaenia affinis*. *C. fasciata* and *C. lorentzi* have also been collected from the Paul River.

References:

Allen G.R. (1980) *Chilatherina axelrodi*, A New Species of Rainbowfish (Melanotaeniidae) From Papua New Guinea. Tropical Fish Hobbyist 28 (5): 48-55.

IUCN Red List accessed on 17 April 2021.
URL http://www.iucnredlist.org/details/4630/0 ,
https://www.iucnredlist.org/species/4628/147680647

Tappin, Adrian. (2005) "Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011" at: https://rainbowfish.angfaqld.org.au/Alleni.htm

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Chilatherina axelrodi* was recorded as mainly filamentous algae by Allen (1980) as is the case of other members of the *Chilatherina* genus are well recorded. All rainbowfishes of the family *Melanotaeniidae* are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1980)

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.f Social behaviour and groupings

Allen (1991) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; "Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac."

References :

Allen G.R. (1980) *Chilatherina axelrodi*, A New Species of Rainbowfish (Melanotaeniidae) From Papua New Guinea. Tropical Fish Hobbyist 28 (5): 48-55.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Fishbase: https://www.fishbase.de/summary/chilatherina-axelrodi.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylised display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as "dither fish" to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References :

Allen G.R. (1980) *Chilatherina axelrodi*, A New Species of Rainbowfish (Melanotaeniidae) From Papua New Guinea. Tropical Fish Hobbyist 28 (5): 48-55.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried rainbowfish for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

References :

Allen G.R. (1980) *Chilatherina axelrodi*, A New Species of Rainbowfish (Melanotaeniidae) From Papua New Guinea. Tropical Fish Hobbyist 28 (5): 48-55.

Fishbase
https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.i characteristics that may cause harm to humans and other species.

There are no sharp spines, toxins or venom in any member of *the Melanotaeniidae* family.

References:

Fishbase: https://www.fishbase.de/summary/chilatherina-axelrodi.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4. Provide information on the reproductive biology of the species, including

There are no scientific records of any work done on the reproductive biology of *Chilatherina axelrodi* but the description *of Chilatherina* by Allen (1979) states that it is most similar to *C. lorentzii* which is widely distributed in northern New Guinea and *C. sentaniensis in Lake Sentani, Irian Jaya. Chilatherina axelrodi* differs by usually having a series of 6-10 pronounced bars on the lower side. It further differs from *C. fasciata* in having a shorter blunter snout. Chilatherina *species are* well known in the aquarium trade and have been kept and bred by the authors since 1983 from stock obtained from Melbourne.

C. axelrodi, C. bleheri, C. crassispinosa, C. bulolo, C. campsi, C. fasciata and *C. sentaniensis* were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Chilatherina axelrodi* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b How frequently breeding occurs

The authors could find no record but have both bred and observed *Chilatherina axelrodi* and closely related *Chilatherina* species producing about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References:

Allen G.R. (1980) *Chilatherina axelrodi*, A New Species of Rainbowfish (Melanotaeniidae) From Papua New Guinea. Tropical Fish Hobbyist 28 (5): 48-55.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Crockford B. (2001) Fishes of Sahul Vol 16.4 Journal of the Australia New Guinea Fishes Association. (ANGFA)

Tappin, A.R., (2011) "Rainbowfishes, their care and keeping in captivity" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record but have both bred and observed *Chilatherina axelrodi* and closely related *Chilatherina* species producing about 40 to 80 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992). There are no naturally occurring *Chilatherina* species in Australia. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia. Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species *of Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *Glossolepis incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish “aquarium” strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under “pseudo-scientific” names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a “Code of Conduct” that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by the authors.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

ANGFA “Code of Conduct”
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There is no record of *Chilatherina axelrodi* being hybridised in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Chilatherina* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between *Melanotaenia praecox* and *Glossolepis incisus*, they produced hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family *Melanotaeniidae* was sufficiently close for them all to hybridise. Author 1 called an expert in the field of rainbowfish for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different rainbowfish *Melanotaenia splendida splendida* has been introduced to a different rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

References:

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific Chromosomal Diversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Chilatherina axelrodi* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6 https://www.fishbase.de/summary/Chilatherina axelrodi.html

Froese, R. and D. Pauly. Editors. 2020. FishBase. available at:
www.fishbase.org, version (12/2020). Accessed 17 Apr 2021

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

Glossolepis incisus, has been assessed by Patricia Kialola for and on behalf of the Pet Industry Association of Australia. *Glossolepis leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005)
https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator;
https://www.baphiq.gov.tw/public/Data/910614193571.pdf
, or
http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of *Chilatherina axelrodi* into the Australian environment should it be released or escape effective human control. Author 1 contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with *Chilatherina axelrodi* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020.

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Chilatherina axelrodi is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar

diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment score attached as appendix B. There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville, Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

7c. ability to find shelter

Allen (1979), describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron.

References:

Allen, G.R. 1979. *Chilatherina axelrodi*, a new species of rainbowfish (Melanotaeniidae) from Papua New Guinea. *Tropical Fish Hobbyist* 28(5): 48-49, 52-55.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7d. rate of reproducing

Chilatherina axelrodi is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen, G.R. 1979. *Chilatherina axelrodi*, a new species of rainbowfish (Melanotaeniidae) from Papua New Guinea. *Tropical Fish Hobbyist* 28(5): 48-49, 52-55.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using the copy of Climex for PC, the process attracts a score of 3 for *Chilatherina axelrodi,* indicating the species has a very low chance of survival in Australian water ways. Attached as appendix B.

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially

in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Chilatherina axelrodi* were to escape, effective control the area where the likelihood of accidental or intentional release is greater. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging.

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to one of the possible suitable natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons that peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Chilatherina axelrodi* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution. It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats.

Chilatherina have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

Chilatherina axelrodi is only found in a very small area. The IUCN list it as endangered in the wild due to introductions of feral species such as tilapia and others. There are mining concessions in part of the distribution area of this species and associated human settlements also represent a threat. Allen mentions a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References ;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Chilatherina axelrodi* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Chilatherina axelrodi* is similar to and is most closely related to *C. lorentzii* and *C. sentaniensis* and other members of the *Chilatherina* genus the behaviour will be similar. Aquarium observations worldwide of *Chilatherina axelrodi* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

References:

Aqua-fish.net – since 2005 - https://en.aqua-fish.net/fish/axelrods-rainbowfish

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Chilatherina axelrodi* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 82mm (Allen 1980)

References:

Allen, G.R. 1979. *Chilatherina axelrodi*, a new species of rainbowfish (Melanotaeniidae) from Papua New Guinea. *Tropical Fish Hobbyist* 28(5): 48-49, 52-55.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

8.c habitat and local environmental conditions

Chilatherina axelrodi are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Chilatherina* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Chilatherina axelrodi* (Fishbase records) diseases in other *Chilatherina* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. found at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Chilatherina,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in Northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed

feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

References:

Allen, G.R. 1979. *Chilatherina axelrodi*, a new species of rainbowfish (Melanotaeniidae) from Papua New Guinea. *Tropical Fish Hobbyist* 28(5): 48-49, 52-55.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Hardy-Smith P., Jones R. and Kailola P. (2007) *"Scientific review of the biosecurity risks associated with the importation of rainbowfish for ornamental purposes"*
Biosecurity Australia by Panaquatic® Health Solutions Pty Ltd

IUCN, *The IUCN Red List of Threatened Species.* https://www.iucnredlist.org/ (accessed 30-04-2021)

Kahn, S.A., Wilson, P.W., Pereira, R.P., Hayder, H. and Gerrity, S.E. 1999. *Import Risk analysis on live ornamental finfish*. Canberra: Australian Quarantine and Inspection Service. 172 p.

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *C. axelrodi, C. bleheri, C. campsi and C. fasciata* have been in Australia, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Chilatherina axelrodi* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from European and North American breeders and then from commercial facilities to which these captive bred stocks are distributed.

Chilatherina axelrodi poses no greater threat to Australian aquatic biodiversity than do the *Glossolepis* sp*. (G. incisus,* and *G. leggetti)* currently permitted for import. Also, other species are being considered for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for “fresh” wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008) [online] Available at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf [Accessed 17 April 2021].

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Chilatherina axelrodi* will be used in the live fish ornamental aquarium display trade. *Chilatherina axelrodi* is to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish. Seven of the eleven species of *Chilatherina* have been in Australia prior to 1983, *C. Axelrodi, C, bleheri, C. bulolo, C campsi, C. crassispinosa, C. fasciata, and C. sentaniensis*. Rainbowfish of the genus *Chilatherina* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960’s.

If *Chilatherina axelrodi is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

References:

Biosecurity Australia. (2009) " **BIOSECURITY AUSTRALIA ADVICE 2009/30 EXTENSION OF POLICY TO INCLUDE THE IMPORTATION OF RED RAINBOWFISH FOR ORNAMENTAL PURPOSES".** Published by the Australian Government, available at: http://www.daff.gov.au/SiteCollectionDocuments/ba/memos/2009/2009-30.pdf Downloaded 17 Jul 2015.

Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity 2nd Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11.a the containment, management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

Reference:

Biosecurity Act 2015 as in force 25 march 2020, Accessed 24 march 2021, available at: https://www.legislation.gov.au/Details/C2020C00127

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Chilatherina* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Chilatherina axelrodi* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Chilatherina axelrodi* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Government Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available at: http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

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12. Provide information on all other Commonwealth, state and territory legislative controls on the species, including:
the species' current quarantine status, or
pest or noxious status, or
whether it is prohibited or controlled by permit or licence in any state or territory.

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species , there are no references or instances of *Chilatherina* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Chilatherina axelrodi* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration

of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow *Chilatherina axelrodi* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows *Chilatherina axelrodi* is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-freshwater/list-of-noxious-fish , and shows no *Chilatherina* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called “Restricted Matter” comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. *Chilatherina axelrodi* is not listed on this schedule as noxious fish or listed in the restricted matter schedule. The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 at: https://www.daf.qld.gov.au/__data/assets/pdf_file/0008/1398842/prohibited-restricted-invasive-fish.pdf , and there are no *Chilatherina* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Chilatherina axelrodi* is not listed as noxious or restricted in Western Australia. West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at, http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Chilatherina* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.
The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Chilatherina* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. *Chilatherina axelrodi* is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish , and shows no *Chilatherina* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. *Chilatherina axelrodi* does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *chilatherina* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp (*Cyprinus carpio*) mosquito fish (*Gambusia* spp.) Didymo a freshwater algae (*Didymosphenia geminata*) and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *chilatherina* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is ‘reckless’ about whether the animal is a prohibited animal and is also ‘reckless’ about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also

declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at:

https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-Animals-Declaration-ACCESS-3.pdf . There are no *Chilatherina* species listed.

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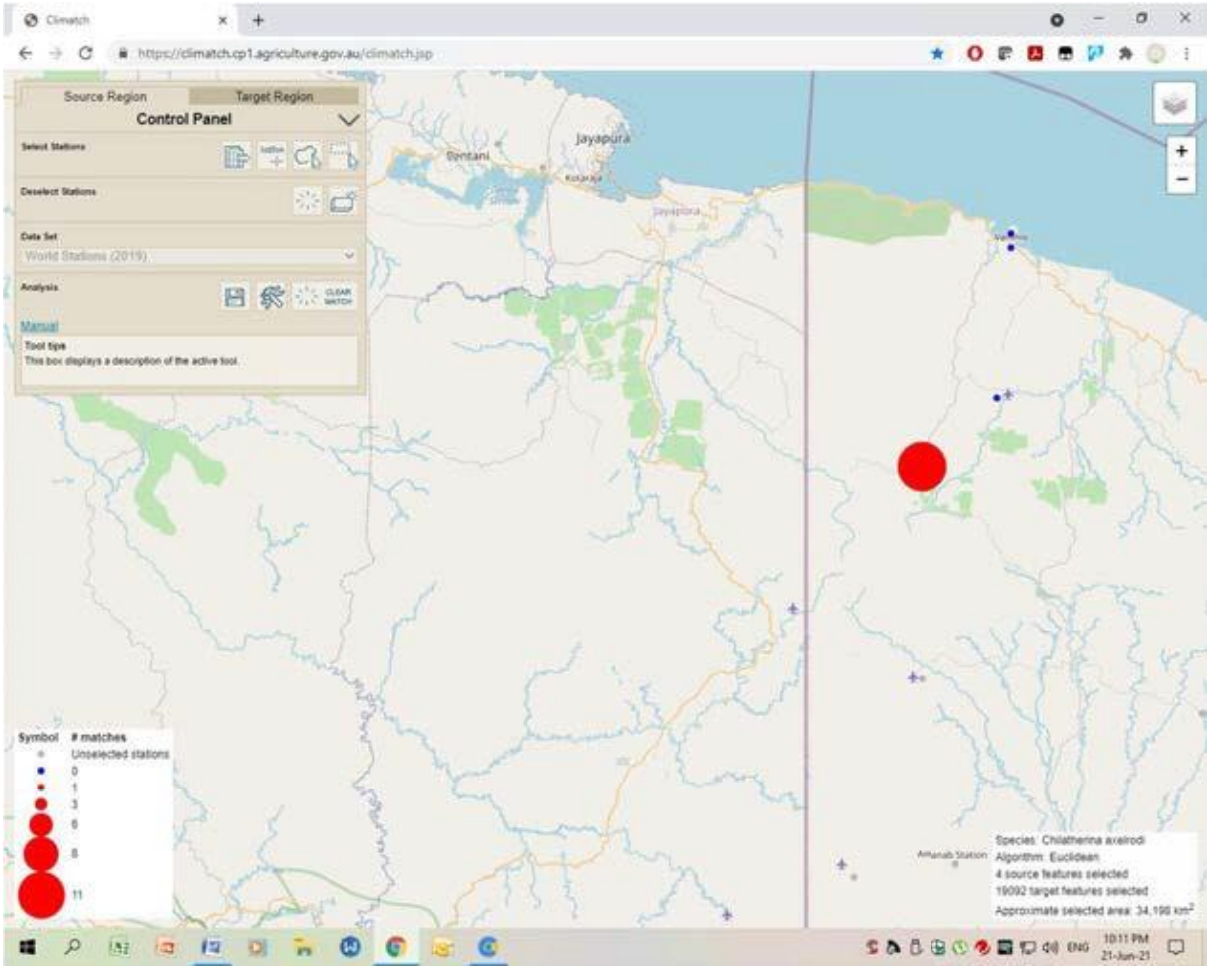
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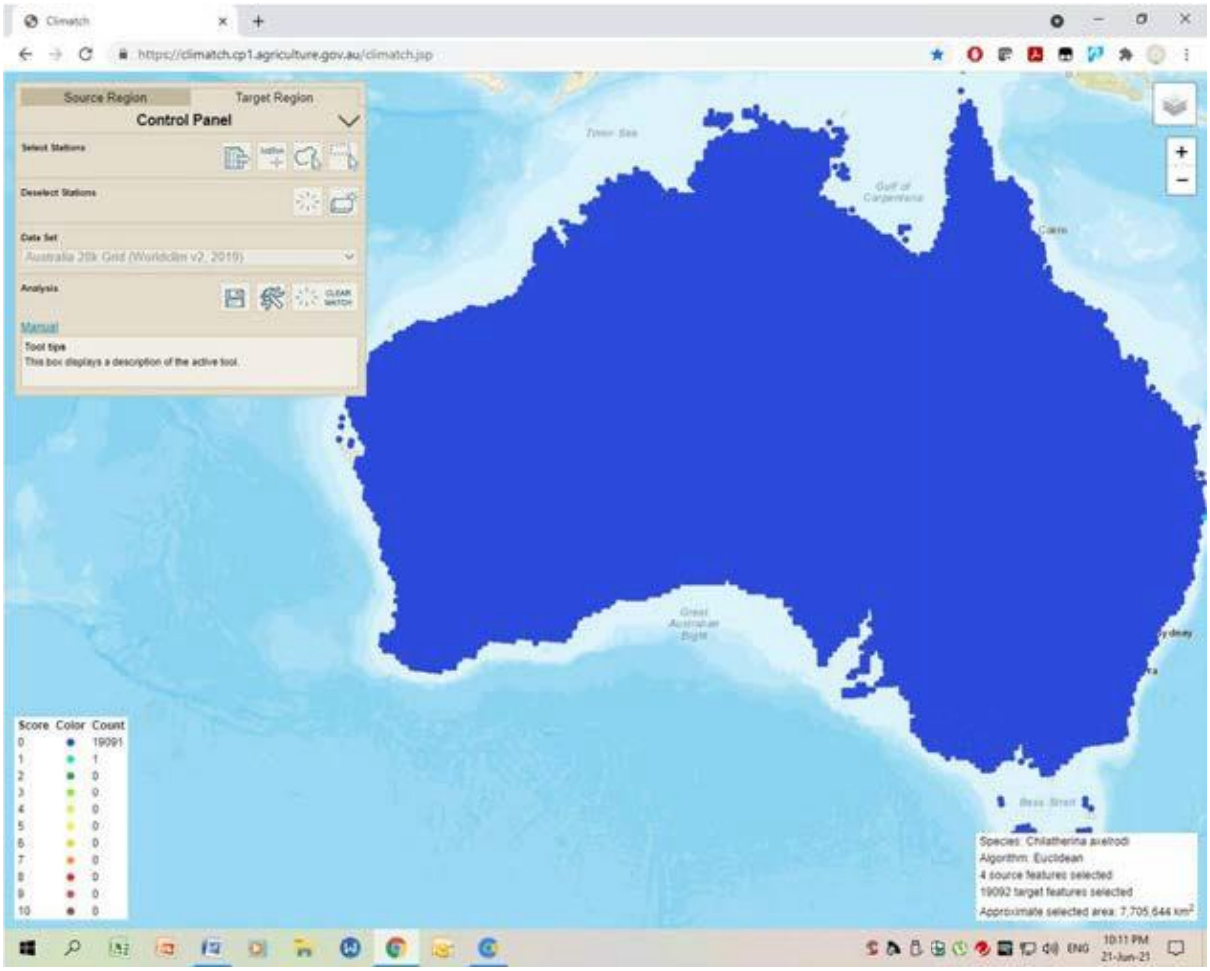
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APPENDIX A – calculation of climate from *Chilatherina axelrodi* distribution climate to Australian Climate.





APPENDIX B

Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were done to provide a score against the provisions in the assessment process.(accessed 6th June 2021.)

BOMFORD ASSESSMENT

SPECIES: Chilatherina Axelrodi

Score A. Climate Match (0-8)

Number of squares within 60% of the mean: (No. 5)	0
Number of squares within 50% of the mean: (No. 6)	0
Number of squares within 40% of the mean: (No. 7)	0
Number of squares within 30% of the mean: (No. 8)	0
Number of squares within 20% of the mean: (No. 9)	0
Number of squares within 10% of the mean: (No. 10)	0

Total = <4
Score: 1 (Ref: fishbase.org, PC CLIMATE)

Score B, Overseas Range

Number of 1° x 1° grids in which species occurs overseas.

No. of squares : 3
Score: 0 (Ref: fishbase.org, googleearth.com)

Score C, Establishment
Locations of establishment incidence: nil - never introduced
Score: 1 (Ref: fishbase.org)

Score D, Introduction Success
Percentage of Introduction events that have been successful
Introductions nil
Successful: nil
Score: 1 (Ref: fishbase.org)

Score E, Taxa risk

Genus: Chilatherina
Introductions: 0
Successful: 0
Score: 0 (Ref: fishbase.org / M. Bomford)

Family: Melanotaeniidae (Rainbowfishes)
Introductions: 5
Successful: 0 unknown
Score: 0 (Ref: fishbase.org / M. Bomford)

Total: 3 (VERY LOW)

The score of 3 according to the assessment model gives the fish a very low chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

References:
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A report to address the “Terms of Reference” for an application to include *Chilatherina bleheri* onto the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.

Chilatherina bleheri Allen, 1985 , Bleher's Rainbowfish



© Photograph Neil Armstrong Permission to use photo obtained 2000.

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that Bleher's Rainbowfish *Chilatherina bleheri* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented for the prosecutor in the witness box by the author of this report, however the accused offender pleaded guilty.

Disease

Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species

Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat

Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species

Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes

Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

References:

Clements, Valentin, Rankin, Baker, Gee, Snellgrove, Sloman (2019) "*The effects of interacting with fish in aquariums on human health and well-being: A systematic review*" published by Institute of Biomedical and Environmental Health Research, School of Health and Life Sciences, University of the West of Scotland, Paisley, United Kingdom.

Cracknell, White, Pahl, Nichols & Depledge. 2016 "*Marine Biota and Psychological Well-Being: A Preliminary Examination of Dose–Response Effects in an Aquarium Setting*" published by Environment and Behavior2016, Vol. 48(10) 1242 –1269© 2015 SAGE Publications

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. (1985), Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea, Revue française d'Aquariologie Herpétologie 12, No. 2, pp. 53-62

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Tappin, Adrian. (2005) "Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011" at: https://rainbowfish.angfaqld.org.au/bleheri.htm

Froese, R. and D. Pauly. Editors. 2021.FishBase. World Wide Web electronic publication. www.fishbase.org, (02/2021) https://www.fishbase.se/summary/Chilatherina-bleheri.html



Typical Chilatherina Habitat. © Michael Wagner permission granted (2019)

Terms of Reference

Overview: The rainbowfish genus *Chilatherina* consists of eleven species.

etymology: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane. Named in honour of Heiko Bleher, a well-known fish collector

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Glossolepis* are:

Chilatherina is closely related to *Melanotaenia*, the largest genus in the family. They differ chiefly with regard to jaw structure. In *Chilatherina* the lateral portion of the premaxillary is either straight or curved gently in a postero-ventral direction. The lower jaw is generally inferior to the upper jaw and the medial portion of the upper lip is swollen and profusely covered with teeth. In addition, the head tends to be more slender and the snout relatively pointed compared with Melanotaenia. The latter genus by contrast, has a more or less abrupt downward bend in the lateral portion of the premaxillary with less swelling of the medial upper lip and fewer teeth on its surface. Moreover, the jaws are usually about even or the upper jaw is slightly inferior (Le. lower jaw protruding). The external jaw features of Chilatherina and Melanotaenia were illustrated by Allen (1980a).

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299. http://museum.wa.gov.au/sites/default/files/a%20revision%20of%20the%20rainbowfish%20genus%20chilatherina%20(melanotaeniidae).pdf

Allen, G.R. (1985), Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea, Revue française d'Aquariologie Herpétologie 12, No. 2, pp. 53-62

1. Provide information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane
Species: *Chilatherina bleheri*, Allen 1985, Bleher's rainbowfish

Chilatherina bleheri Allen, 1985 , Bleher's Rainbowfish



© Photograph Gunther Schmida Permission to use photo obtained 2011.

Species Summary

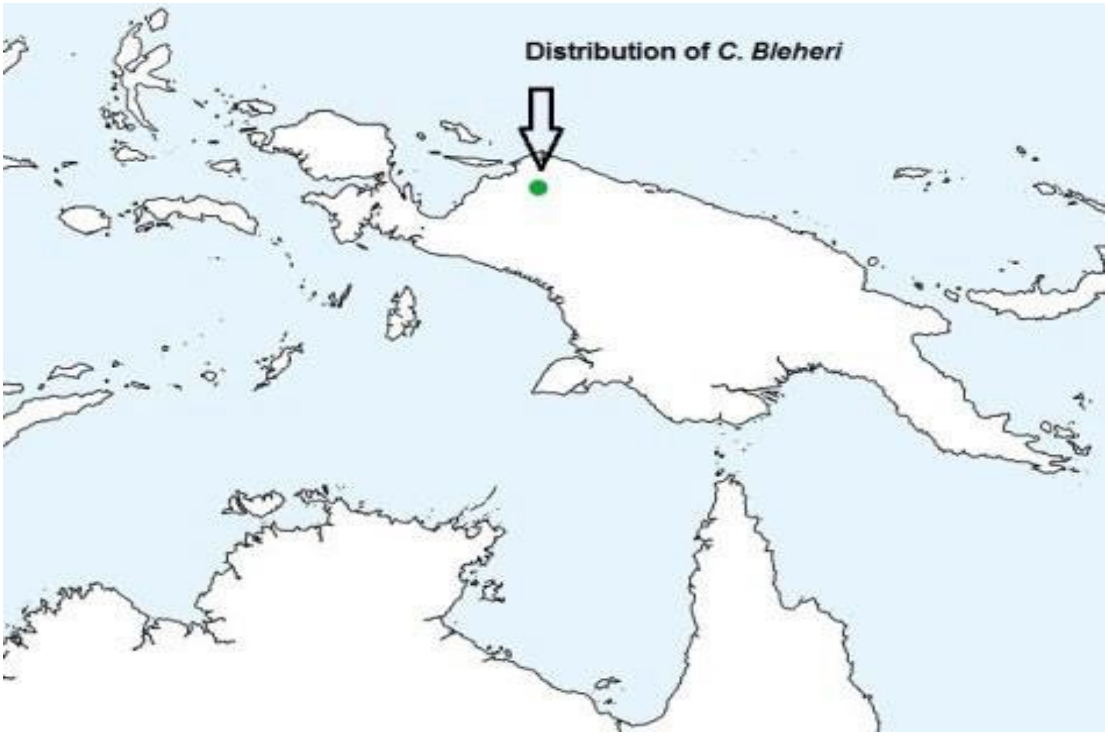
Chilatherina bleheri is a very attractive rainbowfish. They generally have a silvery or bluish-green body colour on the upper back fading posteriorly to pastel shades of yellow to red. The scales on the front half of body, particularly on the dorsal region, have broad yellow-green margins; the first dorsal fin charcoal grey; second dorsal fin grey suffused with red; caudal and anal fins red; pelvic fins reddish anteriorly with remainder white or translucent; pectoral fins translucent. The lower side of the body is white with a series of faint vertical dark markings. Females lack the vivid red hues and are mainly silvery or pale bluish grading to grey or greenish-brown. Males display a brilliant yellow orange stripe on the middle of the forehead during spawning. In addition to the differences in colour pattern and fin lengths between the sexes of *C. bleheri*, there is also a significant difference in the maximum body depth. Mature males are much deeper bodied than females with older males developing a very deep body. Males may reach a maximum size of 12 cm, but females are usually less than 10 cm. *C. bleheri* are essentially a carnivore, feeding on a variety of terrestrial and aquatic insects, insect larvae, and small aquatic crustaceans. *Chilatherina bleheri* is most closely related to *C. fasciata* a widely distributed species inhabiting northern New Guinea in the region between the Markham and Mamberamo Rivers. The two species differ primarily with respect to size of scales and coloration, particularly of mature males. The scale difference is reflected in several counts with *C. bleheri* invariably having smaller scales and hence higher counts: vertical scale rows – 43 to 50 vs. 39 to 44 for *C. fasciata*; horizontal scale rows 14 to 16 vs. 11 or 12 and predorsal scales 22 to 25 vs. 18 to 22. The males of *C. fasciata* lack the red coloration of *C. bleheri* and often possess a series of dark bars on the lower side above the breast region.

Distribution & Habitat

Chilatherina bleheri have been collected from the vegetated shoreline and feeder streams of Lake Holmes (Danau Bira) situated in the Mamberamo region of West Papua. Lake Holmes is a complex of three interconnected lakes lying at an altitude of about 430 metres above sea level and set in the foothills of the van Wees Mountains, approximately 290 kilometres west of Jayapura, the capital city of West Papua. The lakes lie within a radius of 6-7 kilometres with the main lake having a length of approximately 4.5 kilometres and maximum width of about 2 kilometres. The depth appears to be relatively shallow; perhaps averaging less than 5-10 metres. The lakes are drained by a small stream, which flows into the Mamberamo River at a point approximately 15 kilometres directly to the north. *C. bleheri* were collected along the heavily vegetated shoreline of the main lakes and also from small, rocky bottom, tributary streams. The lake and surrounding creeks are inhabited by 11 fish species, including one other rainbowfish, Melanotaenia maylandi.

Remarks

Live specimens of this species were initially collected by Gerald Allen and Heiko Bleher in 1982. When first discovered it was thought that they were just another colour variety of C. fasciata. However, in 1985 they were described by Gerald R. Allen as a new species and named in honour of Heiko Bleher, a well-known fish collector.



References

Froese, R. and D. Pauly. Editors. 2021.FishBase. World Wide Web electronic publication. www.fishbase.org, (02/2021)

Tappin, Adrian (2005) “Rainbowfishes ~ Their Care & Keeping in Captivity 2nd Ed.2011” at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf



Chilatherina bleheri spawning, showing nape flashing on male © Gunther Schmida

2. **Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). For example, is the species listed on CITES Appendix I, II or III, and if so, are there any specific restrictions on the movement of this species? Include information on the conservation value of the species.**

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Chilatherina” revealed no results for those entities.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 11 species of Chilatherina listed.

Chilatherina alleni **listed as vulnerable**
https://www.iucnredlist.org/species/169522/147680522

Chilatherina axelrodi **listed as endangered**
https://www.iucnredlist.org/species/4628/147680647

Chilatherina bleheri **listed as endangered**
https://www.iucnredlist.org/species/4629/147680677

Chilatherina bulolo **listed as least concern**
https://www.iucnredlist.org/species/4630/147680735

Chilatherina campsi **listed as least concern**
https://www.iucnredlist.org/species/161079348/161079383

Chilatherina crassispinosa **listed as least concern**
https://www.iucnredlist.org/species/161079519/161079697

Chilatherina fasciata **listed as least concern**
https://www.iucnredlist.org/species/161079834/161080091

Chilatherina lorentzii **listed as near threatened**
https://www.iucnredlist.org/species/161080164/161080249

Chilatherina pagwiensis **listed as endangered**
https://www.iucnredlist.org/species/161080305/161080322

Chilatherina pricei **listed as vulnerable**
https://www.iucnredlist.org/species/161080365/161080369

Chilatherina sentaniensis **listed as critically endangered**
https://www.iucnredlist.org/species/4631/147680762

References

The CITES Species website with lists and search facility accessed on 17 April 2021.
URL http://www.cites.org/eng/disc/species.php

The IUCN Red List search facility locate accessed on 17 April 2021.
URL http://www.iucnredlist.org/details/4630/0

3. Provide information about the ecology of the species.

Species Summary

Chilatherina bleheri is a very attractive rainbowfish. They generally have a silvery or bluish-green body colour on the upper back fading posteriorly to pastel shades of yellow to red. The scales on the front half of body, particularly on the dorsal region, have broad yellow-green margins; the first dorsal fin charcoal grey; second dorsal fin grey suffused with red; caudal and anal fins red; pelvic fins reddish anteriorly with remainder white or translucent; pectoral fins translucent. The lower side of the body is white with a series of faint vertical dark markings. Females lack the vivid red hues and are mainly silvery or pale bluish grading to grey or greenish-brown. Males display a brilliant yellow orange stripe on the middle of the forehead during spawning. In addition to the differences in colour pattern and fin lengths between the sexes of *Chilatherina bleheri*, there is also a significant difference in the maximum body depth. Mature males are much deeper bodied than females with older males developing a very deep body. Males may reach a maximum size of 12 cm, but females are usually less than 10 cm. *Chilatherina bleheri* are essentially a carnivore, feeding on a variety of terrestrial and aquatic insects, insect larvae, and small aquatic crustaceans.

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References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. (1985), Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea, Revue française d'Aquariologie Herpétologie 12, No. 2, pp. 53-62

Allen, G.R., 1991. Field guide to the freshwater fishes of New Guinea. Publication, no. 9. 268 p. Christensen Research Institute, Madang, Papua New Guinea.

Tappin, Adrian. (2005) “Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011” at: https://rainbowfish.angfaqld.org.au/bleheri.htm

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin

2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available on the world wide web as a portable document format (PDF) at universal resource locator http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Allen (1995), records the Holotype of the species as being 89.0mm standard length, and 57 paratypes as being between 24.0 and 95.2mm standard length, from a small creek next to the landing strip on South shore of Lake Holmes (Danau Biru), Irian Jaya, Indonesia (approximately 2º29'S, 138 º00E) using rotenone, on 21 November 1982 with Heiko Bleher, which is also reflected by **Tappin, A.R.,** (2011)

References:

Allen, G.R. (1985), Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea, Revue française d'Aquariologie Herpétologie 12, No. 2, pp. 53-62

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.c The natural geographic range.

This species is endemic to Indonesia where it is known from Danau Biru (Lake Holmes) in the Mamberamo River system of Papua Province. It has recently been found in hilly terrain (elevation approximately 300 m) south of the Mamberamo plains, approximately 100 km due south of Danau Biru.

References:

Allen, G.R. (1985), Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea, Revue française d'Aquariologie Herpétologie 12, No. 2, pp. 53-62

Boeseman, M. (1963) Notes on the fishes of western New Guinea 1. Zool. Mededelingen, 38(14); 221-242.

IUCN Redlist: https://www.iucnredlist.org/species/4629/147680677

3.d Habitat.

Danau Biru consists of three interconnected lakes lying within a radius of 6-7 kilometres, the largest measuring about 4.5 km long and 2 km wide. The lakes are situated in hilly rainforest terrain, lying at an elevation of about 360 m. The rainbowfish is abundant along the heavily

vegetated shoreline and also occurs in small, rocky tributary streams. It can reach a maximum size of about 10 cm SL

Chilatherina bleheri have been collected from the vegetated shoreline and feeder streams of Lake Holmes (Danau Bira) situated in the Mamberamo region of West Papua. Lake Holmes is a complex of three interconnected lakes lying at an altitude of about 430 metres above sea level and set in the foothills of the van Wees Mountains, approximately 290 kilometres west of Jayapura, the capital city of West Papua. The lakes lie within a radius of 6-7 kilometres with the main lake having a length of approximately 4.5 kilometres and maximum width of about 2 kilometres. The depth appears be relatively shallow; perhaps averaging less than 5-10 metres. The lakes are drained by a small stream, which flows into the Mamberamo River at a point approximately 15 kilometres directly to the north. *Chilatherina bleheri* were collected along the heavily vegetated shoreline of the main lakes and also from small, rocky bottom, tributary streams. The lake and surrounding creeks are inhabited by 11 fish species, including one other rainbowfish, *Melanotaenia maylandi*.

In most cases Chilatherina are found in either low-lying riverine floodplain or foothill streams to altitudes of about 500m. However at least one species (*C. campsi*) frequents streams of the mountainous Central Highlands to about 1500m above sea level.

At least three species (*Chilatherina bleheri, C. fasciata, and C. sentaniensis*) have lake dwelling populations. In stream habitats *Chilatherina* frequent shallow pools where the flow rate is gentle, Typically *Chilatherina* prefers sections of the stream or lake-shore which affords maximum exposure to sunlight. (Allen 1991)

References:

Allen, G.R. (1985), Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea, Revue française d'Aquariologie Herpétologie 12, No. 2, pp. 53-62

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Chilatherina bleheri* was not recorded by Allen(1985) but the diet of other members of the *Chilatherina* genus are well recorded. All rainbowfishes of the family *Melanotaeniidae* are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.f Social behaviour and groupings

Allen (1991) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; “Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac.”

References :

Allen, G.R. & Cross, N.J. (1982) “*Rainbowfishes of Australia and Papua New Guinea”*. Published by Angus and Robertson.

Allen, G.R. (1985), Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea, Revue française d'Aquariologie Herpétologie 12, No. 2, pp. 53-62

Fishbase: https://www.fishbase.de/summary/chilatherina-bleheri.html

Tappin, A.R., (2011) “*Rainbowfishes, their care and keeping in captivity*” available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylised display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as “dither fish” to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References :

Allen, G.R. & Cross, N.J. (1982) “*Rainbowfishes of Australia and Papua New Guinea”*. Published by Angus and Robertson.

Allen, G.R. (1985), Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea, Revue française d'Aquariologie Herpétologie 12, No. 2, pp. 53-62

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried rainbowfish for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Fishbase April 2021. https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.i characteristics that may cause harm to humans and other species.

There are no sharp spines, toxins or venom in any member of *the Melanotaeniidae* family.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Fishbase: https://www.fishbase.de/summary/chilatherina-bleheri.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4. Provide information on the reproductive biology of the species, including

There are no scientific records of any work done on the reproductive biology of *Chilatherina bleheri, but the breeding habits of other* Chilatherina *species are* well known in the aquarium trade and have been kept and bred by the authors since 1983 from stock obtained from Melbourne.

C. axelrodi, C. bleheri, C. crassispinosa, C. bulolo, C. campsi, C. fasciata and *C. sentaniensis* were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Allen, G.R. (1985), Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea, Revue française d'Aquariologie Herpétologie 12, No. 2, pp. 53-62

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Chilatherina bleheri* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b How frequently breeding occurs

The authors could find no record or observation for *Chilatherina bleheri* but closely related *Chilatherina* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Allen, G.R. (1985), Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea, Revue française d'Aquariologie Herpétologie 12, No. 2, pp. 53-62

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Chilatherina bleheri* but closely related *Chilatherina* species will produce about 40 to 80 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season. *Chilatherina bleheri* is a very adaptable species and not difficult to keep in the aquarium. The offspring can be described as easy. It is recommended that it should be kept at a water temperature of 22 - 26 ° C and a pH value of 7 - 8.5 (slightly alkaline). The edge length of an aquarium should be at least 900m, the bigger the better. More females than male ratio, because the males can become aggressive during their courtship.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992). There are no naturally occurring *Chilatherina* species in Australia. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively

restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species *of Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *Glossolepis incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish “aquarium” strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under “pseudo-scientific” names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a “Code of Conduct” that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by the authors.

References:

Allen, G.R. & Cross, N.J. (1982) “*Rainbowfishes of Australia and Papua New Guinea”*. Published by Angus and Robertson

ANGFA “Code of Conduct”
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Aquagreen, Aquarium and Pond Keepers Code of Conduct – available at URL - https://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There is no record of *Chilatherina bleheri* being hybridised in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Chilatherina* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between *Melanotaenia praecox* and *Glossolepis incisus*, they produced hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family *Melanotaeniidae* was sufficiently close for them all to hybridise. Author 1 called an expert in the field of rainbowfish for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different rainbowfish *Melanotaenia splendida splendida* has been introduced to a different rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

References:

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific Chromosomal Diversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Chilatherina bleheri* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6

FishBase. Froese, R. and D. Pauly. Editors. 2020. www.fishbase.org, version (12/2020). Accessed 17 Apr 2021 https://www.fishbase.de/summary/Chilatherina-bleheri.html

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

Glossolepis incisus, has been assessed by Patricia Kialola for and on behalf of the Pet Industry Association of Australia. *Glossolepis leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005) https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator; https://www.baphiq.gov.tw/public/Data/910614193571.pdf , or http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of *Chilatherina bleheri* into the Australian environment should it be released or escape effective human control. Author 1 contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with *Chilatherina bleheri* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020.

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Chilatherina bleheri is a forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to

all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment score attached as appendix B There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville, Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

7c. ability to find shelter

Allen (1979), describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Allen, G.R. (1985), Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea, Revue française d'Aquariologie Herpétologie 12, No. 2, pp. 53-62

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7d. rate of reproducing

Chilatherina bleheri is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Allen, G.R. (1985), Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea, Revue française d'Aquariologie Herpétologie 12, No. 2, pp. 53-62

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using the copy of Climex for PC provided to the Author by Bomford process indicates a score of 4 for *Chilatherina bleheri* which indicates a low chance of survival in Australian water ways, and is attached at Appendix B.

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes

so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Chilatherina* were to escape, effective control the area where the likelihood of accidental or intentional release is greater. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging.

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to one of the possible suitable natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Chilatherina bleheri* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution.

It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats. *Chilatherina* have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

Chilatherina bleheri have been collected from the vegetated shoreline and feeder streams of Lake Holmes (Danau Bira) situated in the Mamberamo region of West Papua. Lake Holmes is a complex of three interconnected lakes lying at an altitude of about 430 metres above sea level and set in the foothills of the van Wees Mountains, approximately 290 kilometres west of Jayapura, the capital city of West Papua. The lakes lie within a radius of 6-7 kilometres with the main lake having a length of approximately 4.5 kilometres and maximum width of about 2 kilometres. The depth appears to be relatively shallow; perhaps averaging less than 5-10 metres. The lakes are drained by a small stream, which flows into the Mamberamo River at a point approximately 15 kilometres directly to the north. *Chilatherina bleheri* were collected along the heavily vegetated shoreline of the main lakes and also from small, rocky bottom, tributary streams. The lake and surrounding creeks are inhabited by 11 fish species, including one other rainbowfish, Melanotaenia maylandi.

The IUCN list this species as Endangered. It has an extent of occurrence (EOO) of 1,350 km^2 and occurs in two locations based on the threats of invasive species and fishing. These are leading to continuing declines in the number of mature individuals. G Allen mentions a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References ;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Chilatherina bleheri* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Chilatherina bleheri* is similar to and is most closely related to *C. fasciata.* Aquarium observations worldwide of *Chilatherina bleheri* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

Reference:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Allen, G.R. (1985), Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea, Revue française d'Aquariologie Herpétologie 12, No. 2, pp. 53-62

Aqua-fish.net – since 2005 - https://en.aqua-fish.net/fish/blehers-rainbowfish

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Chilatherina bleheri* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 120mm (Allen 1985)

References:

Allen, G.R. (1985), Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea, Revue française d'Aquariologie Herpétologie 12, No. 2, pp. 53-62

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

8.c habitat and local environmental conditions

Chilatherina bleheri are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Chilatherina* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species

as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Chilatherina bleheri* (Fishbase records diseases in other *Chilatherina* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. found at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Chilatherina,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

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9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *C. axelrodi, C. bleheri, C. campsi and C. fasciata* have been in Australia, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also).

Permitting *Chilatherina bleheri* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from German breeders and then from commercial facilities to which these captive bred stocks are distributed.

Chilatherina bleheri poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp*. (G. incisus,* and *G. leggetti)* currently permitted for import. Also, other species are being considered for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for “fresh” wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008) [online] Available at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf [Accessed 17 April 2021].

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Chilatherina bleheri* will be used in the live fish ornamental aquarium display trade. *Chilatherina bleheri is* to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish. Seven of the eleven species of *Chilatherina* have been in Australia prior to 1983, *C. Axelrodi, C, bleheri, C. bulolo, C campsi, C. crassispinosa, C. fasciata, and C. sentaniensis*. Rainbowfish of the genus *Chilatherina* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960’s.

If *Chilatherina bleheri is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

References:

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Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity 2nd Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

11.a the containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

Reference:

Biosecurity Act 2015 as in force 25 march 2020, Accessed 24 march 2021, available at: https://www.legislation.gov.au/Details/C2020C00127

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Chilatherina* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and

continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Chilatherina bleheri* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Chilatherina bleheri* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Government Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available at: http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

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ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

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12. Provide information on all other Commonwealth, state and territory legislative controls on the species.

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species , there are no references or instances of *Chilatherina* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Chilatherina bleheri* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow Chilatherina bleheri across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows Chilatherina bleheri is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-freshwater/list-of-noxious-fish , and shows no *Chilatherina* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called “Restricted Matter” comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. Chilatherina bleheri is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 and can be accessed at:
https://www.daf.qld.gov.au/__data/assets/pdf_file/0008/1398842/prohibited-restricted-invasive-fish.pdf , and there are no *Chilatherina* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations

1995 and prohibited to be imported into the State. Chilatherina bleheri is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at,
http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Chilatherina* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Chilatherina* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. Chilatherina bleheri is not listed as noxious in this Regulation.
The New South Wales noxious fish list accessed on 21/04/2021, is available at https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish , and shows no *Chilatherina* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. Chilatherina bleheri does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *chilatherina* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp (*Cyprinus carpio*) mosquito fish (*Gambusia* spp.) Didymo a freshwater algae (*Didymosphenia geminata*) and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *chilatherina* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is 'reckless' about whether the animal is a prohibited animal and is also 'reckless' about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

The Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at:

https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-Animals-Declaration-ACCESS-3.pdf . There are no *Chilatherina* species listed.

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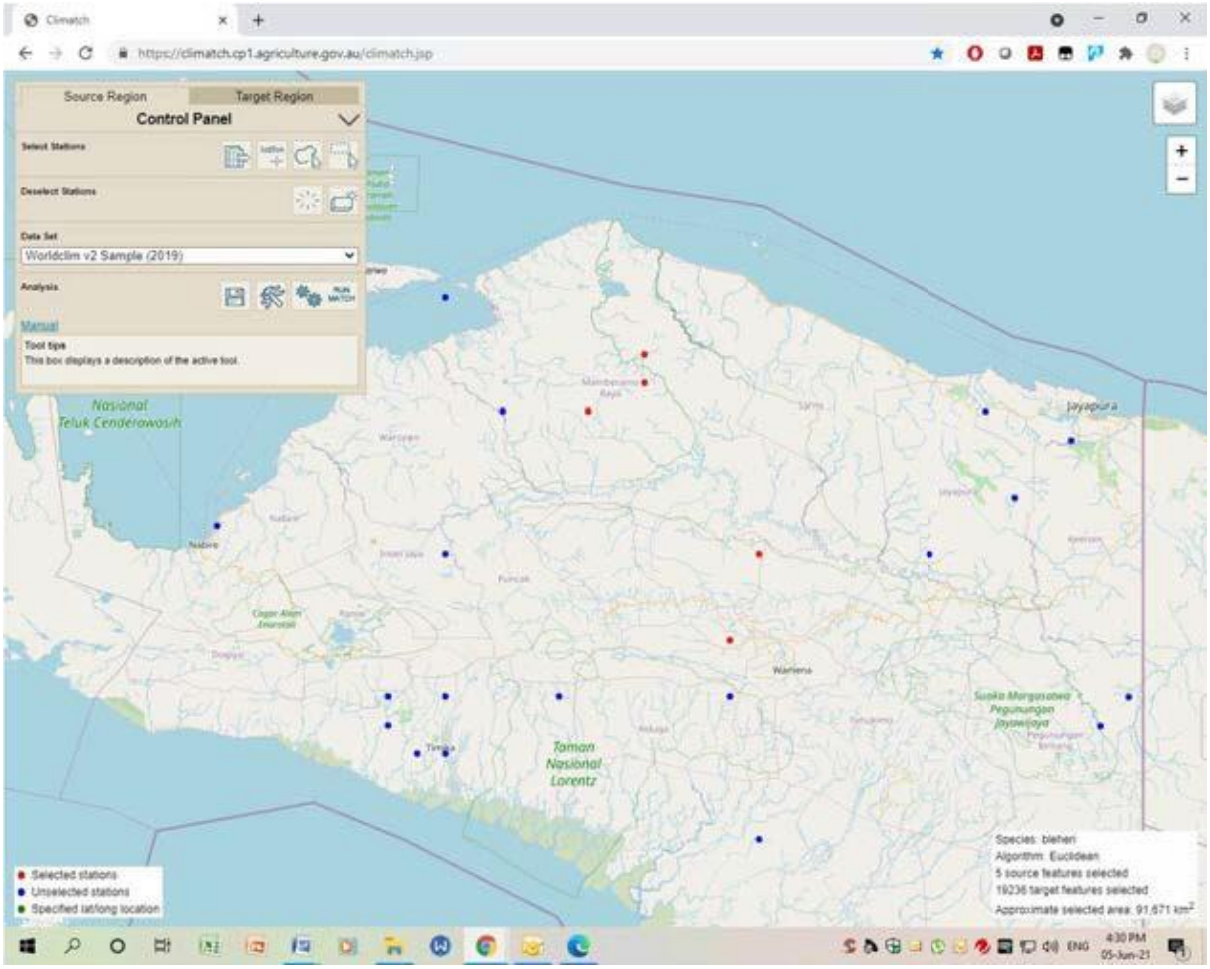
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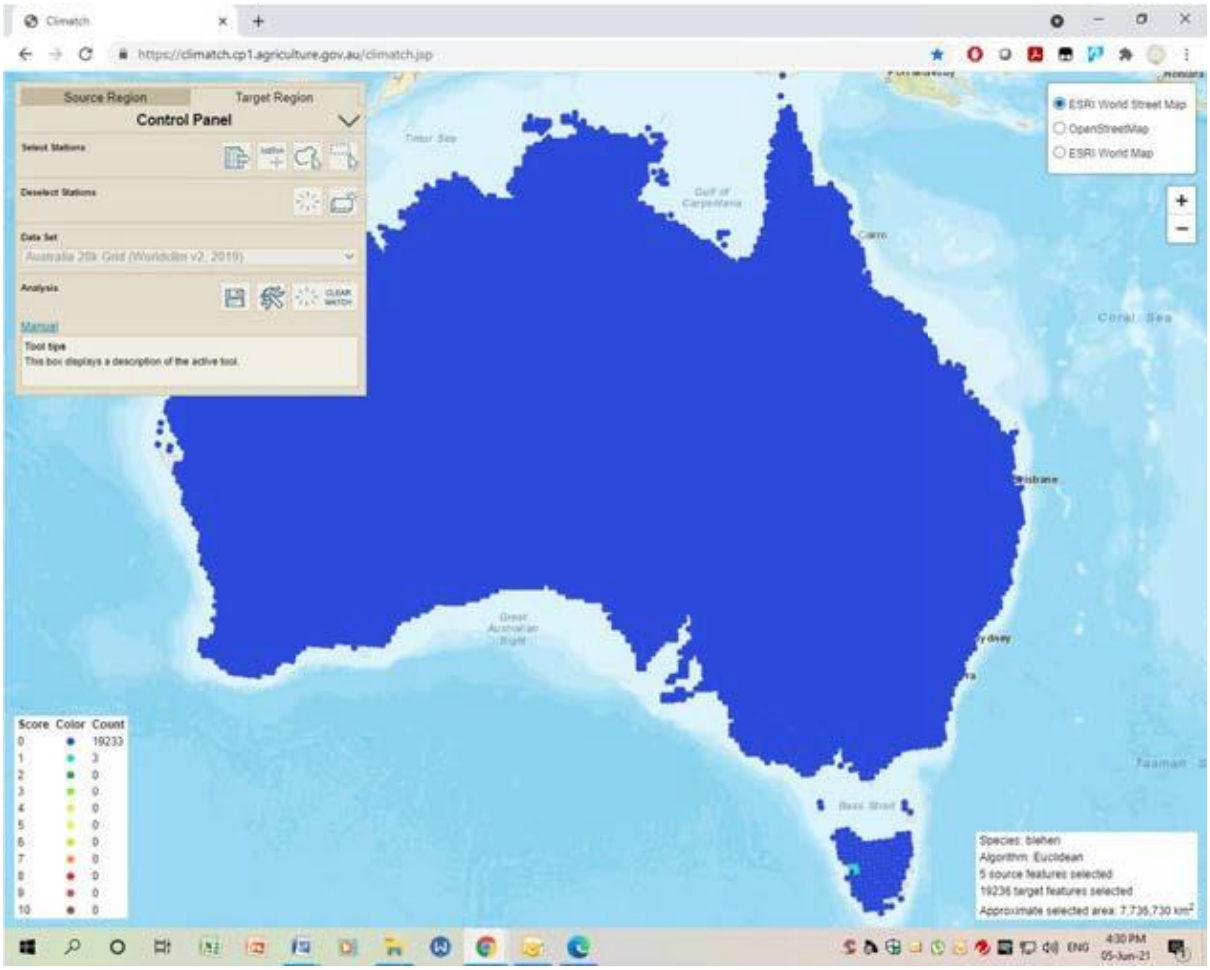
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APPENDIX A – calculation of climate from *Chilatherina bleheri* distribution climate to Australian Climate.





Appendix B

Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were done to provide a score against the provisions in the assessment process.(accessed 6th June 2021.)

BOMFORD ASSESSMENT

SPECIES: Chilatherina bleheri

Score A. Climate Match (0-8)

Number of squares within 60% of the mean: (No. 5)	0
Number of squares within 50% of the mean: (No. 6)	0
Number of squares within 40% of the mean: (No. 7)	0
Number of squares within 30% of the mean: (No. 8)	0
Number of squares within 20% of the mean: (No. 9)	0
Number of squares within 10% of the mean: (No. 10)	0

Total = <3
Score: 1 (Ref: fishbase.org, PC CLIMATE)

Score B, Overseas Range

Number of 1° x 1° grids in which species occurs overseas.
No. of squares : 7

Score: 1 (Ref: fishbase.org, googleearth.com)

Score C, Establishment

Locations of establishment incidence: nil - never introduced
Score: 1 (Ref: fishbase.org)

Score D, Introduction Success

Percentage of Introduction events that have been successful
Introductions nil
Successful: nil
Score: 1 (Ref: fishbase.org)

Score E, Taxa risk

Genus: Chilatherina
Introductions: 0
Successful: 0
Score: 0 (Ref: fishbase.org / M. Bomford)

Family: Melanotaeniidae (Rainbowfishes)
Introductions: 5
Successful: 0 unknown
Score: 0 (Ref: fishbase.org / M. Bomford)

Total: 4 (LOW)

The score of 4 according to the assessment model gives the fish a low chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

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A report to address the "Terms of Reference" for an application to include *Chilatherina bulolo* onto the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.

Chilatherina bulolo



© Photograph Neil Armstrong Permission to use photo obtained 2000.

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that the Bulolo Rainbowfish *Chilatherina bulolo* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented for the prosecution in the witness box by the author of this report, however the accused offender pleaded guilty.

Disease

Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species

Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat

Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species

Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes

Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

References

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Terms of Reference

Overview: The rainbowfish genus *Chilatherina* consists of eleven species.

etymology: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Glossolepis* are:

Chilatherina is closely related to Melanotaenia, the largest genus in the family. They differ chiefly with regard to jaw structure. In Chilatherina the lateral portion of the premaxillary is either straight or curved gently in a postero-ventral direction. The lower jaw is generally inferior to the upper jaw and the medial portion of the upper lip is swollen and profusely covered with teeth. In addition, the head tends to be more slender and the snout relatively pointed compared with Melanotaenia. The latter genus by contrast, has a more or less abrupt downward bend in the lateral portion of the premaxillary with less swelling of the medial upper lip and fewer teeth on its surface. Moreover, the jaws are usually about even or the upper jaw is slightly inferior (Le. lower jaw protruding). The external jaw features of Chilatherina and Melanotaenia were illustrated by Allen (1980a).

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299. http://museum.wa.gov.au/sites/default/files/A%20REVISION%20OF%20THE%20RAINBOWFISH%20GENUS%20CHILATHERINA%20(MELANOTAENIIDAE).pdf



Typical Chilatherina habitat © Michael Wagner permission granted (2019)

1. Provide information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane
Species: Chilatherina bulolo, Centratherina bulolo, Whitley, G.P. (1938). Chilatherina bulolo (Whitley (1938).

Chilatherina bulolo



© Photograph Gunther Schmida Permission to use photo obtained 2010

Species Summary

Chilatherina bulolo have an overall silvery body colour with a black streak on the upper and lower edges of the caudal fin. It is very similar to *C. crassispinosa*, but has a wider head, blunter head, larger eye, and shorter first dorsal fin. It also tends to be more slender, but depth increases with age. Males are usually much larger and deeper bodied than females. Males may reach a maximum size of 10 cm, but females are usually less than 8 cm. They are essentially a carnivore, feeding on a variety of terrestrial and aquatic insects, insect larvae, and small aquatic crustaceans. Algae, plant pollens, and seeds are also ingested. Stomach contents of wild caught specimens indicated a diet of small insects, particularly ants, and algae that is grazed from rocks.

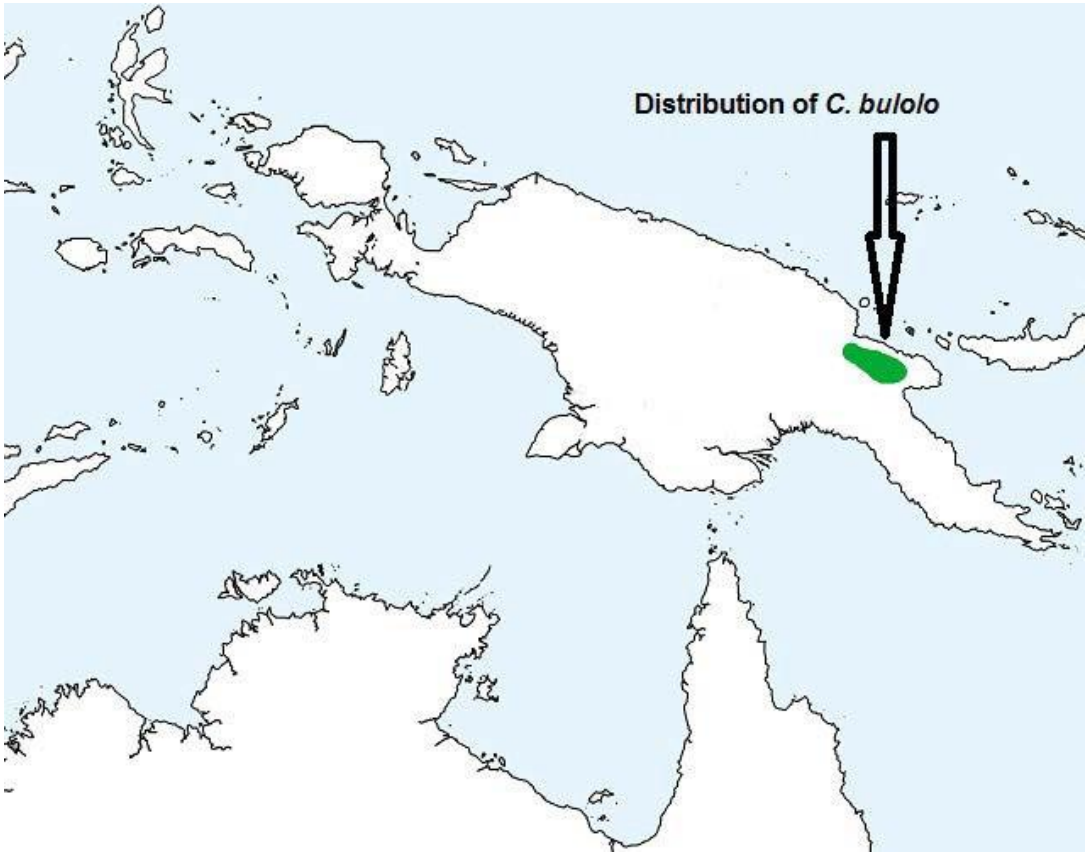
Whitley (1938) reports: Colour, in alcohol, ruddy yellowish, sparsely sprinkled with black chromatophores dorsally. A silvery lateral band posteriorly. Fins with stippled dusky margins; upper and lower caudal rays iIifuscated. Described from the holotype, a specimen 60 mm. in standard length, or 2 inches overall. Austr. Mus. Regd. No. IA.6357. Loc.-Blilolo Valley, Mandated Territory of Papua; freshwater. Presented by Mr. F. B. S. Hislop in 1934.

Distribution & Habitat

Chilatherina bulolo is so far only known from scattered localities in the Markham, Ramu and Sepik River systems of north-eastern Papua New Guinea. They have been collected from the Erap, Snake, Bulolo, and Whege rivers. They are found mainly in mountain streams with rapid flow and coarse gravel bottoms, in water temperatures between 24- 28° Celsius and pH 7.5-8.5.

Remarks

Chilatherina bulolo were originally collected in the Bulolo River system in 1934 by F.B.S. Hislop. Gerald Allen and Brian Parkinson collected live specimens from the Erap River near Lae in 1978. These were transported back to Australia, but failed to become established in the hobby.



References:

Allen G.R. (1983) *Chilatherina bulolo* a valid species of rainbowfish (Melanotaeniidae) from northern New Guinea. Fishes of Sahul 1(2): 13-17.

Allen, G.R., 1991. Field guide to the freshwater fishes of New Guinea. Publication, no. 9. 268 p. Christensen Research Institute, Madang, Papua New Guinea.

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Whitley G.P. (1938) Descriptions of some New Guinea fishes. Records of the Australian Museum 20(3): 223-233.

2. **Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). Include information on the conservation value of the species.**

The IUCN records that this species occurs in the Ramu and Markham river systems of north-eastern Papua New Guinea. It has a relatively restricted extent of occurrence (EOO) of 5,000 km^2. Conversion to oil palm has resulted in the population becoming fragmented, but

more information is required on other effects of oil palm on the population. The hillsides, where this species occurs, are relatively untouched by threats at present. Therefore, this species is assessed at Least Concern. The catchments in which this species occurs have historically been areas of deforestation, although the area may have naturally been largely grassland.

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Chilatherina” revealed no results for those entities.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 11 species of Chilatherina listed.

Chilatherina alleni **listed as vulnerable**
https://www.iucnredlist.org/species/169522/147680522

Chilatherina axelrodi **listed as endangered**
https://www.iucnredlist.org/species/4628/147680647

Chilatherina bleheri **listed as endangered**
https://www.iucnredlist.org/species/4629/147680677

Chilatherina bulolo **listed as least concern**
https://www.iucnredlist.org/species/4630/147680735

Chilatherina campsi **listed as least concern**
https://www.iucnredlist.org/species/161079348/161079383

Chilatherina crassispinosa **listed as least concern**
https://www.iucnredlist.org/species/161079519/161079697

Chilatherina fasciata **listed as least concern**
https://www.iucnredlist.org/species/161079834/161080091

Chilatherina lorentzii **listed as near threatened**
https://www.iucnredlist.org/species/161080164/161080249

Chilatherina pagwiensis **listed as endangered**
https://www.iucnredlist.org/species/161080305/161080322

Chilatherina pricei **listed as vulnerable**
https://www.iucnredlist.org/species/161080365/161080369

Chilatherina sentaniensis **listed as critically endangered**
https://www.iucnredlist.org/species/4631/147680762

References

CITES Species website with lists and search facility accessed on 17 April 2021.
URL http://www.cites.org/eng/disc/species.php

IUCN Red List search facility locate accessed on 17 April 2021.
URL http://www.iucnredlist.org/details/4630/0

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

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3.b Size and weight range.

Described from the holotype, a specimen 60 mm. in standard length, or 2 inches overall. Austr. Mus. Regd. No. IA.6357. Loc.-Bulolo Valley, Mandated Territory of Papua; freshwater. Presented by Mr. F. B. S. Hislop in 1934

Whitley, G.P. (1938), records the Holotype of the species as being 60.0 mm standard length. It was the only specimen collected. This led to the species being questionably considered to be a junior synonym of *Centratherina crassispinosus* (Weber, 1913) by Ian Munro (1958), which is also reflected by Tappin, A.R., (2011)

References:

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Whitley, G.P. 1938. Descriptions of some New Guinea fishes. *Records of the Australian Museum* 20(3): 223-233

3.c The natural geographic range.

This species occurs in the Ramu and Markham river systems of north-eastern Papua New Guinea. It has been reported from the Erap, Snake, and Bulolo rivers in the Markham system and from the Whege River in the Ramu system.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. 1983. *Chilatherina bulolo*, a valid species of rainbowfish (Melanotaeniidae) from northern New Guinea. *Fishes of Sahul, Journal of the Australia New Guinea Fishes Association* 1(2): 13-17

Boeseman, M. (1963) Notes on the fishes of western New Guinea 1. Zool. Mededelingen, 38(14); 221-242.

IUCN. 2020-1. The IUCN Red List of Threatened Species. Version 2020-3. Available at: www.iucnredlist.org. (Accessed: 09 May 2021).

3.d Habitat.

This species occurs in rapid-flowing streams in foothill terrain, often in “white water” rapids, which is an unusual habitat for rainbowfishes. It can reach a maximum size of about 7 cm SL.

This is a benthopelagic species that is found in rivers or streams where the substrate consists of gravel and rocks, and the water is cold, clear and fast-flowing. It is also found in rocky pools and backwaters in rainforest habitat. It has been reported from the Erap, Snake, and Bulolo rivers in the Markham system and from the Whege River in the Ramu system. In most cases Chilatherina are found in either low-lying riverine floodplain or foothill streams to altitudes of about 500m. However at least one species (*C. campsi*) frequents streams of the mountainous Central Highlands to about 1500m above sea level.

At least three species (*C. bleheri, C. fasciata, C. sentaniensis*) have lake dwelling populations. In stream habitats *Chilatherina* frequent shallow pools where the flow rate is gentle, however *C. bulolo* is often found in rapid flowing steep gradient creeks. Typically *Chilatherina* prefers sections of the stream or lake-shore which affords maximum exposure to sunlight. (Allen 1991)

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) “*Rainbowfishes of Australia and Papua New Guinea”*. Published by Angus and Robertson

Allen, G.R. 1983. *Chilatherina bulolo*, a valid species of rainbowfish (Melanotaeniidae) from northern New Guinea. *Fishes of Sahul, Journal of the Australia New Guinea Fishes Association* 1(2): 13-17

IUCN. 2020-1. The IUCN Red List of Threatened Species. Version 2020-3. Available at: www.iucnredlist.org. (Accessed: 09 May 2021).

Tappin, Adrian. (2005) "Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011" at: https://rainbowfish.angfaqld.org.au/

3.e Diet, including potential to feed on agricultural plants

Allen (1983) records the diet of *Chilatherina bulolo* as primarily on small insects particularly ants and filamentous algae which is grazed from rocks. He also states that it is well suited to captivity, as they readily acclimate to aquarium conditions and thrive on a diet of dry flake food and a fresh frozen, fish-beef mixture fortified with spinach and powdered kelp. *T*he diet of other members of the *Chilatherina* genus are well recorded. All rainbowfishes of the family *Melanotaeniidae* are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Allen, G.R. 1983. *Chilatherina bulolo*, a valid species of rainbowfish (Melanotaeniidae) from northern New Guinea. *Fishes of Sahul, Journal of the Australia New Guinea Fishes Association* 1(2): 13-17

Tappin, Adrian. (2005) "Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011" at: https://rainbowfish.angfaqld.org.au/

3.f Social behaviour and groupings

Allen (1991) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; "Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small

snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac."

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Allen, G.R. 1983. *Chilatherina bulolo*, a valid species of rainbowfish (Melanotaeniidae) from northern New Guinea. *Fishes of Sahul, Journal of the Australia New Guinea Fishes Association* 1(2): 13-17

Fishbase: https://www.fishbase.de/summary/chilatherina-bulolo.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylised display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as "dither fish" to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Allen, G.R. 1983. *Chilatherina bulolo*, a valid species of rainbowfish (Melanotaeniidae) from northern New Guinea. *Fishes of Sahul, Journal of the Australia New Guinea Fishes Association* 1(2): 13-17

Fishbase: https://www.fishbase.de/summary/chilatherina-bulolo.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried rainbowfish for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Allen, G.R. 1983. *Chilatherina bulolo*, a valid species of rainbowfish (Melanotaeniidae) from northern New Guinea. *Fishes of Sahul, Journal of the Australia New Guinea Fishes Association* 1(2): 13-17

Fishbase: https://www.fishbase.de/summary/chilatherina-bulolo.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.i characteristics that may cause harm to humans and other species.

There are no sharp spines, toxins or venom in any member of *the Melanotaeniidae* family.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Fishbase: https://www.fishbase.de/summary/chilatherina-bulolo.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4. Provide information on the reproductive biology of the species

There are no scientific records of any work done on the reproductive biology of *Chilatherina bulolo. Chilatherina species are* well known in the aquarium trade and have been kept and bred by the authors since 1983 from stock obtained from Melbourne.

C. axelrodi, C. bleheri, C. crassispinosa, C. bulolo, C. campsi, C. fasciata and *C. sentaniensis* were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Chilatherina bulolo* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b How frequently breeding occurs

The authors could find no record or observation for *Chilatherina bulolo* but closely related *Chilatherina* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Allen, G.R. 1983. *Chilatherina bulolo*, a valid species of rainbowfish (Melanotaeniidae) from northern New Guinea. *Fishes of Sahul, Journal of the Australia New Guinea Fishes Association* 1(2): 13-17

Fishbase: https://www.fishbase.de/summary/chilatherina-bulolo.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Chilatherina bulolo* but closely related *Chilatherina* species will produce about 40 to 80 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992). There are no naturally occurring *Chilatherina* species in Australia. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species *of Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus*

as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *Glossolepis incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish "aquarium" strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under "pseudo-scientific" names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a "Code of Conduct" that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by Author 1.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There is no record of *Chilatherina bulolo* being hybridised in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Chilatherina* with *Melanotaenia* produce

infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between *Melanotaenia praecox* and *Glossolepis incisus*, they produced hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family *Melanotaeniidae* was sufficiently close for them all to hybridise. Author 1 called an expert in the field of rainbowfish for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different rainbowfish *Melanotaenia splendida splendida* has been introduced to a different rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

References:

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific ChromosomalDiversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Chilatherina bulolo* has now been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6 https://www.fishbase.de/summary/Chilatherina_bulolo.html

Froese, R. and D. Pauly. Editors. 2020. FishBase.
World Wide Web publication. www.fishbase.org, version (12/2020). Accessed 17 Apr 2021

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

Glossolepis incisus, has been assessed by Patricia Kialola for and on behalf of the Pet Industry Association of Australia. *Glossolepis leggetti* has been assessed by author 1 and

was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005)
https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator;
https://www.baphiq.gov.tw/public/Data/910614193571.pdf
, or
http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of *Chilatherina bulolo* into the Australian environment should it be released or escape effective human control. Author 1 contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with *Chilatherina bulolo* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020.

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Chilatherina bulolo is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment score attached as appendix B There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville, Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

7c. ability to find shelter

Allen (1979), describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron.

References:

Allen G.R. (1983) *Chilatherina bulolo* a valid species of rainbowfish (Melanotaeniidae) from northern New Guinea. Fishes of Sahul 1(2): 13-17.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7d. rate of reproducing

Chilatherina bulolo is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen G.R. (1983) *Chilatherina bulolo* a valid species of rainbowfish (Melanotaeniidae) from northern New Guinea. Fishes of Sahul 1(2): 13-17.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been here, and popular, for more than 40 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using the copy of Climex for PC, the process attracts a score of 4 for *Chilatherina bulolo,* indicating the species has a low chance of survival in Australian water ways. Attached as appendix B.

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Chilatherina bulolo* were to escape, effective control the area where the likelihood of accidental or intentional release is greater. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging.

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to one of the possible suitable natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons that peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Chilatherina bulolo* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution.

Chilatherina have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

Chilatherina bulolo occurs in rapid-flowing streams in foothill terrain, often in “white water” rapids, which is an unusual habitat for rainbowfishes. It can reach a maximum size of about 7 cm SL.

This is a benthopelagic species that is found in rivers or streams where the substrate consists of gravel and rocks, and the water is cold, clear and fast-flowing. It is also found in rocky pools and backwaters in rainforest habitat. It has been reported from the Erap, Snake, and Bulolo rivers in the Markham system and from the Whege River in the Ramu system.

The IUCN records that , this species occurs in the Ramu and Markham river systems of north-eastern Papua New Guinea. It has a relatively restricted extent of occurrence (EOO) of 5,000 km^2. Conversion to oil palm has resulted in the population becoming fragmented, but more information is required on other effects of oil palm on the population. The hillsides, where this species occurs, are relatively untouched by threats at present. Therefore, this species is assessed at Least Concern. The catchments in which this species occurs have historically been areas of deforestation, although the area may have naturally been largely grassland. More recently, there has been conversion to oil palm plantations in the valley floor, but the hillsides, where this species occurs, are relatively untouched.

Allen mentions a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

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IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Chilatherina bulolo* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Chilatherina bulolo* is similar to and is most closely related to *C. fasciata* and *C. pricei* and other members of the *Chilatherina* genus the behaviour will be similar. Aquarium observations worldwide of *Chilatherina bulolo* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

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8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Chilatherina bulolo* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 70 mm (Allen 1997).

References:

Allen, G.R. 1983. *Chilatherina bulolo*, a valid species of rainbowfish (Melanotaeniidae) from northern New Guinea. *Fishes of Sahul, Journal of the Australia New Guinea Fishes Association* 1(2): 13-17

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Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

8.c habitat and local environmental conditions

Chilatherina bulolo are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Chilatherina* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Chilatherina bulolo* (Fishbase records diseases in other *Chilatherina* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. found at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Chilatherina,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

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IUCN, *The IUCN Red List of Threatened Species.* https://www.iucnredlist.org/ (accessed 30-04-2021)

Kahn, S.A., Wilson, P.W., Pereira, R.P., Hayder, H. and Gerrity, S.E. 1999. *Import Risk analysis on live ornamental finfish*. Canberra: Australian Quarantine and Inspection Service. 172 p.

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *C. axelrodi, C. bleheri, C. campsi and C. fasciata* have been in Australia, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Chilatherina bulolo* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from European and North American breeders and then from commercial facilities to which these captive bred stocks are distributed.

Chilatherina bulolo poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp*. (G. incisus,* and *G. leggetti)* currently permitted for import. Also, other species are being considered for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for “fresh” wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008) [online] Available at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf [Accessed 17 April 2021].

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Chilatherina bulolo* will be used in the live fish ornamental aquarium display trade. *Chilatherina bulolo is* to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish. Seven of the eleven species of *Chilatherina* have been in Australia prior to 1983, *C. Axelrodi, C, bleheri, C. bulolo, C campsi, C. crassispinosa, C. fasciata, C. sentaniensis*. Rainbowfish of the genus *Chilatherina* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960’s.

If *Chilatherina bulolo is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

References:

Biosecurity Australia. (2009) " **BIOSECURITY AUSTRALIA ADVICE 2009/30 EXTENSION OF POLICY TO INCLUDE THE IMPORTATION OF RED RAINBOWFISH FOR ORNAMENTAL PURPOSES".** Published by the Australian Government, available at: http://www.daff.gov.au/SiteCollectionDocuments/ba/memos/2009/2009-30.pdf Downloaded 17 Jul 2015.

Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011"* available on World Wide Web electronic publication at URL http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11.a The containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

Reference:

Biosecurity Act 2015 as in force 25 march 2020, Accessed 24 march 2021, available at: https://www.legislation.gov.au/Details/C2020C00127

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Chilatherina* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Chilatherina bulolo* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Chilatherina bulolo* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Government Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available on the world wide web at universal resource locator - http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

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ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Aquagreen Aquarium and Pond Keepers Code of Conduct – available at URL - https://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

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Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

12. Provide information on all other Commonwealth, state and territory legislative controls on the species, including:
the species' current quarantine status, or
pest or noxious status, or
whether it is prohibited or controlled by permit or licence in any state or territory.

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species , there are no references or instances of *Chilatherina* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection

and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Chilatherina bulolo* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow *Chilatherina bulolo* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows *Chilatherina bulolo* is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-freshwater/list-of-noxious-fish , and shows no *Chilatherina* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called “Restricted Matter” comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. *Chilatherina bulolo* is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 at: https://www.daf.qld.gov.au/__data/assets/pdf_file/0008/1398842/prohibited-restricted-invasive-fish.pdf , and there are no *Chilatherina* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Chilatherina bulolo* is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at, http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Chilatherina* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Chilatherina* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. *Chilatherina bulolo* is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish , and shows no *Chilatherina* on that list.

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. *Chilatherina bulolo* does not appear on this list. The list of Victorian Government declared noxious species is available. The Victorian Fisheries Act accessed 21/04/2021 is available at:
https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *chilatherina* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp **(*Cyprinus carpio*)** mosquito fish **(*Gambusia* spp.)** Didymo a freshwater algae **(*Didymosphenia geminata*)** and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *chilatherina* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is 'reckless' about whether the animal is a prohibited animal and is also 'reckless' about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at : https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-Animals-Declaration-ACCESS-3.pdf . There are no *Chilatherina* species listed.

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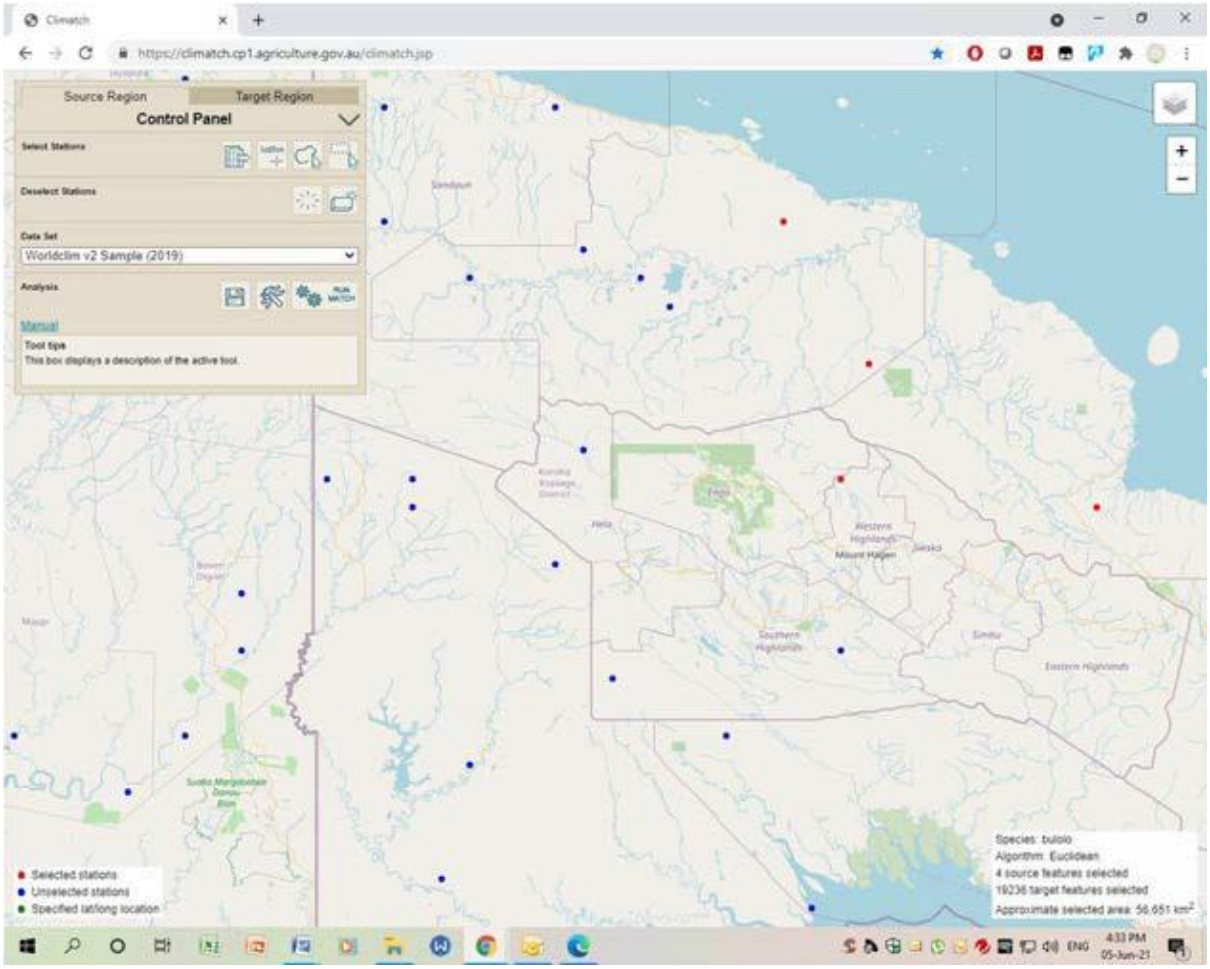
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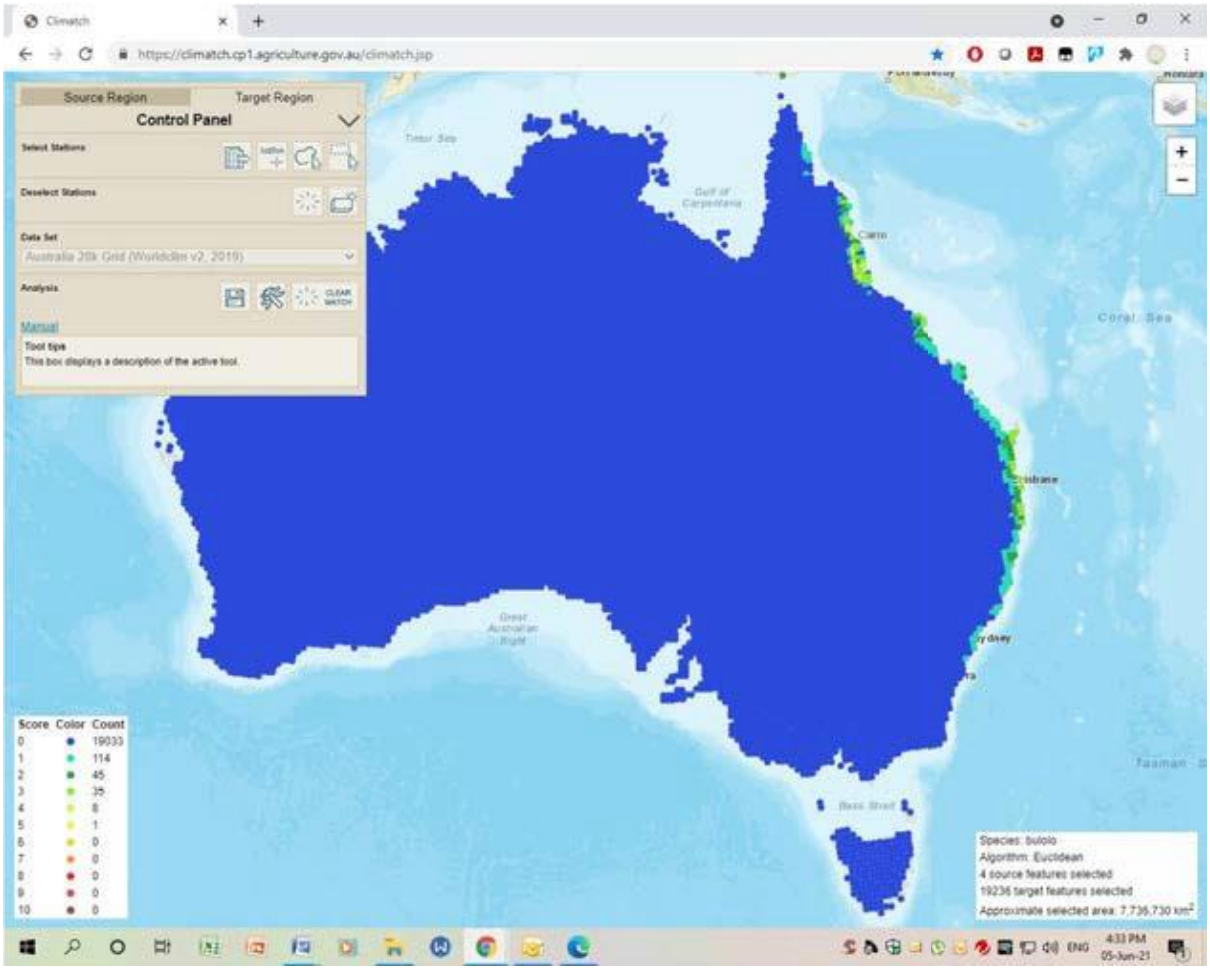
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APPENDIX A – calculation of climate from *Chilatherina bulolo* distribution climate to Australian Climate.





Appendix B

Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were done to provide a score against the provisions in the assessment process.(accessed 6th June 2021.)

BOMFORD ASSESSMENT

SPECIES: Chilatherina bulolo

Score A. Climate Match (0-8)

Number of squares within 60% of the mean: (No. 5)	1
Number of squares within 50% of the mean: (No. 6)	0
Number of squares within 40% of the mean: (No. 7)	0
Number of squares within 30% of the mean: (No. 8)	0
Number of squares within 20% of the mean: (No. 9)	0
Number of squares within 10% of the mean: (No. 10)	0

Total = 1

Score: 2 (Ref: fishbase.org, PC CLIMATE)

Score B, Overseas Range

Number of 1° x 1° grids in which species occurs overseas.

No. of squares : <4

Score: 0 (Ref: fishbase.org, googleearth.com)

Score C, Establishment

Locations of establishment incidence: nil - never introduced
Score: 1 (Ref: fishbase.org)

Score D, Introduction Success

Percentage of Introduction events that have been successful
Introductions nil
Successful: nil
Score: 1 (Ref: fishbase.org)

Score E, Taxa risk

Genus: Chilatherina
Introductions: 0
Successful: 0
Score: 0 (Ref: fishbase.org / M. Bomford)

Family: Melanotaeniidae (Rainbowfishes)
Introductions: 5
Successful: 0 unknown
Score: 0 (Ref: fishbase.org / M. Bomford)

Total: 4 (LOW)

The score of 3 according to the assessment model gives the species a low chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

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A report to address the “Terms of Reference” for an application to include *Chilatherina campsi* onto the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.

Chilatherina campsi (Whitley, 1956), Highlands Rainbowfish



© Photographed by Gary Lange, permission to use photo obtained 11/7/15.

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that the Highlands Rainbowfish *Chilatherina campsi* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented for the prosecution in the witness box by the author of this report, however the accused offender pleaded guilty.

Disease

Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species

Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat

Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species

Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes
Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

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Froese, R. and D. Pauly. Editors. 2021.FishBase. World Wide Web electronic publication. www.fishbase.org, (02/2021) https://www.fishbase.se/summary/Chilatherina-campsi.html

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Typical Chilatherina Habitat. © Michael Wagner permission granted (2019)

Terms of Reference

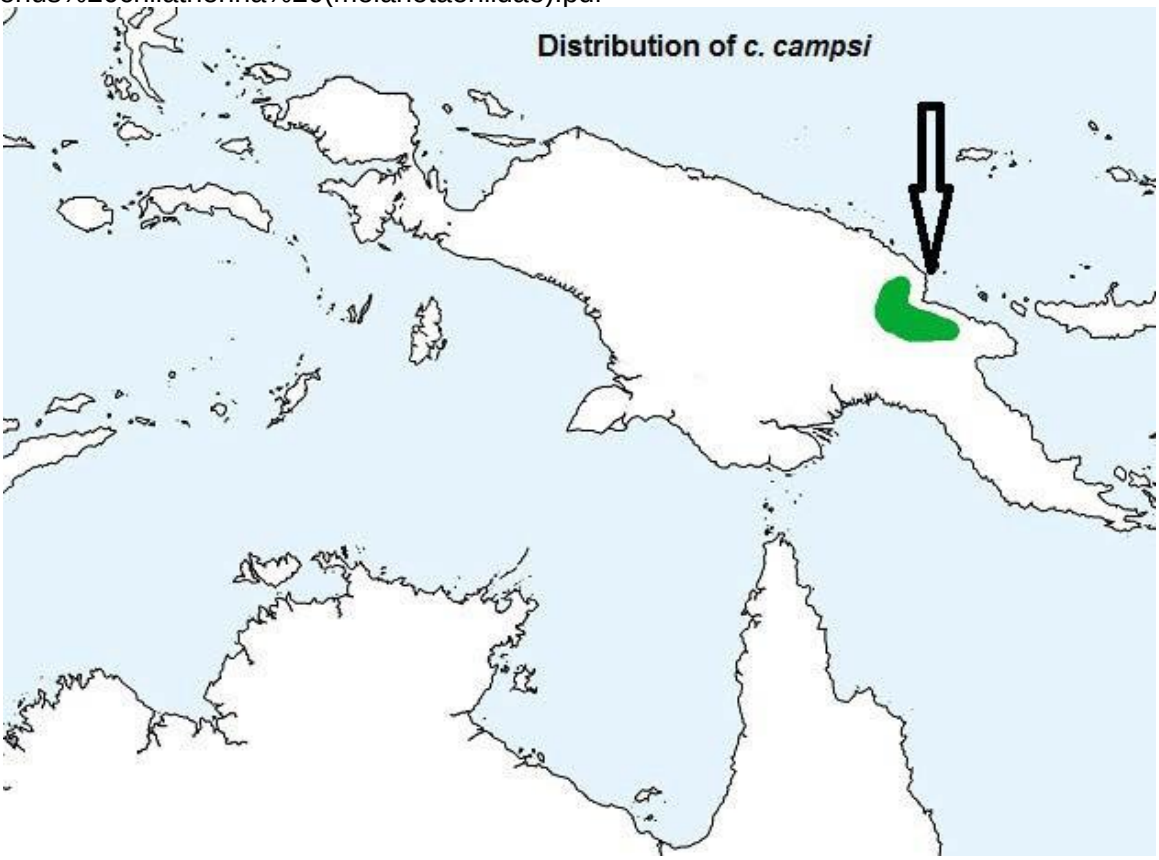
Overview: The rainbowfish genus *Chilatherina* consists of eleven species.

etymology: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane. Campsi - Named in honour of Mr. Norman Camps, formerly a member of the staff of the Australian Museum, who collected fishes from the Jimmi River when associated with Mr. E. Troughton.

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Glossolepis* are:

Chilatherina is closely related to Melanotaenia, the largest genus in the family. They differ chiefly with regard to jaw structure. In Chilatherina the lateral portion of the premaxillary is either straight or curved gently in a postero-ventral direction. The lower jaw is generally inferior to the upper jaw and the medial portion of the upper lip is swollen and profusely covered with teeth. In addition, the head tends to be more slender and the snout relatively pointed compared with Melanotaenia. The latter genus by contrast, has a more or less abrupt downward bend in the lateral portion of the premaxillary with less swelling of the medial upper lip and fewer teeth on its surface. Moreover, the jaws are usually about even or the upper jaw is slightly inferior (Le. lower jaw protruding). The external jaw features of Chilatherina and Melanotaenia were illustrated by Allen (1980a).

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299. http://museum.wa.gov.au/sites/default/files/a%20revision%20of%20the%20rainbowfish%20genus%20chilatherina%20(melanotaeniidae).pdf



1. Provide information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Chilatherina* (origin - Chilatherina Greek) cheilos= lip + Greek , atherina, the Greek name for the eperlane
Species: *Anisocentrus (Regan 1914)* *Chilatherina campsi*, Whitley 1957, Highlands Rainbowfish

Chilatherina campsi (Whitley, 1956), Highlands Rainbowfish (Red form)



© Photograph Gary Lange, permission to use photo obtained 11/7/15.

Species Summary

During July 1954, Ellis Le Geyt Troughton and Norman Camps, from the Australian Museum, visited New Guinea and collected a number of freshwater fishes. Among the fish collected was an undescribed rainbowfish species. Gilbert P. Whitley, an ichthyologist at the Australian Museum, described them as *Anisocentrus campsi* in 1956 after one of the collectors, Norman Camps. They were subsequently reassigned to the *Chilatherina* genus where they remain today.

Chilatherina campsi have a body colour of pale bluish-white with a silvery sheen; pale yellow to whitish longitudinal stripes frequently bordering scale rows and a broad blue mid -lateral stripe (most prominent on posterior part of body); fins white, sometimes with yellow suffusion; maximum size around 8–9 cm SL. Males are deeper bodied than females and their overall pattern is more intense, particularly the mid-lateral stripe. In addition the vertical fins of females are mainly translucent in contrast to the whitish fins of males. There were two different colour varieties available in the aquarium hobby, one with red fins, and one with blue fins.

Distribution & Habitat

Chilatherina campsi occurs in the central highlands of Papua New Guinea, hence its common name 'Highland Rainbowfish'. The genus *Chilatherina* is usually only found in the northern areas of New Guinea but *C. campsi* have been found in southern stream habitats. It is the only member of the genus thus far found on both sides of the Central Dividing Range, which has acted as a most effective geographical barrier to the spread of most rainbowfish species northerly or southerly. This species was first collected in 1954 from a tributary of the Jimmi River, situated approximately 420 km from the mouth of the Sepik River via the Yuat River. They have been collected from dispersed localities in the Markham (Oomsis Creek, Wampit River), Ramu, Sepik, and Purari Rivers (Lima River; Pima River; Wahgi River). Most collection sites have been in the northern drainage division, but they have also been collected from highland tributaries of the Purari River that flows southwards into the Gulf of Papua, and from the Oomsis River near Lae.

Within their distribution range *C. campsi* are generally found in mountainous or foothill streams. They are most abundant in the smaller flowing tributaries, shallow bodies of water shaded by rainforest trees where they find shelter among aquatic plants, roots, and fallen branches. Although situated in rainforest habitat the streams are relatively open and exposed to sunlight, which is typical of the type of habitat where *Chilatherina* normally occurs. Depending on the precise location, the water is generally soft, slightly turbid with a temperature range of 21–26° Celsius and *p*H 7.6–7.8. Other rainbowfishes found co-habiting with *Chilatherina campsi* include *Melanotaenia affinis*, *M. pimaensis*, and *G. maculosus*.

Remarks

This species is mainly known from hilly or mountainous terrain between about 200 and 1,525 m elevation, but has been collected from at least one site in lowlands at 80 m in rainforest in the Ramu valley. It is usually found in clear, moderately fast to swift-flowing

streams with rock and gravel or sand bottoms. It can reach a maximum size of about 8.5 cm SL.

The first live specimens to enter the aquarium hobby were collected by Gerald Allen and Brian Parkinson from the Wahgi River (Purari River) near Mt Hagan in 1979. Then in the early 1980's, additional specimens was collected by Barry Crockford a Melbourne aquarist from the Oomsis River near Lae and a small stream on the Highland Highway 105 km northwest of Lae, both foothill tributaries of the Markham River. Heiko Bleher also collected live specimens from a tributary of the middle Ramu River in 1988. These collections formed the founding stock of current aquarium populations. *C. campsi are* available in the hobby today.

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Tappin, Adrian (2005) "Rainbowfishes ~ Their Care & Keeping in Captivity. 2nd. Ed.2011" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Whitley, G.P. 1957. Fishes from inland New Guinea. *Records of the Australian Museum* 24(3): 23-30.

Chilatherina campsi (Whitley, 1956), Highlands Rainbowfish (Blue form)



© Photograph by Neil Armstrong, permission to use photo obtained 2000.

2. **Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). For example, is the species listed on CITES Appendix I, II or III, and if so, are there any specific restrictions on the movement of this species? Include information on the conservation value of the species.**

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Chilatherina” revealed no results for those entities.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 11 species of Chilatherina listed.

Chilatherina alleni **listed as vulnerable**
https://www.iucnredlist.org/species/169522/147680522

Chilatherina axelrodi **listed as endangered**
https://www.iucnredlist.org/species/4628/147680647

Chilatherina bleheri **listed as endangered**
https://www.iucnredlist.org/species/4629/147680677

Chilatherina bulolo **listed as least concern**
https://www.iucnredlist.org/species/4630/147680735

Chilatherina campsi **listed as least concern**
https://www.iucnredlist.org/species/161079348/161079383

Chilatherina crassispinosa **listed as least concern**
https://www.iucnredlist.org/species/161079519/161079697

Chilatherina fasciata **listed as least concern**
https://www.iucnredlist.org/species/161079834/161080091

Chilatherina lorentzii **listed as near threatened**
https://www.iucnredlist.org/species/161080164/161080249

Chilatherina pagwiensis **listed as endangered**
https://www.iucnredlist.org/species/161080305/161080322

Chilatherina pricei **listed as vulnerable**
https://www.iucnredlist.org/species/161080365/161080369

Chilatherina sentaniensis **listed as critically endangered**
https://www.iucnredlist.org/species/4631/147680762

References

The CITES Species website with lists and search facility accessed on 17 April 2021.
URL http://www.cites.org/eng/disc/species.php

The IUCN Red List search facility locate accessed on 17 April 2021.
URL http://www.iucnredlist.org/details/4630/0

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Described from the holotype (Australian Museum regd. No. lB 3337), a specimen 56 mm in standard length or 69 mm (2.7 in) overall. A smaller paratype (lE. 3342), 50 mm in standard length. They were collected from a small creek flowing into the middle Jimmi River (33 miles, 6° E. of N.E. of Mount Hagen airstrip; altitude 1,200 ft). New Guinea; 21 vii, 1954. Collectors. E.Troughton and N. Camps. It is a species with a maximum recorded length of 8-9 cm

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Whitley, G.P. 1957. Fishes from inland New Guinea. *Records of the Australian Museum* 24(3): 23-30.

3.c The natural geographic range.

This species was first collected in 1954 from a tributary of the Jimmi River, situated approximately 420 km from the mouth of the Sepik River via the Yuat River. They have been collected from dispersed localities in the Markham (Oomsis Creek, Wampit River), Ramu,

Sepik, and Purari Rivers (Lima River; Pima River; Wahgi River). Most collection sites have been in the northern drainage division, but they have also been collected from highland tributaries of the Purari River that flows southwards into the Gulf of Papua, and from the Oomsis River near Lae.

References:

Boeseman, M. (1963) Notes on the fishes of western New Guinea 1. Zool. Mededelingen, 38(14); 221-242.

IUCN Redlist. https://www.iucnredlist.org/

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Whitley, G.P. 1957. Fishes from inland New Guinea. *Records of the Australian Museum* 24(3): 23-30.

3.d Habitat.

Chilatherina campsi known from hilly or mountainous terrain between about 200 and 1,525m elevation, but has been collected from at least one site in lowlands at 80m in rainforest in the Ramu valley. It is usually found in clear, moderately fast to swift-flowing streams with rock and gravel or sand bottoms. It can reach a maximum size of about 8.5 cm SL. It occurs in the central highlands of Papua New Guinea, hence its common name 'Highland Rainbowfish'. The genus Chilatherina is usually only found in the northern areas of New Guinea but *Chilatherina campsi* have been found in southern stream habitats. It is the only member of the genus thus far found on both sides of the Central Dividing Range, which has acted as a most effective geographical barrier to the spread of most rainbowfish species northerly or southerly.

This species was first collected in 1954 from a tributary of the Jimmi River, situated approximately 420 km from the mouth of the Sepik River via the Yuat River. They have been collected from dispersed localities in the Markham (Oomsis Creek, Wampit River), Ramu, Sepik, and Purari Rivers (Lima River; Pima River; Wahgi River). Most collection sites have been in the northern drainage division, but they have also been collected from highland tributaries of the Purari River that flows southwards into the Gulf of Papua, and from the Oomsis River near Lae.

Within their distribution range *Chilatherina campsi* are generally found in mountainous or foothill streams. They are most abundant in the smaller flowing tributaries, shallow bodies of water shaded by rainforest trees where they find shelter among aquatic plants, roots, and fallen branches. Although situated in rainforest habitat the streams are relatively open and exposed to sunlight, which is typical of the type of habitat where Chilatherina normally occurs. Depending on the precise location, the water is generally soft, slightly turbid with a temperature range of 21–26° Celsius and pH 7.6–7.8. Other rainbowfishes found co-habiting with *Chilatherina campsi* include *Melanotaenia affinis, M. pimaensis,* and *G. maculosus.*

In most cases Chilatherina are found in either low-lying riverine floodplain or foothill streams to altitudes of about 500m. However, *Chilatherina campsi* frequents streams of the mountainous Central Highlands to about 1500m above sea level.

At least three species (*C. bleheri, C. fasciata, C. sentaniensis*) have lake dwelling populations. In stream habitats *Chilatherina* frequent shallow pools where the flow rate is gentle, however *C. bulolo* is often found in rapid flowing steep gradient creeks. Typically *Chilatherina* prefers sections of the stream or lake-shore which affords maximum exposure to sunlight. (Allen 1991)

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson **IUCN**

Redlist. https://www.iucnredlist.org/species/161079348/161079383

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Whitley, G.P. 1957. Fishes from inland New Guinea. *Records of the Australian Museum* 24(3): 23-30.

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Chilatherina campsi* was not recorded. However, but the diet of other members of the *Chilatherina* genus are well recorded. All rainbowfishes of the family *Melanotaeniidae* are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.f Social behaviour and groupings

Allen (1991) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; "Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will

sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac."

References :

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Fishbase: https://www.fishbase.de/summary/chilatherina-campsi.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Whitley, G.P. 1957. Fishes from inland New Guinea. *Records of the Australian Museum* 24(3): 23-30.

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylised display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as "dither fish" to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried rainbowfish for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Fishbase
https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.i characteristics that may cause harm to humans and other species.

There are no sharp spines, toxins or venom in any member of *the Melanotaeniidae* family.

References:

Fishbase: https://www.fishbase.de/summary/chilatherina-campsi.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4. Provide information on the reproductive biology of the species, including

There are no scientific records of any work done on the reproductive biology of *Chilatherina campsi* Chilatherina *species are* well known in the aquarium trade and have been kept and bred by the authors since 1983 from stock obtained from Melbourne.

C. axelrodi, C. bleheri, C. crassispinosa, C. campsi, C. crassispinosa, C. fasciata and *C. sentaniensis* were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Chilatherina campsi* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b How frequently breeding occurs

The authors could find no record or observation for *Chilatherina campsi* but closely related *Chilatherina* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Crockford, B. 1985. *Chilatherina campsi*. *Fishes of Sahul* **3(2),** 116–118.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Crockford, B. 1985. *Chilatherina campsi*. *Fishes of Sahul* **3(2),** 116–118.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Chilatherina campsi* but closely related *Chilatherina* species will produce about 40 to 80 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Crockford, B. 1985. *Chilatherina campsi*. *Fishes of Sahul* **3(2),** 116–118.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992). There are no naturally occurring *Chilatherina* species in Australia. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species *of Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *G. incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish "aquarium" strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under "pseudo-scientific" names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a "Code of Conduct" that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by the authors.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There is no record of *Chilatherina campsi* being hybridised in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Chilatherina* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between *Melanotaenia praecox* and *G. incisus*, they produced hybrid but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family *Melanotaeniidae* was sufficiently close for them all to hybridise. Author 1 called an expert in the field of rainbowfish for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different rainbowfish *Melanotaenia splendida splendida* has been introduced to a different rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

Reference:

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific Chromosomal Diversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Chilatherina campsi* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6 https://www.fishbase.de/summary/Chilatherina_campsi.html

Froese, R. and D. Pauly. Editors. 2020. FishBase.
www.fishbase.org, version (12/2020). Accessed 17 Apr 2021

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

G. incisus, has been assessed by Patricia Kialola for and on behalf of the Pet Industry Association of Australia. *G. leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005)
https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator; https://www.baphiq.gov.tw/public/Data/910614193571.pdf
, or
http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of *Chilatherina campsi* into the Australian environment should it be released or escape effective human control. Author 1 contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with *Chilatherina campsi* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020.

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Chilatherina campsi is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment score attached as appendix B. There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville, Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

7c. ability to find shelter

Allen & Cross (1982), describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Crockford, B. 1985. *Chilatherina campsi*. *Fishes of Sahul* **3(2),** 116–118.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7d. rate of reproducing

Chilatherina campsi is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Crockford, B. 1985. *Chilatherina campsi*. *Fishes of Sahul* **3(2),** 116–118.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been

here, and popular, for more than 40 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using the copy of Climex for PC, the process attracts a score of 6 for *Chilatherina campsi* indicating the species has a moderate chance of survival in Australian water ways. Attached as appendix B.

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Chilatherina campsi* were to escape, effective control the area where the likelihood of accidental or intentional release is greater.. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging.

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to one of the possible suitable natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons peacefully co-exist in many other habitats in Northern Australia. Within their distribution range *C. campsi* are generally found in mountainous or foothill streams. They are most abundant in the smaller flowing tributaries, shallow bodies of water shaded by rainforest trees where they find shelter among aquatic plants, roots, and fallen branches. Although situated in rainforest habitat the streams are relatively open and exposed to sunlight, which is typical of the type of habitat where *Chilatherina* normally occurs. Depending on the precise location, the water is generally soft, slightly turbid with a temperature range of 21-26° Celsius and pH 7.6-7.8. Other rainbowfishes found co-habiting with *C. campsi* include *M. affinis*, *M. pimaensis*, and *G. maculosus*.

It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats.

Chilatherina have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995,

Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

The IUCN Redlist has assessed *Chilatherina campsi* as Least Concern. This species occurs in the Markham, Ramu, and Sepik river systems of northern Papua New Guinea and has an extent of occurrence (EOO) of over 40,000 km^2. There are localised threats but no major threats to the overall population. This species is mainly known from hilly or mountainous terrain between about 200 and 1,525 m elevation, but has been collected from at least one site in lowlands at 80 m in rainforest in the Ramu valley. It is usually found in clear, moderately fast to swift-flowing streams with rock and gravel or sand bottoms. It can reach a maximum size of about 8.5 cm SL. The Ramu and Markham catchments in which this species occurs have historically been areas of deforestation, although the area may have naturally been largely grassland. More recently, there has been conversion to oil palm plantations in the valley floor, but the hillsides, where this species occurs, are relatively untouched (U. Kolkolo pers. comm. 2019). However, this would still have negatively affected the species by fragmentation of the population. Additionally, logging is still a threat in the Sepik and Purari catchments.

At least three species (*C. bleheri, C. fasciata, C. sentaniensis*) have lake dwelling populations. In stream habitats *Chilatherina* frequent shallow pools where the flow rate is gentle, however *C. bulolo* is often found in rapid flowing steep gradient creeks. Typically *Chilatherina* prefers sections of the stream or lake-shore which affords maximum exposure to sunlight. (Allen 1991)

Allen mentions a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References ;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN Redlist at: https://www.iucnredlist.org/species/161079348/161079383

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Chilatherina campsi* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that *Chilatherina campsi* is similar to other members of the *Chilatherina* genus the behaviour will be similar. Aquarium observations worldwide of *Chilatherina campsi* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

References:

Aqua-fish.net – since 2005 - https://en.aqua-fish.net/fish/

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Chilatherina campsi* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 8-9cm.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Whitley, G.P. (1957). Fishes from inland New Guinea. *Records of the Australian Museum* 24(3): 23-30.

8.c habitat and local environmental conditions

Chilatherina campsi are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Chilatherina* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Chilatherina campsi* (Fishbase records) diseases in other *Chilatherina* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. found at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Chilatherina,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in Northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Hardy-Smith P., Jones R. and Kailola P. (2007) *"Scientific review of the biosecurity risks associated with the importation of rainbowfish for ornamental purposes"*

IUCN, *The IUCN Red List of Threatened Species.* https://www.iucnredlist.org/ (accessed 30-04-2021)

Kahn, S.A., Wilson, P.W., Pereira, R.P., Hayder, H. and Gerrity, S.E. 1999. *Import Risk analysis on live ornamental finfish*. Canberra: Australian Quarantine and Inspection Service. 172 p.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Whitley, G.P. (1957). Fishes from inland New Guinea. *Records of the Australian Museum* 24(3): 23-30.

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *C. axelrodi, C. bleheri, C. campsi and C. fasciata* have been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Chilatherina campsi* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from German breeders and then from commercial facilities to which these captive bred stocks are distributed.

Chilatherina campsi poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp*. (G. incisus,* and *G. leggetti)* currently permitted for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for "fresh" wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and

Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008) [online] Available at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf [Accessed 17 April 2021].

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Chilatherina campsi* will be used in the live fish ornamental aquarium display trade. *Chilatherina campsi is* to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish. Seven of the eleven species of *Chilatherina* have been in Australia prior to 1983, *C. Axelrodi, C, bleheri, C. bulolo, C campsi, C. crassispinosa, C. fasciata, and C. sentaniensis*. Rainbowfish of the genus *Chilatherina* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960's.

If *Chilatherina campsi is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia.

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

References:

Biosecurity Australia. (2009) " **BIOSECURITY AUSTRALIA ADVICE 2009/30 EXTENSION OF POLICY TO INCLUDE THE IMPORTATION OF RED RAINBOWFISH FOR ORNAMENTAL PURPOSES".** Published by the Australian Government, available at: http://www.daff.gov.au/SiteCollectionDocuments/ba/memos/2009/2009-30.pdf Downloaded 17 Jul 2015.

Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11.a the containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings

Reference:

Biosecurity Act 2015 as in force 25 march 2020, Accessed 24 march 2021, available at: https://www.legislation.gov.au/Details/C2020C00127

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Chilatherina* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Chilatherina campsi* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Chilatherina campsi* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Government Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available on the world wide web at: - http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

References :

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Aquagreen Aquarium and Pond Keepers Code of Conduct – available at URL - https://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008) [online] Available at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf [Accessed 17 April 2021].

Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

12. Provide information on all other Commonwealth, state and territory legislative controls on the species

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species , there are no references or instances of *Chilatherina* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Chilatherina campsi* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow *Chilatherina campsi* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows *Chilatherina campsi* is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-freshwater/list-of-noxious-fish , and shows no *Chilatherina* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called “Restricted Matter” comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. *Chilatherina campsi* is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 and can be accessed at:
https://www.daf.qld.gov.au/__data/assets/pdf_file/0008/1398842/prohibited-restricted-invasive-fish.pdf , and there are no *Chilatherina* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Chilatherina campsi* is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at,
http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Chilatherina* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Chilatherina* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. *Chilatherina campsi* is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at
https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish , and shows no *Chilatherina* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic

Species List on their web site. *Chilatherina campsi* does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *chilatherina* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp (*Cyprinus carpio*) mosquito fish (*Gambusia* spp.) Didymo a freshwater algae (*Didymosphenia geminata*) and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *chilatherina* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is 'reckless' about whether the animal is a prohibited animal and is also 'reckless' about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at

https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-Animals-Declaration-ACCESS-3.pdf . There are no *Chilatherina* species listed.

Bibliography and relevant reading:

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Agriculture Department
http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Allen, G.R. 1979. *Chilatherina axelrodi*, a new species of rainbowfish (Melanotaeniidae) from Papua New Guinea. *Tropical Fish Hobbyist* 28(5): 48-49, 52-55.

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

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Allen, G.R. (1981): Sepik magic. Tropical Fish Hobbyist 39 (8), 19-33.

Allen, G.R. 1983. *Chilatherina bulolo*, a valid species of rainbowfish (Melanotaeniidae) from northern New Guinea. *Fishes of Sahul, Journal of the Australia New Guinea Fishes Association* 1(2): 13-17

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Allen, G.R. (1991) Field Guide to the Freshwater Fishes of New Guinea. Publication No. 9 of the Christensen Research Institute. ISBN 9980-85-304-2

Allen, G.R., (1995) Rainbowfishes In Nature and in the Aquarium, Their identification, care and breeding. Tetra-Verlag Germany. ISBN 1-56465-149-5

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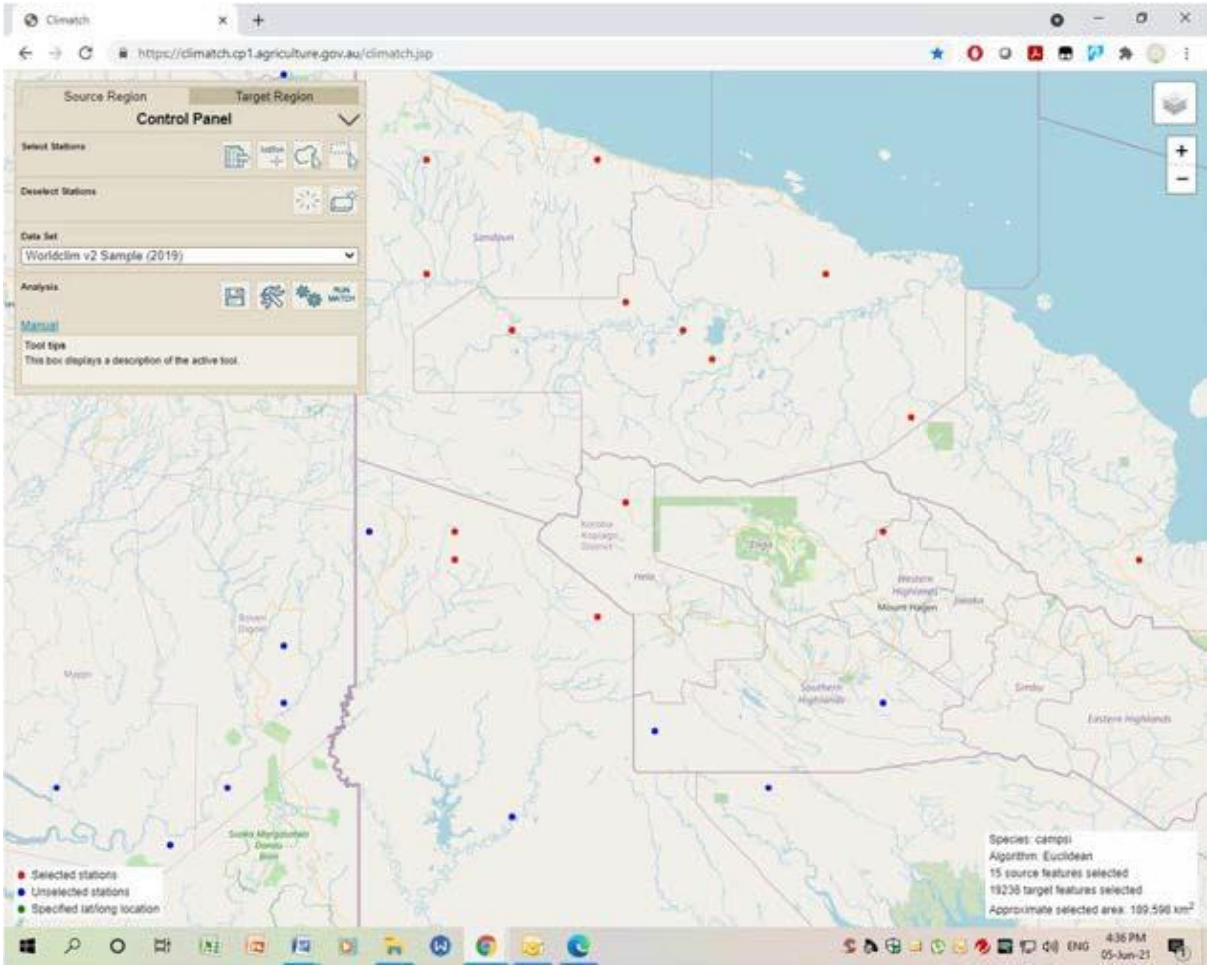
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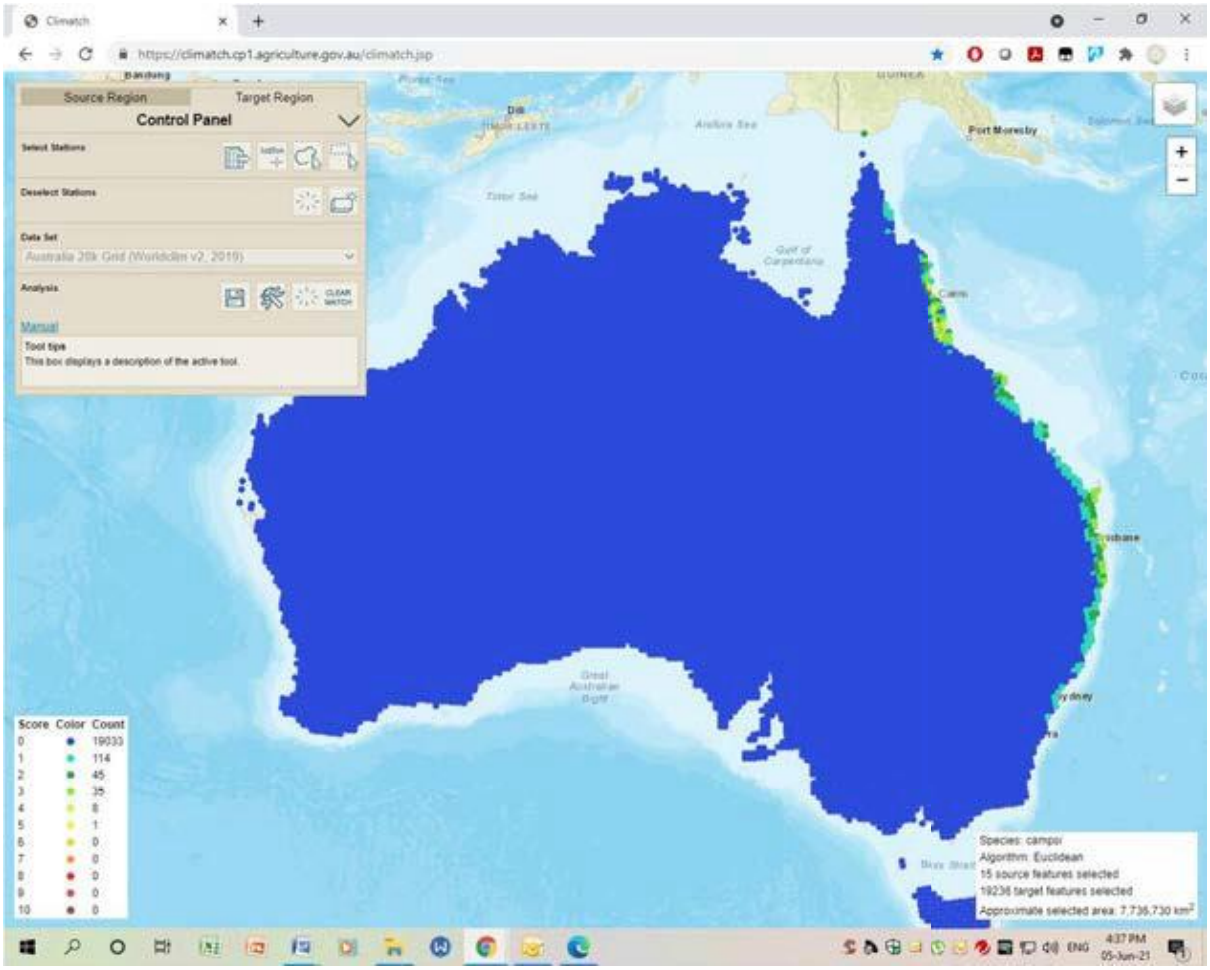
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APPENDIX A – calculation of climate from *Chilatherina campsi* distribution climate to Australian Climate.





Appendix B

Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were done to provide a score against the provisions in the assessment process.(accessed 6th June 2021.)

BOMFORD ASSESSMENT

SPECIES: Chilatherina campsi

Score A. Climate Match (0-8)

Number of squares within 60% of the mean: (No. 5)	1
Number of squares within 50% of the mean: (No. 6)	0
Number of squares within 40% of the mean: (No. 7)	0
Number of squares within 30% of the mean: (No. 8)	0
Number of squares within 20% of the mean: (No. 9)	0
Number of squares within 10% of the mean: (No. 10)	0

Total = 1
Score: 2 (Ref: fishbase.org, PC CLIMATE)

Score B, Overseas Range

Number of 1° x 1° grids in which species occurs overseas.
No. of squares : 15
Score: 2 (Ref: fishbase.org, googleearth.com)

Score C, Establishment

Locations of establishment incidence: nil - never introduced
Score: 1 (Ref: fishbase.org)

Score D, Introduction Success

Percentage of Introduction events that have been successful
Introductions nil
Successful: nil
Score: 1 (Ref: fishbase.org)

Score E, Taxa risk

Genus: Chilatherina
Introductions: 0
Successful: 0
Score: 0 (Ref: fishbase.org / M. Bomford)

Family: Melanotaeniidae (Rainbowfishes)
Introductions: 5
Successful: 0 unknown
Score: 0 (Ref: fishbase.org / M. Bomford)

Total: 6 (moderate)

The score of 5 according to the assessment model gives the fish a moderate chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

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Chilatherina fasciata - Lake Wanam



© Photograph Neil Armstrong. Permission to use photo obtained 2000.

Introduction.

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that the Barred Rainbowfish *Chilatherina fasciata* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented for the prosecution in the witness box by the author of this report, however the accused offender pleaded guilty.

Disease
Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species
Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat
Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species
Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

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Typical Chilatherina Habitat. © Michael Wagner permission granted (2019)

Terms of Reference

Overview: The rainbowfish genus *Chilatherina* consists of eleven species.

etymology: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Glossolepis* are:

Chilatherina is closely related to Melanotaenia, the largest genus in the family. They differ chiefly with regard to jaw structure. In Chilatherina the lateral portion of the premaxillary is either straight or curved gently in a postero-ventral direction. The lower jaw is generally inferior to the upper jaw and the medial portion of the upper lip is swollen and profusely covered with teeth (Fig. 3). In addition, the head tends to be more slender and the snout relatively pointed compared with Melanotaenia. The latter genus by contrast, has a more or less abrupt downward bend in the lateral portion of the premaxillary with less swelling of the medial upper lip and fewer teeth on its surface. Moreover, the jaws are usually about even or the upper jaw is slightly inferior (Le. lower jaw protruding). The external jaw features of Chilatherina and Melanotaenia were illustrated by Allen (1980a).

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299. http://museum.wa.gov.au/sites/default/files/A%20revision%20of%20the%20rainbowfish%20genus%20chilatherina%20(melanotaeniidae).pdf



Chilatherina fasciata - kali biru © Gary Lange

1. Provide information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Chilatherina* (origin - Chilatherina Greek) cheilos= lip + Greek, atherina, the Greek name for the eperlane
Species: *Rhombatractus fasciatus,* Weber, 1913
Chilatherina fasciata Regan, 1914, Barred rainbowfish



© Photograph Gary Lange *Chilatherina fasciata* (Lake Sentani)

Species Summary

The IUCN records the species as widespread across northern New Guinea. There are no major threats. Therefore, it is assessed at Least Concern. As with many rainbowfishes, *Chilatherina fasciata* often display a great variation in body colour and markings depending on location. Throughout New Guinea there are effective natural barriers that isolated various populations, thus contributing to the number of different colour variations. Generally *Chilatherina fasciata* has a body colour of brown to bluish-green on the upper half, white to yellowish on the lower half with a diffuse dark mid-lateral stripe. Scales of this region often bordered with pale yellow.

Males usually have several diffuse blackish bars on the lower sides, above the front half of the anal-fin base; fins dusky grey to yellowish. Males are generally deeper bodied than females, this feature becoming more obvious with increased growth. In addition, the posterior profile of the dorsal and anal fins is more pointed and elongated in males. In contrast to males, which have longer posterior dorsal rays, females have the longest rays at the anterior part of the fin. Finally, mature males are more colourful than females often exhibiting reddish or yellowish dorsal and anal fins. While spawning the males colour becomes very intense and the top of the head radiates a brilliant bronze to vermilion hue. Females are basically silver to olive overall with clear fins. Perhaps the most distinguishing feature of *Chilatherina fasciata* is their deep, laterally compressed body that increases with age, particularly in males.

Munro (1964) considered *Chilatherina fasciata* to be a junior synonym of *C. lorentzii*, but comparison of the respective types at the Zoological Museum of Amsterdam by Gerald Allen revealed important differences between these species. *Chilatherina fasciata* is a much more slender fish; males seldom exceed a maximum depth of 35% of the SL compared with frequent values exceeding this figure and sometimes over 40% in *C. lorentzii*. The caudal peduncle depth also reflects this difference with most specimens of *Chilatherina fasciata* under 11.3% whereas the values in *C. lorentzii* ranged from 11.3– 13.6% SL. Counts for the anal rays and preoperclesuborbital scales are also useful for separating these species, although there is some overlap in the ranges. Additionally, the upper jaw of *C. lorentzii* is longer and reaches the level of the anterior edge of the eye, whereas that of *Chilatherina fasciata* fails to reach eye level.

Chilatherina fasciata are relatively small fishes, males may reach a maximum size of 12 cm, but females are usually less than 10 cm. Sexual maturity occurs in most species at a relatively small size, usually about 3.5–4.0 cm SL in females and 4.5–5.5 cm SL in males (Allen, 1981). Diet includes filamentous algae, small crustaceans, terrestrial insects (particularly ants and tiny beetles), and aquatic insect larvae.

Distribution & Habitat

Chilatherina fasciata are restricted primarily to northern New Guinea and are probably one of the most abundant and widely distributed rainbowfishes in northern New Guinea. The type-locality is the mouth of the Sermowai River. However, they have been found in tributaries of the Markham, Ramu, Sepik, Pual and Mamberamo River systems of northern New Guinea. They have also been collected from Lake Wanam, near Lae in Papua New Guinea. In

February 2008 a survey by Conservation International and the Papuan State University (UNIPA) found them in tributary streams near Haya Village (02º48.951'S and 138º05.903'E), in the Rouffaer River system (Mamberamo).

Chilatherina fasciata have been collected mainly in clear, slow-flowing rainforest streams, generally inhabiting deeper pools that are exposed to sunlight for most of the day. These streams usually have a substrate consisting mainly of gravel or sand and littered with leaves and other debris. The natural pH and temperature ranges have been reported as 6.2–8.1 and 27–32° Celsius. Typically these fishes prefer sections of the stream which afford maximum exposure to sunlight. The substratum generally consists of gravel or sand, frequently littered with leaves or log debris.

Remarks

Pieter Nicolaas van Kampen first collected Chilatherina fasciata in June 1910 in a stream near Njao, West Papua. Live specimens were collected for the aquarium hobby by Barry Crockford and Gerald Allen during several trips to Papua New Guinea in the late 1970's and early 1980's. Around 1983, live specimens were also collected from the Jafuri River, an outlet of Lake Sentani which flows into the Pacific Ocean near the Papua New Guinea border.

In 1981, Barry Crockford and Neil Travis collected specimens (Clearwater Creek) from a tributary of the Markham River, approximately 60 km east of Lae, PNG. The creek had a water depth of about 50 cm. The water conditions reported were pH 7.5, hardness 90 ppm and temperature 24°C. The creek was slow-flowing with a very muddy substrate and vegetation lining the shore. In 1991, another live collection was made by Gilbert Maebe from the Jafuri River and taken back to Europe.

Males of this variety have an upper body colour of brilliant bronze while the lower half shows a silvery-white colouration with a diffuse dark mid-lateral stripe. The lower half of the body has several diffused brownish-black vertical bars. These sometimes change to the same colour as the mid-lateral stripe. During spawning, the lower half of the males' body deepens to a golden-yellow colour (as shown in the accompanying photo) and the dorsal region deepens to a burnished copper colour, while the darker body markings intensify to near black. The first two rays of the first dorsal and first ray of the second dorsal change from their normal orange colour to a brilliant vermilion.

The nape region from the dorsal fin to the tip of the nose becomes a flashing reddish-bronze colour. The colour in the lower part of the iris develops a beautiful blue-violet opalescence ringed by orange-gold. This rich gold is also brilliant on the central area of the gill plate. During spawning the central section of the caudal fin is much lighter than the blue of the outer lobes. The scales on the sides of the fish above the lateral line show some subtle violet hues in the mid-scale region.

The female is much more slender than the male. It is silvery in colour, with shorter and more rounded finnage. The female has a violet-blue reflective colour in the mid-lateral region. The base colour above the lateral line is a dull olivegreen with dark scale outlines. A dark continuous stripe runs back from the eye into the peduncle at the lateral line. The peduncle

is very slim and shows only a narrow edge of olive above and below the dark line. The lower part of the chest is a dull yellow with a strong sprinkling of black speckles from the lower jaw back to the ventrals. The fins are all a dull olive-yellow which fade to white toward the edges. The gill cover has a strong orange-copper toning rather deeper in hue than the colour of the iris. Several rather indistinct vertical bars occur on the lower sides of the female.

Heiko Bleher has collected live specimens for the aquarium trade from various locations in New Guinea. There have also been a number of collections by individual aquarists from other various locations and these are frequently available in the hobby.

Gerald Allen (1981) noted that Chilatherina fasciata are sometimes hermaphroditic; that is both male and female reproductive organs are present in the same individual. This is the only known species of melanotaeniid in which hermaphroditism occurs (at least in some individuals). Both male and female gonads were found in 12 specimens, 44–82 mm SL. The smallest female examined with ripe eggs was 35 mm SL.

References:

Froese, R. and D. Pauly. Editors. 2021.FishBase. www.fishbase.org, (02/2021)

IUCN Redlist. https://www.iucnredlist.org/

Tappin, Adrian (2005) “Rainbowfishes ~ Their Care & Keeping in Captivity. 2nd Ed. - 2011” at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Weber, M. 1913. Süsswasserfische aus Niederländisch Süd- und Nord-Neu-Guinea. *Nova Guinea. Résultats de l'expédition scientifique Néerlandaise à la Nouvelle-Guinée. Zoologie. Leiden* 9(4): 513-613.



male barred rainbowfish, showing nape flaring

2. **Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). For example, is the species listed on CITES Appendix I, II or III, and if so, are there any specific restrictions on the movement of this species? Include information on the conservation value of the species.**

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Chilatherina” revealed no results for those entities.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 11 species of Chilatherina listed.

Chilatherina alleni **listed as vulnerable**
https://www.iucnredlist.org/species/169522/147680522

Chilatherina axelrodi **listed as endangered**
https://www.iucnredlist.org/species/4628/147680647

Chilatherina bleheri **listed as endangered**
https://www.iucnredlist.org/species/4629/147680677

Chilatherina bulolo **listed as least concern**
https://www.iucnredlist.org/species/4630/147680735

Chilatherina campsi **listed as least concern**
https://www.iucnredlist.org/species/161079348/161079383

Chilatherina crassispinosa **listed as least concern**
https://www.iucnredlist.org/species/161079519/161079697

Chilatherina fasciata **listed as least concern**
https://www.iucnredlist.org/species/161079834/161080091

Chilatherina lorentzii **listed as near threatened**
https://www.iucnredlist.org/species/161080164/161080249

Chilatherina pagwiensis **listed as endangered**
https://www.iucnredlist.org/species/161080305/161080322

Chilatherina pricei **listed as vulnerable**
https://www.iucnredlist.org/species/161080365/161080369

Chilatherina sentaniensis **listed as critically endangered**
https://www.iucnredlist.org/species/4631/147680762

References:

The CITES Species website with lists and search facility accessed on 17 April 2021.
URL http://www.cites.org/eng/disc/species.php

The IUCN Red List search facility locate accessed on 17 April 2021.
URL http://www.iucnredlist.org/details/4630/0

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Beaufortia records identify the following data:

Rhombatractus fasciatus WEBER, 1913, Nova Guinea, Lecto-holotype: 108 mm standard length (largest, and first mentioned specimen), type-locality: mouth of Sermowai river, north N. Guinea. Collector: K. GJELLERUP, May 15, 1911.

Lecto-paratypes: 3 ex, ZMA 103097, Buarin, side branch of upper Sermowai river near Walckenaer bend. Collector: K. GJELLERUP, April 26, 1911.

Lecto-paratype: 1 ex, ZMA 103101, side-branch of Kaiserin Augusta river, opposite the central camp. Collector: K. GJELLERUP, October 7, 1910.

Lecto-paratypes: 2 ex, ZMA 103100, river at Njao, north N. Guinea. Collector: Dr. P. N. VAN KAMPEN, June 15, 1910.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Beaufortia SERIES OF MISCELLANEOUS PUBLICATIONS ZOOLOGICAL MUSEUM - AMSTERDAM No. 87 Volume 7 January 15, 1960 A list of type specimens of fishes in the Zoological Museum, University of Amsterdam. 1. Order Mugiliformes by J.J. Hoedeman (Zoological Museum, Amsterdam)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.c The natural geographic range.

This species is widespread in northern New Guinea including the Markham, Gogol, Ramu and Sepik river systems in Papua New Guinea and the Mamberamo river system in Indonesia. *Chilatherina fasciata* are restricted primarily to northern New Guinea and are probably one of the most abundant and widely distributed rainbowfishes in northern New Guinea. The type-locality is the mouth of the Sermowai River. However, they have been found in tributaries of the Markham, Ramu, Sepik, Pual and Mamberamo River systems of northern New Guinea. They have also been collected from Lake Wanam, near Lae in Papua New Guinea. In February 2008 a survey by Conservation International and the Papuan State University (UNIPA) found them in tributary streams near Haya Village (02º48.951'S and 138º05.903'E), in the Rouffaer River system (Mamberamo).

Pieter Nicolaas van Kampen first collected Chilatherina fasciata in June 1910 in a stream near Njao, West Papua. Live specimens were collected for the aquarium hobby by Barry Crockford and Gerald Allen during several trips to Papua New Guinea in the late 1970's and early 1980's. Around 1983, live specimens were also collected from the Jafuri River, an outlet of Lake Sentani which flows into the Pacific Ocean near the Papua New Guinea border.

In 1981, Barry Crockford and Neil Travis collected specimens (Clearwater Creek) from a tributary of the Markham River, approximately 60 km east of Lae, PNG. The creek had a water depth of about 50 cm. The water conditions reported were pH 7.5, hardness 90 ppm and temperature 24°C. The creek was slow-flowing with a very muddy substrate and vegetation lining the shore. In 1991, another live collection was made by Gilbert Maebe from the Jafuri River and taken back to Europe.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

IUCN Redlist. https://www.iucnredlist.org/species/161079834/161080091

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.d Habitat.

This species usually occurs in clear rainforest streams, but it is also found in lakes such as Lake Wanam near Lae, Papua New Guinea. Its habitat includes both lowland tributaries of major rivers and mountain tributaries to an elevation of about 500 m. It congregates in

deeper pools, often around log debris or among aquatic vegetation, and can reach a maximum size of about 11 cm SL

Chilatherina fasciata have been collected mainly in clear, slow-flowing rainforest streams, generally inhabiting deeper pools that are exposed to sunlight for most of the day. These streams usually have a substrate consisting mainly of gravel or sand and littered with leaves and other debris. The natural pH and temperature ranges have been reported as 6.2–8.1 and 27–32° Celsius. Typically these fishes prefer sections of the stream which afford maximum exposure to sunlight. The substratum generally consists of gravel or sand, frequently littered with leaves or log debris. At least three species (*C. bleheri, C. fasciata, C. sentaniensis*) have lake dwelling populations. In stream habitats *Chilatherina* frequent shallow pools where the flow rate is gentle. Typically *Chilatherina* prefers sections of the stream or lake-shore which affords maximum exposure to sunlight. (Allen 1991)

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

IUCN Redlist. https://www.iucnredlist.org/species/161079834/161080091

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Weber, M. 1913. Süsswasserfische aus Niederländisch Süd- und Nord-Neu-Guinea. *Nova Guinea. Résultats de l'expédition scientifique Néerlandaise à la Nouvelle-Guinée. Zoologie. Leiden* 9(4): 513-613.

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Chilatherina fasciata* was not recorded. The diet of other members of the *Chilatherina* genus are well recorded. All rainbowfishes of the family *Melanotaeniidae* are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Weber, M. 1913. Süsswasserfische aus Niederländisch Süd- und Nord-Neu-Guinea. *Nova Guinea. Résultats de l'expédition scientifique Néerlandaise à la Nouvelle-Guinée. Zoologie. Leiden* 9(4): 513-613.



3.f Social behaviour and groupings

Chilatherina fasciata are very abundant in small pools of their habitat. They were not schooling but in loose aggregations swimming at all levels in water up to 70cm deep. Allen (1991) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; "Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac."

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Fishbase: https://www.fishbase.de/summary/chilatherina-fasciata.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Weber, M. 1913. Süsswasserfische aus Niederländisch Süd- und Nord-Neu-Guinea. *Nova Guinea. Résultats de l'expédition scientifique Néerlandaise à la Nouvelle-Guinée. Zoologie. Leiden* 9(4): 513-613.**Fishbase:** https://www.fishbase.de/summary/chilatherina-fasciata.html

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylised display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as "dither fish" to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried rainbowfish for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Fishbase:

https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.i characteristics that may cause harm to humans and other species.

There are no sharp spines, toxins or venom in any member of *the Melanotaeniidae* family.

References:

Fishbase: https://www.fishbase.de/summary/chilatherina-fasciata.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4. Provide information on the reproductive biology of the species, including

Allen and Coates(1990), record that sexual maturity occurs at about 35-40mm SL in females, and 45-55mm SL in males. Hatching time for eggs in about 15 days at 22º-24 º . The young develop rapidly and sexual maturity is attained before the end of their first year. Chilatherina *species are* well known in the aquarium trade and have been kept and bred by the authors since 1983 from stock obtained from Melbourne.

C. axelrodi, C. bleheri, C. bulolo, C. crassispinosa, C. campsi, C. fasciata, and *C. sentaniensis* were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Allen, G.R., and Coates, D. (1990) An Ichthyological survey of the Sepik River, Papua New Guinea. Records of the Western Australian Museum Supplement No. 34 (1990) Studies on Freshwater Fishes of New Guinea and Northern Australia. Western Australian Museum

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Chilatherina fasciata* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b How frequently breeding occurs

The authors could find no record or observation for *Chilatherina fasciata* but closely related *Chilatherina* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Bowman, R. 1984. *Chilatherina fasciata* (Clearwater Creek) – some colour observations. *Fishes of Sahul* **2(1),** 57

Crockford, B. 2001. Lake Wanam fasciata *Chilatherina fasciata, wanamensis*, a subspecies in trouble. *Fishes of Sahul* **15(3),** 776–779.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Crockford, B. 2001. Lake Wanam fasciata *Chilatherina fasciata, wanamensis*, a subspecies in trouble. *Fishes of Sahul* **15(3),** 776–779

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Chilatherina fasciata* but closely related *Chilatherina* species will produce about 40 to 80 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Crockford, B. 2001. Lake Wanam fasciata *Chilatherina fasciata, wanamensis*, a subspecies in trouble. *Fishes of Sahul* **15(3),** 776–779

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992). There are no naturally occurring *Chilatherina* species in Australia. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species *of Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *G. incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish "aquarium" strains of hybrids between various *Melanotaenia* species and none of

these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under “pseudo-scientific” names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a “Code of Conduct” that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by the authors.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

ANGFA “Code of Conduct”
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) “*Rainbowfishes, their care and keeping in captivity*” available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There is no record of *Chilatherina fasciata* being hybridised in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Chilatherina* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between *M. praecox* and *G. incisus*, they produced hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family *Melanotaeniidae* was sufficiently close for them all to hybridise. Author 1 called an expert in the field of rainbowfish for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different rainbowfish *Melanotaenia splendida splendida* has been

introduced to a different rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

References:

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific Chromosomal Diversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Chilatherina fasciata* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6. https://www.fishbase.de/summary/Chilatherina_fasciata.html

Froese, R. and D. Pauly. Editors. 2020. FishBase.
www.fishbase.org, version (12/2020). Accessed 17 Apr 2021

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

G. incisus, has been assessed by Patricia Kialola for and on behalf of the Pet Industry Association of Australia. *G. leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005)
https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator; https://www.baphiq.gov.tw/public/Data/910614193571.pdf , or http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of *Chilatherina fasciata* into the Australian environment should it be released or escape effective human control. Author 1 contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with *Chilatherina fasciata* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020.

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Chilatherina fasciata is a forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment score attached as appendix B. There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville,

Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

7c. ability to find shelter

Allen & Cross (1982), describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Bowman, R. 1984. *Chilatherina fasciata* (Clearwater Creek) – some colour observations. *Fishes of Sahul* **2(1),** 57

Crockford, B. 2001. Lake Wanam fasciata *Chilatherina fasciata, wanamensis*, a subspecies in trouble. *Fishes of Sahul* **15(3),** 776–779.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7d. rate of reproducing

Chilatherina fasciata is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Crockford, B. 2001. Lake Wanam fasciata *Chilatherina fasciata, wanamensis*, a subspecies in trouble. *Fishes of Sahul* **15(3),** 776–779.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been here, and popular, for more than 40 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004. Using the provisions in "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using the copy of Climex for PC, the process attracts a score of 8 for *Chilatherina fasciata* indicating the species has a moderate chance of survival in Australian water ways. Attached as appendix B.

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Chilatherina fasciata* were to escape, effective control the area where the likelihood of accidental or intentional release is greater. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging.

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to one of the possible suitable natural habitats (e.g. Lake Argyle in

W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons peacefully co-exist in many other habitats in Northern Australia.

It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats.

Chilatherina have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

This species usually occurs in clear rainforest streams, but it is also found in lakes such as Lake Wanam near Lae, Papua New Guinea. Its habitat includes both lowland tributaries of major rivers and mountain tributaries to an elevation of about 500 m. It congregates in deeper pools, often around log debris or among aquatic vegetation, and can reach a maximum size of about 11 cm SL

Chilatherina fasciata have been collected mainly in clear, slow-flowing rainforest streams, generally inhabiting deeper pools that are exposed to sunlight for most of the day. These streams usually have a substrate consisting mainly of gravel or sand and littered with leaves and other debris. The natural pH and temperature ranges have been reported as 6.2–8.1 and 27–32° Celsius. Typically these fishes prefer sections of the stream which afford maximum exposure to sunlight. The substratum generally consists of gravel or sand, frequently littered with leaves or log debris.

The IUCN list this species as widespread across northern New Guinea. There are no major threats. Therefore, it is assessed at Least Concern.

At least three species (*C. bleheri, C. fasciata, C. sentaniensis*) have lake dwelling populations. In stream habitats *Chilatherina* frequent shallow pools where the flow rate is gentle, however *C. bulolo* is often found in rapid flowing steep gradient creeks. Typically *Chilatherina* prefers sections of the stream or lake-shore which affords maximum exposure to sunlight. (Allen 1991)

Allen mentions a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References ;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Chilatherina fasciata* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Chilatherina fasciata* is similar to other members of the *Chilatherina* genus the behaviour will be similar. Aquarium observations worldwide of *Chilatherina fasciata* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

References:

Aqua-fish.net – since 2005 - https://en.aqua-fish.net/fish/

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Chilatherina fasciata* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 120mm (Weber 1907)

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Weber, M. 1907. Süsswasserfische von Neu-Guinea. Ein Beitrag zur Frage nach dem früheren Zusammenhang von Neu-Guinea und Australien. In: Wichmann, A. (ed.), *Nova Guinea. Résultats de l'expédition scientifique Néerlandaise à la Nouvelle-Guinée en 1903*, pp. 201-267, plates 11-13. E. J. Brill, Leiden, Netherlands

8.c habitat and local environmental conditions

Chilatherina fasciata congregates in deeper pools, often around log debris or among aquatic vegetation, and can reach a maximum size of about 11 cm SL. They are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Chilatherina* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Chilatherina fasciata*(Fishbase records diseases in other *Chilatherina* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. found at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Chilatherina,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in Northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Hardy-Smith P., Jones R. and Kailola P. (2007) *"Scientific review of the biosecurity risks associated with the importation of rainbowfish for ornamental purposes"*
Biosecurity Australia by Panaquatic® Health Solutions Pty Ltd

IUCN, *The IUCN Red List of Threatened Species.* https://www.iucnredlist.org/ (accessed 30-04-2021)

Kahn, S.A., Wilson, P.W., Pereira, R.P., Hayder, H. and Gerrity, S.E. 1999. *Import Risk analysis on live ornamental finfish*. Canberra: Australian Quarantine and Inspection Service. 172 p.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *C. axelrodi, C. bleheri, C. campsi and C. fasciata* have been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Chilatherina fasciata* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from German breeders and then from commercial facilities to which these captive bred stocks are distributed.

Chilatherina fasciata poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp*. (G. incisus,* and *G. leggetti)* currently permitted for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10

millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for “fresh” wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008) [online] Available at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf [Accessed 17 April 2021].

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Chilatherina fasciata* will be used in the live fish ornamental aquarium display trade. *Chilatherina fasciata is* to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish. Seven, of the eleven species of *Chilatherina* have been in Australia prior to 1983, *C. axelrodi, C, bleheri, C. bulolo, C campsi, C. crassispinosa, C. fasciata, and C. sentaniensis*. Rainbowfish of the genus *Chilatherina* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960’s.

If *Chilatherina fasciata is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

References:

Biosecurity Australia. (2009) “ **BIOSECURITY AUSTRALIA ADVICE 2009/30 EXTENSION OF POLICY TO INCLUDE THE IMPORTATION OF RED RAINBOWFISH FOR ORNAMENTAL PURPOSES”.** Published by the Australian Government, available at: http://www.daff.gov.au/SiteCollectionDocuments/ba/memos/2009/2009-30.pdf Downloaded 17 Jul 2015.

Tappin, Adrian. (2005) “*Rainbowfishes ~ Their Care & Keeping in Captivity*

Second Edition - 2011" available at:
http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

Reference:

Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011"* available on at:
http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11.a the containment, management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

Reference:

Biosecurity Act 2015 as in force 25 march 2020, Accessed 24 march 2021, available at: https://www.legislation.gov.au/Details/C2020C00127

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Chilatherina* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Chilatherina fasciata* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Chilatherina fasciata* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Government Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available on the world wide web at: http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

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12. Provide information on all other Commonwealth, state and territory legislative controls on the species.

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species , there are no references or instances of *Chilatherina* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Chilatherina fasciata* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is

available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade

will not allow *Chilatherina fasciata* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows *Chilatherina fasciata* is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-freshwater/list-of-noxious-fish , and shows no *Chilatherina* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called “Restricted Matter” comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. *Chilatherina fasciata* is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 and can be accessed at:
https://www.daf.qld.gov.au/__data/assets/pdf_file/0008/1398842/prohibited-restricted-invasive-fish.pdf , and there are no *Chilatherina* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Chilatherina fasciata* is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at, http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Chilatherina* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Chilatherina* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. *Chilatherina fasciata* is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish , and shows no *Chilatherina* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. *Chilatherina fasciata* does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at: https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *chilatherina* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp **(*Cyprinus carpio*)** mosquito fish **(*Gambusia* spp.)** Didymo a freshwater algae **(*Didymosphenia geminata*)** and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *chilatherina* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is 'reckless' about whether the animal is a prohibited animal and is also 'reckless' about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at:

https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-Animals-Declaration-ACCESS-3.pdf . There are no *Chilatherina* species listed.

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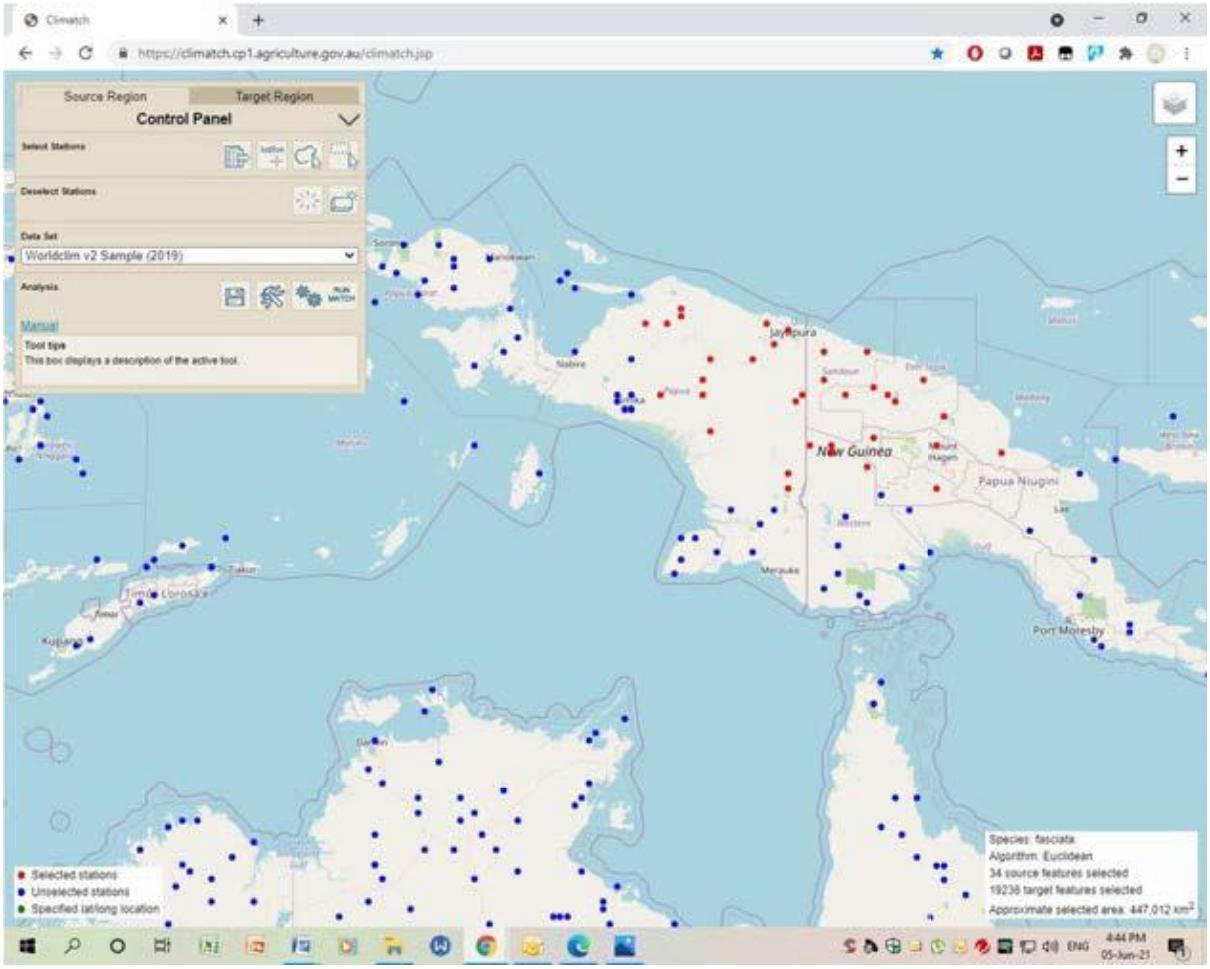
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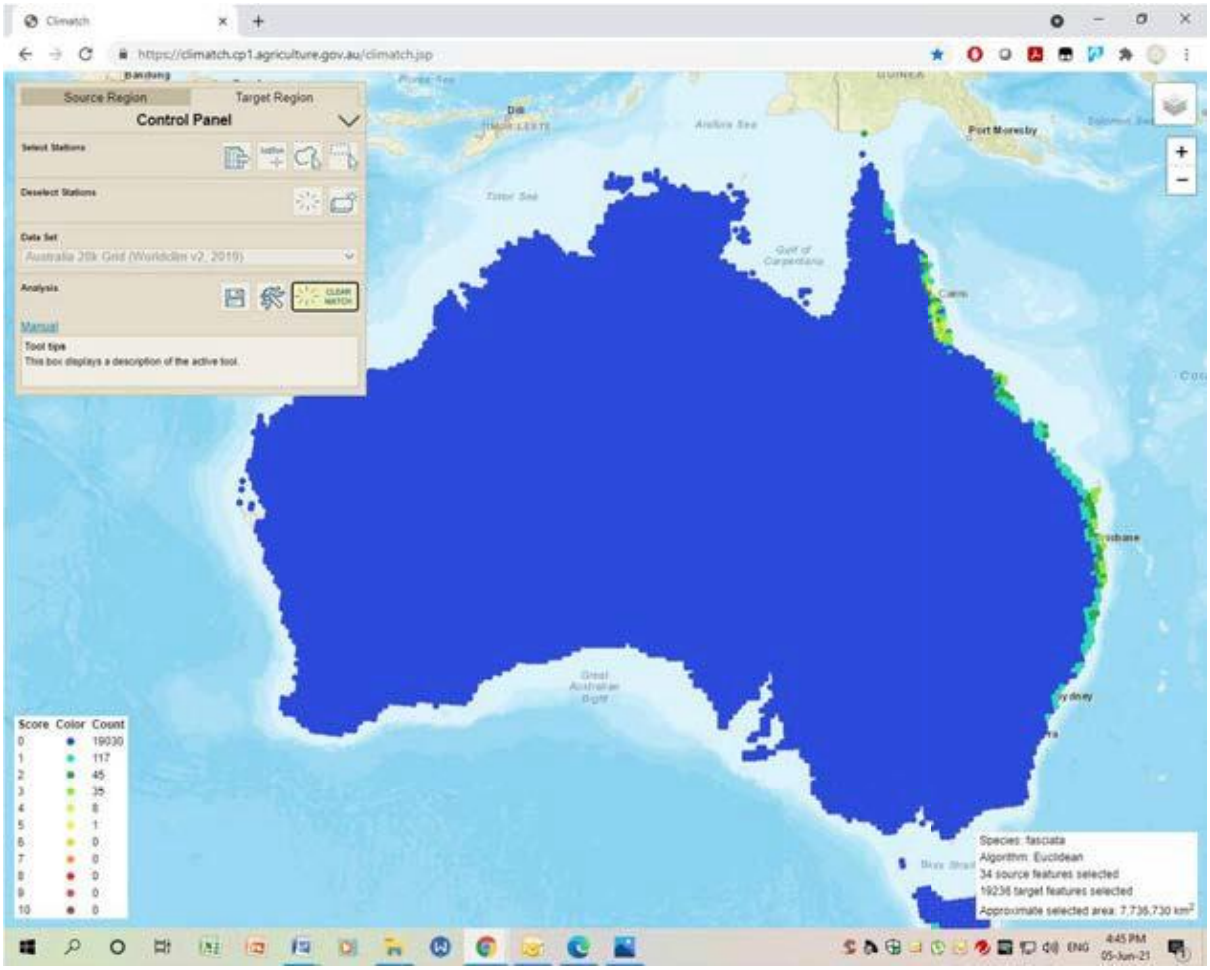
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APPENDIX A – calculation of climate from *Chilatherina fasciata* distribution climate to Australian Climate.





Appendix B

Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were done to provide a score against the provisions in the assessment process.(accessed 6th June 2021.)

BOMFORD ASSESSMENT

SPECIES: Chilatherina fasciata

Score A. Climate Match (0-8)

Number of squares within 60% of the mean: (No. 5)	1
Number of squares within 50% of the mean: (No. 6)	0
Number of squares within 40% of the mean: (No. 7)	0
Number of squares within 30% of the mean: (No. 8)	0
Number of squares within 20% of the mean: (No. 9)	0
Number of squares within 10% of the mean: (No. 10)	0

Total = 1
Score: 2 (Ref: fishbase.org, PC CLIMATE)

Score B, Overseas Range

Number of 1° x 1° grids in which species occurs overseas.
No. of squares : 36
Score: 4 (Ref: fishbase.org, googleearth.com)

Score C, Establishment

Locations of establishment incidence: nil - never introduced
Score: 1 (Ref: fishbase.org)

Score D, Introduction Success

Percentage of Introduction events that have been successful
Introductions nil
Successful: nil
Score: 1 (Ref: fishbase.org)

Score E, Taxa risk

Genus: Chilatherina
Introductions: 0
Successful: 0
Score: 0 (Ref: fishbase.org / M. Bomford)

Family: Melanotaeniidae (Rainbowfishes)
Introductions: 5
Successful: 0 unknown
Score: 0 (Ref: fishbase.org / M. Bomford)

Total: 8 (MODERATE)

The score of 8 according to the assessment model gives the species a moderate chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

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A report to address the “Terms of Reference” for an application to include *Chilatherina lorentz ii*onto the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.

Chilatherina lorentz ii (Weber, 1908), Lorentz's Rainbowfish



© Photographed by Gerald Allen, Permission to use photo obtained 9th July 2015.

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that Lorentz's Rainbowfish *Chilatherina lorentzii* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented for the prosecution in the witness box by the author of this report, however the accused offender pleaded guilty.

Disease

Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species

Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat

Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species

Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes

Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

References

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Terms of Reference

Overview: The rainbowfish genus *Chilatherina* consists of eleven species.

etymology: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Glossolepis* are:

Chilatherina is closely related to Melanotaenia, the largest genus in the family. They differ chiefly with regard to jaw structure. In Chilatherina the lateral portion of the premaxillary is either straight or curved gently in a postero-ventral direction. The lower jaw is generally inferior to the upper jaw and the medial portion of the upper lip is swollen and profusely covered with teeth. In addition, the head tends to be more slender and the snout relatively pointed compared with Melanotaenia. The latter genus by contrast, has a more or less abrupt downward bend in the lateral portion of the premaxillary with less swelling of the medial upper lip and fewer teeth on its surface. Moreover, the jaws are usually about even or the upper jaw is slightly inferior (Le. lower jaw protruding). The external jaw features of Chilatherina and Melanotaenia were illustrated by Allen (1980a).

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299: http://museum.wa.gov.au/sites/default/files/A%20revision%20of%20the%20rainbowfish%20genus%20chilatherina%20(melanotaeniidae).pdf



Typical Chilatherina habitat © Michael Wagner permission granted (2019)

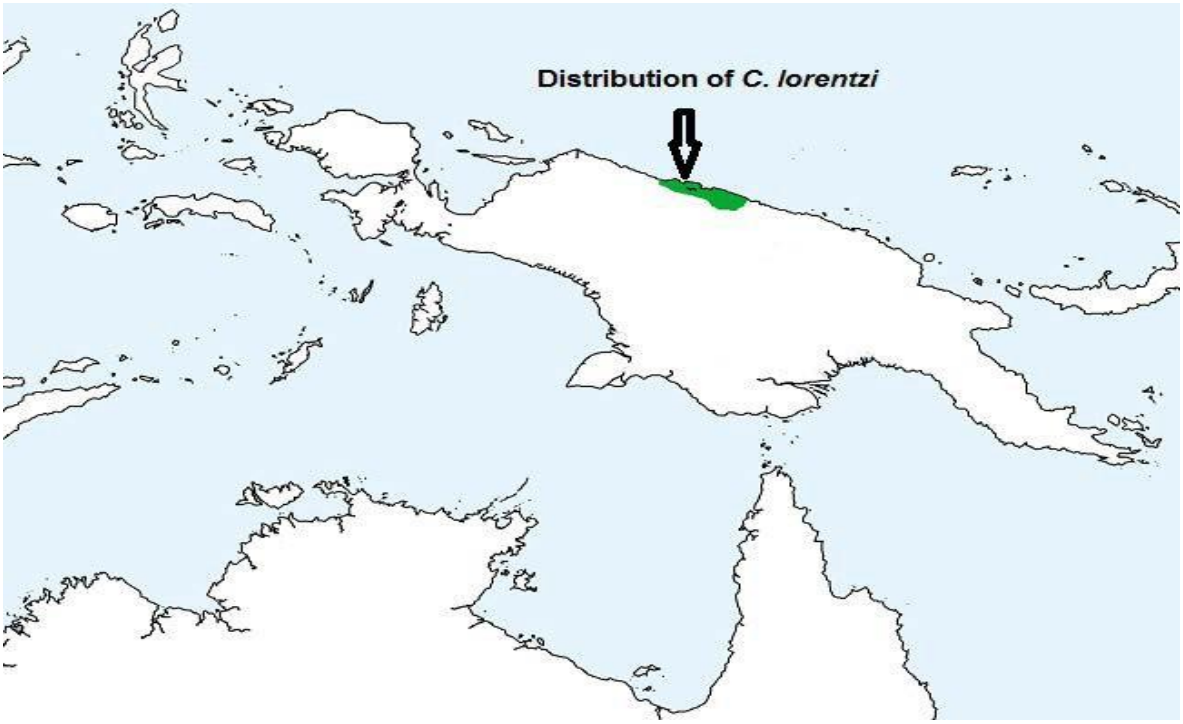
1. Provide information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane
Species: *Rhombatractus lorentzii* Weber, 1908, *Rhombosoma lorentzii* Regan, 1914, *Chilatherina lorentzii* Regan, 1914
Lorentzi's rainbowfish

Chilatherina lorentzii (Weber, 1908), Lorentz's Rainbowfish



Chilatherina lorentzii [Sokoata River] - photo© Christophe Mailliet, permission to use granted on 7th January 2021



Species Summary

Chilatherina lorentzii have a basic bluish body colour grading to silvery-blue ventrally and a broad darker blue midlateral band, with clear to yellowish fins. They may attain a length of about 12 cm with a body depth of around 3-4 cm. Females are brownish-green on the upper body and silvery-white on lower half with a diffuse bluish mid-lateral band that extends from the eye to the middle of caudal fin base. The dorsal, caudal and anal fins are darkly-faded with the anal fin having a pale yellowish colour. The pelvic and pectoral fins are translucent.

Munro (1964) considered *C. fasciata* to be a junior synonym of *C. lorentzii*, but comparison of the respective types at the Zoological Museum of Amsterdam by Gerald Allen revealed important differences between these species. *C. fasciata* is a much more slender fish; males seldom exceed a maximum depth of 35% of the SL compared with frequent values exceeding this figure and sometimes over 40% in *C. lorentzii*. The caudal peduncle depth also reflects this difference with most specimens of *C. fasciata* under 11.3% whereas the values in *C. lorentzii* ranged from 11.3–13.6% SL.

Counts for the anal rays and preopercle-suborbital scales are also useful for separating these species, although there is some overlap in the ranges. Additionally, the upper jaw of *C. lorentzii* is longer and reaches the level of the anterior edge of the eye, whereas that of *C. fasciata* fails to reach eye level.

Distribution & Habitat

Chilatherina lorentzii is known only from a few streams flowing to the central north coast of New Guinea centred around Jayapura. It has been collected at Puive Creek, a tributary of

the Pual River near Vanimo, Papua New Guinea, and from the Tawarin and Upper Sermowai rivers of Papua Province, Indonesia.

In February 2008 a survey by Conservation International and the Papuan State University at Manokwari found *Chilatherina lorentzii* in tributary streams of the Tariku River **(**Rouffaer) near Haya Village (02º48.951'S and 138º05.903'E). Three species of rainbowfishes were collected during these surveys which included *C. fasciata*, *C. lorentzii* and *Glossolepis multisquamata*. *G. multisquamata* was found in the lake-marsh habitats, *C. fasciata* was found in creeks near the village, and *C. lorentzii* were found in clear rocky streams about 6 km from the village.

References

Froese, R. and D. Pauly. Editors. 2021.FishBase. World Wide Web electronic publication. www.fishbase.org, (02/2021)

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2. Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). For example, is the species listed on CITES Appendix I, II or III, and if so, are there any specific restrictions on the movement of this species? Include information on the conservation value of the species.

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Chilatherina” revealed no results for those entities.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 11 species of Chilatherina listed.

Chilatherina alleni **listed as vulnerable**
https://www.iucnredlist.org/species/169522/147680522

Chilatherina axelrodi **listed as endangered**
https://www.iucnredlist.org/species/4628/147680647

Chilatherina bleheri **listed as endangered**
https://www.iucnredlist.org/species/4629/147680677

Chilatherina bulolo **listed as least concern**
https://www.iucnredlist.org/species/4630/147680735

Chilatherina campsi **listed as least concern**
https://www.iucnredlist.org/species/161079348/161079383

Chilatherina crassispinosa **listed as least concern**
https://www.iucnredlist.org/species/161079519/161079697

Chilatherina fasciata **listed as least concern**
https://www.iucnredlist.org/species/161079834/161080091

Chilatherina lorentzii **listed as near threatened**
https://www.iucnredlist.org/species/161080164/161080249

Chilatherina pagwiensis **listed as endangered**
https://www.iucnredlist.org/species/161080305/161080322

Chilatherina pricei **listed as vulnerable**
https://www.iucnredlist.org/species/161080365/161080369

Chilatherina sentaniensis **listed as critically endangered**
https://www.iucnredlist.org/species/4631/147680762

References

The CITES Species website with lists and search facility accessed on 17 April 2021.
URL http://www.cites.org/eng/disc/species.php

The IUCN Red List search facility locate accessed on 17 April 2021.
URL http://www.iucnredlist.org/details/4630/0

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "Rainbowfishes, their care and keeping in captivity" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Weber, (1908) , Collector: New Guinea Expedition, June 20, 1903.records the Holotype of the species as being 96.0 mm standard length, and the type locality as Tawarin river, north New Guinea, fresh water.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "Rainbowfishes, their care and keeping in captivity" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

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3.c The natural geographic range.

Chilatherina lorentzii is known only from a few streams flowing to the central north coast of New Guinea centred around Jayapura. It has been collected at Puive Creek, a tributary of the Pual River near Vanimo, Papua New Guinea, and from the Tawarin and Upper Sermowai rivers of Papua Province, Indonesia

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

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Boeseman, M. (1963) Notes on the fishes of western New Guinea 1. Zool. Mededelingen, 38(14); 221-242.

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3.d Habitat.

Chilatherina lorentzii is known only from a few streams flowing to the central north coast of New Guinea centred around Jayapura. It has been collected at Puive Creek, a tributary of the Pual River near Vanimo, Papua New Guinea, and from the Tawarin and Upper Sermowai rivers of Papua Province, Indonesia.

This species occurs in clear rainforest streams between about 100-400 m elevation. It prefers deeper shaded pools with leaf litter and gravel bottoms, and fish generally congregate among the branches of fallen trees. It can reach a maximum size to about 10 cm SL

This is a benthopelagic species that is found in rivers or streams where the substrate consists of gravel and rocks, and the water is cold, clear and fast-flowing. It is also found in rocky pools and backwaters in rainforest habitat. It generally occurs well upstream at elevations above 200m in the Tarawin and Upper Sermonai Rivers.

In most cases Chilatherina are found in either low-lying riverine floodplain or foothill streams to altitudes of about 500m. However *Chilatherina lorentzii* frequents streams of the mountainous Central Highlands to about 1500m above sea level.

At least three species (*C. bleheri, C. fasciata, C. sentaniensis*) have lake dwelling populations. In stream habitats *Chilatherina* frequent shallow pools where the flow rate is gentle, however *C. lorentzii* is often frequents streams of the mountainous Central Highlands to about 1500m above sea level. Typically *Chilatherina* prefers sections of the stream or lake-shore which affords maximum exposure to sunlight. (Allen 1991)

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

IUCN Redlist. https://www.iucnredlist.org/species/161079834/161080091

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Chilatherina lorentzii* was not recorded by Weber (1908)Price (1997) but the diet of other members of the *Chilatherina* genus are well recorded. All rainbowfishes of the family *Melanotaeniidae* are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

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3.f Social behaviour and groupings

Allen (1991) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; "Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac."

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

IUCN Redlist. https://www.iucnredlist.org/species/161079834/161080091

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Weber, M. 1907. Süsswasserfische von Neu-Guinea. Ein Beitrag zur Frage nach dem früheren Zusammenhang von Neu-Guinea und Australien. In: Wichmann, A. (ed.), *Nova Guinea. Résultats de l'expédition scientifique Néerlandaise à la Nouvelle-Guinée en 1903*, pp. 201-267, plates 11-13. E. J. Brill, Leiden, Netherlands

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylised display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as "dither fish" to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried rainbowfish for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Fishbase 2021:
https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.i characteristics that may cause harm to humans and other species.

There are no sharp spines, toxins or venom in any member of *the Melanotaeniidae* family.

References:

Fishbase: https://www.fishbase.de/summary/chilatherina-lorentzi.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4. Provide information on the reproductive biology of the species, including

There are no scientific records of any work done on the reproductive biology of *Chilatherina lorentzii* but the description *of Chilatherina* by Allen (1991) states that it is most similar to *C. pricei* of Yapen Island in Geelvink Bay. It differs greatly from these in colouration, C. alleni having a dark mid-lateral stripe and reddish fins in males. It further differs from *C. fasciata* in having a shorter blunter snout with the maxillary reaching to about the level of the anterior edge of the eye (falling well short in *C. fasciata*). It further differs from *C. pricei* in the modal counts of soft anal rays (usually 19-24 in *alleni* vs 24-27 in *pricei*), and in the number of cheek scales (16-18 in alleni vs 19-23). Chilatherina *species are* well known in the aquarium trade and have been kept and bred by the authors since 1983 from stock obtained from Melbourne.

C. axelrodi, C. bleheri, C. bulolo, C. campsi, C. crassispinosa, C. fasciata, and *C. sentaniensis* were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Chilatherina lorentzii* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b How frequently breeding occurs

The authors could find no record or observation for *Chilatherina lorentzii* but closely related *Chilatherina* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Chilatherina lorentzii* but closely related *Chilatherina* species will produce about 40 to 80 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "Rainbowfishes, their care and keeping in captivity" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species.

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992). There are no naturally occurring *Chilatherina* species in Australia. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species *of Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *Glossolepis incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish "aquarium" strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under "pseudo-scientific" names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a "Code of Conduct" that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National

Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by the authors.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There is no record of *Chilatherina lorentzii* being hybridised in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Chilatherina* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between *Melanotaenia praecox* and *Glossolepis incisus*, they produced hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family *Melanotaeniidae* was sufficiently close for them all to hybridise. Author 1 called an expert in the field of rainbowfish for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different rainbowfish *Melanotaenia splendida splendida* has been introduced to a different rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

References

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific Chromosomal Diversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Chilatherina lorentzii* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6 https://www.fishbase.de/summary/Chilatherina lorentzii.html

Froese, R. and D. Pauly. Editors. 2020. FishBase.
www.fishbase.org, version (12/2020). Accessed 17 Apr 2021

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

Glossolepis incisus, has been assessed by Patricia Kialola for and on behalf of the Pet Industry Association of Australia. *Glossolepis leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

Reference:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005)
https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available at: https://www.baphiq.gov.tw/public/Data/910614193571.pdf
, or
http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of *Chilatherina lorentzii* into the Australian environment should it be released or escape effective human control. Author 1 contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with *Chilatherina lorentzii* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020.

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Chilatherina lorentzii is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment score attached at appendix B. There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville, Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

7c. ability to find shelter

Allen (1979), describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Weber, M. 1907. Süsswasserfische von Neu-Guinea. Ein Beitrag zur Frage nach dem früheren Zusammenhang von Neu-Guinea und Australien. In: Wichmann, A. (ed.), *Nova Guinea. Résultats de l'expédition scientifique Néerlandaise à la Nouvelle-Guinée en 1903*, pp. 201-267, plates 11-13. E. J. Brill, Leiden, Netherlands

7d. rate of reproducing

Chilatherina lorentzii is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been here, and popular, for more than 40 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using the copy of Climex for PC, the process attracts a score of 5 for *Chilatherina lorentzii,* indicating the species has a low chance of survival in Australian water ways. Attached as appendix B.

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Chilatherina lorentzii* were to escape, effective control the area where the likelihood of accidental or intentional release is greater. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging.

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to one of the possible suitable natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Chilatherina lorentzii* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution. It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats.

Chilatherina have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

Chilatherina lorentzii is only found in a few small areas in West Papua. This species is assessed as Near Threatened. It has an extent of occurrence (EOO) of 17,000 km^2 and is undergoing continuing decline in habitat due to multiple threats including oil palm plantations, logging, settlements and invasive species. However, there are more than 10 threat-based locations, meaning it does not qualify for a threatened category.

This species is known only from a few streams flowing to the central north coast of New Guinea centred around Jayapura. It has been collected at Puive Creek, a tributary of the Pual River near Vanimo, Papua New Guinea, and from the Tawarin and Upper Sermowai rivers of Papua Province, Indonesia.

Threats to this species include invasive species, logging, oil palm plantations and settlements in Papua

Allen mentions a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References ;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Chilatherina lorentzii* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads,

gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Chilatherina lorentzii* is similar to and is most closely related to *C. pricei* and other members of the *Chilatherina* genus the behaviour will be similar. Aquarium observations worldwide of *Chilatherina lorentzii* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

References:

Aqua-fish.net – since 2005 - https://en.aqua-fish.net/fish/

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Chilatherina lorentzii* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 96.0 mm (Weber, (1908)

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Weber, M. 1907. Süsswasserfische von Neu-Guinea. Ein Beitrag zur Frage nach dem früheren Zusammenhang von Neu-Guinea und Australien. In: Wichmann, A. (ed.), *Nova Guinea. Résultats de l'expédition scientifique Néerlandaise à la Nouvelle-Guinée en 1903*, pp. 201-267, plates 11-13. E. J. Brill, Leiden, Netherlands.

8.c habitat and local environmental conditions

Chilatherina lorentzii are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Chilatherina* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Chilatherina lorentzii* (Fishbase records diseases in other *Chilatherina* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. found at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Chilatherina,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Hardy-Smith P., Jones R. and Kailola P. (2007) *"Scientific review of the biosecurity risks associated with the importation of rainbowfish for ornamental purposes"*

Biosecurity Australia by Panaquatic® Health Solutions Pty Ltd

IUCN, ***The IUCN Red List of Threatened Species.*** https://www.iucnredlist.org/ (accessed 30-04-2021)

Kahn, S.A., Wilson, P.W., Pereira, R.P., Hayder, H. and Gerrity, S.E. 1999. *Import Risk analysis on live ornamental finfish*. Canberra: Australian Quarantine and Inspection Service. 172 p.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *C. axelrodi, C. bleheri, C. campsi, and C. fasciata* have been in Australia, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Chilatherina lorentzii* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from European and North American breeders and then from commercial facilities to which these captive bred stocks are distributed.

Chilatherina lorentzii poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp*. (G. incisus,* and *G. leggetti)* currently permitted for import. Also, other species are being considered for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for "fresh" wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

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Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008) [online] Available at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf [Accessed 17 April 2021].

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Chilatherina lorentzii* will be used in the live fish ornamental aquarium display trade. *Chilatherina lorentzii is* to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish. Seven of the eleven species of *Chilatherina* have been in Australia prior to 1983, *C. Axelrodi, C, bleheri, C. bulolo, C campsi, C. crassispinosa, C. fasciata, C. sentaniensis*. Rainbowfish of the genus *Chilatherina* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960's.

If *Chilatherina lorentzii is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

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Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

Reference:

Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity 2nd Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11.a the containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

Reference:

Biosecurity Act 2015 as in force 25 march 2020, Accessed 24 march 2021, available at: https://www.legislation.gov.au/Details/C2020C00127

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Chilatherina* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Chilatherina lorentzii* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Chilatherina lorentzii* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Government Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available at : http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

References :

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Aquagreen Aquarium and Pond Keepers Code of Conduct – available at URL - https://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

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Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

12. Provide information on all other Commonwealth, state and territory legislative controls on the species, including:
the species' current quarantine status, or
pest or noxious status, or
whether it is prohibited or controlled by permit or licence in any state or territory.

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species , there are no references or instances of *Chilatherina* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Chilatherina lorentzii* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow *Chilatherina lorentzii* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows *Chilatherina lorentzii* is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-freshwater/list-of-noxious-fish , and shows no *Chilatherina* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called “Restricted Matter” comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. *Chilatherina lorentzii* is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 and can be accessed at:
https://www.daf.qld.gov.au/__data/assets/pdf_file/0008/1398842/prohibited-restricted-invasive-fish.pdf , and there are no *Chilatherina* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Chilatherina lorentzii* is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at,
http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Chilatherina* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Chilatherina* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. *Chilatherina lorentzii* is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish , and shows no *Chilatherina* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. *Chilatherina lorentzii* does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no chilatherina on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp (*Cyprinus carpio*) mosquito fish (*Gambusia* spp.) Didymo a freshwater algae (*Didymosphenia geminata*) and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *chilatherina* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is 'reckless' about whether the animal is a prohibited animal and is also 'reckless' about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at

https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-Animals-Declaration-ACCESS-3.pdf . There are no *Chilatherina* species listed.

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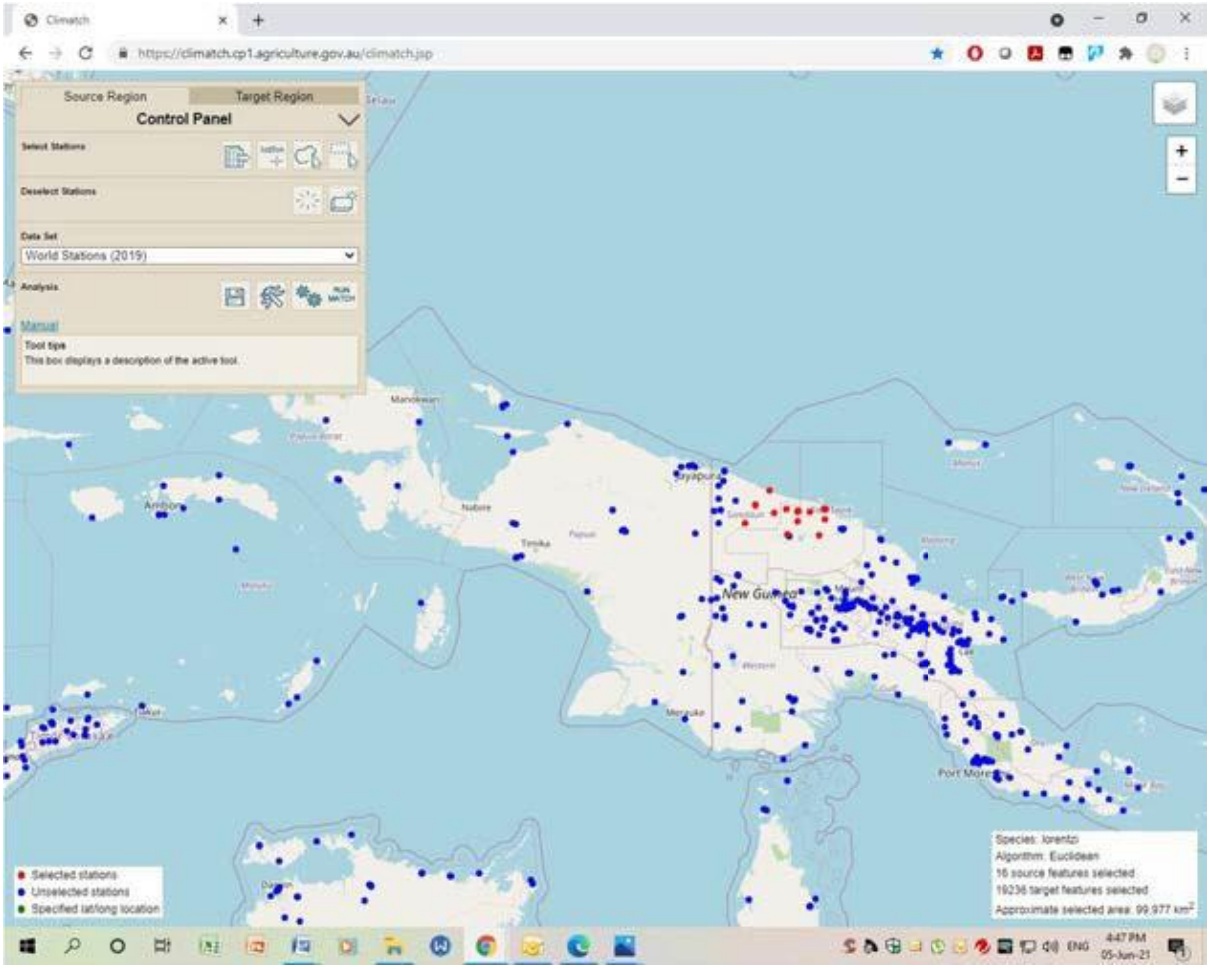
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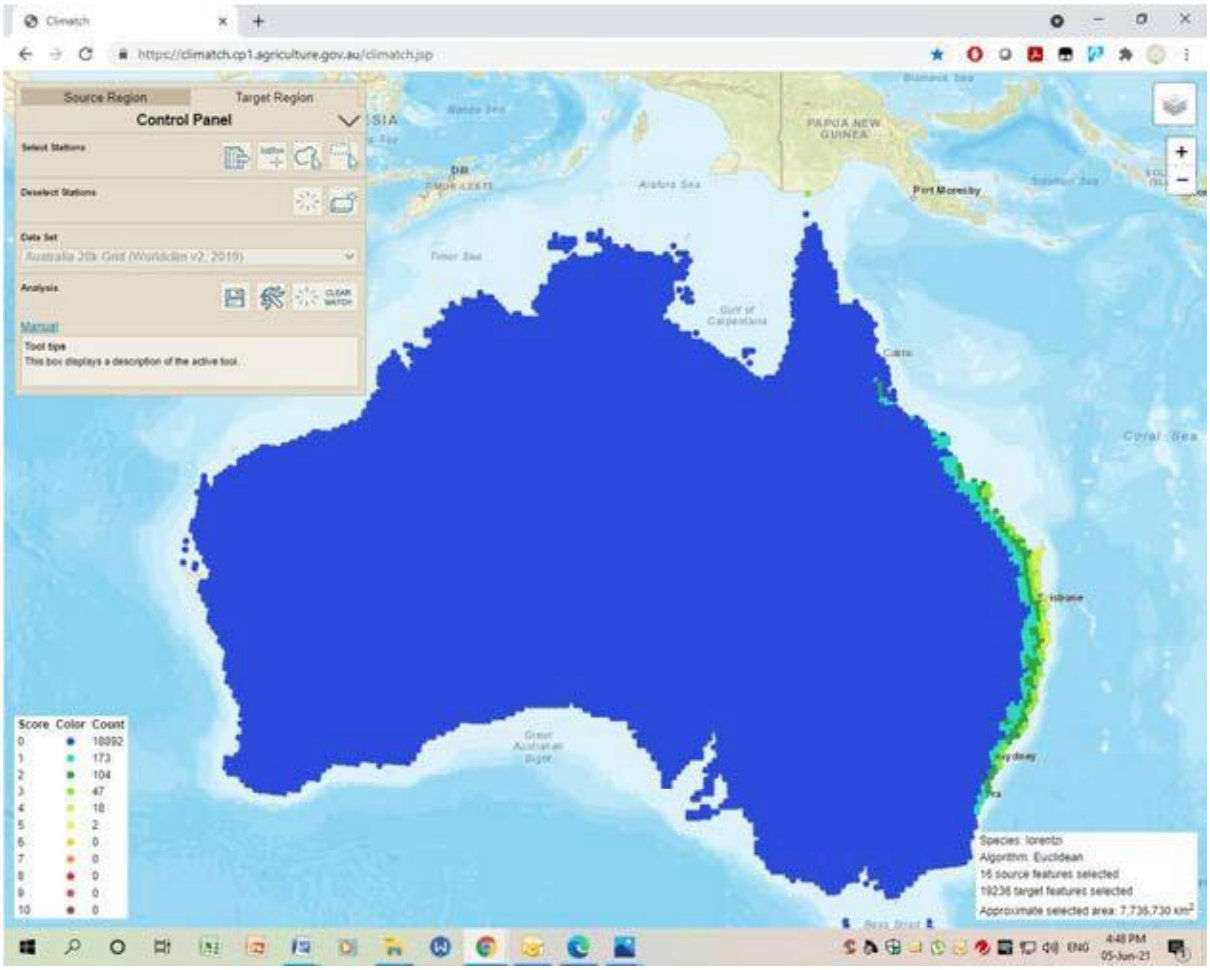
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APPENDIX A – calculation of climate from *Chilatherina lorentz ii* distribution climate to Australian Climate.





Appendix B

Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were done to provide a score against the provisions in the assessment process.(accessed 6th June 2021.)

BOMFORD ASSESSMENT

SPECIES: Chilatherina lorentzii

Score A. Climate Match (0-8)

Number of squares within 60% of the mean: (No. 5)	2
Number of squares within 50% of the mean: (No. 6)	0
Number of squares within 40% of the mean: (No. 7)	0
Number of squares within 30% of the mean: (No. 8)	0
Number of squares within 20% of the mean: (No. 9)	0
Number of squares within 10% of the mean: (No. 10)	0

Total = 2
Score: 2 (Ref: fishbase.org, PC CLIMATE)

Score B, Overseas Range

Number of 1° x 1° grids in which species occurs overseas.
No. of squares : 8
Score: 1 (Ref: fishbase.org, googleearth.com)

Score C, Establishment

Locations of establishment incidence: nil - never introduced
Score: 1 (Ref: fishbase.org)

Score D, Introduction Success

Percentage of Introduction events that have been successful
Introductions nil
Successful: nil
Score: 1 (Ref: fishbase.org)

Score E, Taxa risk

Genus: Chilatherina
Introductions: 0
Successful: 0
Score: 0 (Ref: fishbase.org / M. Bomford)

Family: Melanotaeniidae (Rainbowfishes)
Introductions: 5
Successful: 0 unknown
Score: 0 (Ref: fishbase.org / M. Bomford)

Total: 5 (LOW)

The score of 5 according to the assessment model gives the species a low chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

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A report to address the “Terms of Reference” for an application to include *Chilatherina pagwiensis* onto the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.

Chilatherina pagwiensis



© Gerald R Allen - preserved male holotype

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that the Pagwi Rainbowfish *Chilatherina pagwiensis* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented for the prosecution in the witness box by the author of this report, however the accused offender pleaded guilty.

Disease

Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species

Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat

Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species

Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes

Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

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Terms of Reference

Overview: The rainbowfish genus *Chilatherina* consists of eleven species.

etymology: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Glossolepis* are:

Chilatherina is closely related to Melanotaenia, the largest genus in the family. They differ chiefly with regard to jaw structure. In Chilatherina the lateral portion of the premaxillary is either straight or curved gently in a postero-ventral direction. The lower jaw is generally inferior to the upper jaw and the medial portion of the upper lip is swollen and profusely covered with teeth (Fig. 3). In addition, the head tends to be more slender and the snout relatively pointed compared with Melanotaenia. The latter genus by contrast, has a more or less abrupt downward bend in the lateral portion of the premaxillary with less swelling of the medial upper lip and fewer teeth on its surface. Moreover, the jaws are usually about even or the upper jaw is slightly inferior (Le. lower jaw protruding). The external jaw features of Chilatherina and Melanotaenia were illustrated by Allen (1980a).

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299. http://museum.wa.gov.au/sites/default/files/A%20revision%20of%20the%20rainbowfish%20genus%20chilatherina%20(melanotaeniidae).pdf



Typical Chilatherina habitat © Michael Wagner permission granted (2019)

1. Provide information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane
Species: *Chilatherina pagwiensis*, Pagwi Rainbowfish (Allen & Unmack September 2012.

Chilatherina pagwiensis



© Peter J Unmack

Species Summary

Chilatherina pagwiensis is a small stream dwelling species, growing to a length of about 7 to 8 cm. They were described by Gerald R. Allen and Peter J. Unmack in 2012 on the basis of 31 specimens, 20.5-6.1 mm SL, collected from a tributary of the Sepik River near Pagwi village, East Sepik Province, Papua New Guinea. Morphologically it is closely allied to *C. campsi*, an inhabitant of mainly hilly or mountainous terrain in the Markham, Ramu, and Sepik river systems of northern Papua New Guinea and the Purari system, south of the Central Dividing Range. Both species are characterised by the absence of vomerine and palatine teeth, and males and females are relatively slender (greatest body depth 23.7-32.3 % SL) compared to most other family members. However, the two species exhibit pronounced modal differences in soft dorsal and anal rays. *Chilatherina pagwiensis* usually has 10-12 soft dorsal rays compared to usual counts of 13-15 in *C. campsi*. Likewise, the former species most frequently has 20-21 soft anal rays compared to 21-26 (most frequently 22-23) in *C. campsi*. Analysis of genetic relationships based on mitochondrial cytochrome b sequences indicates a close relationship between *Chilatherina pagwiensis* and the ancestor to *C. axelrodi* and *C. campsi*.

The body colour is overall pale-grey on upper back grading to white over most of body; diffuse greyish stripe on each scale row of back; fins generally reddish, except pectorals semi-translucent whitish. *Chilatherina pagwiensis* was found in the same habitat with *C. fasciata*, which is widely distributed in northern New Guinea. The two species are easily confused without microscopic examination of the dentition, especially specimens under about 60 mm SL. However, *C. fasciata* differs in having both vomerine and palatine teeth, and although counts of dorsal and anal soft rays overlap with those of *Chilatherina pagwiensis*, it tends to have higher counts, especially for the anal rays. There is also an apparent difference in maximum SL with *C. fasciata* attaining 105 mm versus less than 80 mm SL for *Chilatherina pagwiensis*.

Distribution & Habitat

Chilatherina pagwiensis is currently known only from a single creek in the vicinity of Pagwi village, Sepik River system, Papua New Guinea. There are different names for the same creek, Kuin and Huin and it remains unresolved as to which name is correct. It is the only creek which crosses the southern section of the Maprik-Pagwi road, once in its upper reaches and once in the lower reaches. Given it seems widespread within this creek it is likely to be found in similar habitats elsewhere in the Sepik drainage. The type locality consisted of a quiet pool in a small creek, flowing through secondary forest. The paratypes were collected to a depth of 1.8 metres over a rock and mud bottom in a slow-flowing stream in closed-canopy forest. The latter site is situated approximately 400 km upstream from the sea at an elevation of about 30 m above sea level.

This species is assessed as Endangered. It has an extent of occurrence (EOO) of 150 km^2, occurs in one location (a single creek) based on the threat of invasive species, and there is continuing decline in habitat.

Geographic range information

This species is known only from a single creek north of Pagwi Village, which is situated on the banks of the Sepik River, Papua New Guinea. There has been sampling in the surrounding area, which has not found this species, but it could easily be confused with other species.

Habitat and ecology information

The holotype of this species was collected in a quiet pool in a small creek, flowing through secondary forest. Paratypes were collected to a depth of 1.8 m over a rock and mud bottom in a slow-flowing stream in closed-canopy forest. The latter site is situated approximately 400 km upstream from the sea at an elevation of about 30 m above sea level. It has a maximum size of about 10 cm SL.

Threats information

This species is threatened by at least four exotic species.

References

Allen, Gerald R. and Unmack, Peter J. (2012) A new species of Rainbowfish (Chilatherina: Melanotaeniidae), from the Sepik River System of Papua New Guinea. aqua, International Journal of Ichthyology. aqua vol. 18 no. 4 - 15 October 2012

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Tappin, Adrian (2005) “Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011” at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

2. Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). For example, is the species listed on CITES Appendix I, II or III, and if so, are there any specific restrictions on the movement of this species? Include information on the conservation value of the species.

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Chilatherina” revealed no results for those entities.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 11 species of Chilatherina listed.

Chilatherina alleni **listed as vulnerable**
https://www.iucnredlist.org/species/169522/147680522

Chilatherina axelrodi **listed as endangered**
https://www.iucnredlist.org/species/4628/147680647

Chilatherina bleheri **listed as endangered**
https://www.iucnredlist.org/species/4629/147680677

Chilatherina bulolo **listed as least concern**
https://www.iucnredlist.org/species/4630/147680735

Chilatherina campsi **listed as least concern**
https://www.iucnredlist.org/species/161079348/161079383

Chilatherina crassispinosa **listed as least concern**
https://www.iucnredlist.org/species/161079519/161079697

Chilatherina fasciata **listed as least concern**
https://www.iucnredlist.org/species/161079834/161080091

Chilatherina lorentzii **listed as near threatened**
https://www.iucnredlist.org/species/161080164/161080249

Chilatherina pagwiensis **listed as endangered**
https://www.iucnredlist.org/species/161080305/161080322

Chilatherina pricei **listed as vulnerable**
https://www.iucnredlist.org/species/161080365/161080369

Chilatherina sentaniensis **listed as critically endangered**
https://www.iucnredlist.org/species/4631/147680762

References

The CITES Species website with lists and search facility accessed on 17 April 2021.
URL http://www.cites.org/eng/disc/species.php

The IUCN Red List search facility locate accessed on 17 April 2021.
URL http://www.iucnredlist.org/details/4630/0

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available on the world wide web as a portable document format (PDF) at universal resource locator http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Holotype: AUM 58007, male, 76.1 mm SL, upper Kuins Creek, 03.87436°S, 143.02377°E, on Maprik-Pagwi road, East Sepik Province, Papua New Guinea, seine, J. W. Armbruster, P. J. Unmack, and A.Y. Ko'ou, 12 October 2007. Paratypes: AUM 47649, 4 specimens, 44.0-64.3 mm SL, collected with holotype; WAM P.27836- 006, 26 specimens, 20.5-66.3 mm SL, lower Huins Creek, approximately 03°58'S, 143°00'E, about 10 km north of Pagwi on Maprik road, East Sepik Province, Papua New Guinea, rotenone, G. Allen, 19 October 1982.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, Gerald R. and Unmack, Peter J. (2012) A new species of Rainbowfish (Chilatherina: Melanotaeniidae), from the Sepik River System of Papua New Guinea. aqua, International Journal of Ichthyology. aqua vol. 18 no. 4 - 15 October 2012

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.c The natural geographic range.

Chilatherina pagwiensis, is known only from upper Kuins Creek, on Maprik-Pagwi road, East Sepik Province, Papua New Guinea and lower Huins Creek, approximately 10 km north of Pagwi on Maprik road, East Sepik

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

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3.d Habitat.

The holotype of this species was collected in a quiet pool in a small creek, flowing through secondary forest. Paratypes were collected to a depth of 1.8 m over a rock and mud bottom in a slow-flowing stream in closed-canopy forest. The latter site is situated approximately 400 km upstream from the sea at an elevation of about 30 m above sea level. It has a maximum size of about 10 cm SL. *Chilatherina pagwiensis* frequents streams of the mountainous Central Highlands to about 1500m above sea level.

At least three species (*C. bleheri, C. fasciata, C. sentaniensis*) have lake dwelling populations. In stream habitats *Chilatherina* frequent shallow pools where the flow rate is gentle, however *C. bulolo* is often found in rapid flowing steep gradient creeks. Typically *Chilatherina* prefers sections of the stream or lake-shore which affords maximum exposure to sunlight. (Allen 1991)

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Allen, Gerald R. and Unmack, Peter J. (2012) A new species of Rainbowfish (Chilatherina: Melanotaeniidae), from the Sepik River System of Papua New Guinea. aqua, International Journal of Ichthyology. aqua vol. 18 no. 4 - 15 October 2012

IUCN Redlist. https://www.iucnredlist.org/species/161079834/161080091

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Chilatherina pagwiensis* was not recorded by Allen (1982) or Unmack (2007) but the diet of other members of the *Chilatherina* genus are well recorded. All rainbowfishes of the family *Melanotaeniidae* are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.f Social behaviour and groupings

Unmack, 2012 described them as quiet pool in a small creek, flowing through secondary forest abundant in small pools of collecting site. They were not schooling but in loose aggregations swimming at all levels in water up to 70cm deep. Allen (1991) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; "Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac."

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Allen, Gerald R. and Unmack, Peter J. (2012) A new species of Rainbowfish (Chilatherina: Melanotaeniidae), from the Sepik River System of Papua New Guinea. aqua, International Journal of Ichthyology. aqua vol. 18 no. 4 - 15 October 2012

IUCN Redlist. https://www.iucnredlist.org/species/161079834/161080091

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylised display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as "dither fish" to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried rainbowfish for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Fishbase 2021:
https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.i characteristics that may cause harm to humans and other species.

There are no sharp spines, toxins or venom in any member of *the Melanotaeniidae* family.

References:

Fishbase: https://www.fishbase.de/summary/chilatherina-pagwiensis.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4. Provide information on the reproductive biology of the species, including

There are no scientific records of any work done on the reproductive biology of *Chilatherina pagwiensis* but the description *of Chilatherina* by Allen & Unmack states that it is a close sister-species relationship between the new taxon and the ancestral lineage to both C. axelrodi and C. campsi. Morphologically, it is most closely allied to C. campsi, an inhabitant of mainly hilly or mountainous terrain in the Markham, Ramu, and Sepik river systems of northern Papua New Guinea, and south of the Central Dividing Range in the Purari system (Allen, 1981). Chilatherina *species are* well known in the aquarium trade and have been kept and bred by the authors since 1983 from stock obtained from Melbourne.

C. axelrodi, C. bleheri, C. bulolo, C. campsi C. crassispinosa, C. fasciata, and C. sentaniensis were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Chilatherina pagwiensis* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b How frequently breeding occurs

The authors could find no record or observation for *Chilatherina pagwiensis* but closely related *Chilatherina* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Chilatherina pagwiensis* but closely related *Chilatherina* species will produce about 40 to 80 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) “Rainbowfishes, their care and keeping in captivity” at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992). There are no naturally occurring *Chilatherina* species in Australia. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia. Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species *of Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *Glossolepis incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish “aquarium” strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under “pseudo-scientific” names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a “Code of Conduct” that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by the authors.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There is no record of *Chilatherina pagwiensis* being hybridised in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Chilatherina* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between *Melanotaenia praecox* and *Glossolepis incisus*, they produced hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, (2020), concluded that their DNA in the family *Melanotaeniidae* was sufficiently close for them all to hybridise. Author 1 called an expert in the field of rainbowfish for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different rainbowfish *Melanotaenia splendida splendida* has been introduced to a different rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

References

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific ChromosomalDiversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several

decades this genus has never established feral populations here. *Chilatherina pagwiensis* has not been introduced to Europe and North America.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6 https://www.fishbase.de/summary/Chilatherina-pagwiensis.html

Froese, R. and D. Pauly. Editors. 2020. FishBase.
www.fishbase.org, version (12/2020). Accessed 17 Apr 2021

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

Glossolepis incisus, has been assessed by Patricia Kialola for and on behalf of the Pet Industry Association of Australia. *Glossolepis leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005)
https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator; https://www.baphiq.gov.tw/public/Data/910614193571.pdf
, or
http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of *Chilatherina pagwiensis* into the Australian environment should it be released or escape effective human control. Author 1 contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with *Chilatherina pagwiensis* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020.

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Chilatherina pagwiensis is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment score attached as appendix B. There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville, Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

7c. ability to find shelter

Allen (1979), describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Allen, Gerald R. and Unmack, Peter J. (2012) A new species of Rainbowfish (Chilatherina: Melanotaeniidae), from the Sepik River System of Papua New Guinea. aqua, International Journal of Ichthyology. aqua vol. 18 no. 4 - 15 October 2012

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7d. rate of reproducing

Chilatherina pagwiensis is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been here, and popular, for more than 40 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using the copy of Climex for PC, the process attracts a score of 4 for *Chilatherina pagwiensis* indicating the species has a low chance of survival in Australian water ways. Attached as appendix B.

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Chilatherina pagwiensis* were to escape effective control the area where the likelihood of accidental or intentional release is greater. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging.

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to one of the possible suitable natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Chilatherina pagwiensis* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution. It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats.

Chilatherina have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

Chilatherina pagwiensis is assessed as Endangered. It has an extent of occurrence (EOO) of 150 km^2, occurs in one location (a single creek) based on the threat of invasive species, and there is continuing decline in habitat. Allen mentions a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References ;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Chilatherina pagwiensis* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Chilatherina pagwiensis* is similar to and is most closely related to *C. axelrodi* and *C. campsi* and other members of the *Chilatherina* genus the behaviour will be similar. Aquarium observations worldwide of *Chilatherina* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

References:

Aqua-fish.net – since 2005 - https://en.aqua-fish.net/

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

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8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Chilatherina pagwiensis* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 82 mm (Allen & Unmack 2012).

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8.c habitat and local environmental conditions

Chilatherina pagwiensis are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Chilatherina* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Chilatherina pagwiensis* (Fishbase records) diseases in other *Chilatherina* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids

(ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. found at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Chilatherina,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

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9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *C. axelrodi, C. bleheri, C. campsi and C. fasciata* have been in Australia, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Chilatherina* into Australia would not create undue pressure on the populations in their native habitat as all

stocks would come initially from European and North American breeders and then from commercial facilities to which these captive bred stocks are distributed.

Chilatherina pagwiensis poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp*. (Glossolepis. incisus,* and *glossolepis leggetti)* currently permitted for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for “fresh” wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

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PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008) [online] Available at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf [Accessed 17 April 2021].

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Chilatherina pagwiensis* will be used in the live fish ornamental aquarium display trade. *Chilatherina pagwiensis is* to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish Seven of the eleven species of *Chilatherina* have been in Australia prior to 1983, *C. Axelrodi, C, bleheri, C. bulolo, C campsi, C. crassispinosa, C. fasciata, C. sentaniensis*. Rainbowfish of the genus *Chilatherina* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960’s.

If *Chilatherina pagwiensis is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

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11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

References:

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11. a the containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

Reference:

Biosecurity Act 2015 as in force 25 march 2020, Accessed 24 march 2021, available at: https://www.legislation.gov.au/Details/C2020C00127

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Chilatherina* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Chilatherina pagwiensis* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Chilatherina pagwiensis* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Government Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available at: http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

References :

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https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

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12. Provide information on all other Commonwealth, state and territory legislative controls on the species, including:

the species' current quarantine status, or
pest or noxious status, or
whether it is prohibited or controlled by permit or licence in any state or territory.

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species , there are no references or instances of *Chilatherina* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Chilatherina pagwiensis* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow *Chilatherina pagwiensis* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows *Chilatherina pagwiensis* is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-freshwater/list-of-noxious-fish , and shows no *Chilatherina* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called “Restricted Matter” comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. *Chilatherina pagwiensis* is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 and can be accessed at

https://www.daf.qld.gov.au/__data/assets/pdf_file/0008/1398842/prohibited-restricted-invasive-fish.pdf , and there are no *Chilatherina* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Chilatherina pagwiensis* is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at, http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Chilatherina* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Chilatherina* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. *Chilatherina pagwiensis* is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish , and shows no *Chilatherina* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. *Chilatherina pagwiensis* does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *chilatherina* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp **(*Cyprinus carpio*)** mosquito fish **(*Gambusia* spp.)** Didymo a freshwater algae **(*Didymosphenia geminata*)** and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *chilatherina* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is 'reckless' about whether the animal is a prohibited animal and is also 'reckless' about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at

https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-Animals-Declaration-ACCESS-3.pdf . There are no *Chilatherina* species listed.

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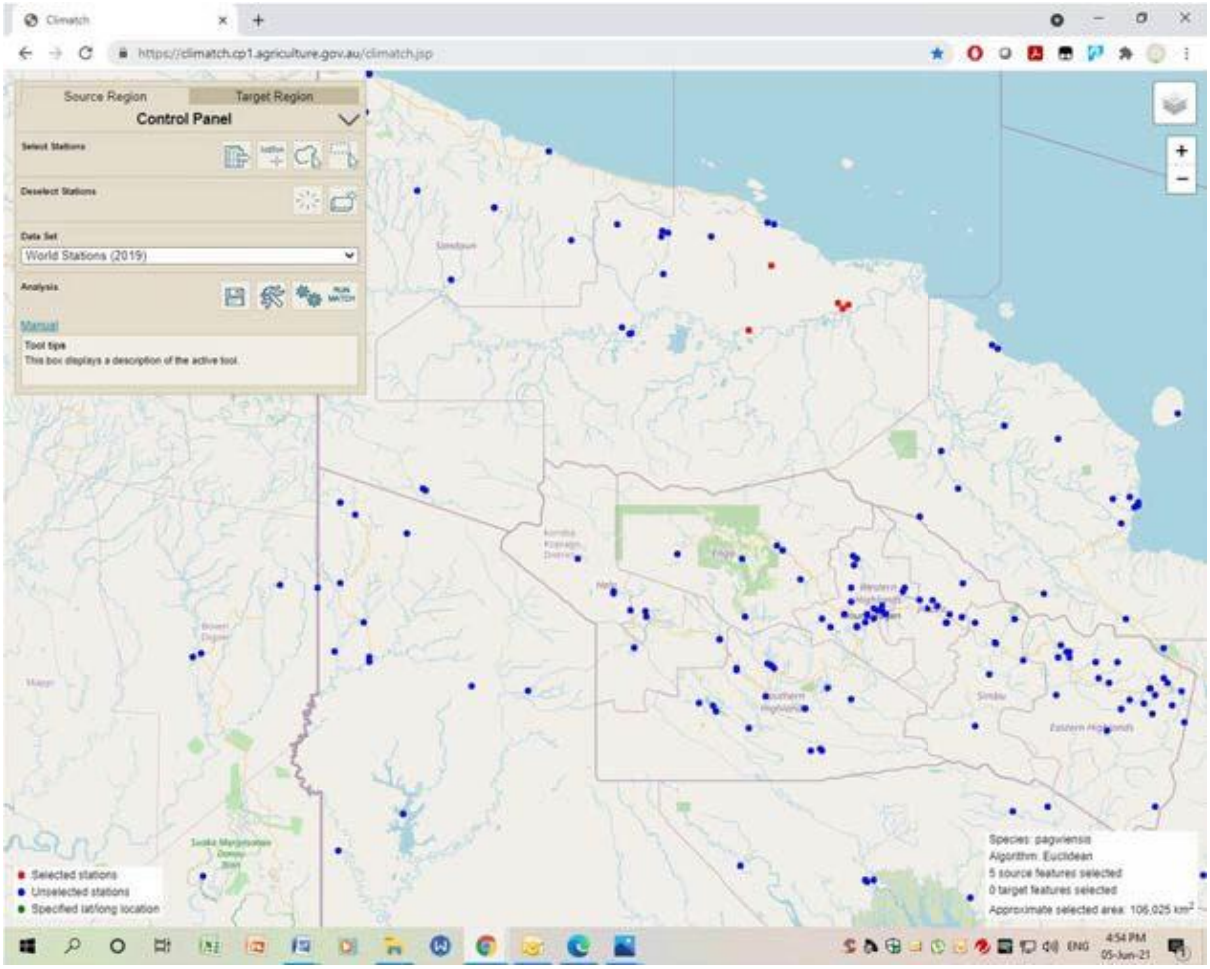
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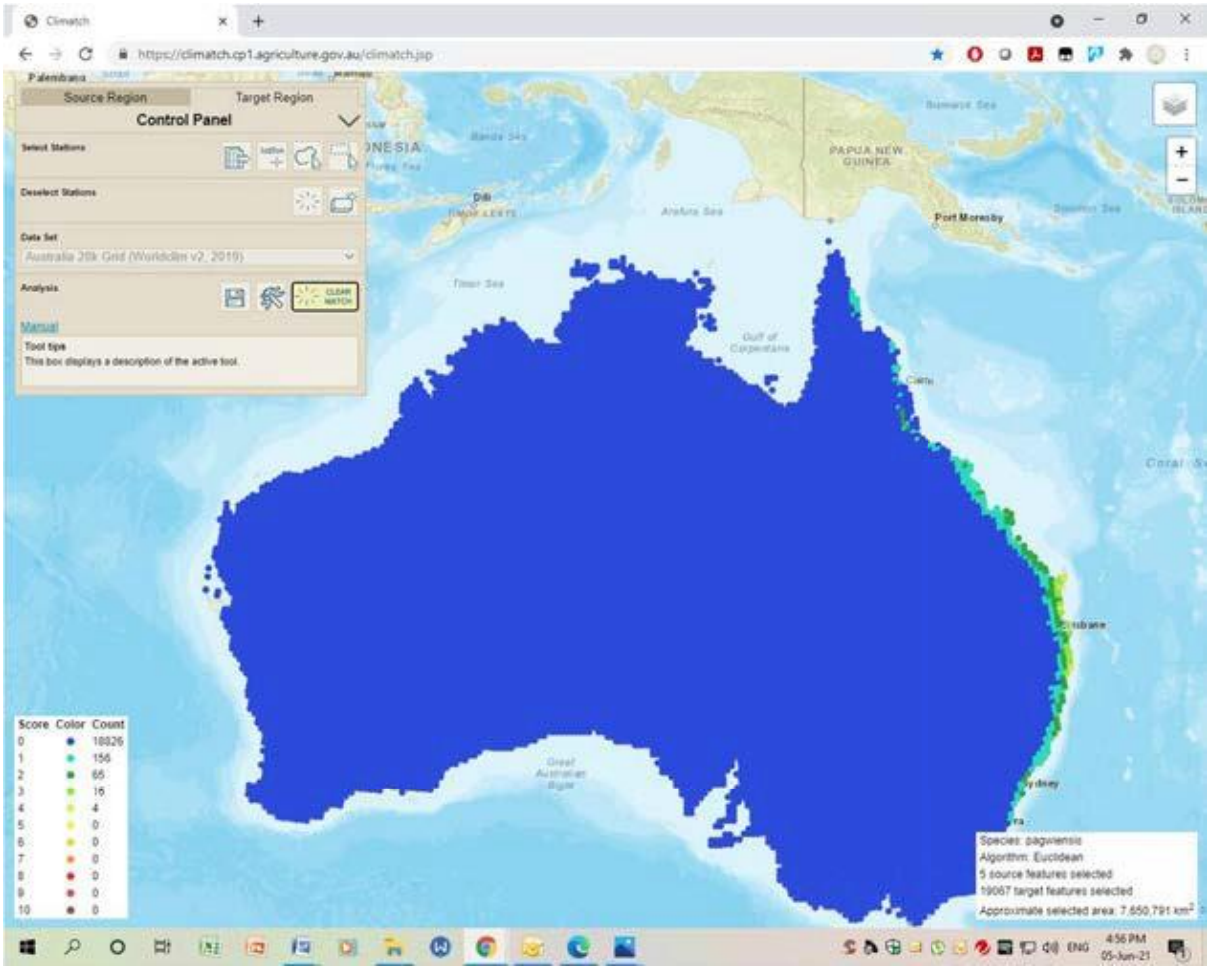
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APPENDIX A – calculation of climate from *Chilatherina pagwiensis* distribution climate to Australian Climate.





Appendix B

Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were done to provide a score against the provisions in the assessment process.(accessed 6th June 2021.)

BOMFORD ASSESSMENT

SPECIES: Chilatherina pagwiensis

Score A. Climate Match (0-8)

Number of squares within 60% of the mean: (No. 5)	0
Number of squares within 50% of the mean: (No. 6)	0
Number of squares within 40% of the mean: (No. 7)	0
Number of squares within 30% of the mean: (No. 8)	0
Number of squares within 20% of the mean: (No. 9)	0
Number of squares within 10% of the mean: (No. 10)	0

Total = 0

Score: 1 (Ref: fishbase.org, PC CLIMATE)

Score B, Overseas Range

Number of 1° x 1° grids in which species occurs overseas.

No. of squares : 8

Score: 1 (Ref: fishbase.org, googleearth.com)

Score C, Establishment

Locations of establishment incidence: nil - never introduced
Score: 1 (Ref: fishbase.org)

Score D, Introduction Success

Percentage of Introduction events that have been successful
Introductions nil
Successful: nil
Score: 1 (Ref: fishbase.org)

Score E, Taxa risk

Genus: Chilatherina
Introductions: 0
Successful: 0
Score: 0 (Ref: fishbase.org / M. Bomford)

Family: Melanotaeniidae (Rainbowfishes)
Introductions: 5
Successful: 0 unknown
Score: 0 (Ref: fishbase.org / M. Bomford)

Total: 4 (LOW)

The score of 4 according to the assessment model gives the species a low chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

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A report to address the "Terms of Reference" for an application to include *Chilatherina pricei* onto the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.

Chilatherina pricei



© Photograph Gerald Allen Permission to use photo obtained 9th July 2015.

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that Price's Rainbowfish *Chilatherina pricei* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented for the prosecution in the witness box by author 1 of this report, however the accused offender pleaded guilty.

Disease
Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species
Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat
Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species
Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes
Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

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Terms of Reference

Overview: The rainbowfish genus *Chilatherina* consists of eleven species.

etymology*:* *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane. Named *pricei* after David Price, in recognition of his keen interest in the natural history of New Guinea. He has lived periodically on Yapen Island with his family over the past decade, making valuable collections of fishes and frogs, including the type specimens of Chilatherina pricei.

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Glossolepis* are:

Chilatherina is closely related to *Melanotaenia*, the largest genus in the family. They differ chiefly with regard to jaw structure. In *Chilatherina* the lateral portion of the premaxillary is either straight or curved gently in a postero-ventral direction. The lower jaw is generally inferior to the upper jaw and the medial portion of the upper lip is swollen and profusely covered with teeth. In addition, the head tends to be more slender and the snout relatively pointed compared with *Melanotaenia*. The latter genus by contrast, has a more or less abrupt downward bend in the lateral portion of the premaxillary with less swelling of the medial upper lip and fewer teeth on its surface. Moreover, the jaws are usually about even or the upper jaw is slightly inferior (Le. lower jaw protruding). The external jaw features of Chilatherina and Melanotaenia were illustrated by Allen (1980a).

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299. http://museum.wa.gov.au/sites/default/files/a%20revision%20of%20the%20rainbowfish%20genus%20chilatherina%20(melanotaeniidae).pdf



Typical Chilatherina habitat © Michael Wagner permission granted (2019)

1. Provide information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Chilatherina* (origin - Chilatherina Greek) cheilos= lip + Greek, atherina, the Greek name for the eperlane
Species: *Chilatherina pricei*, **Allen & Renyaan. (1996)**
Price's rainbowfish

Chilatherina pricei



© Photograph Hans-Georg Evers *Chilatherina pricei* Yapen Island.

Species Summary

Chilatherina pricei is a small stream dwelling species, growing to a length of about 7 to 10 cm. They were described by Gerald R. Allen and Samuel J. Renyaan in 1996 on the basis of 23 specimens collected in 1991 and 1995 from the Reifafeif River near Warironi Village on Yapen Island, off the central north coast of West Papua. They are most similar to *C. fasciata* which is broadly distributed in northern New Guinea between Markham and Mamberamo river systems and an undescribed *Chilatherina* from the vicinity of Siriwo, Irian Jaya (3º38ºS. 136º05ºE). The latter species differs in having reddish median fins (at least in males) and a pronounced dark midlateral stripe, which is either absent or weakly developed in both *Chilatherina pricei* and *C. fasciata.* Colouration of these last named species is similar, but *C. fasciata* generally lacks yellow scale edges on the back and males frequently have much more intense dark bars on the lower half of the body. Besides colour pattern, *Chilatherina pricei* differs from the undescribed species in modal counts of soft anal rays (usually 24-27 in *Chilatherina pricei* versus 19-24) and number of cheek scales (usually 19-23 in *Chilatherina pricei* versus 16-18). The snouts of both *Chilatherina pricei* and the undescribed species are short and blunt in comparison to the elongate, more or less pointed snout of *C. fasciata*. Also, the rear edge of the maxillary in the former two species is about level with the anterior edge of the eye, but falls well short of the eye in *C. fasciata.*

The body colour is overall silvery-grey to bluish; scales on back sometimes with golden or yellow margins, wider on upper and lower edge of scale and forming a longitudinal yellow stripe between each scale row. Scales on caudal peduncle sometimes entirely yellow. About 5–10 dull grey to dark blue bars on lower half of side between level of pelvic fin base and middle of anal fin; some individuals have 2–6 small dark blue spots on mid-lateral scale row or on scale row immediately above, on rear half of body. Fins mainly translucent bluish, except dorsal and anal fins of mature males often golden yellow.

Distribution & Habitat

The Reifafeif River habitat is typical of numerous streams on Yapen Island, which no doubt are populated by this species. Yapen Island is situated in Cenderawasih Bay (formerly Geelvink Bay) off the northern coast of West Papua. It is a narrow, elongate (approximately 170 km long and up to 25 km wide) island with a central spine of mountains which rise to a maximum elevation of 1500 metres, and was once part of the New Guinea mainland. It has an area of approximately 2424 km2 . The mountain range is dissected by numerous independent drainage systems, such as the Reifafeif River. The streams rise in the steep mountains and plunge to a relatively narrow (3–5 km wide) coastal plain, which is the home of *Chilatherina pricei* and most other freshwater fishes on Yapen. The main channel of the Reifafeif River on the coastal plain is approximately 15–30 m wide and in non-flood periods averages about 1–2 m in depth. Water temperatures and pH in July 1995 ranged between 24.2°–26.4°C and 7.5–8.1. Progressing inland, the river quickly narrows as it approaches the mountains and is characterised by scenic rapids, waterfalls, and deep pools. *Chilatherina pricei* is abundant in the main channel, usually over rock or boulder bottoms. It forms midwater aggregations that feed on algae and small invertebrates, particularly insects. Although the river flows through rainforest and gardens, it is generally open to sunlight over the coastal plain. *Melanotaenia japenensis* is sometimes found with *Chilatherina pricei*, but seems to be more common in smaller, shaded tributaries, rather than the main channel.

Remarks:

This species was named after David Price, in recognition of his keen interest in the natural history of New Guinea. He has lived periodically on Yapen Island with his family over the past decade, making valuable collections of fishes and frogs, including the type specimens of Chilatherina pricei.

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2. **Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). For example, is the species listed on CITES Appendix I, II or III, and if so, are there any specific restrictions on the movement of this species? Include information on the conservation value of the species.**

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Chilatherina” revealed no results for those entities.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 11 species of Chilatherina listed.

Chilatherina alleni **listed as vulnerable**
https://www.iucnredlist.org/species/169522/147680522

Chilatherina axelrodi **listed as endangered**
https://www.iucnredlist.org/species/4628/147680647

Chilatherina bleheri **listed as endangered**
https://www.iucnredlist.org/species/4629/147680677

Chilatherina bulolo **listed as least concern**
https://www.iucnredlist.org/species/4630/147680735

Chilatherina campsi **listed as least concern**
https://www.iucnredlist.org/species/161079348/161079383

Chilatherina crassispinosa **listed as least concern**
https://www.iucnredlist.org/species/161079519/161079697

Chilatherina fasciata **listed as least concern**
https://www.iucnredlist.org/species/161079834/161080091

Chilatherina lorentzii **listed as near threatened**
https://www.iucnredlist.org/species/161080164/161080249

Chilatherina pagwiensis **listed as endangered**
https://www.iucnredlist.org/species/161080305/161080322

Chilatherina pricei **listed as vulnerable**
https://www.iucnredlist.org/species/161080365/161080369

Chilatherina sentaniensis **listed as critically endangered**
https://www.iucnredlist.org/species/4631/147680762

References

The CITES Species website with lists and search facility accessed on 17 April 2021.
URL http://www.cites.org/eng/disc/species.php

The IUCN Red List search facility locate accessed on 17 April 2021.
URL http://www.iucnredlist.org/details/4630/0

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Allen, & Renyaan (1996) record the holotype as a male, 88.7mm SL, Reifafeif River about 4km upstream from Warironi Village, Yapen Island, Irian Jaya (1º51ºS. 136º33ºE), using rotenone, by G. Allen, S. Renyaan and D. Price on 11 July 1995.

Allen, & Renyaan (1996) record the paratypes (22) as being between 42.5mm and 88.7mm SL from the same area, over three collecting trips, between 1991 and 1995.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, Gerald R. & S. J. Renyaan. (1996). Chilatherina pricei, a new species of rainbowfish (Melanotaeniidae) from Irian Jaya. Revue française d'Aquariologie Herpétologie 23(1-2): 5-8.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.c The natural geographic range.

This species is known from a single stream near Warironi Village on south-eastern Yapen Island, Papua Province, Indonesia. It probably occurs in other streams on the southern side of Yapen, which extends for about 165 km

.**References:**

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, Gerald R. & S. J. Renyaan. (1996). Chilatherina pricei, a new species of rainbowfish (Melanotaeniidae) from Irian Jaya. Revue française d'Aquariologie Herpétologie 23(1-2): 5-8.

Boeseman, M. (1963) Notes on the fishes of western New Guinea 1. Zool. Mededelingen, 38(14); 221-242.

IUCN Redlist: https://www.iucnredlist.org/species/161080365/161080369

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.d Habitat.

The Reifafeif River habitat is typical of numerous streams on Yapen Island, which no doubt are populated by this species. Yapen Island is situated in Cenderawasih Bay (formerly Geelvink Bay) off the northern coast of West Papua. It is a narrow, elongate (approximately 170 km long and up to 25 km wide) island with a central spine of mountains which rise to a maximum elevation of 1500 metres, and was once part of the New Guinea mainland. It has an area of approximately 2424 km2. The mountain range is dissected by numerous independent drainage systems, such as the Reifafeif River. The streams rise in the steep mountains and plunge to a relatively narrow (3–5 km wide) coastal plain, which is the home of *Chilatherina pricei* and most other freshwater fishes on Yapen. The main channel of the Reifafeif River on the coastal plain is approximately 15–30 m wide and in non-flood periods averages about 1–2 m in depth. Water temperatures and pH in July 1995 ranged between 24.2°–26.4°C and 7.5–8.1.

This is a benthopelagic species that is found in rivers or streams where the substrate consists of gravel and rocks, and the water is cold, clear and fast-flowing. It is also found in rocky pools and backwaters in rainforest habitat. It generally occurs well upstream at elevations above 200m in the Reifafeif River system and more than 60m in the Wapoga system. This species has a maximum size of about 9 cm SL

In most cases Chilatherina are found in either low-lying riverine floodplain or foothill streams However at least one species (*Chilatherina pricei*) frequents streams of the mountainous Yapen Island to about 1500m above sea level.

At least three species (*C.bleheri, C.fasciata, C.sentaniensis*) have lake dwelling populations. In stream habitats *Chilatherina* frequent shallow pools where the flow rate is gentle, however *Chilatherina pricei* is often found in rapid flowing steep gradient creeks. Typically *Chilatherina* prefers sections of the stream or lake-shore which affords maximum exposure to sunlight. (Allen 1991)

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Allen, Gerald R. & S. J. Renyaan. (1996). Chilatherina pricei, a new species of rainbowfish (Melanotaeniidae) from Irian Jaya. Revue française d'Aquariologie Herpétologie 23(1-2): 5-8.

IUCN Redlist: https://www.iucnredlist.org/species/161080365/161080369

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Chilatherina pricei* was recorded. It forms midwater aggregations that feed on algae and small invertebrates, particularly insects. Although the river flows through rainforest and gardens, it is generally open to sunlight over the coastal plain. The diet of other members of the *Chilatherina* genus are well recorded. All rainbowfishes of the family *Melanotaeniidae* are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

3.f Social behaviour and groupings

Allen & Renyaan (1996) describer the diet of *Chilatherina pricei*. It forms midwater aggregations that feed on algae and small invertebrates, particularly insects. Although the river flows through rainforest and gardens, it is generally open to sunlight over the coastal. They were not schooling but in loose aggregations swimming at all levels in water up to 1.2m deep. Allen & Renyaan (1996) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 10 cm in length and common in most habitats below 1500m elevation. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; "Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac."

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Allen, Gerald R. & S. J. Renyaan. (1996). Chilatherina pricei, a new species of rainbowfish (Melanotaeniidae) from Irian Jaya. Revue française d'Aquariologie Herpétologie 23(1-2): 5-8.

IUCN Redlist: https://www.iucnredlist.org/species/161080365/161080369

Tappin, A.R., (2011) "Rainbowfishes, their care and keeping in captivity" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylised display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as "dither fish" to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried rainbowfish for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Fishbase 2021:
https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.i characteristics that may cause harm to humans and other species.

There are no sharp spines, toxins or venom in any member of *the Melanotaeniidae* family.

References:

Fishbase: https://www.fishbase.de/summary/chilatherina-pricei.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4. Provide information on the reproductive biology of the species, including

There are no scientific records of any work done on the reproductive biology of *Chilatherina pricei* but the description *of Chilatherina pricei* (1997) states that it is most similar to *C. fasciata* of the northern New Guinea mainland.. It differs greatly from these in colouration, C. fasciata having a dark mid-lateral stripe and reddish fins in males. It further differs from *C. fasciata* in having a shorter blunter snout with the maxillary reaching to about the level of the anterior edge of the eye (falling well short in *C. fasciata*). It further differs from *C. pricei* in the modal counts of soft anal rays (usually 19-24 in *alleni* versus 24-27 in *pricei*), and in the number of cheek scales (16-18 in alleni versus 19-23). Chilatherina *species are* well known in the aquarium trade and have been kept and bred by the authors since 1983 from stock obtained from Melbourne.

C. axelrodi, C. bleheri, C. pricei, C. pricei, C. pricei, C. pricei and *C. sentaniensis* were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Chilatherina pricei* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b How frequently breeding occurs

The authors could find no record or observation for *Chilatherina pricei* but closely related *Chilatherina* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Chilatherina pricei* but closely related *Chilatherina* species will produce about 40 to 80 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "Rainbowfishes, their care and keeping in captivity" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992). There are no naturally occurring *Chilatherina* species in Australia. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species *of Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *Glossolepis incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish “aquarium” strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under “pseudo-scientific” names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a “Code of Conduct” that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by the authors.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There is no record of *Chilatherina pricei* being hybridised in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Chilatherina* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between *Melanotaenia praecox* and *Glossolepis incisus*, they produced hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family *Melanotaeniidae* was sufficiently close for them all to hybridise. Author 1 called an expert in the field of rainbowfish for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different rainbowfish *Melanotaenia splendida splendida* has been introduced to a different rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

References

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific Chromosomal Diversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Chilatherina pricei* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6 https://www.fishbase.de/summary/Chilatherina-pricei.html

Froese, R. and D. Pauly. Editors. 2020. FishBase.
www.fishbase.org, version (12/2020). Accessed 17 Apr 2021

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

Glossolepis incisus, has been assessed by Patricia Kialola for and on behalf of the Pet Industry Association of Australia. *Glossolepis leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005)
https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator; https://www.baphiq.gov.tw/public/Data/910614193571.pdf
, or
http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of *Chilatherina pricei* into the Australian environment should it be released or escape effective human control. Author 1 contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is

reproduced and is attached with *Chilatherina pricei* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020.

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Chilatherina pricei is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment score attached as appendix B. There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville, Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

7c. ability to find shelter

Allen (1979), describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Allen, Gerald R. & S. J. Renyaan. (1996). Chilatherina pricei, a new species of rainbowfish (Melanotaeniidae) from Irian Jaya. Revue française d'Aquariologie Herpétologie 23(1-2): 5-8.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7d. rate of reproducing

Chilatherina pricei is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been here, and popular, for more than 40 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using the copy of Climex for PC, the process attracts a score of 4 for *Chilatherina pricei,* indicating the species has a low chance of survival in Australian water ways. Attached as appendix B.

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Chilatherina pricei* were to escape, effective control the area where the likelihood of accidental or intentional release is greater.. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging.

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to one of the possible suitable natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Chilatherina pricei* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution. It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats.

Chilatherina have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory.

Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

Chilatherina pricei is known from coastal streams in southern Yapen Island, which typically rise in the steep interior mountains and plunge to the narrow (3-5 km) coastal plain, which is the home of Chilatherina pricei. The species is abundant over rock or boulder bottoms of the main stream channels, usually in exposed sections that receive abundant sunlight. It has a maximum size of about 8.5 cm SL. The IUCN Redlist has assessed *Chilatherina pricei* as Vulnerable. It is restricted to a single stream near Warironi Village on south-eastern Yapen Island, but may be more widespread in the lowlands of the island. Sea level rise is a plausible threat that could push the species to Critically Endangered or Extinct in a very short time period. There are no major threats to this species at present. However, sea level rise could be a future potential threat to this species.

Allen mentions a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References ;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/species/

8.a similar niche species (i.e. competition with other species for food, shelter etc.)

If *Chilatherina pricei* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Chilatherina pricei* is similar to and is most closely related to *C. fasciata and* other members of the *Chilatherina* genus the behaviour will be similar. Aquarium observations worldwide of *Chilatherina pricei* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless

and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

References:

Aqua-fish.net – since 2005 - https://en.aqua-fish.net/fish/

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

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8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Chilatherina pricei* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 82 mm (Allen 1980).

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Allen, Gerald R. & S. J. Renyaan. (1996). Chilatherina pricei, a new species of rainbowfish (Melanotaeniidae) from Irian Jaya. Revue française d'Aquariologie Herpétologie 23(1-2): 5-8.

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Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

8.c habitat and local environmental conditions

Chilatherina pricei are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or

debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Chilatherina* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Chilatherina pricei* (Fishbase records) diseases in other *Chilatherina* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. found at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Chilatherina,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in Northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

References :

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Hardy-Smith P., Jones R. and Kailola P. (2007) *"Scientific review of the biosecurity risks associated with the importation of rainbowfish for ornamental purposes"* - Prepared for Biosecurity Australia by Panaquatic® Health Solutions Pty Ltd

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

Kahn, S.A., Wilson, P.W., Pereira, R.P., Hayder, H. and Gerrity, S.E. 1999. *Import Risk analysis on live ornamental finfish*. Canberra: Australian Quarantine and Inspection Service. 172 p.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *C. axelrodi, C. bleheri, C. campsi and C. fasciata* have been in Australia, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Chilatherina pricei* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from North American and European breeders and then from commercial facilities to which these captive bred stocks are distributed.

Chilatherina pricei poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp. *(G. incisus,* and *G. leggetti)* currently permitted for import. Also, other species are being considered for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for “fresh” wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008) [online] Available at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf [Accessed 17 April 2021].

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Chilatherina pricei* will be used in the live fish ornamental aquarium display trade. *Chilatherina pricei is* to be added to the live import list to legitimise the use of

the species within Australia as an ornamental aquarium fish. Seven of the eleven species of *Chilatherina* have been in Australia prior to 1983, *C. Axelrodi, C, bleheri, C. bulolo, C campsi, C. crassispinosa, C. fasciata, and C. sentaniensis*. Rainbowfish of the genus *Chilatherina* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960's.

If *Chilatherina pricei is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

References:

Biosecurity Australia. (2009) " **BIOSECURITY AUSTRALIA ADVICE 2009/30 EXTENSION OF POLICY TO INCLUDE THE IMPORTATION OF RED RAINBOWFISH FOR ORNAMENTAL PURPOSES".** Published by the Australian Government, available at: http://www.daff.gov.au/SiteCollectionDocuments/ba/memos/2009/2009-30.pdf Downloaded 17 Jul 2015.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

References:

Biosecurity Australia. (2009) " **BIOSECURITY AUSTRALIA ADVICE 2009/30 EXTENSION OF POLICY TO INCLUDE THE IMPORTATION OF RED RAINBOWFISH FOR ORNAMENTAL PURPOSES".** Published by the Australian Government, available at: http://www.daff.gov.au/SiteCollectionDocuments/ba/memos/2009/2009-30.pdf Downloaded 17 Jul 2015.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11.a the containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

Reference:

Biosecurity Act 2015 as in force 25 march 2020, Accessed 24 march 2021, available at: https://www.legislation.gov.au/Details/C2020C00127

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Chilatherina* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Chilatherina pricei* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Chilatherina pricei* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Government Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available at: http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

References :

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Aquagreen Aquarium and Pond Keepers Code of Conduct – available at URL - https://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at:
http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

12. Provide information on all other Commonwealth, state and territory legislative controls on the species, including:
the species' current quarantine status, or
pest or noxious status, or
whether it is prohibited or controlled by permit or licence in any state or territory.

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species, there are no references or instances of *Chilatherina* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Chilatherina pricei* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow *Chilatherina pricei* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows *Chilatherina pricei* is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-freshwater/list-of-noxious-fish , and shows no *Chilatherina* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called “Restricted Matter” comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. *Chilatherina pricei* is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 and can be accessed at:
https://www.daf.qld.gov.au/__data/assets/pdf_file/0008/1398842/prohibited-restricted-invasive-fish.pdf , and there are no *Chilatherina* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Chilatherina pricei* is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at,
http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Chilatherina* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Chilatherina* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. *Chilatherina pricei* is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at

https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish , and shows no *Chilatherina* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. *Chilatherina pricei* does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *chilatherina* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp **(*Cyprinus carpio*)** mosquito fish **(*Gambusia* spp.)** Didymo a freshwater algae **(*Didymosphenia geminata*)** and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *chilatherina* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is ‘reckless’ about whether the animal is a prohibited animal and is also ‘reckless’ about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept. Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at:

https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-Animals-Declaration-ACCESS-3.pdf . There are no *Chilatherina* species listed.

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Allen, G.R., S.H. Midgley and M. Allen (2002). Field Guide to the Freshwater Fishes of Australia, Western Australian Museum.

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Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005) https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

ANGFA, **Australia New Guinea Fishes Association** https://angfa.org.au/

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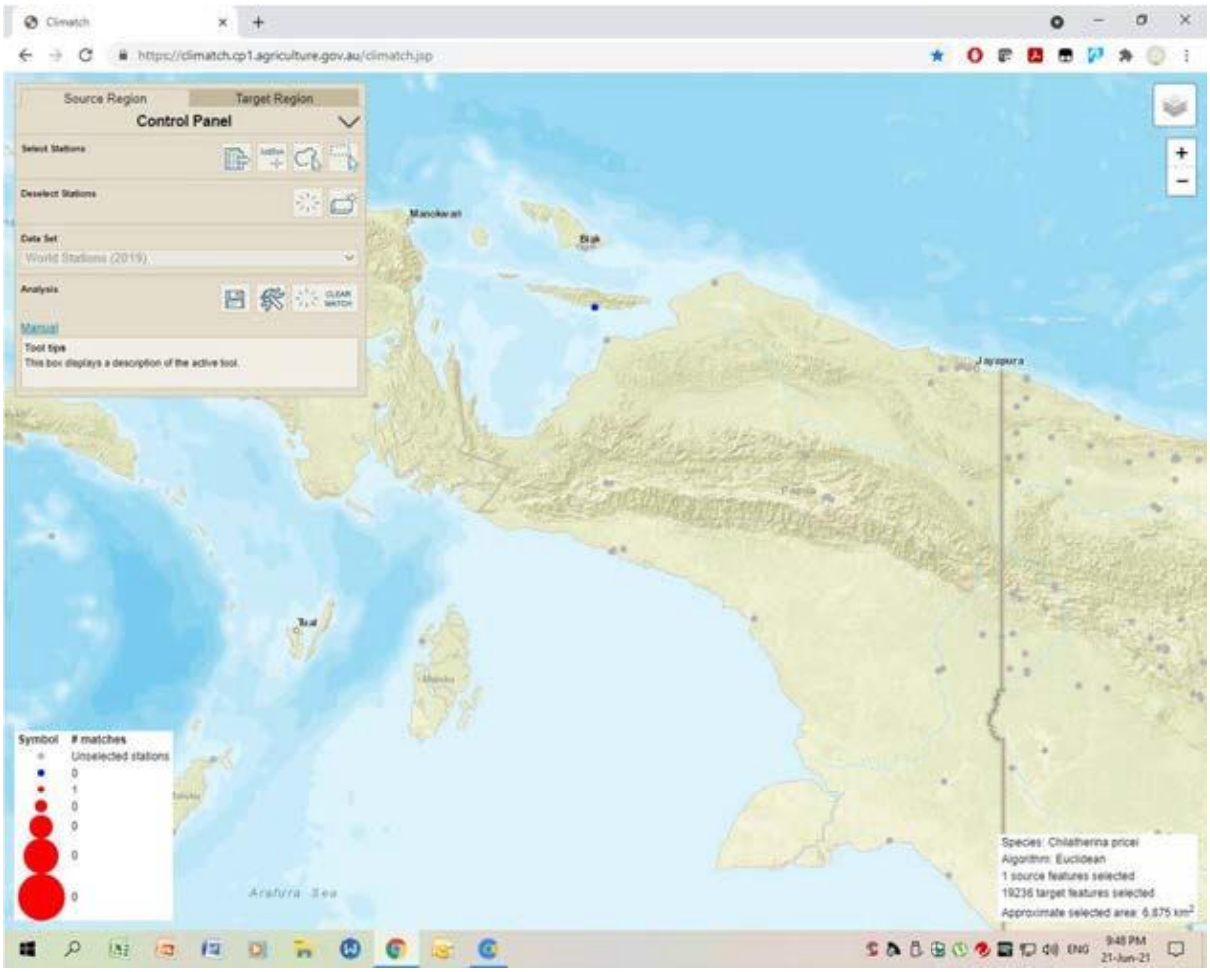
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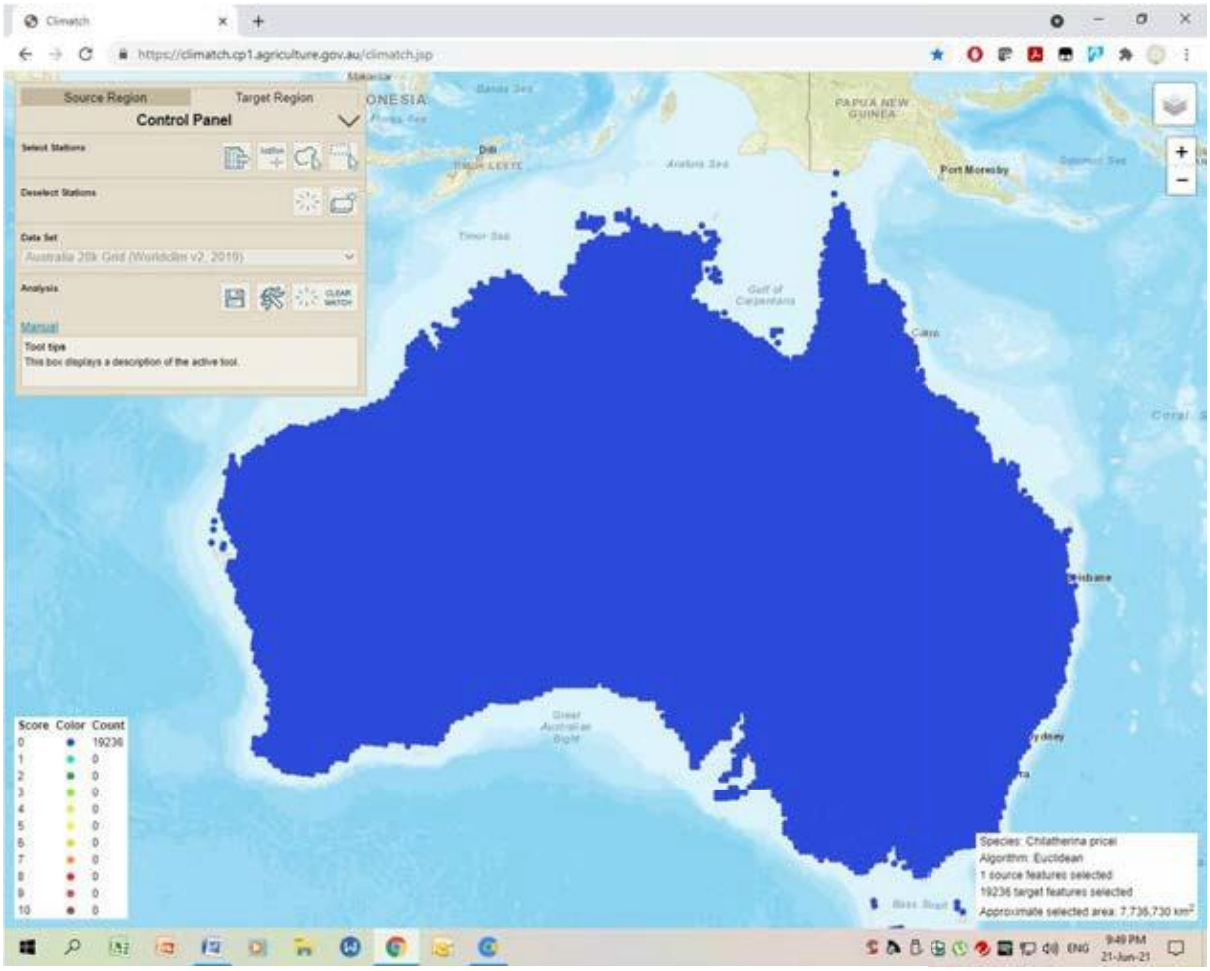
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Chilatherina pricei





Appendix B

Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were done to provide a score against the provisions in the assessment process.(accessed 6th June 2021.)

BOMFORD ASSESSMENT

SPECIES: Chilatherina pagwiensis

Score A. Climate Match (0-8)

Number of squares within 60% of the mean: (No. 5)	0
Number of squares within 50% of the mean: (No. 6)	0
Number of squares within 40% of the mean: (No. 7)	0
Number of squares within 30% of the mean: (No. 8)	0
Number of squares within 20% of the mean: (No. 9)	0
Number of squares within 10% of the mean: (No. 10)	0

Total = 0

Score: 1 (Ref: fishbase.org, PC CLIMATE)

Score B, Overseas Range

Number of 1° x 1° grids in which species occurs overseas.

No. of squares : 1

Score: 0 (Ref: fishbase.org, googleearth.com)

Score C, Establishment

Locations of establishment incidence:	nil - never introduced
Score: 1	(Ref: fishbase.org)

Score D, Introduction Success

Percentage of Introduction events that have been successful

Introductions	nil
Successful:	nil
Score: 1	(Ref: fishbase.org)

Score E, Taxa risk

Genus:	Chilatherina	
Introductions:	0	
Successful:	0	
Score:	0	(Ref: fishbase.org / M. Bomford)

Family:	Melanotaeniidae (Rainbowfishes)	
Introductions:	5	
Successful:	0	unknown
Score: 0		(Ref: fishbase.org / M. Bomford)

Total: 4 (LOW)

The score of 4 according to the assessment model gives the species a low chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

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A report to address the "Terms of Reference" for an application to include *Chilatherina sentaniensis* onto the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.

Chilatherina sentaniensis



© Photograph Gerald Allen Permission to use photo obtained 9th July 2015.

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that the Lake Sentani Rainbowfish *Chilatherina sentaniensis* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented for the prosecution in the witness box by author 1 of this report, however the accused pleaded guilty.

Disease

Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species

Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat

Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species

Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes

Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

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Lake Sentani © Photograph Johannes Graf Permission to use photo

Terms of Reference

Overview: The rainbowfish genus *Chilatherina* consists of eleven species.

etymology: *Chilatherina* (origin - Chilatherina Greek) cheilos = lip + Greek, atherina, the Greek name for the eperlane

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Glossolepis* are:

Chilatherina is closely related to Melanotaenia, the largest genus in the family. They differ chiefly with regard to jaw structure. In Chilatherina the lateral portion of the premaxillary is either straight or curved gently in a postero-ventral direction. The lower jaw is generally inferior to the upper jaw and the medial portion of the upper lip is swollen and profusely covered with teeth (Fig. 3). In addition, the head tends to be more slender and the snout relatively pointed compared with Melanotaenia. The latter genus by contrast, has a more or less abrupt downward bend in the lateral portion of the premaxillary with less swelling of the medial upper lip and fewer teeth on its surface. Moreover, the jaws are usually about even or the upper jaw is slightly inferior (Le. lower jaw protruding). The external jaw features of Chilatherina and Melanotaenia were illustrated by Allen (1980a).

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Chilatherina sentaniensis © Photograph Johannes Graf Permission to use photo

1. Provide information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Chilatherina* (origin - Chilatherina Greek) cheilos= lip + Greek , atherina, the Greek ` name for the eperlane
Species: *Rhombatractus sentaniensis* Weber, 1908
Chilatherina sentaniensis (Weber, 1908)
Chilatherina sentaniensis, , Lake Sentani rainbowfish

Chilatherina sentaniensis



Chilatherina sentaniensis - © photo: Christophe Mailliet

Species Summary

Perhaps the most distinguishing feature of the Chilatherina genus is their deep, laterally compressed body that increases with age, particularly in males, and *Chilatherina sentaniensis* is no different. Their overall body colouration is silvery-blue or greenish on the upper back fading laterally to silverly orange. They have a diffuse blue or green mid-lateral band and narrow silver or light blue stripes between each horizontal scale rows. Males often show 6–8 reddish-brown bars on the lower sides of the body between the pectoral fin base and the level of the middle anal rays. However, colour can be variable depending on captive conditions. Males are more brightly coloured, larger, and deeper bodied than females. Males may reach a maximum size of 12 cm, but females are usually less than 10 cm.

Distribution & Habitat

Chilatherina sentaniensis are endemic to Lake Sentani and its tributaries streams. Lake Sentani is located some 10 kilometres west of Jayapura at the NE extremity of West Papua. It is an irregularly shaped lake with approximate dimensions of 28 km (E-W) by 19 km (N-S) and a surface area of 104 km2 . Its blue green waters are dotted with at least 16 small islands, and it is surrounded by hillsides in the south and the Cyclops Mountains in the north, which separate the lake from the Pacific Ocean. Lake Sentani is by far the largest of the West Papuan lakes and has a catchment area of about 600 km2 . About 35 small rivers flow into the lake, and there is one natural outlet in the south-eastern tip, via the Jafuri and Tami rivers to the Pacific Ocean near the Papua New Guinea border. The lake is divided into three main sections with recorded depths of 7 to 52 metres. According to surveys in 1970-71, 1984 and 1987 the lake is thermally unstratified, with surface temperatures of 29–32° and pH 6.2–6.8. Rainbowfishes are generally found around the margins of the lake. Large numbers are found congregating around submerged aquatic vegetation, fallen tree branches etc.

Because of its proximity to the provincial capital Jayapura and the large population around it, Sentani is no longer the pristine lake it once was. A survey by Samuel J. Renyaan in 1993 recorded 33 species of fish, of which 13 were introduced. Surveys have shown an increase in introduced species but the impact on the total fish population has not been documented. Fish are extensively raised in ponds and cages around the perimeter of the lake and the introduction of species (particularly carp and tilapia) has been both accidental and intentional.

Remarks

Chilatherina sentaniensis was originally collected from Lake Sentani and the Sekanto River during the 1899–1900 Siboga Expedition to the Dutch East Indies (West Papua). A large collection of specimens were also obtained from the lake by Marinus Boeseman during a collecting expedition for the Leiden Museum in 1954–1955. The lectotype of *Chilatherina sentaniensis*, preserved in the Amsterdam museum, shows a very long snout, which according to Gerald Allen, is an important distinguishing mark. In his 1982 book, “Rainbowfishes of Australia and New Guinea” Allen showed *Chilatherina sentaniensis* among the colour sketches, because he didn’t have any photographs of live specimens.

In 1982, live specimens of *C. fasciata* were collected from the Jafuri River and during the 1980s and early 1990s they were being distributed in the hobby as *Chilatherina sentaniensis*. In his Field Guide to the Freshwater Fishes of New Guinea of 1991 Gerald

Allen noted that probably all records of *Chilatherina sentaniensis* in the aquarium literature related to *C. fasciata* varieties and that the most recent collection of the true *Chilatherina sentaniensis* was made in 1954. In yet another book, Rainbowfishes in Nature and in the Aquarium, published in 1995, Gerald Allen showed a picture of a live specimen, with the remarkably long snout, that was collected in a small tributary stream flowing into the north-eastern end of Lake Sentani in 1991. Several specimens were netted along with *C. fasciata* and *Glossolepis incisus*. None of these specimens however, were collected live for the aquarium hobby.

The “genuine” *Chilatherina sentaniensis* does however, exist in the hobby and they have a much longer, more pointed head and usually 9–12 soft dorsal rays compared to 11–16 rays in *C. fasciata*. Live specimens were collected from the lake in 1991 by Charles Nishihira and distributed in the aquarium hobby. Specimens were also collected from a small tributary stream in 2004 and 2005. However, they have not been widely available and only a handful of enthusiasts are maintaining them in captivity.

There is some concern that *Chilatherina sentaniensis* may not occur in Lake Sentani anymore, only in some of the feeder streams. The only currently known location is “Carwash Creek” which is crossed by the road from Sentani to Jayapura. This creek is nowadays heavily polluted by upstream mining activities. In the last years, attempts to re-collect *Chilatherina sentaniensis* from this creek have been unsuccessful. It hasn’t been found at any other location so far (J. Graf 2009, pers. comm.).

Morphology

Chilatherina sentaniensis : hard *dorsal rays* : 5-7; soft dorsal rays: 9-12; hard anal jets: 1; soft anal jets: 21-26. 22-27 scales for the dorsal fin. 10-12 soft dorsal rays (Weber, 1922). Colour of specimens preserved in alcohol reddish brown above, silvery below, with a more or less pronounced black longitudinal stripe and sometimes with narrow transverse bands on the lower half of the body. Fins blackish.

C. fasciata : hard dorsal rays: 5-8; soft dorsal rays: 11-16; hard anal jets: 1; soft anal jets: 21-28. 19-21 scales for the dorsal fin. 13-16 soft dorsal rays (Weber, 1922). Colour of specimens preserved in alcohol brownish above, lighter towards the bottom, with a more or less pronounced black longitudinal stripe and a number of transverse narrow stripes, at approximately right angles to the longitudinal stripe on the lower half of the body. These transverse stripes are sometimes absent. Fins dim.

References

Froese, R. and D. Pauly. Editors. 2021.FishBase. World Wide Web electronic publication. www.fishbase.org, (02/2021)

Tappin, Adrian (2005) “Rainbowfishes ~ Their Care & Keeping in Captivity 2nd. Edition at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Weber, M. 1907. Süsswasserfische von Neu-Guinea. Ein Beitrag zur Frage nach dem früheren Zusammenhang von Neu-Guinea und Australien. In: Wichmann, A. (ed.), *Nova Guinea. Résultats de l'expédition scientifique Néerlandaise à la Nouvelle-Guinée en 1903*, pp. 201-267, plates 11-13. E. J. Brill, Leiden, Netherlands

2. Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). For example, is the species listed on CITES Appendix I, II or III, and if so, are there any specific restrictions on the movement of this species? Include information on the conservation value of the species.

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Chilatherina” revealed no results for those entities.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 11 species of Chilatherina listed.

Chilatherina alleni **listed as vulnerable**
https://www.iucnredlist.org/species/169522/147680522

Chilatherina axelrodi **listed as endangered**
https://www.iucnredlist.org/species/4628/147680647

Chilatherina bleheri **listed as endangered**
https://www.iucnredlist.org/species/4629/147680677

Chilatherina bulolo **listed as least concern**
https://www.iucnredlist.org/species/4630/147680735

Chilatherina campsi **listed as least concern**
https://www.iucnredlist.org/species/161079348/161079383

Chilatherina crassispinosa **listed as least concern**
https://www.iucnredlist.org/species/161079519/161079697

Chilatherina fasciata **listed as least concern**
https://www.iucnredlist.org/species/161079834/161080091

Chilatherina lorentzii **listed as near threatened**
https://www.iucnredlist.org/species/161080164/161080249

Chilatherina pagwiensis **listed as endangered**
https://www.iucnredlist.org/species/161080305/161080322

Chilatherina pricei **listed as vulnerable**
https://www.iucnredlist.org/species/161080365/161080369

Chilatherina sentaniensis **listed as critically endangered**
https://www.iucnredlist.org/species/4631/147680762

References

The CITES Species website with lists and search facility accessed on 17 April 2021.
URL http://www.cites.org/eng/disc/species.php

The IUCN Red List search facility locate accessed on 17 April 2021.
URL http://www.iucnredlist.org/details/4630/0

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

WEBER, 1908, records: Nova Guinea, 5: 235—236, pl. 11, fig. 3. a. Lecto-holotype: 96 mm standard length (finest specimen out of 5 of the same length, apparently the one figured in 1908), ZMA 103093; type-locality: Sentani lake. 217 b. Lecto-paratypes: 109 ex, same data. Collector: N. Guinea Expedition, 1903. Males may reach a maximum size of 12 cm, but females are usually less than 10 cm.

References:

G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Beauforti (1960) A series of miscellaneous publications zoological museum - Amsterdam No. 87 Volume 7 January 15, 1960 A list of type specimens of fishes in the Zoological Museum, University of Amsterdam. 1. Order Mugiliformes by J.J. Hoedeman (Zoological Museum, Amsterdam)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Weber, M. 1907. Süsswasserfische von Neu-Guinea. Ein Beitrag zur Frage nach dem früheren Zusammenhang von Neu-Guinea und Australien. In: Wichmann, A. (ed.), *Nova Guinea. Résultats de l'expédition scientifique Néerlandaise à la Nouvelle-Guinée en 1903*, pp. 201-267, plates 11-13. E. J. Brill, Leiden, Netherlands

3.c The natural geographic range.

The IUCN Redlist states: This species is known only from Lake Sentani and small tributaries flowing into the lake near Jayapura, Papua Province, Indonesia (G.R. Allen pers. comm. 2019). It is now considered extant only at the eastern end of the lake (Kadarusman

pers. comm. 2019). This species is known only from the large freshwater Lake Sentani, which is approximately 30 km long and 2-5 km wide, and its small tributaries. It has a maximum size of around 8.5 cm SL (G.R. Allen pers. comm. 2019).

References:

Allen, G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

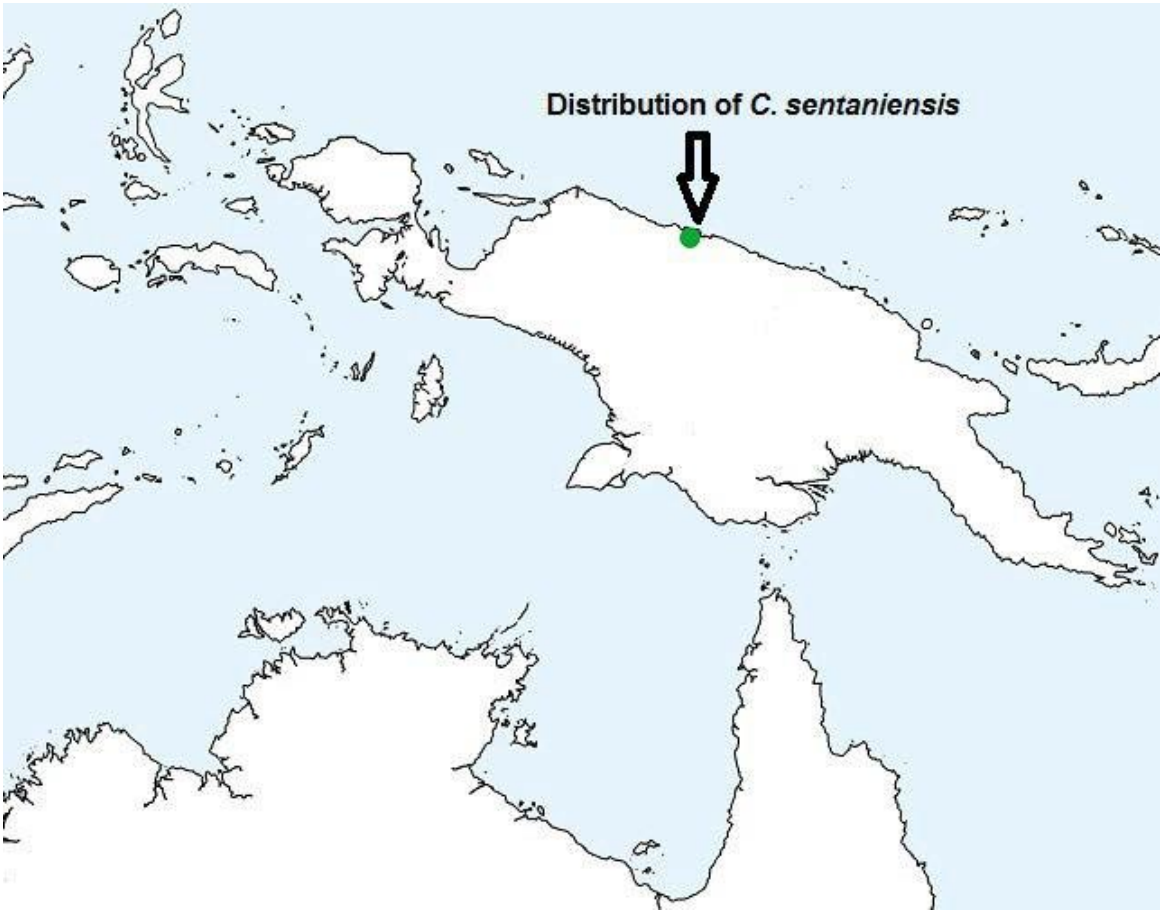
Boeseman, M. (1963) Notes on the fishes of western New Guinea 1. Zool. Mededelingen, 38(14); 221-242.

Graf, Johannes (2007). Chilatherina sentaniensis, how to recognize the real species? Original written in German in "Regenbogenfisch", magazine of the International Rainbowfish Association (IRG), No 4 – 2007 Revised and supplemented English version

IUCN Redlist: https://www.iucnredlist.org/species/4631/147680762

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.d Habitat.



Chilatherina sentaniensis is assessed by the IUCN as Critically Endangered. The species is considered extant only at the eastern end of Lake Sentani and based on this it has an extent of occurrence (EOO) of 90 km^2. There is a single location based on the threat of predatory and competitive invasive species. There is also a continuing decline in habitat due to pollution from the nearby settlement.

The species was reported as being common in the 1950s. However, repeated attempts to collect the fish between 1980 and 2000 yielded only around ten specimens taken from a single creek in 1991. In 2015, under 30 individuals were collected in the east of Lake Sentani (Kadarusman pers. comm. 2019). The population size is considered to be low, but the trend is thought to be stable (Kadarusman 2019). However, this could potentially change due to the several invasive species present.

Major threats include, the human population living along the shore of Lake Sentani is rapidly increasing and was estimated at 25,000 in 1996. The population has continued to grow since the 1990s, and was estimated at 137,000 in 2014. The resultant pollution from domestic waste entering the lake is a threat to the species living there. A further threat to this fish comes from the introduction of exotic species, and associated disease, into its habitat, including carp, tilapia, walking catfish, barbs, snakehead, red devil cichlids and gouramies. There is also traditional gold mining to the west of the lake (G.R. Allen and Kadarusman 2019).

At least three species (*C. bleheri, C. fasciata, C. sentaniensis*) have lake dwelling populations. In stream habitats *Chilatherina* frequent shallow pools where the flow rate is gentle, however *C. bulolo* is often found in rapid flowing steep gradient creeks. Typically *Chilatherina* prefers sections of the stream or lake-shore which affords maximum exposure to sunlight. (Allen 1991)

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Graf, Johannes (2007). Chilatherina sentaniensis, how to recognize the real species? Original written in German in "Regenbogenfisch", magazine of the International Rainbowfish Association (IRG), No 4 – 2007 Revised and supplemented English version

IUCN Redlist: https://www.iucnredlist.org/species/4631/147680762

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Chilatherina sentaniensis* was not recorded, but the diet of other members of the *Chilatherina* genus are well recorded. All rainbowfishes of the family *Melanotaeniidae* are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape

algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

3.f Social behaviour and groupings

Allen (1991) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; “Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac.”

References :

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) “*Rainbowfishes of Australia and Papua New Guinea”*. Published by Angus and Robertson

Graf, Johannes (2007). Chilatherina sentaniensis, how to recognize the real species? Original written in German in “Regenbogenfisch”, magazine of the International Rainbowfish Association (IRG), No 4 – 2007 Revised and supplemented English version

IUCN Redlist: https://www.iucnredlist.org/species/4631/147680762

Tappin, A.R., (2011) “*Rainbowfishes, their care and keeping in captivity*” available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylised display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as “dither fish” to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried rainbowfish for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

References:

Allen, G.R. & Cross, N.J. (1982) "Rainbowfishes of Australia and Papua New Guinea". Published by Angus and Robertson.

Fishbase 2021:
https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.i characteristics that may cause harm to humans and other species.

There are no sharp spines, toxins or venom in any member of *the Melanotaeniidae* family.

References:

Fishbase: https://www.fishbase.de/summary/chilatherina-sentaniensis.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4. Provide information on the reproductive biology of the species, including

There are no scientific records of any work done on the reproductive biology of *Chilatherina sentaniensis.* Chilatherina *species are* well known in the aquarium trade and have been kept and bred by the authors since 1983 from stock obtained from Melbourne.

C. axelrodi, C. bleheri, C. bulolo, C. campsi C. crassispinosa, C. fasciata, were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Chilatherina sentaniensis* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b How frequently breeding occurs

The authors could find no record or observation for *Chilatherina sentaniensis* but closely related *Chilatherina* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Chilatherina sentaniensis* but closely related *Chilatherina* species will produce about 40 to 80 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "Rainbowfishes, their care and keeping in captivity" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992). There are no naturally occurring *Chilatherina* species in Australia. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species *of Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in

the aquarium by providing only one sex of two different species. A closely related species, *Glossolepis incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish "aquarium" strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby, club and market resistance to such crosses. The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under "pseudo-scientific" names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a "Code of Conduct" that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by the authors.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There is no record of *Chilatherina sentaniensis* being hybridised in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Chilatherina* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between *Melanotaenia praecox* and *Glossolepis incisus*, they produced hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family *Melanotaeniidae* was sufficiently close for them all to hybridise. Author 1 called an expert in the field of rainbowfish for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different rainbowfish *Melanotaenia splendida splendida* has been introduced to a different rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

References

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific ChromosomalDiversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Chilatherina* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Chilatherina sentaniensis* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6 https://www.fishbase.de/summary/Chilatherina_sentaniensis.html

Froese, R. and D. Pauly. Editors. 2020. FishBase.
www.fishbase.org, version (12/2020). Accessed 17 Apr 2021

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

Glossolepis incisus, has been assessed by Patricia Kialola for and on behalf of the Pet Industry Association of Australia. *Glossolepis leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005) https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator; https://www.baphiq.gov.tw/public/Data/910614193571.pdf , or http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of *Chilatherina sentaniensis* into the Australian environment should it be released or escape effective human control. Author 1 contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with *Chilatherina sentaniensis* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020.

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Chilatherina sentaniensis is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment score attached as appendix B. There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville, Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

7c. ability to find shelter

Allen & Cross (1982), describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron.

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes (2007). Chilatherina sentaniensis, how to recognize the real species? Original written in German in “Regenbogenfisch”, magazine of the International Rainbowfish Association (IRG), No 4 – 2007 Revised and supplemented English version

Tappin, A.R., (2011) “*Rainbowfishes, their care and keeping in captivity*” available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Weber, M. 1907. Süsswasserfische von Neu-Guinea. Ein Beitrag zur Frage nach dem früheren Zusammenhang von Neu-Guinea und Australien. In: Wichmann, A. (ed.), *Nova Guinea. Résultats de l'expédition scientifique Néerlandaise à la Nouvelle-Guinée en 1903*, pp. 201-267, plates 11-13. E. J. Brill, Leiden, Netherlands

7d. rate of reproducing

Chilatherina sentaniensis is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using the copy of Climex for PC, the process attracts a score of 3 for *Chilatherina sentaniensis* indicating the species has a very low chance of survival in Australian water ways. Attached as appendix B.

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Chilatherina sentaniensis* were to escape, the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging.

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to one of the possible suitable natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons that peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Chilatherina sentaniensis* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution.

It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats.

Chilatherina have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

The species is considered extant only at the eastern end of Lake Sentani and based on this it has an extent of occurrence (EOO) of 90 km^2. There is a single location based on the threat of predatory and competitive invasive species. There is also a continuing decline in habitat due to pollution from the nearby settlement.

The species was reported as being common in the 1950s. However, repeated attempts to collect the fish between 1980 and 2000 yielded only around ten specimens taken from a single creek in 1991. In 2015, under 30 individuals were collected in the east of Lake Sentani (Kadarusman 2019). The population size is considered to be low, but the trend is thought to be stable (Kadarusman 2019). However, this could potentially change due to the several invasive species present.

Major threats include, the human population living along the shore of Lake Sentani is rapidly increasing and was estimated at 25,000 in 1996. The population has continued to grow since the 1990s, and was estimated at 137,000 in 2014. The resultant pollution from domestic waste entering the lake is a threat to the species living there. A further threat to this fish comes from the introduction of exotic species, and associated disease, into its habitat, including carp, tilapia, walking catfish, barbs, snakehead, red devil cichlids and gouramis. There is also traditional gold mining to the west of the lake (G.R. Allen and Kadarusman 2019).

At least three species (*C. bleheri, C. fasciata, C. sentaniensis*) have lake dwelling populations. In stream habitats *Chilatherina* frequent shallow pools where the flow rate is gentle, however *C. bulolo* is often found in rapid flowing steep gradient creeks. Typically *Chilatherina* prefers sections of the stream or lake-shore which affords maximum exposure to sunlight. (Allen 1991)

Allen mentions a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References ;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

Graf, Johannes (2007). Chilatherina sentaniensis, how to recognize the real species? Original written in German in "Regenbogenfisch", magazine of the International Rainbowfish Association (IRG), No 4 – 2007 Revised and supplemented English version

IUCN Redlist: https://www.iucnredlist.org/species/4631/147680762

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/species/161080365/161080369/

8.a similar niche species (i.e. competition with other species for food, shelter etc.)

If *Chilatherina sentaniensis* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious

competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Chilatherina sentaniensis* is similar to other members of the *Chilatherina* genus the behaviour will be similar. Aquarium observations worldwide of *Chilatherina sentaniensis* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

References:

Aqua-fish.net – since 2005 - https://en.aqua-fish.net/fish/

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Chilatherina sentaniensis* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 12cmm (Weber 1907).

References:

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Weber, M. 1907. Süsswasserfische von Neu-Guinea. Ein Beitrag zur Frage nach dem früheren Zusammenhang von Neu-Guinea und Australien. In: Wichmann, A. (ed.), *Nova Guinea. Résultats de l'expédition scientifique Néerlandaise à la Nouvelle-Guinée en 1903*, pp. 201-267, plates 11-13. E. J. Brill, Leiden, Netherlands

8.c habitat and local environmental conditions

Chilatherina sentaniensis are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Chilatherina* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Chilatherina sentaniensis* (Fishbase records) diseases in other *Chilatherina* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. found at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Chilatherina,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in Northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

References :

Allen G.R. (1981) A Revision of the Rainbowfish Genus *Chilatherina* (Melanotaeniidae). Records of the Western Australian Museum 9(3): 279-299.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes (2007). Chilatherina sentaniensis, how to recognize the real species? Original written in German in “Regenbogenfisch”, magazine of the International Rainbowfish Association (IRG), No 4 – 2007 Revised and supplemented English version

Hardy-Smith P., Jones R. and Kailola P. (2007) *"Scientific review of the biosecurity risks associated with the importation of rainbowfish for ornamental purposes"* - Prepared for Biosecurity Australia by Panaquatic® Health Solutions Pty Ltd

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

Kahn, S.A., Wilson, P.W., Pereira, R.P., Hayder, H. and Gerrity, S.E. 1999. *Import Risk analysis on live ornamental finfish*. Canberra: Australian Quarantine and Inspection Service. 172 p.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *C. axelrodi, C. bleheri, C. campsi and C. fasciata* have been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Chilatherina sentaniensis* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from North American and European breeders and then from commercial facilities to which these captive bred stocks are distributed.

Chilatherina sentaniensis poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp*. (G. incisus,* and *G. leggetti) are* currently permitted for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for "fresh" wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008) [online] Available at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf [Accessed 17 April 2021].

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Chilatherina sentaniensis* will be used in the live fish ornamental aquarium display trade. *Chilatherina sentaniensis is* to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish. Seven of the eleven species of *Chilatherina* have been in Australia prior to 1983, *C. Axelrodi, C, bleheri, C. bulolo, C campsi, C. crassispinosa, C. fasciata, and C. sentaniensis*. Rainbowfish of the genus *Chilatherina* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960's.

If *Chilatherina sentaniensis is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

References:

Biosecurity Australia. (2009) " **BIOSECURITY AUSTRALIA ADVICE 2009/30 EXTENSION OF POLICY TO INCLUDE THE IMPORTATION OF RED RAINBOWFISH FOR ORNAMENTAL PURPOSES".** Published by the Australian Government, available at: http://www.daff.gov.au/SiteCollectionDocuments/ba/memos/2009/2009-30.pdf Downloaded 17 Jul 2015.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

References:

Biosecurity Australia. (2009) " **BIOSECURITY AUSTRALIA ADVICE 2009/30 EXTENSION OF POLICY TO INCLUDE THE IMPORTATION OF RED RAINBOWFISH FOR ORNAMENTAL PURPOSES".** Published by the Australian Government, available at:

http://www.daff.gov.au/SiteCollectionDocuments/ba/memos/2009/2009-30.pdf Downloaded 17 Jul 2015.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11.a the containment, management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings

Reference:

Biosecurity Act 2015 as in force 25 march 2020, Accessed 24 march 2021, available at: https://www.legislation.gov.au/Details/C2020C00127

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Chilatherina* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Chilatherina sentaniensis* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Chilatherina sentaniensis* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available at: http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

References :

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Aquagreen Aquarium and Pond Keepers Code of Conduct – available at URL - https://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

12. Provide information on all other Commonwealth, state and territory legislative controls on the species, including:
the species' current quarantine status, or
pest or noxious status, or
whether it is prohibited or controlled by permit or licence in any state or territory.

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species , there are no references or instances of *Chilatherina* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Chilatherina sentaniensis* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow *Chilatherina sentaniensis* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows *Chilatherina sentaniensis* is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-freshwater/list-of-noxious-fish , and shows no *Chilatherina* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called "Restricted Matter" comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. *Chilatherina sentaniensis* is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 and can be accessed at:
https://www.daf.qld.gov.au/__data/assets/pdf_file/0008/1398842/prohibited-restricted-invasive-fish.pdf , and there are no *Chilatherina* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Chilatherina sentaniensis* is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at,
http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Chilatherina* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Chilatherina* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. *Chilatherina sentaniensis* is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish , and shows no *Chilatherina* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. *Chilatherina sentaniensis* does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *chilatherina* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp **(*Cyprinus carpio*)** mosquito fish **(*Gambusia* spp.)** Didymo a freshwater algae **(*Didymosphenia geminata*)** and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *chilatherina* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is ‘reckless’ about whether the animal is a prohibited animal and is also ‘reckless’ about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at:

https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-Animals-Declaration-ACCESS-3.pdf . There are no *Chilatherina* species listed.

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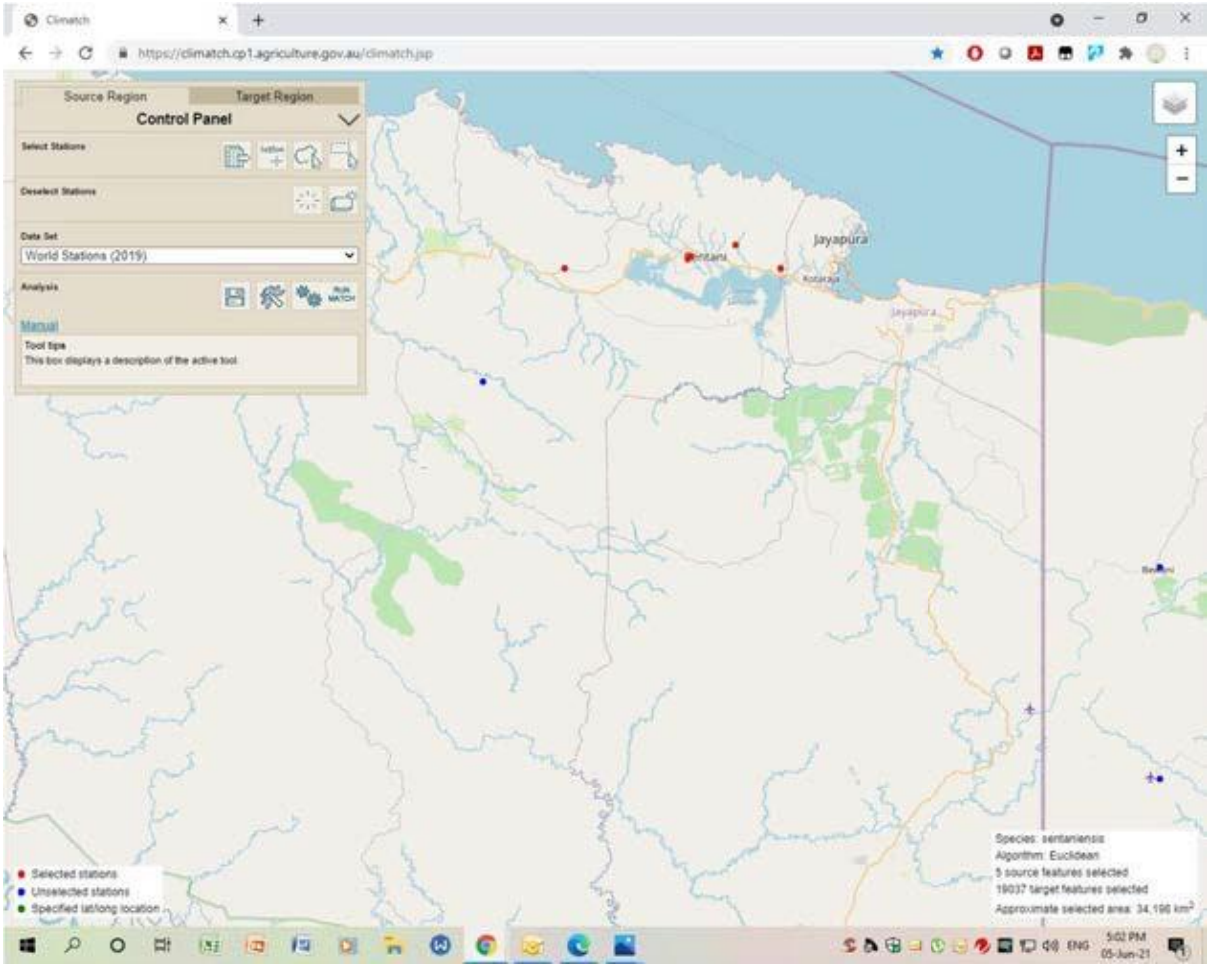
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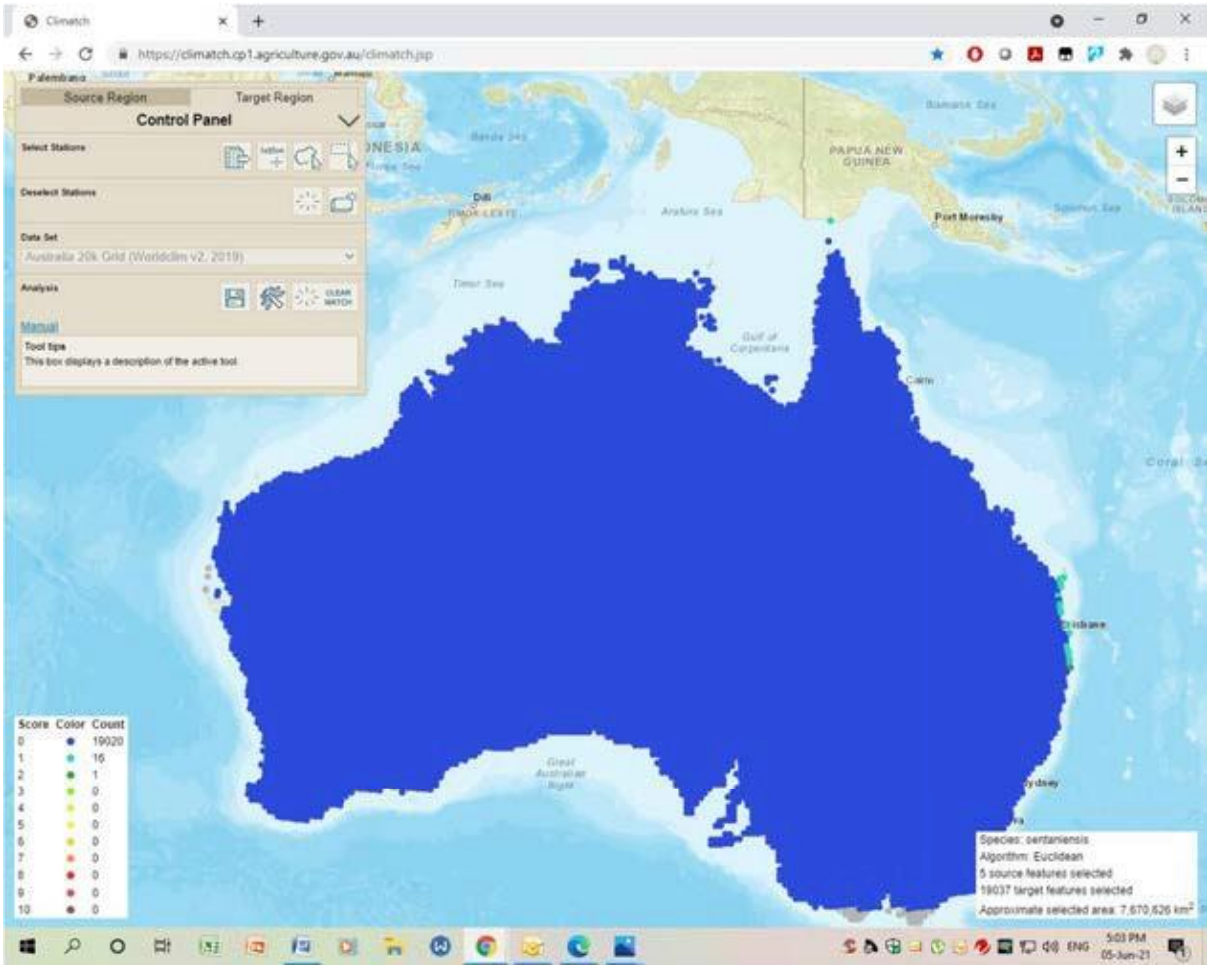
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APPENDIX A – calculation of climate from *Chilatherina sentaniensis* distribution climate to Australian Climate





Appendix B

Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were done to provide a score against the provisions in the assessment process.(accessed 6th June 2021.)

BOMFORD ASSESSMENT

SPECIES: Chilatherina sentaniensis

Score A. Climate Match (0-8)

Number of squares within 60% of the mean: (No. 5)	0
Number of squares within 50% of the mean: (No. 6)	0
Number of squares within 40% of the mean: (No. 7)	0
Number of squares within 30% of the mean: (No. 8)	0
Number of squares within 20% of the mean: (No. 9)	0
Number of squares within 10% of the mean: (No. 10)	0

Total = 0

Score: 1 (Ref: fishbase.org, PC CLIMATE)

Score B, Overseas Range

Number of 1° x 1° grids in which species occurs overseas.

No. of squares : <3

Score: 0 (Ref: fishbase.org, googleearth.com)

Score C, Establishment

Locations of establishment incidence: nil - never introduced
Score: 1 (Ref: fishbase.org)

Score D, Introduction Success

Percentage of Introduction events that have been successful
Introductions nil
Successful: nil
Score: 1 (Ref: fishbase.org)

Score E, Taxa risk

Genus: Chilatherina
Introductions: 0
Successful: 0
Score: 0 (Ref: fishbase.org / M. Bomford)

Family: Melanotaeniidae (Rainbowfishes)
Introductions: 0
Successful: 0 unknown
Score: 0 (Ref: fishbase.org / M. Bomford)

Total: 3 (VERY LOW)

The score of 3 according to the assessment model gives the fish a very low chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

Bomford, Mary (2006) "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia

Bomford, Mary and Glover, Julie (June 2004) "*Risk assessment model for the import and keeping of exotic freshwater and estuarine finfish*", A report produced by the Bureau of Rural Sciences for The Department of Environment and Heritage.

Phelong, P.C. (1996b) "Climex: a system to predict the distribution of an organism based on climate preferences". Available at: http://www.agric.wa.gov.au

A report to address the “Terms of Reference” for an application to include *Glossolepis dorityi* on the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.



Photographer - Ian Robertson, permission to use image obtained 17 March 2021

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of Social Media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that Dan Dority's Grime Rainbowfish *Glossolepis dorityi* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented in the witness box by the author of this report, however the accused offender pleaded guilty.

Disease

Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species

Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat

Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species

Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes

Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

References

Clements, Valentin, Rankin, Baker, Gee, Snellgrove, Sloman (2019) "*The effects of interacting with fish in aquariums on human health and well-being: A systematic review*" published by Institute of Biomedical and Environmental Health Research, School of Health and Life Sciences, University of the West of Scotland, Paisley, United Kingdom.

Cracknell, White, Pahl, Nichols & Depledge. 2016 "*Marine Biota and Psychological Well-Being: A Preliminary Examination of Dose–Response Effects in an Aquarium Setting*" published by Environment and Behavior2016, Vol. 48(10) 1242 –1269© 2015 SAGE Publications

Allen, G.R., 2001. A new species of rainbowfish (*Glossolepis*: Melanotaeniidae) from Irian Jaya, Indonesia. Fish. Sahul 15(3):766-775. (Ref. 44111)

https://www.fishbase.in/summary/Glossolepis-dorityi.html
Froese, R. and D. Pauly. Editors. 2020. FishBase.
World Wide Web electronic publication.
www.fishbase.org, version (12/2020).

Terms of Reference

1. Provide information on the taxonomy of the species.

Overview: The rainbowfish genus *Glossolepis* consists of nine species occurring only in the northern half of New Guinea. The name *Glossolepis* consists of two words from the greek language: "glossa" = tongue "lepis" = scale and refers to the tongue-shaped scale margins.

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Chilatherina* are:

- tongue-shaped scales,
- increased number of gill rakers,
- first spine of the second dorsal fin stronger than the first spine of the first dorsal fin and
- relatively elongated pectoral fins and enlarged teeth in the lateral wing of the remaxillary.



Fig. 1: Distribution of the genus *Glossolepis*. Map: Creative commons, modified.

Information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Glossolepis* (origin - *Glossolepis*: Greek, "glossa" = tongue, and "lepis" = scale which refers to the tongue shaped scale margins
Species: *Glossolepis dorityi* (Allen 2001), Dority's Rainbowfish, Zig-Zag rainbowfish

Etymology: *Glossolepis:* Greek, glossa = tongue + Greek, lepis = scale,
This species is named dorityi in honour of **Dan Dority** for his efforts in collecting the type specimens.

Reference:
Allen, Gerald R. (2001) A new species of rainbowfish (*Glossolepis*: Melanotaeniidae) from Irian Jaya, Fishes of Sahul, Journal of the Australia New Guinea fishes association, Volume 15, Number 3, PP766-775



Glossolepis dorityi from Lake Nenggwambu. © Johannes Graf



Glossolepis dorityi mature male from Lake Nenggwambu. © J. Felix



Creative commons. Distribution range of Glossolepis dorityi. © Johannes Graf

2. Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). For example, is the species listed on CITES Appendix I, II or III, and if so, are there any specific restrictions on the movement of this species? Include information on the conservation value of the species.

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Glossolepis” revealed no results for those entities. (accessed 21 April 2021).

A search of the International Union for the Conservation Red List web site indicated the Grime Rainbowfish, *Glossolepis dorityi* as critically endangered. It has listed the threatening process as residential and commercial development, aquaculture and agriculture and invasive species introductions. (Accessed 23 March 2021). The use of local trees for poisons to catch fish for food was also mentioned as a threatening process. Any specimens imported if the application is improved will be from aquaculture in the USA or Germany. No wild collections will be made.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 9 species of Glossolepis listed.

Glossolepis dorityi listed as critically endangered
https://www.iucnredlist.org/species/161080437/161080455

Glossolepis incisus listed as endangered
https://www.iucnredlist.org/species/9268/147681075

Glossolepis leggetti listed as least concern
https://www.iucnredlist.org/species/161080708/161080713

Glossolepis kabia listed as least concern
https://www.iucnredlist.org/species/161080469/161080528

Glossolepis maculosus listed as endangered
https://www.iucnredlist.org/species/9269/147681182

Glossolepis multisquamata listed as least concern
https://www.iucnredlist.org/species/169502/147681206

Glossolepis ramuensis listed as vulnerable
https://www.iucnredlist.org/species/9271/147681464

Glossolepis pseudoincisus listed as vulnerable
https://www.iucnredlist.org/species/9270/147681435

Glossolepis wanamensis listed as critically endangered
https://www.iucnredlist.org/species/9272/147681490

References:

The Cites Species website with lists and search facility URL
http://www.cites.org/eng/disc/species.php

The IUCN Red List search facility locate at URL http://www.iucnredlist.org/search

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available on the world wide web as a portable document format (PDF) at universal resource locator http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Allen, (2001), records the Holotype of the species as being 88.0 mm standard length, and 14 paratypes as being between 77.4 and 115.0 mm standard length, which is also reflected by **Tappin, A.R.,** (2011)

References:

Allen, Gerald R. (2001) A new species of rainbowfish (*Glossolepis*: Melanotaeniidae) from Irian Jaya, Fishes of Sahul, Journal of the Australia New Guinea fishes association, Volume 15, Number 3, PP766-775

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available on the world wide web as a portable document format (PDF) at universal resource locator http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.c The natural geographic range.

Glossolepis dorityi is currently known only from the Grimé River region of northern West Papua. The area was formerly known by the Dutch administrators as the Nimboran (Grimé) Plain, was described by Boeseman (1963), although no reference was made to the floodplain lakes. The type locality consists of a small (estimated area of 4-5 hectares) round lake (Lake Nenggwambu). It is located roughly 50 kilometres west of Lake Sentani.

References:

Allen, Gerald R. (2001) A new species of rainbowfish (*Glossolepis*: Melanotaeniidae) from Irian Jaya, Fishes of Sahul, Journal of the Australia New Guinea fishes association, Volume 15, Number 3, PP766-775

Boeseman, M. (1963) Notes on the fishes of western New Guinea 1. Zool. Mededelingen, 38(14); 221-242.

3.d Habitat.

There is a vigorously flowing outlet stream, but no apparent inlet, indicative of a subterranean connection with neighbouring lakes via the limestone substratum. Water was relatively clear and maximum depth was estimated to be at least 10–15 m. The lake is surrounded by secondary forest and aquatic plants were abundant, but relatively few species were evident.

Fishes were most strongly congregated around the outlet, where vegetation was very dense. *G. dorityi* was the most abundant fish species and a second rainbowfish, *C. fasciata* was also common. The body colouration of this *C. fasciata* variety is mostly an orange to mauve and shows a golden luminescent nuptial stripe on their forehead which is switched on and off during spawning.

Reference:

Allen, Gerald R. (2001) A new species of rainbowfish (*Glossolepis*: Melanotaeniidae) from Irian Jaya, Fishes of Sahul, Journal of the Australia New Guinea fishes association, Volume 15, Number 3, PP766-775

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4



Lake Nenggwambu, habitat of *Glossolepis dorityi*. © Johannes Graf

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Glossolepis dorityi* was not recorded by Allen (2001) but the diet of other members of the *Glossolepis* genus are well recorded. All rainbowfishes of the family Melanotaeniidae are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

3.f Social behaviour and groupings

Their founder described them as very abundant around the margins of Lake Nenggwambu. They were not schooling but in loose aggregations swimming at all levels in water half to one and a half meters deep. Allen (1991) describes the general behaviour of rainbowfishes as

small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. The habits of other members of *Glossolepis* genus in captivity are well documented. Behavioural observations for *Glossolepis* are typical for most rainbowfishes and may be considered indicative of the behaviour of *Glossolepis Dorityi*. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium; “Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac.”

Reference:
Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as “dither fish” to diffuse aggressive behaviour because the are able to keep out of the way and distract the aggressive species from hurting each other.

Reference:
Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried Glossolepis for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

3.i characteristics that may cause harm to humans and other species.

There are no really sharp spines or any toxins or venom in any member of the Melanotaeniidae family.

Reference:
Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

Fishbase: https://www.fishbase.de/summary/Glossolepis-maculosa.html

4. Provide information on the reproductive biology of the species, including

There are no scientific records of any work done on the reproductive biology of *Glossolepis dorityi* but the description of the *Glossolepis dorityi* by Allan G.R (2001) states that it is closely related to *Glossolepis leggetti* and *Glossolepis multisquamatus. Glossolepis multisquamatus* is a species that is well known in the aquarium trade and has been kept and bred by the authors since 1983 from stock obtained from Melbourne. Four other *Glossolepis* species are well known in Australia; *Glossolepis maculosus, Glossolepis incisus, Glossolepis ramuensis* and *Glossolepis wanamensis*. The members of this genus were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Glossolepis dorityi* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

Reference:
Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

4.b how frequently breeding occurs

The authors could find no record or observation for *Glossolepis dorityi* but closely related *Glossolepis* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

Reference:
Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References
Tappin, A.R., (2011) “Rainbowfishes, their care and keeping in captivity” available on the world wide web as a portable document format (PDF) at universal resource locator http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Glossolepis dorityi* but closely related *Glossolepis* species will produce about 40 to 100 viable eggs a day for several consecutive

days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

Reference:
Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992) but there are no known naturally occurring hybrids between *Glossolepis* sp. and *Melanotaenia* sp.. There are no naturally occurring *Glossoplepis* species in Australia. Despite the fact that some species of *Glossolepis* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species of *Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *Glossolepis incisus* was hybridized with a *Melanotaenia praecox* by Jarred Patrick of Bay Tropical Fish of Brisbane in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish “aquarium” strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under “pseudo-scientific” names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a “Code of Conduct” that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by Author 1.

References

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available on the world wide web as a portable document format (PDF) at universal resource locator http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

4.f Fertility of Hybrid Progeny

There is no record of *Glossolepis dorityi* being hybridized in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Glossolepis* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. Bay Tropical Fish in Qld, Jarrod Patrick tried to make a more colourful hybrid between Melanotaenia praecox and Glossolepis incisus, they produced an hybris but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family Melanotaeniidae was sufficiently close for them all to hybridise. Author 1 called Dr Peter Unmack for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different Rainbowfish *Melanotaenia splendida splendida* has been introduced to a different Rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific ChromosomalDiversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Glossolepis* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Glossolepis dorityi* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6

https://www.fishbase.de/summary/Glossolepis-dorityi.html
Froese, R. and D. Pauly. Editors. 2020. FishBase.
World Wide Web electronic publication.
www.fishbase.org, version (12/2020). Accessed 04 Apr 2021

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

Glossolepis incisus, has been assessed by Patricia Kialola for and on behalf of the Pet Industry Association of Australia. *Glossolepis leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

Reference:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005)
https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator;
https://www.baphiq.gov.tw/public/Data/910614193571.pdf
, or
http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

Bomford and Glover 2004 risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment model for import and keeping of exotic freshwater and Estuarine Fish" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004

Using the copy of Climex for PC provided to the Author by Mary Bomford the following calculations were done to provide a score against the provisions in the assessment process.

BOMFORD ASSESSMENT

SPECIES: *Glossolepis dorityi*

Score A, Climate Match		NT	Aus
Number of squares within 60% of the mean:	(No. 5)	2	94
Number of squares within 50% of the mean:	(No. 6)	7	19
Number of squares within 40% of the mean:	(No. 7)	3	2
Number of squares within 30% of the mean:	(No. 8)	0	
Number of squares within 20% of the mean:	(No. 9)	0	
Number of squares within 10% of the mean:	(No. 10)	0	

	NT	Aus
Total =	12	115
Score:	**2**	**3**(Ref: fishbase.org, PC CLIMATE)

Score B, Overseas Range

Number of 1° x 1° grids in which species occures overseas.

No. of squares : <4

Score: **0** (Ref: fishbase.org, googleearth.com)

Score C, Establishment

Locations of establishment incidence: Nil

Score: **1** (Ref: fishbase.org)

Score D, Introduction Success

Percentage of Introduction events that have been successful

Introductions: nil

Successful:

Score: **2** (Ref: fishbase.org)

Score E, Taxa risk

Genus:

Introductions: 0

Successful: 0

Score: (Ref: fishbase.org / M. Bomford)

Family:

Introductions: 5

Successful: 5 unknown

Score: **2** (Ref: fishbase.org / M. Bomford)

AUS

Total: **7**

The score of 7 according to the assessment model gives the fish a moderate chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	13
Very High	11–12
High	9–10
Moderate	6–8
Low	4–5
Very Low	≤ 3

7a. ability to find food sources

Glossolepis dorityi is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment. There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville, Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. Personal communication with proprietor, Cornelius Johansen. There have been no reports of ferals establishing in that river.

7c. ability to find shelter

The founder of the species describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from noctournal hunters in the deep water. This makes them an easy meal for Night Herron

7d. rate of reproducing

Glossolepis dorityi is assumed to be similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

Reference:
Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been here, and popular, for more than 25 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in “Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models” A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using the copy of Climex for PC provided to the Author by Bomford process indicates a score of 7 for *Glossolepis dorityi*, a moderate chance of survival in Australian water ways.

Glossolepis dorityi has a small distribution in North Western Irian Jaya restricted to the Grime River system and its tributaries. The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine

environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

This species is a lake species only known from two lakes, the lake where it was collected is blue clear water, there are chunks of limestone in the channel where the water exits and the area is limestone base. This would indicate the water is most likely hard and alkaline with a pH over 7.5 and hardness 300 ppm or higher, alkalinity 150 ppm or higher based on Author 1 measurements of other limestone influenced water ways and from ANGFA Database records.

If Glossolepis dorityi were to escape effective control the area where the fish may establish is where the suitable climate is adjacent areas of more dense population, where the likelihood of accidental or intentional release is greater. Possible areas may include areas such as Townsville to Cairns, Queensland and the areas adjacent Darwin in the Northern Territory. The likelihood of escaping effective human control in the Kimberley region of WA is reduced because of the low population density. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to one of the possible suitable natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous red and blue fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Glossolepis dorityi* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution. It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats. *Glossolepis* have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984). IUCN suggest the species may be extinct in the wild.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species on:

It would appear from conversations with the founder of the species that this species is only found in a few small areas in West Papua. The IUCN list it as possibly extinct in the wild due to introductions of feral species such as tilapia and channa. It was also mentioned there is a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

Reference ;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Glossolepis dorityi* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Glossolepis dorityi* is similar to and is most closely related to *Glossolepis leggetti,* and *G.multisquamatus* and other members of the *Glossolepis* genus the behaviour will be similar. Aquarium observations worldwide of *Glossolepis dorityi* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

Reference:
Aqua-fish.net – since 2005 - https://en.aqua-fish.net/fish/dorittys-rainbowfish

8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. Grime Rainbowfish, *Glossolepis dorityi* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 104 mm (Allan 2001). The predators in the Grime River System are similar but less in number than the predators in the undisturbed habitats in the North of Australia.

8.c habitat and local environmental conditions

Glossolepis dorityi are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Glossolepis* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to Melanotaeniids. Any diseases that are carried into native waters by escaped *G. dorityi* (Fishbase records diseases in other *Glossolepis* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.
There is no firm evidence, from all of the areas where other *Glossolepis*, e.g. *G. incisus,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

Reference :

Hardy-Smith P., Jones R. and Kailola P. (2007) *"Scientific review of the biosecurity risks associated with the importation of rainbowfish for ornamental purposes"* - Prepared for Biosecurity Australia by Panaquatic® Health Solutions Pty Ltd

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *Glossolepis incisus, maculosus, ramuensis, multisquamatus,* and *wanamensiss* have been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Glossolepis dorityi* into Australia would not create undue pressure on the populations in the Grime River system as all stocks would come initially from German breeders and then from commercial facilities to which these captive bred stocks are distributed. Further demand from the Grime River system would be unnecessary once captive stocks are established as ease of supply would be greater from these sources (as it would be very difficult to form an aquarium fish exporting business in West Papua).

G. dorityi poses no greater threat to Australian aquatic biodiversity than does the other *Glossolepis* sp*. (Glossolepis. incisus,* and *soon glossolepis leggetti)* currently permitted for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

As it is planned that species is to be imported via a commercial facility in Europe and then distributed via commercial facilities in Australia it may be difficult to control the distribution and abundance of the species once established in Australia. The establishment of a permit system would not be feasible on an individual fish basis as it would require coordination of permits from the wholesaler, to the individual retailer and then on to the individual purchaser, certainly crossing state boundaries in the process.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous Melanotaeniidae species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for "fresh" wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Glossolepis dorityi* will be used in the live fish ornamental aquarium display trade. *Glossolepis dorityi* are to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish. Five of the nine species of *Glossolepis* have been in Australia prior to 1983, G*lossolepis incisus* and Glossolepis *leggetti* appear on the 'List of Specimens Suitable for Live Import' under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act. Rainbowfish of the genus *Glossolepis* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960's.

If *Glossolepis dorityi* is added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

Reference:
Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011"* available on World Wide Web electronic publication at URL http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11. a the containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Glossolepis* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Glossolepis dorityi* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Glossolepis dorityi* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture Water, and the Environment. Australian Government

Department of Agriculture Water, and the Environment, conditions for importing live ornamental fish into Australia available on the world wide web at universal resource locator - http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

Reference :
Aquagreen Aquarium and Pond Keepers Code of Conduct – available at URL - https://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

12. Provide information on all other Commonwealth, state and territory legislative controls on the species, including:
- **the species' current quarantine status, or**
- **pest or noxious status, or**
- **whether it is prohibited or controlled by permit or licence in any state or territory.**

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species, there are no references or instances of any *Glossolepis* spp. being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Glossolepis dorityi* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed through universal resource locator accessed 24 March 2021 - https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 25 march 2020 available on the Federal Register of Legislation at Universal Resource Locator https://www.legislation.gov.au/Details/C2020C00127 and accessed 24 march 2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow *Glossolepis dorityi* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017. The most current version of the Northern Territory Fisheries Regulations is available on line at universal resource locator accessed 24/03/2021 - https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-

freshwater/list-of-noxious-fish and shows no *glossolepis* on that list that was last updated 16 March 2018.

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called "Restricted Matter" comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule. Part 6 of the Act lists further Noxious Fish. *Glossolepis dorityi* is not listed on this schedule as noxious fish or listed in the restricted matter schedule. The most current version of Queensland Biosecurity Act 2014 can be accessed on the world wide web at universal resource locator -
https://www.legislation.qld.gov.au/LEGISLTN/CURRENT/B/BiosecurityA14.pdf
and there are no glossolepis on the list. Accessed 05 April 2021

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Glossolepis dorityi* is not listed as noxious or restricted in Western Australia. West Australian Government Fish Resources Management Regulations 1995 current at 9 Dec 2016 accessed 14 March 2017, available on world wide web universal resource locator -
https://www.slp.wa.gov.au/legislation/statutes.nsf/main_mrtitle_1458_homepage.html The West Australian Government of noxious fish list accessed 24/11/2017, is available on the world wide web at universal resource locator -
http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf and shows no glossolepis on that list.

12.e The South Australian Government

The South Australian Fisheries legislation relating to exotic aquarium is a "Noxious Fish List" created under the provisions of the Fisheries Management Act 2007.

The Fisheries Management Act is available here -
https://www.legislation.sa.gov.au/LZ/C/A/FISHERIES%20MANAGEMENT%20ACT%202007.aspx and was accessed 05 April 2021.

The noxious fish list is available on SA Gov web site available here -
https://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list - accessed on 05 April 2021.

A search of that list did not locate any listing of *Glossolepis dorityi*.

12.f The New South Wales Government

NSW Government implemented the Biosecurity Act 2015 (the Act).....Under Section 18 of the *Regulation* it is illegal to possess, buy, sell or move notifiable aquatic pests in *NSW*. It is also an offence to possess any prohibited matter. *Glossolepis dorityi* is not listed as a pest fish. Schedule 2 of that act lists "Prohibited Matter" that includes freshwater fish species. A check of the prohibited matter list failed to locate any record of Glossolepis dorityi

That act and schedule can be located here -
https://www.legislation.nsw.gov.au/view/html/inforce/current/act-2015-024#sch.2 – accessed 05 April 2021

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. *Glossolepis dorityi* does not appear on this list. The list of Victorian Government declared noxious species is available on the World Wide Web at universal resource The Victorian Fisheries Act accessed 07/04/2021 is available on the World Wide Web at universal resource locator - https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service lists allowable species. The list is created under the provisions of the Animal Health Act 1995, a list of allowable species is created under the provisions of that act and published on Tasmanian Government URL -
https://dpipwe.tas.gov.au/Documents/IFS%20Permissible%20Fish%20List.pdf
A number of apecies are declared pest species and Controlled Species and Noxious Fish must not be imported.
Glossolepis dorityi is not a listed noxious fish. Glossolepis dorityi is not listed as an allowable species.

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If reviewers require further information contact Author 1 for password access.

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A report to address the “Terms of Reference” for an application to include *Glossolepis kabia* onto the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.

Glossolepis kabia



© Neil Armstrong, permission to use image obtained 2000

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that the Kabia Rainbowfish *Glossolepis kabia* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented for the prosecutor in the witness box by author1 of this report, however the accused offender pleaded guilty.

Disease
Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species
Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat
Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species
Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes
Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

References

Clements, Valentin, Rankin, Baker, Gee, Snellgrove, Sloman (2019) "*The effects of interacting with fish in aquariums on human health and well-being: A systematic review*" published by Institute of Biomedical and Environmental Health Research, School of Health and Life Sciences, University of the West of Scotland, Paisley, United Kingdom.

Cracknell, White, Pahl, Nichols & Depledge. 2016 "*Marine Biota and Psychological WellBeing: A Preliminary Examination of Dose–Response Effects in an Aquarium Setting*" published by Environment and Behavior2016, Vol. 48(10) 1242 –1269© 2015 SAGE Publications

Froese, R. and D. Pauly. Editors. 2020. FishBase**. www.fishbase.org, version (12/2020).** https://www.fishbase.se/summary/Glossolepiskabia.html



Ramu River © Tok Pisin (New Guinea Pidgin) English Bilingual Dictionary & Encyclopaedia of Papua New Guinea

Terms of Reference

1. Provide information on the taxonomy of the species.

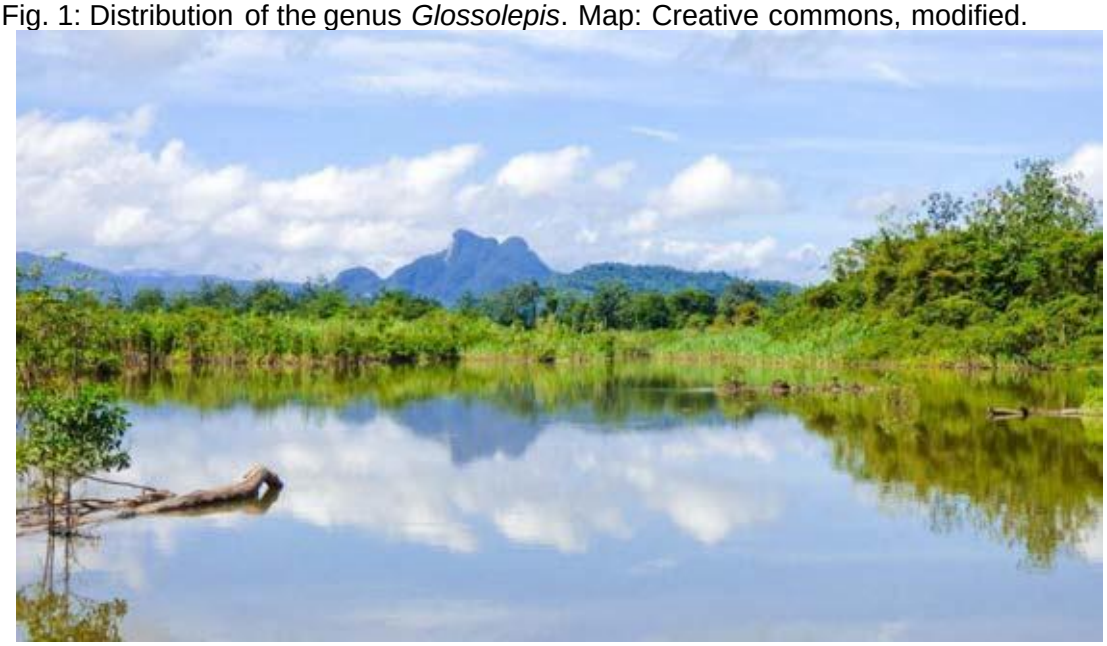
Overview: The rainbowfish genus *Glossolepis* consists of nine species occurring only in the northern half of New Guinea. The name *Glossolepis* consists of two words from the Greek language: “glossa” = tongue “lepis” = scale and refers to the tongue-shaped scale margins.

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Chilatherina* are:

- tongue-shaped scales,
- increased number of gill rakers,
- first spine of the second dorsal fin stronger than the first spine of the first dorsal fin and
- relatively elongated pectoral fins and enlarged teeth in the lateral wing of the remaxillary.



Fig. 1: Distribution of the genus *Glossolepis*. Map: Creative commons, modified.


Sepik River, New Guinea © Sepik River Adventure Tours

Information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Glossolepis* (origin - *Glossolepis*: Greek, "glossa" = tongue, and "lepis" = scale which refers to the tongue shaped scale margins
Species: *Melanotaenia kabia,* (Herre, 1935)
Melanotaenia rosacea (Herre 1935)
Lomanetia multisquamata Whitley, 1936
Glossolepis multisquamatus Allen, 1980
Glossolepis kabia, Kabia Rainbowfish

Etymology: *Glossolepis:* Greek, glossa = tongue + Greek, lepis = scale, Kabia: From kabi, native name for this rainbowfish at Koragu, New Guinea.

Reference:
Herre, A.W.C.T. (1935): New fishes obtained by the Crane Pacific expedition. Field Museum of Natural History, Publications, Zoological Series 18 (12), 383-438



Glossolepis kabia © Gary Lange - permission granted 2017

2. Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES).

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Glossolepis” revealed no results for those entities. (accessed 21 April 2021).

The IUCN indicated it is assessed as Least Concern. This species is widespread in northern Papua New Guinea. There are localised threats but no major threats to the population overall. This species occurs on lowland floodplains of the Sepik, Ramu, and Markham river systems of Papua New Guinea. This species occurs in swampy lagoons, lakes, and small side channels of larger rivers, usually where there is abundant aquatic vegetation. It can reach a maximum size of about 11 cm SL

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 9 species of Glossolepis listed.

Glossolepis dorityi listed as critically endangered
https://www.iucnredlist.org/species/161080437/161080455

Glossolepis incisus listed as endangered
https://www.iucnredlist.org/species/9268/147681075

Glossolepis leggetti listed as least concern
https://www.iucnredlist.org/species/161080708/161080713

Glossolepis kabia listed as least concern
https://www.iucnredlist.org/species/161080469/161080528

Glossolepis maculosus listed as endangered
https://www.iucnredlist.org/species/9269/147681182

Glossolepis multisquamata listed as least concern
https://www.iucnredlist.org/species/169502/147681206

Glossolepis ramuensis listed as vulnerable
https://www.iucnredlist.org/species/9271/147681464

Glossolepis pseudoincisus listed as vulnerable
https://www.iucnredlist.org/species/9270/147681435

Glossolepis wanamensis listed as critically endangered
https://www.iucnredlist.org/species/9272/147681490

References:

Cites Species website with lists and search facility URL http://www.cites.org/eng/disc/species.php , the search terms “Rainbowfish” and “Glossolepis” revealed no results for those entities. (accessed 21 April 2021).

The IUCN Red List search facility located at URL http://www.iucnredlist.org/search

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Herre (1935) records the Holotype of the species from Nyaurangai, Sepik River, New Guinea. Length 84 mm. May 22, 1929. Described from the type, 84 mm. long, six paratypes, 67 to 73 mm. long, from Nyaurangai, and twenty-six paratypes, 53 to 83 mm. long, from Koragu. He also records *melanotaenia rosacea* (later proven to be same species) Type from Koragu, Sepik River, New Guinea. Length 84 mm. May 23, 1929. The type, 84 mm. long, and thirty-two paratypes, 33 to 76 mm. in length, were collected at Koragu, on the Sepik River, New which is also reflected by **Tappin, A.R.,** (2011)

References:

Herre, A.W.C.T. (1935): New fishes obtained by the Crane Pacific expedition. Field Museum of Natural History, Publications, Zoological Series 18 (12), 383-438

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available on the world wide web as a portable document format (PDF) at universal resource locator http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.c The natural geographic range.

This species occurs in swampy lagoons, lakes, and small side channels of larger rivers, usually where there is abundant aquatic vegetation. It can reach a maximum size of about 11 cm SL. This species occurs on lowland floodplains of the Sepik, Ramu, and Markham river systems of Papua New Guinea. This species is abundant throughout much of its range and the population is considered stable

References:

Herre, A.W.C.T. (1935): New fishes obtained by the Crane Pacific expedition. Field Museum of Natural History, Publications, Zoological Series 18 (12), 383-438

IUCN Redlist: accessed 28th May 2021 at:
https://www.iucnredlist.org/species/161080469/161080528

3.d Habitat.

Glossolepis kabia is found in the Sepik and Ramu river systems in New Guinea. They are found in floodplains and swampy lagoons, lakes, and small tributary streams. It is the only rainbowfish that is abundant in the extensive floodplain regions of the Sepik River. They are usually found where there is an abundance of aquatic vegetation in moderate turbid to clear, still to slow-flowing water. Young fish form aggregations around submerged logs and branches or among reeds and other shoreline vegetation.

The water temperature at lower elevations on the Sepik River usually remains within the range 27–29°C. It is thought that average temperatures in the Sepik tributaries stay relatively low at lower altitudes than in most equatorial regions. This is partly due to the unusual topography of the basin in which lowland swamps are surrounded on most sides by relatively steep mountains resulting in cooler water being transported rapidly into the lowlands. Secondly, the degree of riparian shade covering feeder streams and rivers is pronounced in the Sepik in comparison with many other regions which have lost much of their vegetative cover through human activity. Surface water temperature commonly varies between 28°C and 35°C, and the bottom waters between 24.8°C and 30°C. Conductivity levels in the Sepik are high (110–250 µS/cm) although this is most likely related to hardness and dissolved organic matter, rather than to nutrients. The Sepik water chemistry is dominated by calcium and bicarbonate ions. In the Middle Sepik water conditions were reported as conductivity 103–125 µS/cm and total hardness 45–56 mg $CaCO_3$; slightly acidic pH and low alkalinity. Seasonal of the lakes have different water chemistry.

References:

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available on the world wide web as a portable document format (PDF) at universal resource locator http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf



Markham River, habitat of *Glossolepis kabia*. © Malum Nalu, happenings in New Guinea

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Glossolepis kabia* was not recorded by Allen (2001) but the diet of other members of the *Glossolepis* genus are well recorded. All rainbowfishes of the family Melanotaeniidae are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

3.f Social behaviour and groupings

They are usually found where there is an abundance of aquatic vegetation in moderate turbid to clear, still to slow-flowing water. Young fish form aggregations around submerged logs and branches or among reeds and other shoreline vegetation. Allen (1991) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. The habits of other members of *Glossolepis* genus in captivity are well documented. Behavioural observations for *Glossolepis* are typical for most rainbowfishes and may be considered indicative of the behaviour of *Glossolepis kabia*. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; “Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac.”

Reference:

Tappin, A.R., (2011) “*Rainbowfishes, their care and keeping in captivity*” available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as “dither fish” to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried Glossolepis for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae,

Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

3.i characteristics that may cause harm to humans and other species.

There are no really sharp spines or any toxins or venom in any member of the Melanotaeniidae family.

References:

Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

Fishbase, https://www.fishbase.de/summary/Glossolepis-kabia.html

4. Provide information on the reproductive biology of the species, including

There are no scientific records of any work done on the reproductive biology of *Glossolepis kabia. Glossolepis* species are well known in the aquarium trade and has been kept and bred by the authors since 1983 from stock obtained from Melbourne. Four other *Glossolepis* species are well known in Australia; *Glossolepis maculosus, Glossolepis incisus, Glossolepis multisquamata* and *Glossolepis wanamensis*. The members of this genus were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Glossolepis kabia* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b how frequently breeding occurs

The authors could find no record or observation for *Glossolepis kabia* but closely related *Glossolepis* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

Reference

Tappin, A.R., (2011) "Rainbowfishes, their care and keeping in captivity" available at http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Glossolepis kabia* but closely related *Glossolepis* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992) but there are no known naturally occurring hybrids between *Glossolepis* sp. and *Melanotaenia* sp.. There are no naturally occurring *Glossoplepis* species in Australia. Despite the fact that some species of *Glossolepis* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species of *Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in

the aquarium by providing only one sex of two different species. A closely related species, *Glossolepis incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish “aquarium” strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under “pseudo-scientific” names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a “Code of Conduct” that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by the author.

References:

ANGFA “Code of Conduct”
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAACodeofPractice.pdf

Tappin, A.R., (2011) “*Rainbowfishes, their care and keeping in captivity*” available at:http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There is no record of *Glossolepis kabia* being hybridized in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Glossolepis* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between Melanotaenia praecox and Glossolepis incisus, they produced an hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family Melanotaeniidae was sufficiently close for them all to hybridise. The author called an expert in the field of rainbowfish for clarification and was reminded that rRainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different Rainbowfish *Melanotaenia splendida splendida* has been introduced to a different Rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

References:

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific Chromosomal Diversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Glossolepis* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Glossolepis kabia* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/newlegislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-184971-228-6

Froese, R. and D. Pauly. Editors. 2020. FishBase.www.fishbase.org, version (12/2020). Accessed 04 Apr 2021 https://www.fishbase.de/summary/Glossolepis-kabia.html

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

Glossolepis incisus, has been assessed on behalf of the Pet Industry Association of Australia. *Glossolepis leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005) **https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text**

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator; https://www.baphiq.gov.tw/public/Data/910614193571.pdf , or http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/200924a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of Glossolepis kabia in the Australian environment should it be released or escape effective human control. The author contacted Mary Bomford in after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with Glossolepis kabia data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were produced a score for Glossolepis kabia data against the provisions in the assessment process.(accessed 6th June 2021.), is attached at Appendix B.

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Glossolepis kabia is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at:http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between Papua New Guinea, West Irian, and the Australian continent. See Bomford risk assessment score attached as appendix B. There are few places where a large population is near a suitable aquatic environment for this species. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

7c. ability to find shelter

Allen (1979), describes rainbowfish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron

References:

Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at:http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7d. rate of reproducing

Glossolepis Kabia is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

Tappin, Adrian. (2005) "Rainbowfishes ~ Their Care & Keeping in Captivity available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using the Climatch v2.0 for PC process indicates a score of 5 for *Glossolepis Kabia* indicating a low chance of survival in Australian water ways. Attached as appendix A.

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Glossolepis Kabia* were to escape effective control is where the likelihood of accidental or intentional release is greatest. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to a natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Glossolepis Kabia* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution. It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats. *Glossolepis* have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020 Available at: https://climatch.cp1.agriculture.gov.au/

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

Glossolepis kabia occurs on lowland floodplains of the Sepik, Ramu, and Markham river systems of Papua New Guinea widespread in Northern Papua New Guinea. The IUCN list this species as Least Concern. There are localised threats but no major threats to the population overall. This species occurs in swampy lagoons, lakes, and small side channels of larger rivers, usually where there is abundant aquatic vegetation. It can reach a maximum size of about 11 cm SL. There is mention of a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References ;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Glossolepis kabia* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Glossolepis kabia* is similar other members of the *Glossolepis* genus the behaviour will be similar. Aquarium observations worldwide of *Glossolepis kabia* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

References:

Aqua-fish.net – since 2005 - https://www.fishbase.de/summary/Glossolepis-kabia.html

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Glossolepis kabia* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 90mm (Allen 1981)

References:

Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

Tappin, Adrian. (2005) "Rainbowfishes ~ Their Care & Keeping in Captivity available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

8.c Habitat and local environmental conditions

Glossolepis Kabia are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Glossolepis* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Glossolepis kabia* (Fishbase records diseases in other *Glossolepis* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. located at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Glossolepis,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

References:

Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

Hardy-Smith P., Jones R. and Kailola P. (2007) *"Scientific review of the biosecurity risks associated with the importation of rainbowfish for ornamental purposes"* - Prepared for Biosecurity Australia by Panaquatic® Health Solutions Pty Ltd

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

Kahn, S.A., Wilson, P.W., Pereira, R.P., Hayder, H. and Gerrity, S.E. 1999. *Import Risk analysis on live ornamental finfish*. Canberra: Australian Quarantine and Inspection Service. 172 p.

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *G. incisus, Gl. kabia, G.*

maculosus, G. multisquamata, G. ramuensis and G. wanamensis have been kept and bred here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Glossolepis kabia* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from German breeders and then from commercial facilities to which these captive bred stocks are distributed.

Glossolepis Kabia poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp*. (G., incisus,* and *G. leggetti)* currently permitted for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for “fresh” wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008) [online] Available at: http://piaa.net.au/wp-content/uploads/2015/03/PIAACodeofPractice.pdf [Accessed 17 April 2021].

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Glossolepis kabia* will be used in the live fish ornamental aquarium display trade. *Glossolepis kabia* are to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish. Six of the nine species of *Glossolepis, incisus, kabia, maculosus, multisquamata, ramuensis and wanamensis* have been kept, bred here, and popular in Australia, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Two of the remaining three, *Glossolepis incisus* and Glossolepis *leggetti* appear on the 'List of Specimens Suitable for Live Import' under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act. Rainbowfish of the genus *Glossolepis* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960’s.

If *Glossolepis kabia is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

References:

Biosecurity Australia. (2009) " **BIOSECURITY AUSTRALIA ADVICE 2009/30 EXTENSION OF POLICY TO INCLUDE THE IMPORTATION OF RED RAINBOWFISH FOR ORNAMENTAL PURPOSES".** Published by the Australian Government, available at: http://www.daff.gov.au/SiteCollectionDocuments/ba/memos/2009/2009-30.pdf Downloaded 17 Jul 2015.

Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11.a the containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

Reference:

Biosecurity Act 2015 as in force 25 march 2020, available on Federal Register of Legislation at Universal Resource Locator https://www.legislation.gov.au/Details/C2020C00127 Accessed 24 march 2021

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Glossolepis* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Glossolepis kabia* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Glossolepis kabia* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Government Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available at http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

If application is successful and the author is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

References:

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Aquagreen Aquarium and Pond Keepers Code of Conduct – available at URL - https://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008) [online] Available at: http://piaa.net.au/wp-content/uploads/2015/03/PIAACodeofPractice.pdf [Accessed 17 April 2021].

12. Provide information on all other Commonwealth, state and territory legislative controls on the species, including:
the species' current quarantine status, or pest or noxious status, or whether it is prohibited or controlled by permit or licence in any state or territory.

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species, there are no references or instances of *Glossolepis* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Glossolepis kabia* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow Glossolepis kabia across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows Glossolepis kabia is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-andfreshwater/list-of-noxious-fish, and shows no *Glossolepis* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called "Restricted Matter" comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. Glossolepis kabia is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 and accessed at:
https://www.daf.qld.gov.au/__data/assets/pdf_file/0008/1398842/prohibitedrestricted-invasive-fish.pdf , and there are no *Glossolepis* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. Glossolepis kabia is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at, http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Glossolepis* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Glossolepis* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. Glossolepis kabia is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwaterpests/freshwater-finfish , and shows no *Glossolepis* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. Glossolepis kabia does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *Glossolepis* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp **(*Cyprinus carpio*)** mosquito fish **(*Gambusia* spp.)** Didymo a freshwater algae **(*Didymosphenia geminata*)** and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *Glossolepis* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies nonnative animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is 'reckless' about whether the animal is a prohibited animal and is also 'reckless' about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-AnimalsDeclaration-ACCESS-3.pdf . There are no *Glossolepis* species listed.

Bibliography & Relevant Reading:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020 Available at: https://climatch.cp1.agriculture.gov.au/

Agriculture Department
http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/newlegislation/submission/terrestrial-ecosystems.pdf

ALLEN, G.R. (1980). A generic classification of the rainbowfishes (Melanotaeniidae). Rec. West. Aust. Mus. 8 (3): 449-490.

Allen, G. R. (1981a). A new species of Glossolepis (Pisces: Melanotaeniidae) from fresh waters of Papua New Guinea. Records of the Western Australian Museum 9(3): 301-306

Allen, G.R. (1981): Sepik magic. Tropical Fish Hobbyist 39 (8), 19-33.
Allen, G.R. 1985. Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea. *Revue fr. aquariol.* 12 (2): 53-62.

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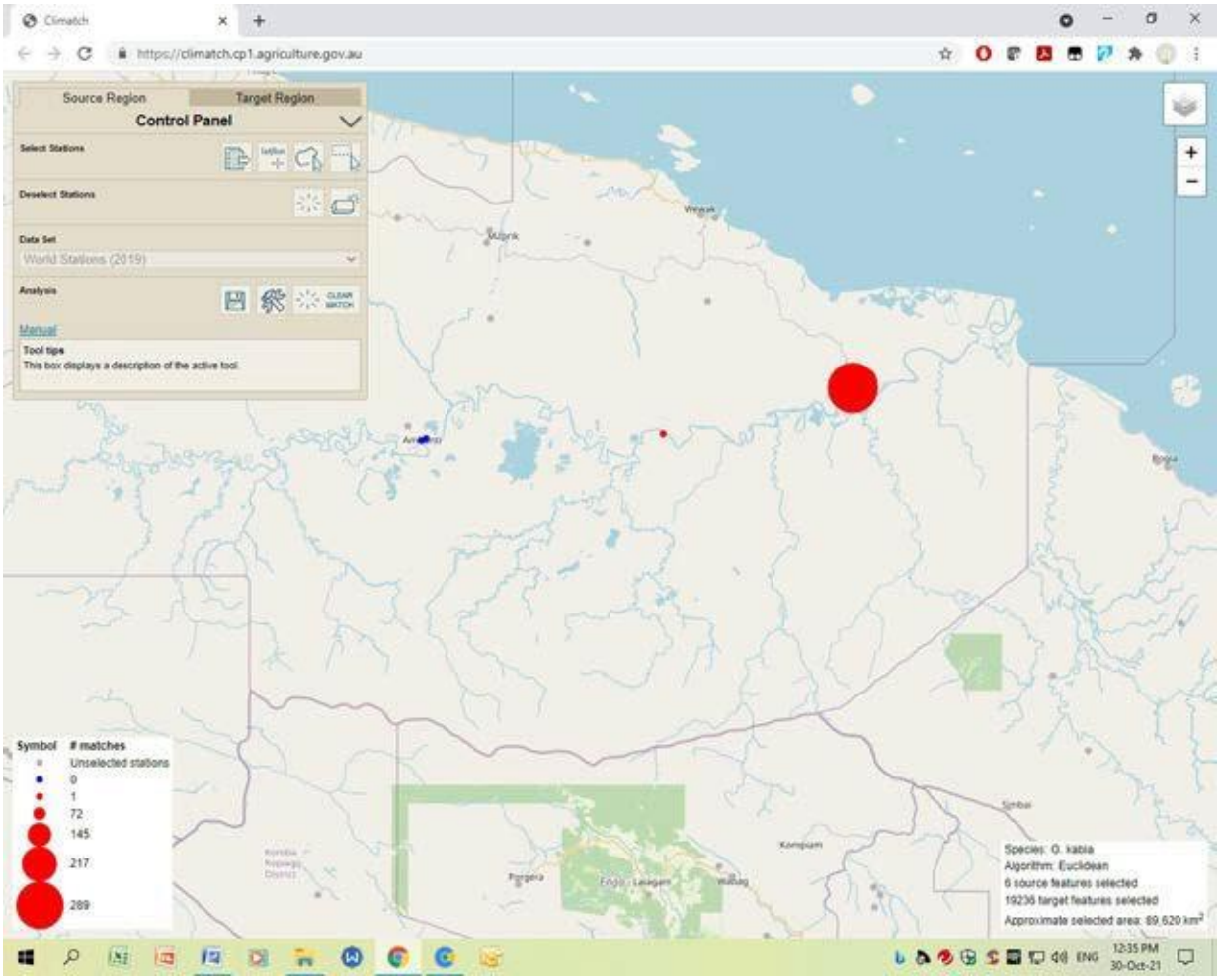
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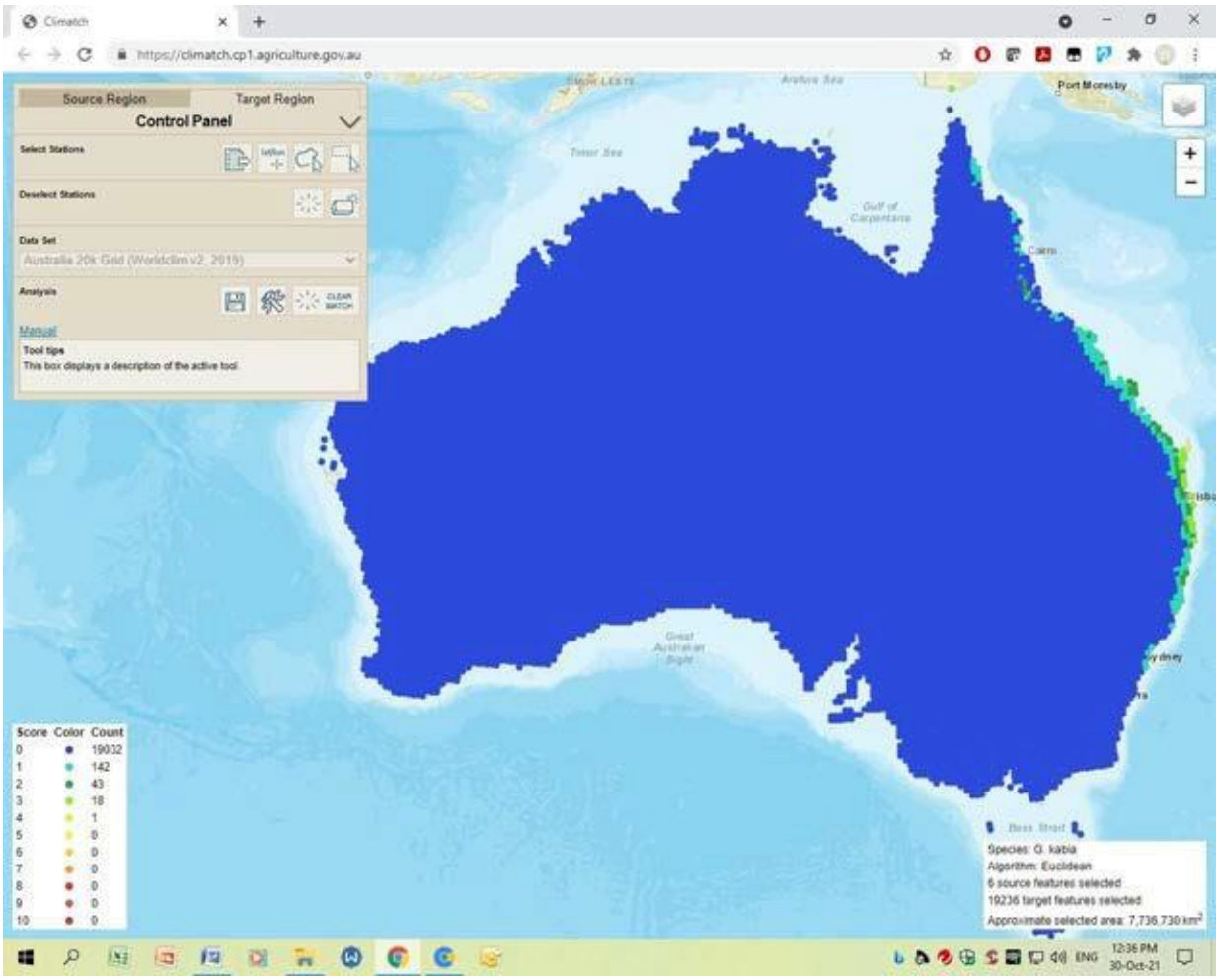
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Climatch
https://climatch.cp1.agriculture.gov.au
Source Region
Target Region
Control Panel
Select Stations
Deselect Stations
Data Set
World Stations (2019)
Analysis
Manual
Tool tips
This box displays a description of the active tool.
Symbol # matches
Unselected stations
0
1
72
145
217
289
Species: O. kabia
Algorithm: Euclidean
6 source features selected
19236 target features selected
Approximate selected area: 89,620 km²
12:35 PM
30-Oct-21


Climatch
https://climatch.cp1.agriculture.gov.au
Source Region
Target Region
Control Panel
Select Stations
Deselect Stations
Data Set
Australia 20k Grid (Worldclim v2, 2019)
Analysis
Manual
Tool tips
This box displays a description of the active tool.
Score Color Count
0 19032
1 142
2 43
3 18
4 1
5 0
6 0
7 0
8 0
9 0
10 0
Port Moresby
Arafura Sea
Timor Sea
Gulf of Carpentaria
Great Australian Bight
Species: O. kabia
Algorithm: Euclidean
6 source features selected
19236 target features selected
Approximate selected area: 7,736,730 km²
12:36 PM
30-Oct-21

APPENDIX B

Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were done to provide a score against the provisions in the assessment process.(accessed 6th June 2021.)

BOMFORD ASSESSMENT

SPECIES: Glossolepis kabia

Score A. Climate Match (0-8)

Number of squares within 60% of the mean: (No. 5)	0
Number of squares within 50% of the mean: (No. 6)	0
Number of squares within 40% of the mean: (No. 7)	0
Number of squares within 30% of the mean: (No. 8)	0
Number of squares within 20% of the mean: (No. 9)	0
Number of squares within 10% of the mean: (No. 10)	0

Total = <3
Score: 1 (Ref: fishbase.org, PC CLIMATE)

Score B, Overseas Range

Number of 1° x 1° grids in which species occurs overseas.
No. of squares : 7
Score: 2 (Ref: fishbase.org, googleearth.com)

Score C, Establishment

Locations of establishment incidence: nil - never introduced
Score: 1 (Ref: fishbase.org)

Score D, Introduction Success

Percentage of Introduction events that have been successful

Introductions	nil	
Successful:	nil	
Score:	**1**	(Ref: fishbase.org)

Score E, Taxa risk

Genus:	Glossolepis	
Introductions:	0	
Successful:	0	
Score:	0	(Ref: fishbase.org / M. Bomford)

Family:	Melanotaeniidae (Rainbowfishes)	
Introductions:	5	
Successful:	0	unknown
Score:	**0**	(Ref: fishbase.org / M. Bomford)

Total: 5 (LOW)

The score of 5 according to the assessment model gives the fish a low chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

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A report to address the "Terms of Reference" for an application to include *Glossolepis maculosus* onto the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.

Glossolepis maculosus



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Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that the spotted Rainbowfish *Glossolepis maculosus* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented for the prosecutor in the witness box by the author of this report, however the accused offender pleaded guilty.

Disease
Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species
Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat
Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species
Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes
Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

References:

Allen G.R. (1981) A new species of *Glossolepis* (Pisces: Melanotaeniidae) from fresh waters of Papua New Guinea. Records of the Western Australian Museum 9(3): 301-306

Clements, Valentin, Rankin, Baker, Gee, Snellgrove, Sloman (2019) "*The effects of interacting with fish in aquariums on human health and well-being: A systematic review*" published by Institute of Biomedical and Environmental Health Research, School of Health and Life Sciences, University of the West of Scotland, Paisley, United Kingdom.

Cracknell, White, Pahl, Nichols & Depledge. 2016 "*Marine Biota and Psychological Well-Being: A Preliminary Examination of Dose–Response Effects in an Aquarium Setting*" published by Environment and Behavior2016, Vol. 48(10) 1242 –1269© 2015 SAGE Publications

Froese, R. and D. Pauly. Editors. 2020. FishBase: www.fishbase.org, version (12/2020). https://www.fishbase.in/summary/Glossolepis-maculosus.html

Terms of Reference

1. Provide information on the taxonomy of the species.

Overview: The rainbowfish genus *Glossolepis* consists of nine species occurring only in the northern half of New Guinea. The name *Glossolepis* consists of two words from the Greek language: “glossa” = tongue “lepis” = scale and refers to the tongue-shaped scale margins.

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Chilatherina* are:

- tongue-shaped scales,
- increased number of gill rakers,
- first spine of the second dorsal fin stronger than the first spine of the first dorsal fin and
- relatively elongated pectoral fins and enlarged teeth in the lateral wing of the remaxillary.



Fig. 1: Distribution of the genus *Glossolepis*. Map: Creative commons, modified.

Information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Glossolepis* (origin - *Glossolepis*: Greek, "glossa" = tongue, and "lepis" = scale which refers to the tongue shaped scale margins
Species: *Glossolepis maculosus,* spotted rainbowfish

Etymology:
Glossolepis: Greek, glossa = tongue + Greek, lepis = scale,
The species is named maculosus (Latin: spotted) with reference to the colour pattern
.

Reference:

Allen G.R. (1981) A new species of *Glossolepis* (Pisces: Melanotaeniidae) from fresh waters of Papua New Guinea. Records of the Western Australian Museum 9(3): 301-306.

Glossolepis maculosus



Glossolepis maculosus (male + female) - photo © Dirk Godlinski

Glossolepis maculosus has been found in the Omsis Creek close to Lae (a Markham River tributary) and at a second place near Brahman Mission in the Ramu valley. This species was discovered in 1979 by Barry Crockford, a Melbourne aquarist who, frustrated by a failed

attempt to reach Lake Wanam, fished in the nearby waters. Mr Crockford is responsible for informing the author about the existence of *Glossolepis maculosus* prior to the 1980 New Guinea visit and kindly joined the expedition at Lae to assist with the capture of specimens. The species reached Australia in 1980, and Europe and North America in 1987. Since then, it has been maintained in the aquarium hobby. This is a fact that we should be proud as well for other species being held in the hobby for decades without any imports. This species lives in slow flowing creeks and swamps. According to literature, it has been found occasionally together with G*. kabia, M. affinis, C. campsi and C. crassispinosa*. This is somewhat interesting as C. campsi and C. crassispinosa are known for living in faster flowing habitats The species is named maculosus (Latin: spotted) with reference to the colour pattern.

The IUCN classifies it as endangered: This species occurs in the Markham and Ramu river systems of Papua New Guinea. It has an extent of occurrence (EOO) of 4,300 km^2 and occurs in two locations based on the threat of invasive species. There are continuing declines in habitat due to mining and oil palm plantations.

Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES).

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms "Rainbowfish" and "*Glossolepis"* revealed no results for those entities. (accessed 21 April 2021).

A search of the International Union for the Conservation Red List web site indicated the spotted Rainbowfish, *Glossolepis maculosus* as endangered. This species occurs in the Markham and Ramu river systems of Papua New Guinea. It has an extent of occurrence (EOO) of 4,300 km^2 and occurs in two locations based on the threat of invasive species. There are continuing declines in habitat due to mining and oil palm plantations. There are three gold mines in the Markham River system. Oil palm plantations are found throughout the valley of the Ramu River system. Invasive species also represent a threat. It has listed the threatening process as residential and commercial development, aquaculture and agriculture and invasive species introductions. (Accessed 6th May 2021). The use of local trees for poisons to catch fish for food was also mentioned as a threatening process. Any specimens imported if the application is improved will be from aquaculture in the USA or Europe. No wild collections will be made.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 9 species of Glossolepis listed.

Glossolepis dorityi listed as critically endangered
https://www.iucnredlist.org/species/161080437/161080455

Glossolepis incisus listed as endangered
https://www.iucnredlist.org/species/9268/147681075

Glossolepis leggetti listed as least concern
https://www.iucnredlist.org/species/161080708/161080713

Glossolepis kabia listed as least concern
https://www.iucnredlist.org/species/161080469/161080528

Glossolepis maculosus listed as endangered
https://www.iucnredlist.org/species/9269/147681182

Glossolepis multisquamata listed as least concern
https://www.iucnredlist.org/species/169502/147681206

Glossolepis ramuensis listed as vulnerable
https://www.iucnredlist.org/species/9271/147681464

Glossolepis pseudoincisus listed as vulnerable
https://www.iucnredlist.org/species/9270/147681435

Glossolepis wanamensis listed as critically endangered
https://www.iucnredlist.org/species/9272/147681490

References:

The Cites Species website with lists and search facility URL
http://www.cites.org/eng/disc/species.php

The IUCN Red List search facility locate at URL http://www.iucnredlist.org/search

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Allen, G.R. (1981) records the Holotype of the species as being, male 46.2 mm SL, from a small tributary of Omsis River about 22 km west of Lae, Markham River System, Papua New Guinea (approximately 6°42'S, 146°47.5'E), caught by seine net, by G. Allen and B. Crockford, 27 September 1980. 6 Paratypes, between, 24.2-43.8mm standard length were collected with holotype, which is also reflected by **Tappin, A.R.,** (2011)

References:

Allen G.R. (1981) A new species of *Glossolepis* (Pisces: Melanotaeniidae) from fresh waters of Papua New Guinea. Records of the Western Australian Museum 9(3): 301-306.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.c The natural geographic range.

This species occurs in the Markham and Ramu river systems of Papua New Guinea

References:

Allen G.R. (1981) A new species of *Glossolepis* (Pisces: Melanotaeniidae) from fresh waters of Papua New Guinea. Records of the Western Australian Museum 9(3): 301-306.

The IUCN Red List search facility locate at URL http://www.iucnredlist.org/search
Glossolepis maculosus : https://www.iucnredlist.org/species/9269/147681182

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.d Habitat.

All but one of the types were collected from a small, clear, slow flowing creek. The width ranged from about 0.5 to 3.0 m, and the depth from about 10 to 70 cm. The stream was bordered by tall grass and occasional patches of rainforest. The types were taken from a narrow (1.5 m) section containing a dense cover of aquatic vegetation. A pH of 7.8 and temperature of 25.0oC were recorded. The site is situated about 50 m upstream from the Omsis River. The remaining type was taken from a small side channel in the main stream-bed of the Omsis River. A number of seine hauls in the main river yielded two other rainbowfishes, Melanotaenia affinis (Weber) and Chilatherina campsi (Whitley). The type locality stream was also inhabited by these species, although they frequented the deeper sections in contrast to *Glossolepis maculosus*.

References:

Allen G.R. (1981) A new species of *Glossolepis* (Pisces: Melanotaeniidae) from fresh waters of Papua New Guinea. Records of the Western Australian Museum 9(3): 301-306.

The **IUCN Red List** search facility locate at URL http://www.iucnredlist.org/search
Glossolepis maculosus : https://www.iucnredlist.org/species/9269/147681182

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Glossolepis maculosus* was not recorded by Allen(1981) but the diet of other members of the *Glossolepis* genus are well recorded. All rainbowfishes of the family *Melanotaeniidae* are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

3.f Social behaviour and groupings

Tappin (2011) gives the following general descriptions of rainbowfish behaviour in the aquarium ; "Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac."

References:

Allen G.R. (1981) A new species of *Glossolepis* (Pisces: Melanotaeniidae) from fresh waters of Papua New Guinea. Records of the Western Australian Museum 9(3): 301-306.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylised display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as "dither fish" to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried rainbowfish for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

Fishbase:
https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

3.i characteristics that may cause harm to humans and other species.

There are no sharp spines, toxins or venom in any member of *the Melanotaeniidae* family.

References:

Allen, G.R. and N.J. Cross (1982). Rainbowfishes of Australia and Papua New Guinea. Angus & Robertson. (pp9-16)

Fishbase: https://www.fishbase.de/summary/Glossolepis-maculosa.html

4. Provide information on the reproductive biology of the species, including

There are no scientific records of any work done on the reproductive biology of *Glossolepis maculosus. Glossolepis species are* well known in the aquarium trade and have been kept and bred by the authors since 1983 from stock obtained from Melbourne.

G. incisus, G. kabia, *G. maculosus*, *G. multisquamata, G. ramuensis* and *G. wanamensis* have been imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Glossolepis maculosus* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen G.R. (1981) A new species of *Glossolepis* (Pisces: Melanotaeniidae) from fresh waters of Papua New Guinea. Records of the Western Australian Museum 9(3): 301-306.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b How frequently breeding occurs

The authors could find no record or observation for *Glossolepis maculosus* but closely related *Glossolepis* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen G.R. (1981) A new species of *Glossolepis* (Pisces: Melanotaeniidae) from fresh waters of Papua New Guinea. Records of the Western Australian Museum 9(3): 301-306.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

Reference:

Tappin, A.R., (2011) "Rainbowfishes, their care and keeping in captivity" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Glossolepis maculosus* but closely related Rainbowfish species will produce about 40 to 80 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen G.R. (1981) A new species of *Glossolepis* (Pisces: Melanotaeniidae) from fresh waters of Papua New Guinea. Records of the Western Australian Museum 9(3): 301-306.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992). There are no naturally occurring *Glossolepis* species in Australia. Despite the fact that some species of *Chilatherina, and Glossolepis* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species *of Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A species, *Glossolepis incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish “aquarium” strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby, club and market resistance to such crosses. The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under “pseudo-scientific” names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a “Code of Conduct” that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by the authors.

References

Tappin, A.R., (2011) “*Rainbowfishes, their care and keeping in captivity*” available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

ANGFA “Code of Conduct”
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

4.f Fertility of Hybrid Progeny

There is no record of *Glossolepis maculosus* being hybridised in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Chilatherina* with *Melanotaenia* produce

infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between *Melanotaenia praecox* and *Glossolepis incisus*, they produced hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family *Melanotaeniidae* was sufficiently close for them all to hybridise. The author called an expert in the field of rainbowfish for clarification and was reminded that rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different rainbowfish *Melanotaenia splendida splendida* has been introduced to a different rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

Reference:

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific Chromosomal Diversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Glossolepis* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Glossolepis maculosus* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6: https://www.fishbase.de/summary/Glossolepis.maculosus.html

Froese, R. and D. Pauly. Editors. 2020. FishBase.
www.fishbase.org https://www.fishbase.de/summary/Glossolepis-maculosus.html version (12/2020). Accessed 17 Apr 2021

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

Glossolepis incisus, has been assessed by Patricia Kialola for and on behalf of the Pet Industry Association of Australia. *Glossolepis leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005)
https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator;
https://www.baphiq.gov.tw/public/Data/910614193571.pdf
, or
http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of Chilatherina alleni in the Australian environment should it be released or escape effective human control. The author contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with *Glossolepis maculosus* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were produced a score for *Glossolepis maculosus* data against the provisions in the assessment process.(accessed 6th June 2021.),

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Glossolepis maculosus is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen G.R. (1981) A new species of *Glossolepis* (Pisces: Melanotaeniidae) from fresh waters of Papua New Guinea. Records of the Western Australian Museum 9(3): 301-306.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment. There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville, Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

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7c. ability to find shelter

Allen (1979), describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron

Reference:

Allen G.R. (1981) A new species of *Glossolepis* (Pisces: Melanotaeniidae) from fresh waters of Papua New Guinea. Records of the Western Australian Museum 9(3): 301-306

7d. rate of reproducing

Glossolepis maculosus is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen G.R. (1981) A new species of *Glossolepis* (Pisces: Melanotaeniidae) from fresh waters of Papua New Guinea. Records of the Western Australian Museum 9(3): 301-306.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using the copy of Climex for PC provided to the author by Bomford process indicates a score of 3 for *Glossolepis maculosus* a very low chance of survival in Australian water ways, as shown in appendix A.

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Glossolepis maculosus* were to escape effective control is where the likelihood of accidental or intentional release is greatest. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to a natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Glossolepis maculosus* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution. It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats. *Glossolepis* have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020 Available at: https://climatch.cp1.agriculture.gov.au/

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

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Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

Glossolepis maculosus *has* been found in the Omsis Creek close to Lae (a Markham River tributary) and at a second place near Brahman Mission in the Ramu valley. The IUCN list it as endangered It has an extent of occurrence (EOO) of 4,300 km^2 and occurs in two locations based on the threat of invasive species. There are continuing declines in habitat due to mining and oil palm plantations. There are three gold mines in the Markham River system (U. Kolkolo pers. comm. 2019). Oil palm plantations are found throughout the valley of the Ramu River system (U. Kolkolo pers. comm. 2019). Invasive species also represent a threat (P. Unmack pers. comm. 2019). Allen (pers conv) mentions a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References ;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Glossolepis maculosus* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Glossolepis maculosus* is similar other members of the *Glossolepis* genus the behaviour will be similar. Aquarium observations worldwide of *Glossolepis maculosus* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

References:

Aqua-fish.net – since 2005 - https://www.fishbase.de/summary/Glossolepis-maculosus.html

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Glossolepis maculosus* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 55 mm (Allen 1981)

References:

Allen G.R. (1981) A new species of *Glossolepis* (Pisces: Melanotaeniidae) from fresh waters of Papua New Guinea. Records of the Western Australian Museum 9(3): 301-306

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

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8.c habitat and local environmental conditions

Glossolepis maculosus are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Glossolepis* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Glossolepis maculosus* (Fishbase records diseases in other *Glossolepis* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. Located at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Glossolepis,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

References :

Hardy-Smith P., Jones R. and Kailola P. (2007) *"Scientific review of the biosecurity risks associated with the importation of rainbowfish for ornamental purposes"* - Prepared for Biosecurity Australia by Panaquatic® Health Solutions Pty Ltd

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

Kahn, S.A., Wilson, P.W., Pereira, R.P., Hayder, H. and Gerrity, S.E. 1999. *Import Risk analysis on live ornamental finfish*. Canberra: Australian Quarantine and Inspection Service. 172 p

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *G. incisus, Glossolepis kabia*, *G. maculosus*, *G. multisquamata, G.s ramuensis* and *G. wanamensis* have been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Glossolepis maculosus* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from European and North American breeders and then from commercial facilities to which these captive bred stocks are distributed.

Glossolepis maculosus poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp*. (Glossolepis. incisus,* and *glossolepis leggetti)* currently permitted for import. Another species *Glossolepis dorityi* is currently being assessed by the department. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for "fresh" wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Glossolepis maculosus* will be used in the live fish ornamental aquarium display trade. *Glossolepis maculosus* are to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish. Six of the nine species of *Glossolepis* have been in Australia prior to 1983, two *G. incisus* and G. *leggetti* appear on the 'List of Specimens Suitable for Live Import' under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act. Rainbowfish of the genus *Glossolepis* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960's.

If *Glossolepis maculosus is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

References:

Biosecurity Australia. (2009) " **BIOSECURITY AUSTRALIA ADVICE 2009/30 EXTENSION OF POLICY TO INCLUDE THE IMPORTATION OF RED RAINBOWFISH FOR ORNAMENTAL PURPOSES".** Published by the Australian Government, available at: http://www.daff.gov.au/SiteCollectionDocuments/ba/memos/2009/2009-30.pdf Downloaded 17 Jul 2015.

Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11.a the containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimens

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

Reference:

Biosecurity Act 2015 as in force 25 march 2020, available on Federal Register of Legislation at Universal Resource Locator https://www.legislation.gov.au/Details/C2020C00127 Accessed 24 march 2021

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Glossolepis* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Glossolepis maculosus* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Glossolepis maculosus* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Government Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available at - http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

If application is successful and the author is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

References:

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Aquagreen Aquarium and Pond Keepers Code of Conduct – available at:
https://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

12. Provide information on all other Commonwealth, state and territory legislative controls on the species, including:

the species' current quarantine status, or

pest or noxious status, or

whether it is prohibited or controlled by permit or licence in any state or territory.

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species , there are no references or instances of *Glossolepis* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Glossolepis maculosus* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021.

The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow *Glossolepis maculosus* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows *Glossolepis maculosus* is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-freshwater/list-of-noxious-fish , and shows no *Glossolepis* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called "Restricted Matter" comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. *Glossolepis maculosus* is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 and can be accessed https://www.daf.qld.gov.au/ data/assets/pdf_file/0008/1398842/prohibited-restricted-invasive-fish.pdf , and there are no *Glossolepis* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Glossolepis maculosus* is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at,
http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Glossolepis* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Glossolepis* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. *Glossolepis maculosus* is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish, and shows no *Glossolepis* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. *Glossolepis maculosus* does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *Glossolepis* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp (*Cyprinus carpio*) mosquito fish (*Gambusia* spp.) Didymo a freshwater algae (*Didymosphenia geminata*) and freshwater turtles.
The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *Glossolepis* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.
Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is 'reckless' about whether the animal is a prohibited animal and is also 'reckless' about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-Animals-Declaration-ACCESS-3.pdf . There are no *Glossolepis* listed.

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Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005) https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

ANGFA, Australia New Guinea Fishes Association https://angfa.org.au/

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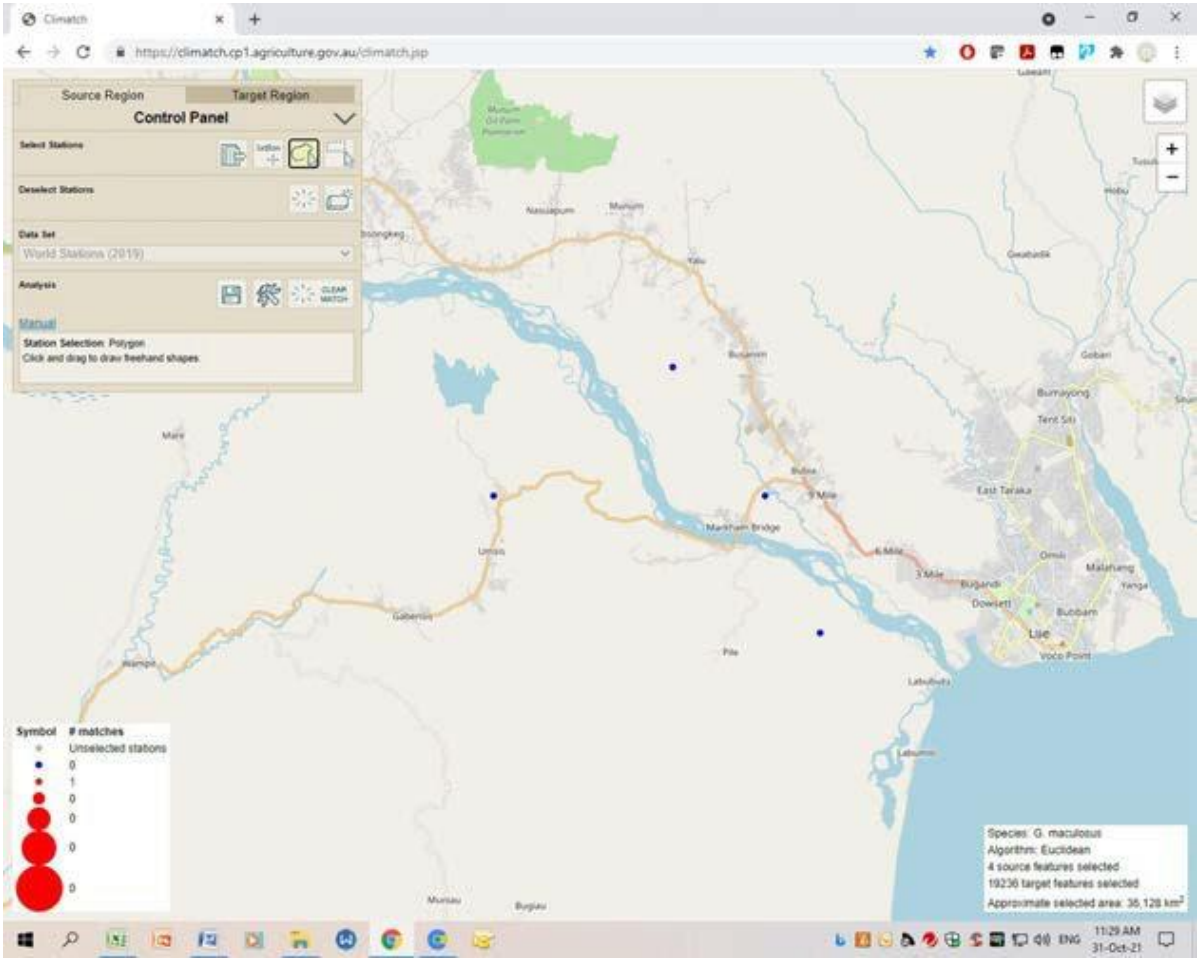
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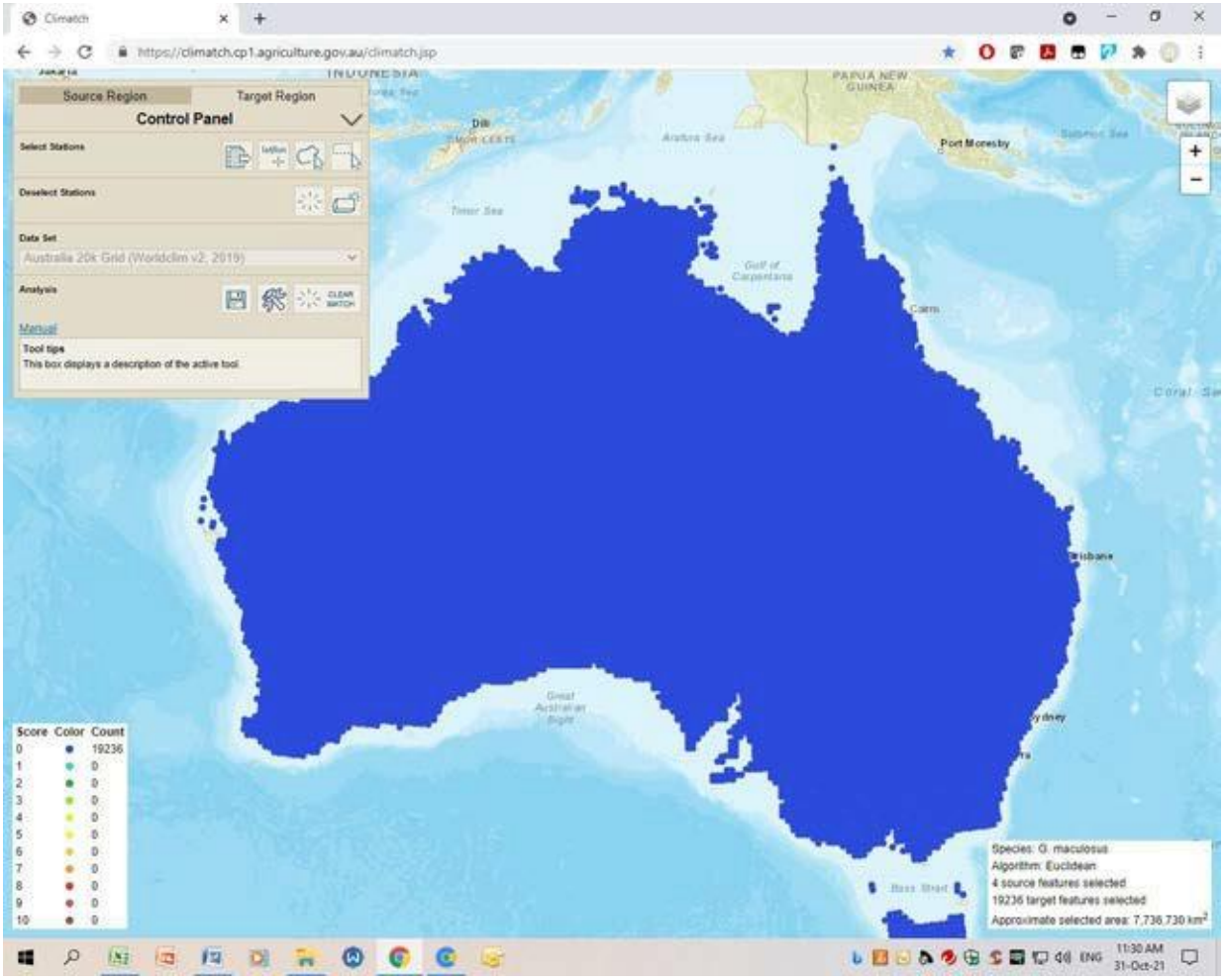
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Appendix A – calculation of climate from *Glossolepis maculosus* distribution climate to Australian Climate.





APPENDIX B

BOMFORD ASSESSMENT

SPECIES: Glossolepis maculosus

Score A. Climate Match (0-8)

Number of squares within 60% of the mean: (No. 5)	0
Number of squares within 50% of the mean: (No. 6)	0
Number of squares within 40% of the mean: (No. 7)	0
Number of squares within 30% of the mean: (No. 8)	0
Number of squares within 20% of the mean: (No. 9)	0
Number of squares within 10% of the mean: (No. 10)	0

Total = <3
Score: 1 (Ref: fishbase.org, PC CLIMATE)

Score B, Overseas Range

Number of 1° x 1° grids in which species occurs overseas. (3)
No. of squares : <4
Score: 0 (Ref: fishbase.org, googleearth.com)

Score C, Establishment

Locations of establishment incidence: nil - never introduced
Score: 1 (Ref: fishbase.org)

Score D, Introduction Success

Percentage of Introduction events that have been successful
Introductions nil
Successful: nil
Score: 1 (Ref: fishbase.org)

Score E, Taxa risk

Genus: Glossolepis
Introductions: 0
Successful: 0
Score: 0 (Ref: fishbase.org / M. Bomford)

Family: Melanotaeniidae (Rainbowfishes)
Introductions: 5
Successful: 0 unknown
Score: 0 (Ref: fishbase.org / M. Bomford)

Total: 3 (VERY LOW)

The score of 3 according to the assessment model gives the fish a very low chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

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Glossolepis multisquamata - Lake Kli



Photograph - © Gary Lange, permission to use image obtained 2017

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that the Mamberamo Rainbowfish *Glossolepis multisquamata* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented for the prosecutor in the witness box by the author of this report, however the accused offender pleaded guilty.

Disease
Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species
Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat
Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species
Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes
Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

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Terms of Reference

1. Provide information on the taxonomy of the species.

Overview: The rainbowfish genus *Glossolepis* consists of nine species occurring only in the northern half of New Guinea. The name *Glossolepis* consists of two words from the greek language: "glossa" = tongue "lepis" = scale and refers to the tongue-shaped scale margins.

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Chilatherina* are:

- tongue-shaped scales,
- increased number of gill rakers,
- first spine of the second dorsal fin stronger than the first spine of the first dorsal fin and
- relatively elongated pectoral fins and enlarged teeth in the lateral wing of the remaxillary.



Fig. 1: Distribution of the genus *Glossolepis*. Map: Creative commons, modified.

Information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Glossolepis* (origin - *Glossolepis*: Greek, "glossa" = tongue, and "lepis" = scale which refers to the tongue shaped scale margins
Species: *Melanotaenia* multisquamata (Weber & de Beaufort, 1922), Mamberamo Rainbowfish
Glossolepis multisquamatus Allen, 1980
Glossolepis multisquamata Eschmeyer, (1998) Mamberamo Rainbowfish

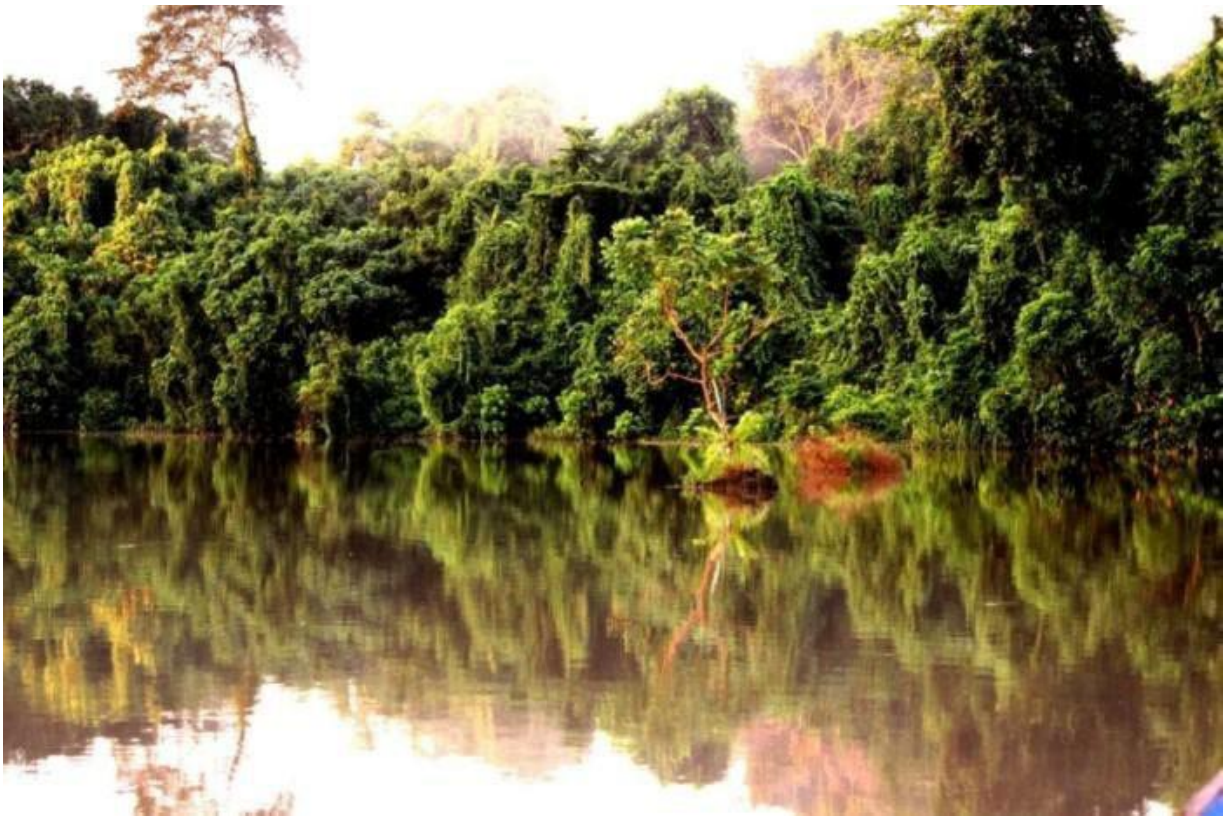
Etymology: *Glossolepis:* Greek, glossa = tongue + Greek, lepis = scale,
multi = many, squamata: = scales - with many scales

Reference:

Weber, M. & de Beaufort, L.F. (1922): The fishes of the Indo-Australian Archipelago. IV. Heteromi, Solenichthyes, Synentognathi, Percesoces, Labyrinthici, Microcyprini. E. J. Brill, Le



***Glossolepis multisquamata* from Lake Kli. © Gunther Schmida**



Mamberamo river, habitat of *Glossolepis multisquamata*. © Jefalgi Papua Tours



Glossolepis multisquamata. " Pagai Village " © Johannes Graf

This Rainbowfish comes from the lowlands of the Mamberamo system in North Western New Guinea. Several collection places (Lake Kli near Dabra , Faowi , Pagai , Haya) are known. The typical habitat are oxbow lakes without or very low currents. Glossolepis multisquamata sometimes co-occurs with Melanotaenia praecox.

2. Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). For example, is the species listed on CITES Appendix I, II or III, and if so, are there any specific restrictions on the movement of this species? Include information on the conservation value of the species.

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Glossolepis” revealed no results for those entities. (accessed 21 April 2021).

A search of the International Union for the Conservation Red List web site indicated the Mamberamo rainbowfish, *Glossolepis multisquamata* is assessed as Least Concern. This species is widespread in the Mamberamo River system. There are a number of localised threats but no major threats across the entire range. Therefore, at present, the region which this species inhabits is largely undisturbed. However, future threats to biodiversity in northern New Guinea include regional development plans, such as construction of forest concessions, oil palm plantations, coal mines, and the proposed Mamberamo Dam. Invasive species are also found within the distribution. Any specimens imported if the application is improved will be from aquaculture in the USA or Germany. No wild collections will be made.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 9 species of Glossolepis listed.

Glossolepis dorityi listed as critically endangered
https://www.iucnredlist.org/species/161080437/161080455

Glossolepis incisus listed as endangered
https://www.iucnredlist.org/species/9268/147681075

Glossolepis leggetti listed as least concern
https://www.iucnredlist.org/species/161080708/161080713

Glossolepis kabia listed as least concern
https://www.iucnredlist.org/species/161080469/161080528

Glossolepis maculosus listed as endangered
https://www.iucnredlist.org/species/9269/147681182

Glossolepis multisquamata listed as least concern
https://www.iucnredlist.org/species/169502/147681206

Glossolepis ramuensis listed as vulnerable
https://www.iucnredlist.org/species/9271/147681464

Glossolepis pseudoincisus listed as vulnerable
https://www.iucnredlist.org/species/9270/147681435

Glossolepis wanamensis listed as critically endangered
https://www.iucnredlist.org/species/9272/147681490

References:

The **Cites** Species website with lists and search facility URL
http://www.cites.org/eng/disc/species.php

The **IUCN Red List** search facility locate at URL http://www.iucnredlist.org/search

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Weber & de Beaufort record the holotype as 97mm standard length. Type locality: Pool at Doorman river, rotan bridge, Idenburg tributary. and Paratypes: 22 ex. same data. Collector: Jhr. W. C. van Heurn, North N. Guinea Expedition, November 8, 1920. **Allen** records the following specimens at the Western Australia Museum. 311 specimens, between 22and 95mm SL.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Weber, M. & de Beaufort, L.F. (1922): The fishes of the Indo-Australian Archipelago. IV. Heteromi, Solenichthyes, Synentognathi, Percesoces, Labyrinthici, Microcyprini. E. J. Brill, Le

3.c The natural geographic range.

The typical biotope for *Glossolepis multisquamata* are silting lakes with little or no current. *Glossolepis multisquamata* also occurs there together with Melanotaenia praecox. This is a benthopelagic species that inhabits swampy lagoons, lakes and small side channels of large rivers. It is one the only known floodplain dwelling rainbowfish and is usually found below 100 m elevation. Young fish form aggregations around sub-surface vegetation, submerged logs and branches, or among reeds and other shoreline vegetation. This species can grow to a maximum size of about 11 cm SL, however some reach up to 14cm SL.

Current locations where the species are known from include:" Haya (E 138°03.600´, S 02°28.800´), Van Rees Mountains, Faowi (S 03°13.418´, E 137°43.640´), upper Tariku, Pagai (S 03°32.185´, E 139°46.931´) middle Taritatu, Lake Kli (ca. 03º 14.06´, S 138º 26.62´E), close to Dabra Buare (z. B. 03°15.573´S, 138°41.352´E) at four places (Rogutreweij Lake, Sijfufe Lake, Kurekruwa Lake, Kubai Lake) Furu River (3°16.590'S, 138°38.295'E), close to Dabra.

References:

Boeseman, M. (1963) Notes on the fishes of western New Guinea 1. Zool. Mededelingen, 38(14); 221-242.

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/species/169502/147681206

Weber, M. & de Beaufort, L.F. (1922): The fishes of the Indo-Australian Archipelago. IV. Heteromi, Solenichthyes, Synentognathi, Percesoces, Labyrinthici, Microcyprini. E. J. Brill, Le

3.d Habitat.

Glossolepis multisquamata is currently found in lakes, slowflowing streams and backwaters of the Mamberamo River system in West Papua. They were originally collected from the Idenburg River (= Taritatu River) in the Mamberamo region by the Dutch zoologist and explorer W. C. van Heurn in 1920. They were also collected from the Doorman River, a major tributary of the Taritatu.

The Mamberamo region is not well-studied but possesses a wealth of biodiversity. The first scientific fish collections from the Mamberamo were made by van Heurn in 1920-21. These collections were mainly described by Weber and de Beaufort (1911–1962). There have been some other expeditions; 1938–1939 (Archbold expedition) and Gerald Allen did some surveys in this area. Several locations within the Mamberamo catchment, including Danau Biru, Obogwi, Faui, Kordesi, Dabra, Nevere, and Senggi were surveyed by Gerald Allen between 1982 and 1991. In February 2008 a survey by Conservation International and the Papuan State University (UNIPA) at Manokwari found *Glossolepis multisquamata* in lake-marsh habitats of the Rouffaer River system (Mamberamo) near Haya Village (02º48.951'S and 138º05.903'E).

The Mamberamo River (also called Tarikaikea) is the largest in northern West Papua, draining a catchment that encompasses all northward flowing streams descending from the New Guinea central mountains between the Papua New Guinea border and approximately 137° west longitude. The source of the river is formed from the confluences of its upper tributaries, the Tariku, Van Daalen and Taritatu Rivers.

The Tariku River (previously known as the Rouffaer River) in the west flows eastward and the Taritatu River (previously known as the Idenburg River) in the east flows roughly westward. They meet in the Meervlakte Basin to form the main Mamberamo River. Extensive inland swamps surround the Taritatu and Tariku rivers in the central depression of the Lakes-Plains province. Beyond the confluence of Tariku and Taritatu, the Mamberamo flows abruptly northwards 175 km through the Van Rees Range to reach the lowland marshes of its broad river delta on the coast at Cape D'Urville on the northeast margin of Cenderawasih Bay. The Mamberamo River has a total length of about 1000 km; the Taritatu is about 467 km long; the Tariku 327 km; and the Mamberamo itself is about 283 km long.

References:

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Glossolepis multisquamata* was not recorded. The diet of other members of the *Glossolepis* genus are well recorded. All rainbowfishes of the family Melanotaeniidae

are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.f Social behaviour and groupings

Allen (1991) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. The habits of other members of *Glossolepis* genus in captivity are well documented. Behavioural observations for *Glossolepis* are typical for most rainbowfishes and may be considered indicative of the behaviour of *Glossolepis multisquamata*. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; "Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac."

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as "dither fish" to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried Glossolepis for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

Reference:

Fishbase: April 2021. https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

3.i characteristics that may cause harm to humans and other species.

There are no really sharp spines or any toxins or venom in any member of the Melanotaeniidae family.

References:

Fishbase: https://www.fishbase.de/summary/Glossolepis-multisquamata.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Remarks:

Gerald Allen collected a number of live rainbowfishes in 1979, while collecting in the Sepik-Ramu River region, and brought them back to Australia where they were subsequently bred and distributed in the hobby. He later identified them as Glossolepis multisquamatus. Heiko Bleher collected live specimens from the same area and another collection near the Ramu River and took them back to Europe. However, it is thought that none of these fish still remain in captivity.

Heiko Bleher also collected a number of Glossolepis specimens from the Mamberamo region in 1992. It was unclear whether these specimens represented an undescribed species or perhaps just a colour variation of G. multisquamata. Heiko Bleher had collected this form a couple of times and reported that in his opinion they were quite different from the Sepik/Ramu form (H. Bleher pers. comm.). These species were bred and distributed in Australia under the common name of "Red-eyed Tiger Rainbowfish". In Europe, they were generally known as Glossolepis sp. (Mamberamo).

As it turns out, the specimens from the Mamberamo region are the true Glossolepis multisquamata while those from the Sepik -Ramu River system are considered to be Glossolepis kabia. The Mamberamo River specimens are quite different, but the most obvious

difference is they have quite large anal fins, which are reminiscent of Glossolepis wanamensis. They also have a really bright red eye which seems somewhat unique in rainbows (P. J. Unmack 2009, pers. comm.).

Around 1993, Heiko Bleher collected another rainbowfish from Lake Kli in the Mamberamo valley. It is generally known in the hobby as Glossolepis sp. (Lake Kli) or as the Fringefin Rainbowfish. Since then there has been a number of collections by individual aquarists and some of these forms are currently available in the hobby. Additional live specimens were collected and introduced into the aquarium hobby in 2009.

Reference:

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4. Provide information on the reproductive biology of the species, including

Breeding G. multisquamata has its difficulties and is a task for good breeders. The more than 15 year old strain from Lake Kli is sometimes problematic to spawn. Part of the problem is the age of the breeding specimens. Breeding works better with specimens of 6-8 cm length. Due to the very small eggs, the larvae are very small at hatching, and unlike the also small larvae of *G.s kabia* difficult to feed in the first days. Green water and industrial dust food of 5-50µm size are helpful in this regard. No water changes should be done in the first or even in the second week after hatching. *Glossolepis are a genus* that is well known in the aquarium trade and has been kept and bred by the authors since 1983 from stock obtained from Melbourne. Six *Glossolepis* species are well known in Australia; *G. incisus, G. kabia, G. maculosus, G. multisquamata, G. ramuensis* and *G. wanamensis*. The members of this genus were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

References:

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Glossolepis multisquamata* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b how frequently breeding occurs

The authors could find no record or observation for *Glossolepis multisquamata* but closely related *Glossolepis* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Glossolepis multisquamata* but closely related *Glossolepis* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992) but there are no known naturally occurring hybrids between *Glossolepis* sp. and *Melanotaenia* sp.. There are no naturally occurring *Glossoplepis* species in Australia. Despite the fact that some species of *Glossolepis* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species of *Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *Glossolepis incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish “aquarium” strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under “pseudo-scientific” names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a “Code of Conduct” that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by Author 1.

References

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)
ANGFA “Code of Conduct”
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Aquagreen, Aquarium and Pond Keepers Code of Conduct – available at URL - https://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) “*Rainbowfishes, their care and keeping in captivity*” at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There is no record of *Glossolepis multisquamata* being hybridized in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Glossolepis* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between Melanotaenia praecox and Glossolepis incisus, they produced an hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family Melanotaeniidae was sufficiently close for them all to hybridise. Author 1 called an expert in the field of rainbowfish for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different Rainbowfish *Melanotaenia splendida splendida* has been introduced to a different Rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

References:

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific Chromosomal Diversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Glossolepis* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Glossolepis multisquamata* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6

Froese, R. and D. Pauly. Editors. 2020. FishBase. www.fishbase.org, version (12/2020). Accessed 04 Apr 2021 https://www.fishbase.de/summary/Glossolepis-multisquamata.html

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

Glossolepis incisus, has been assessed on behalf of the Pet Industry Association of Australia. *Glossolepis leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes
References:

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005) **https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text**

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator; https://www.baphiq.gov.tw/public/Data/910614193571.pdf , or http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of *Glossolepis multisquamata* into the Australian environment should it be released or escape effective human control. Author 1 contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with *Glossolepis multisquamata* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Glossolepis multisquamata is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, J. 2010. The genus Glossolepis: Special Edition no. 1 of the "Rainbowfish" International Rainbowfish Association (IRG) © 2010 Internationale Gesellschaft für Regenbogenfische, Dompfaffweg 53, D-42659 Solingen ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment. There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville, Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

7c. ability to find shelter

Allen (1979), describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, J. 2010. The genus Glossolepis: Special Edition no. 1 of the “Rainbowfish” International Rainbowfish Association (IRG) © 2010 Internationale Gesellschaft für Regenbogenfische, Dompfaffweg 53, D-42659 Solingen ISBN 978-3-936616-64-4

Tappin, A.R., (2011) “*Rainbowfishes, their care and keeping in captivity*” available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7d. rate of reproducing

Glossolepis multisquamata is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, J. 2010. The genus Glossolepis: Special Edition no. 1 of the “Rainbowfish” International Rainbowfish Association (IRG) © 2010 Internationale Gesellschaft für Regenbogenfische, Dompfaffweg 53, D-42659 Solingen ISBN 978-3-936616-64-4

Tappin, A.R., (2011) “*Rainbowfishes, their care and keeping in captivity*” available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using Climatch software, results in a score of 4 for *Glossolepis multisquamata, indicating the species has* a low chance of survival in Australian water ways.

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Glossolepis multisquamata* were to escape, effective control is where the likelihood of accidental or intentional release is greatest. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to one of the possible suitable natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Glossolepis multisquamata* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution.

It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats. *Glossolepis* have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020 Available at: https://climatch.cp1.agriculture.gov.au/

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

Glossolepis multisquamata is widespread in the Mamberamo River system. There are a number of localised threats but no major threats across the entire range. Therefore, it is assessed as Least Concern. This species is found in the Mamberamo River system in northern Papua Province, Indonesia. At present, the region which this species inhabits is largely undisturbed. However, future threats to biodiversity in northern New Guinea include regional development plans, such as construction of forest concessions, oil palm plantations, coal mines, and the proposed Mamberamo Dam. Invasive species are also found within the distribution. Allen (pers conv) mentions a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References ;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Glossolepis multisquamata* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Glossolepis multisquamata* is similar other members of the *Glossolepis* genus the behaviour will be similar. Aquarium observations worldwide of *Glossolepis multisquamata* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

Reference:

Aqua-fish.net – since 2005 - https://en.aqua-fish.net/fish/doritys-rainbowfish

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Glossolepis multisquamata* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 55 mm (Allen 1981)

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, J. 2010. The genus Glossolepis: Special Edition no. 1 of the “Rainbowfish” International Rainbowfish Association (IRG) © 2010 Internationale Gesellschaft für Regenbogenfische, Dompfaffweg 53, D-42659 Solingen ISBN 978-3-936616-64-4

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

8.c habitat and local environmental conditions

Glossolepis multisquamata are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Glossolepis* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Glossolepis multisquamata* (Fishbase records diseases in other *Glossolepis* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. Located at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Glossolepis,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and

swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

References :

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, J. 2010. The genus Glossolepis: Special Edition no. 1 of the “Rainbowfish” International Rainbowfish Association (IRG) © 2010 Internationale Gesellschaft für Regenbogenfische, Dompfaffweg 53, D-42659 Solingen ISBN 978-3-936616-64-4

Hardy-Smith P., Jones R. and Kailola P. (2007) *“Scientific review of the biosecurity risks associated with the importation of rainbowfish for ornamental purposes”* - Prepared for Biosecurity Australia by Panaquatic® Health Solutions Pty Ltd

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

Kahn, S.A., Wilson, P.W., Pereira, R.P., Hayder, H. and Gerrity, S.E. 1999. *Import Risk analysis on live ornamental finfish*. Canberra: Australian Quarantine and Inspection Service. 172 p

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *G. incisus, G. kabia*, *G. maculosus*, *G. multisquamata, G. ramuensis* and *G. wanamensis* have been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Glossolepis multisquamata* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from European and North American breeders and then from commercial facilities to which these captive bred stocks are distributed.

Glossolepis multisquamata poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp*. (Glossolepis. incisus,* and *glossolepis leggetti)* currently permitted for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for “fresh” wild stock

imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Glossolepis multisquamata* will be used in the live fish ornamental aquarium display trade. *Glossolepis multisquamata* are to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish. Six of the nine species of *Glossolepis, G. incisus, G. kabia, Gl. maculosus, G. multisquamata, G. ramuensis and G. wanamensis* have been kept, bred here, and popular in Australia, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Two of the species, *Glossolepis incisus* and Glossolepis *leggetti* appear on the 'List of Specimens Suitable for Live Import' under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act. Rainbowfish of the genus *Glossolepis* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960's.

If *Glossolepis multisquamata is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

References:

Biosecurity Australia. (2009) " **BIOSECURITY AUSTRALIA ADVICE 2009/30 EXTENSION OF POLICY TO INCLUDE THE IMPORTATION OF RED RAINBOWFISH FOR ORNAMENTAL PURPOSES".** Published by the Australian Government, available at:

http://www.daff.gov.au/SiteCollectionDocuments/ba/memos/2009/2009-30.pdf Downloaded 17 Jul 2015.

Tappin, Adrian. (2005) "Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011" available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11.a the containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

Reference:

Biosecurity Act 2015 as in force 25 march 2020, available on Federal Register of Legislation at Universal Resource Locator https://www.legislation.gov.au/Details/C2020C00127 Accessed 24 march 2021

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Glossolepis* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Glossolepis multisquamata* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Glossolepis multisquamata* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available at - http://www.agriculture.gov.au/import/goods/live- animals/importing-live-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

References:

ANGFA "Code of Conduct" https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Aquagreen, Aquarium and Pond Keepers Code of Conduct – available at URL - https://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

12. Provide information on all other Commonwealth, state and territory legislative controls on the species, including:
the species' current quarantine status, or
pest or noxious status, or
whether it is prohibited or controlled by permit or licence in any state or territory.

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species , there are no references or instances of *Glossolepis* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Glossolepis multisquamata* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow *Glossolepis multisquamata* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows *Glossolepis multisquamata* is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-freshwater/list-of-noxious-fish, and shows no *Glossolepis* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called “Restricted Matter” comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. *Glossolepis multisquamata* is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 and can be accessed https://www.daf.qld.gov.au/ data/assets/pdf_file/0008/1398842/prohibited-restricted-invasive-fish.pdf , and there are no *Glossolepis* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Glossolepis multisquamata* is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at, http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Glossolepis* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Glossolepis* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. *Glossolepis multisquamata* is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish , and shows no *Glossolepis* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. *Glossolepis multisquamata* does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *Glossolepis* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp **(*Cyprinus carpio*)** mosquito fish **(*Gambusia* spp.)** Didymo a freshwater algae **(*Didymosphenia geminata*)** and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *Glossolepis* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is 'reckless' about whether the animal is a prohibited animal and is also 'reckless' about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

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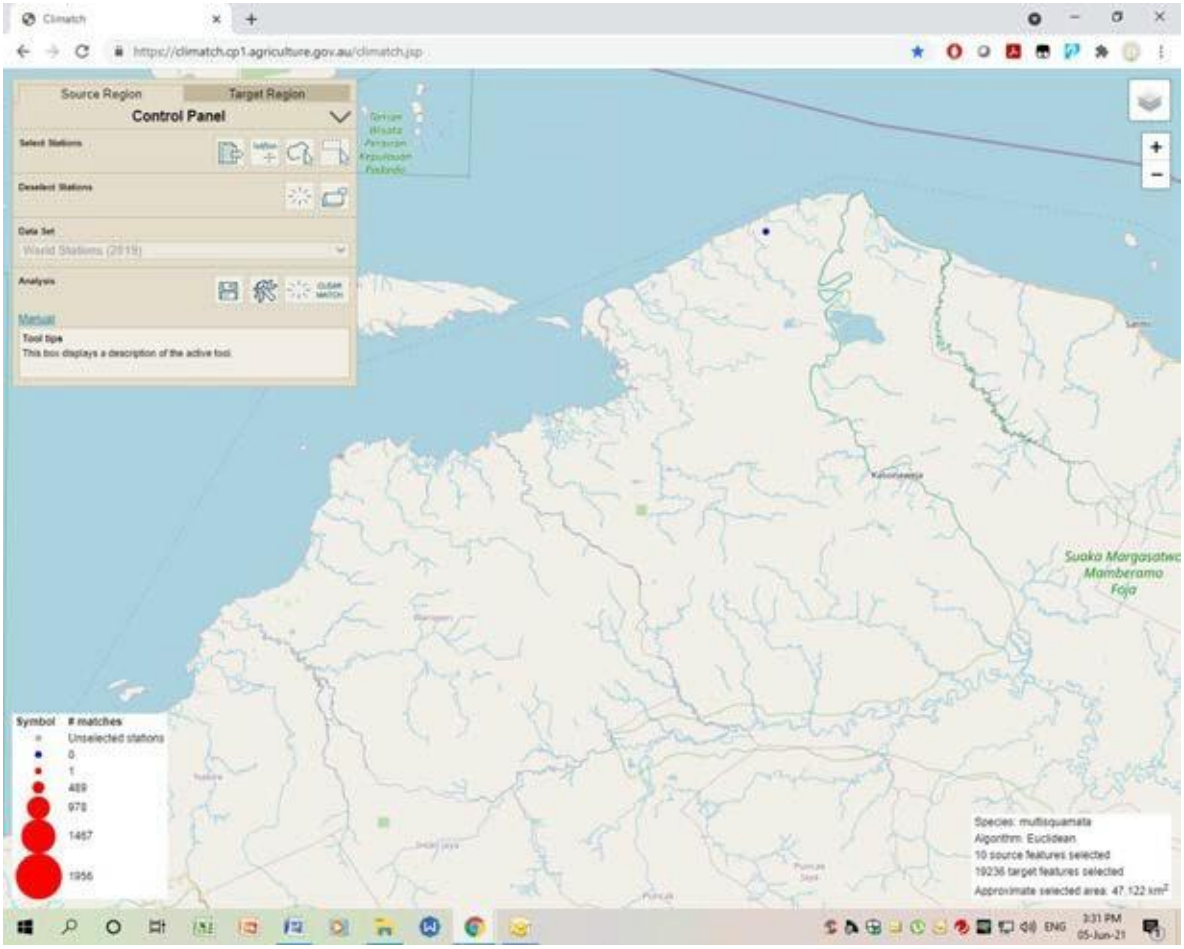
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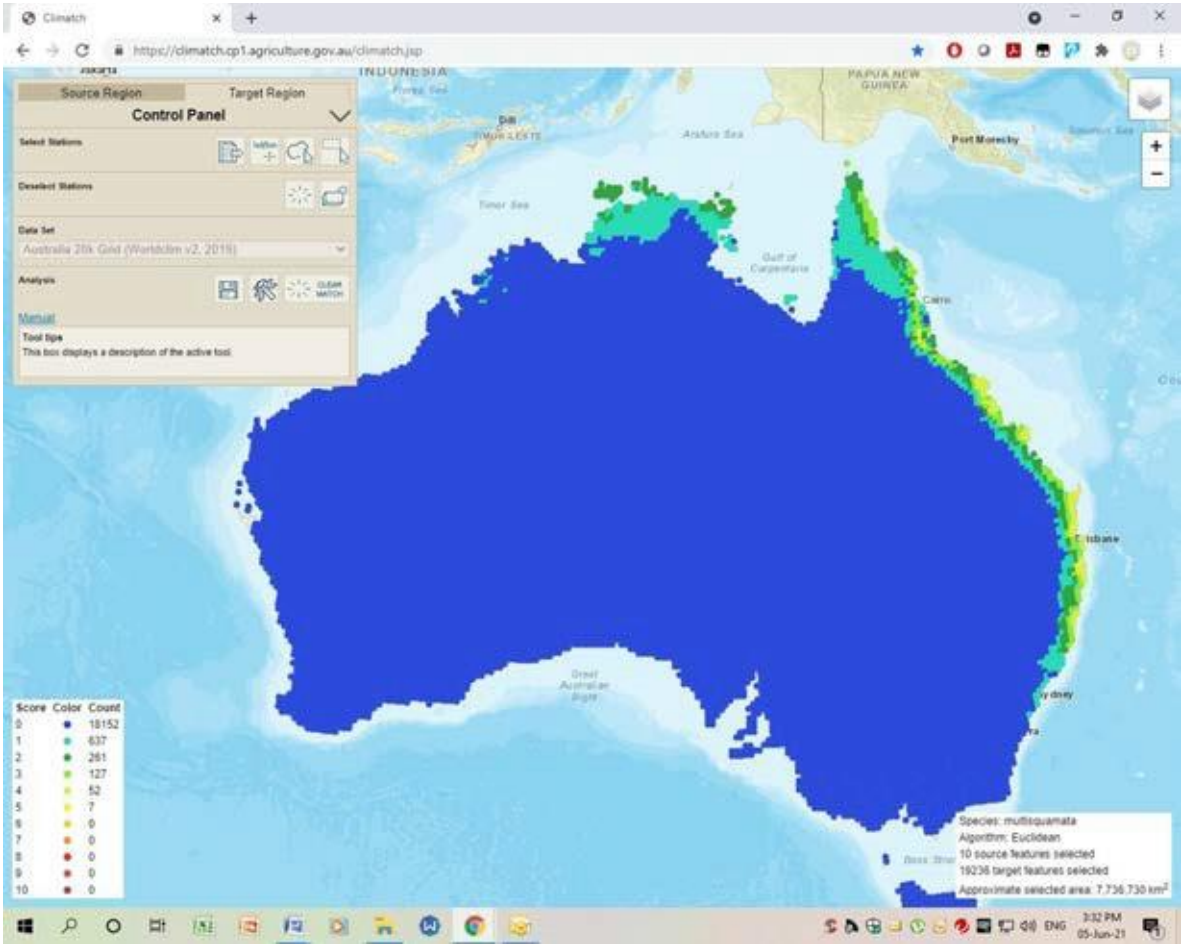
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APPENDIX A – calculation of climate from *Glossolepis multisquamata* distribution climate to Australian Climate.





Appendix B

Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were done to provide a score against the provisions in the assessment process.(accessed 6th June 2021.)

BOMFORD ASSESSMENT

SPECIES: Glossolepis multisquamata

Score A. Climate Match (0-8)

Number of squares within 60% of the mean: (No. 5)	7
Number of squares within 50% of the mean: (No. 6)	0
Number of squares within 40% of the mean: (No. 7)	0
Number of squares within 30% of the mean: (No. 8)	0
Number of squares within 20% of the mean: (No. 9)	0
Number of squares within 10% of the mean: (No. 10)	0

Total = 7
Score: 2 (Ref: fishbase.org, PC CLIMATE)

Score B. Overseas Range

Number of 1° x 1° grids in which species occurs overseas. (4)
No. of squares : 4
Score: 0 (Ref: fishbase.org, googleearth.com)

Score C. Establishment

Locations of establishment incidence: nil - never introduced

Score: 1 (Ref: fishbase.org)

Score D. Introduction Success

Percentage of Introduction events that have been successful

Introductions	nil
Successful:	nil

Score: 1 (Ref: fishbase.org)

Score E. Taxa risk

Genus:	Glossolepis	
Introductions:	0	
Successful:	0	
Score:	0	(Ref: fishbase.org / M. Bomford)

Family:	Melanotaeniidae (Rainbowfishes)	
Introductions:	0	
Successful:	0	unknown
Score:	**0**	(Ref: fishbase.org / M. Bomford)

Total: 4 (LOW)

The score of 4 according to the assessment model gives the fish a low chance of establishment.

Establishment Risk Rank	**Establishment Risk Score**
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

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Bomford, Mary (2006) "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia

Bomford, Mary and Glover, Julie (June 2004) "*Risk assessment model for the import and keeping of exotic freshwater and estuarine finfish*", A report produced by the Bureau of Rural Sciences for The Department of Environment and Heritage.

Phelong, P.C. (1996b) "Climex: a system to predict the distribution of an organism based on climate preferences". Available at: http://www.agric.wa.gov.au

A report to address the “Terms of Reference” for an application to include *Glossolepis pseudoincisus* onto the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.



Glossolepis pseudoincisus © Johannes Graf

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that the Tami River Rainbowfish, *Glossolepis pseudoincisus* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented for the prosecutor in the witness box by the author of this report, however the accused offender pleaded guilty.

Disease
Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species
Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat
Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species
Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes
Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

References:

Clements, Valentin, Rankin, Baker, Gee, Snellgrove, Sloman (2019) "*The effects of interacting with fish in aquariums on human health and well-being: A systematic review*" published by Institute of Biomedical and Environmental Health Research, School of Health and Life Sciences, University of the West of Scotland, Paisley, United Kingdom.

Cracknell, White, Pahl, Nichols & Depledge. 2016 "*Marine Biota and Psychological Well-Being: A Preliminary Examination of Dose–Response Effects in an Aquarium Setting*" published by Environment and Behavior2016, Vol. 48(10) 1242 –1269© 2015 SAGE Publications

Allen, G.R. and Cross, N.J. 1980. Descriptions of five new rainbowfishes (Melanotaeniidae) from New Guinea. *Records of the Western Australian Museum* 8(3): 377-396.

Froese, R. and D. Pauly. Editors. 2020. FishBase. www.fishbase.org, version (12/2020). https://www.fishbase.se/summary/Glossolepis-pseudoincisus.html



Glossolepis pseudoincisus (Lake Emfote) © Gunther Schmida

Terms of Reference

1. Provide information on the taxonomy of the species.

Overview: The rainbowfish genus *Glossolepis* consists of nine species occurring only in the northern half of New Guinea. The name *Glossolepis* consists of two words from the Greek language: “glossa” = tongue “lepis” = scale and refers to the tongue-shaped scale margins.

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Chilatherina* are:

- tongue-shaped scales,
- increased number of gill rakers,
- first spine of the second dorsal fin stronger than the first spine of the first dorsal fin and
- relatively elongated pectoral fins and enlarged teeth in the lateral wing of the remaxillary.



Distribution of the genus *Glossolepis*. Map: Creative commons, modified.

Information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Glossolepis* (origin - *Glossolepis*: Greek, "glossa" = tongue, and "lepis" = scale which refers to the tongue shaped scale margins
Species: *Glossolepis pseudoincisus* (Allen & Cross 1980), Tami River Rainbowfish

Etymology: *Glossolepis:* Greek, glossa = tongue + Greek, lepis = scale,
pseudo, false, i.e., although this species may resemble G. incisus, and lives in close proximity to it, such an appearance is false.*

Reference:

Allen, G.R. and Cross, N.J. 1980. Descriptions of five new rainbowfishes (Melanotaeniidae) from New Guinea. *Records of the Western Australian Museum* 8(3): 377-396.



Glossolepis pseudoincisus habitat, (Lake Emfote) Jayapura, PNG

2. Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). For example, is the species listed on CITES Appendix I, II or III, and if so, are there any specific restrictions on the movement of this species? Include information on the conservation value of the species.

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Glossolepis” revealed no results for those entities. (accessed 21 April 2021).

A search of the International Union for the Conservation Red List web site indicated the Tami River Rainbowfish, *Glossolepis pseudoincisus* is assessed as Vulnerable. It has an extent of occurrence (EOO) of 1,250 km^2. It occurs in seven locations, based on four settlements along the Tami River, and three small lakes that are affected separately by threats. There is also continuing decline in habitat. Threats to this species include settlements, oil palm plantations and invasive species. Any specimens imported if the application is improved will be from aquaculture in the USA or Germany. No wild collections will be made.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 9 species of Glossolepis listed.

Glossolepis dorityi listed as critically endangered
https://www.iucnredlist.org/species/161080437/161080455

Glossolepis incisus listed as endangered
https://www.iucnredlist.org/species/9268/147681075

Glossolepis leggetti listed as least concern
https://www.iucnredlist.org/species/161080708/161080713

Glossolepis kabia listed as least concern
https://www.iucnredlist.org/species/161080469/161080528

Glossolepis maculosus listed as endangered
https://www.iucnredlist.org/species/9269/147681182

Glossolepis multisquamata listed as least concern
https://www.iucnredlist.org/species/169502/147681206

Glossolepis ramuensis listed as vulnerable
https://www.iucnredlist.org/species/9271/147681464

Glossolepis pseudoincisus listed as vulnerable
https://www.iucnredlist.org/species/9270/147681435

Glossolepis wanamensis listed as critically endangered
https://www.iucnredlist.org/species/9272/147681490

References:

The **Cites** Species website with lists and search facility URL
http://www.cites.org/eng/disc/species.php

The **IUCN** Red List search facility locate at URL http://www.iucnredlist.org/search

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Allen (1980) records the holotype as male, 75.7 mm SL, collected from ox-bow lake next to Tami River, 23 km SE of Jayapura, Irian Jaya, Indonesia (approximately 20 42'S, 1400 55'E) by M. Boeseman on 19-21 November 1954. Paratypes 54 specimens, 33.1- 78.5 mm SL.

References:

Allen, G.R. and Cross, N.J. 1980. Descriptions of five new rainbowfishes (Melanotaeniidae) from New Guinea. *Records of the Western Australian Museum* 8(3): 377-396.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.c The natural geographic range.

Glossolepis pseudoincisus has been recorded from the Tami River system of northern Papua Province near the Indonesia-Papua New Guinea border. It is also known from Lake Ifaten/Emfote, a tiny lake situated at about 110 m elevation near the southern shore of Lake Sentani or about 25 km north-west of the Tami River. It is also known from Lakes Iwom and Yaniruk.

References:

Allen, G.R. and Cross, N.J. 1980. Descriptions of five new rainbowfishes (Melanotaeniidae) from New Guinea. *Records of the Western Australian Museum* 8(3): 377-396.

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

3.d Habitat.

Specimens of *G. pseudoincisus* were collected by Boeseman in November, 1954 in an ox-bow lake of the Tami River, about 30 kilometres to the east of Lake Sentani. They are also known from Lake Emfote, Lake Iwom and Lake Yaniruk. This species occurs in ox-bow lakes of the Tami River floodplain and tiny lakes perched above the southern shore of Lake Sentani. It congregates in areas of dense aquatic vegetation and can grow to a maximum size of about 8

cm SL This species occurs in ox-bow lakes of the Tami River floodplain and tiny lakes perched above the southern shore of Lake Sentani. It congregates in areas of dense aquatic vegetation and can grow to a maximum size of about 8 cm SL. The species was named 'pseudoincisus' with references to its similar appearance and geographic proximity to G. incisus.

References:

Allen, G.R. and Cross, N.J. 1980. Descriptions of five new rainbowfishes (Melanotaeniidae) from New Guinea. *Records of the Western Australian Museum* 8(3): 377-396.

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.e Diet, including potential to feed on agricultural plants

Allen (1980) records *Glossolepis pseudoincisus* gut contents of the types indicate a diet consisting mainly of small insects (such as ants) with lesser amounts of tiny crustaceans and algae. The gonads were poorly preserved and it was therefore difficult to determine the minimum size at maturation. The smallest ripe female examined was 47 mm SL. The species is named pseudoincisus with reference to its similar appearance and geographic proximity to G. incisus. This is similar to the diet of other members of the *Glossolepis* genus. All rainbowfishes of the family Melanotaeniidae are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

References:

Allen, G.R. and Cross, N.J. 1980. Descriptions of five new rainbowfishes (Melanotaeniidae) from New Guinea. *Records of the Western Australian Museum* 8(3): 377-396.

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.f Social behaviour and groupings

Allen (1991) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. The habits of other members of *Glossolepis* genus in captivity are well documented. Behavioural observations for *Glossolepis* are typical for most rainbowfishes and may be considered indicative of the behaviour of *Glossolepis Pseudoincisus*. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; "Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the

same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac."

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as "dither fish" to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried Glossolepis for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

3.i characteristics that may cause harm to humans and other species.

There are no really sharp spines or any toxins or venom in any member of the Melanotaeniidae family.

References:

Fishbase: https://www.fishbase.de/summary/Glossolepis-pseudoincisa.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4. Provide information on the reproductive biology of the species, including

There are no scientific records of any work done on the reproductive biology of *Glossolepis pseudoincisus* but the description of the *Glossolepis pseudoincisus* by Allan G.R (1980) *Glossolepis pseudoincisus* is most closely allied to *G. incisus.* They differ from the other members of the genus by possessing more gill rakers on the first arch (26-32 us. 19-23) and by having more pronounced crenulations on the scale margins. *Gl. incisus* is a species that is well known in the aquarium trade and has been kept and bred by the authors since 1983 from stock obtained from Melbourne. Six other *Glossolepis* species are well known in Australia; *G. incisus, G. kabia, G. maculosus, G. multisquamata, G. ramuensis* and *G. wanamensis*. The members of this genus were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

References:

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Glossolepis pseudoincisus* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b how frequently breeding occurs

The authors could find no record or observation for *Glossolepis pseudoincisus* but closely related *Glossolepis* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during

times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Glossolepis pseudoincisus* but closely related *Glossolepis* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992) but there are no known naturally occurring hybrids between *Glossolepis* sp. and *Melanotaenia* sp.. There are no naturally occurring *Glossoplepis* species in Australia. Despite the fact that some species of *Glossolepis* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species of *Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *G. incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish "aquarium" strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under "pseudo-scientific" names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a "Code of Conduct" that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by the author.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available on the world wide web as a portable document format (PDF) at universal resource locator http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There is no record of *Glossolepis pseudoincisus* being hybridized in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Glossolepis* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between *Melanotaenia praecox* and *G. incisus*, they produced an hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family Melanotaeniidae was sufficiently close for them all to hybridise. Author 1 called an expert in the field of rainbowfish for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different Rainbowfish *Melanotaenia splendida splendida* has been introduced to a different Rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

References:

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific Chromosomal Diversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Glossolepis* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Glossolepis pseudoincisus* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6

Froese, R. and D. Pauly. Editors. 2020. FishBase. www.fishbase.org, version (12/2020). Accessed 04 Apr 2021 https://www.fishbase.de/summary/Glossolepis-pseudoincisa.html

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

G. incisus, has been assessed on behalf of the Pet Industry Association of Australia. *G. leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005)
https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator; https://www.baphiq.gov.tw/public/Data/910614193571.pdf
, or
http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of *Glossolepis pseudoincisus* into the Australian environment should it be released or escape effective human control. Author 1 contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with *Glossolepis pseudoincisus* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Glossolepis pseudoincisus is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment. There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville, Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop.There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

7c. ability to find shelter

Allen (1979), describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, J. 2010. The genus Glossolepis: Special Edition no. 1 of the “Rainbowfish” International Rainbowfish Association (IRG) © 2010 Internationale Gesellschaft für Regenbogenfische, Dompfaffweg 53, D-42659 Solingen ISBN 978-3-936616-64-4

Tappin, A.R., (2011) “*Rainbowfishes, their care and keeping in captivity*” available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7d. rate of reproducing

Glossolepis pseudoincisus is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, J. 2010. The genus Glossolepis: Special Edition no. 1 of the "Rainbowfish" International Rainbowfish Association (IRG) © 2010 Internationale Gesellschaft für Regenbogenfische, Dompfaffweg 53, D-42659 Solingen ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *G. incisus* has been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using Climatch software, results in a score of 3for *Glossolepis pseudoincisusa, indicating the species has* a very low chance of survival in Australian water ways.

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Glossolepis pseudoincisus* were to escape, effective control is where the likelihood of accidental or intentional release is greatest. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to one of the possible suitable natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Glossolepis pseudoincisus* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution.

It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats. *Glossolepis* have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984). .

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

Glossolepis pseudoincisus has been recorded from the Tami River system of northern Papua Province near the Indonesia-Papua New Guinea border. It is also known from Lake Ifaten/Emfote, a tiny lake situated at about 110 m elevation near the southern shore of Lake Sentani or about 25 km north-west of the Tami River. It is also known from Lakes Iwom and Yaniruk. The IUCN list it as vulnerable. It has an extent of occurrence (EOO) of 1,250 km^2. It occurs in seven locations, based on four settlements along the Tami River, and three small lakes that are affected separately by threats. There is also continuing decline in habitat. Threats to this species include settlements, oil palm plantations and invasive species. Allen mentions a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Glossolepis pseudoincisus* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because

Glossolepis pseudoincisus is similar other members of the *Glossolepis* genus the behaviour will be similar. Aquarium observations worldwide of *Glossolepis pseudoincisus* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

Reference:

Aqua-fish.net – since 2005 - https://en.aqua-fish.net/fish/tami-rainbowfish

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Glossolepis pseudoincisus* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 79mm SL (Allen 1980)

References:

Allen, G.R. and Cross, N.J. 1980. Descriptions of five new rainbowfishes (Melanotaeniidae) from New Guinea. *Records of the Western Australian Museum* 8(3): 377-396.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, J. 2010. The genus Glossolepis: Special Edition no. 1 of the “Rainbowfish” International Rainbowfish Association (IRG) © 2010 Internationale Gesellschaft für Regenbogenfische, Dompfaffweg 53, D-42659 Solingen ISBN 978-3-936616-64-4

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

8.c habitat and local environmental conditions

Glossolepis pseudoincisus are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Glossolepis* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are

carried into native waters by escaped *Glossolepis pseudoincisus* (Fishbase records diseases in other *Glossolepis* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. located at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Glossolepis,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

References :

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, J. 2010. The genus Glossolepis: Special Edition no. 1 of the “Rainbowfish” International Rainbowfish Association (IRG) © 2010 Internationale Gesellschaft für Regenbogenfische, Dompfaffweg 53, D-42659 Solingen ISBN 978-3-936616-64-4

Hardy-Smith P., Jones R. and Kailola P. (2007) “Scientific review of the biosecurity risks associated with the importation of rainbowfish for ornamental purposes” - Prepared for Biosecurity Australia by Panaquatic® Health Solutions Pty Ltd

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

Kahn, S.A., Wilson, P.W., Pereira, R.P., Hayder, H. and Gerrity, S.E. 1999. *Import Risk analysis on live ornamental finfish*. Canberra: Australian Quarantine and Inspection Service. 172 p.

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *G. incisus, G. kabia*, *G. maculosus*, *G. multisquamata, G. ramuensis* and *G. wanamensis* have been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Glossolepis pseudoincisus* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from European and North American breeders and then from commercial facilities to which these captive bred stocks are distributed.

Glossolepis pseudoincisus poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp. *(G. incisus,* and *G. leggetti)* currently permitted for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for “fresh” wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Glossolepis pseudoincisus* will be used in the live fish ornamental aquarium display trade. *Glossolepis pseudoincisusa* are to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish. Six of the nine species of *Glossolepis, G. incisus, G. kabia, Gl. maculosus, G. multisquamata, G. ramuensis and G. wanamensis* have been kept, bred here, and popular in Australia, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Two of the species, *Glossolepis incisus* and Glossolepis *leggetti* appear on the 'List of Specimens Suitable for Live Import' under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act. Rainbowfish of the genus *Glossolepis* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960’s.

If *Glossolepis pseudoincisus is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

References:

Biosecurity Australia. (2009) " **BIOSECURITY AUSTRALIA ADVICE 2009/30 EXTENSION OF POLICY TO INCLUDE THE IMPORTATION OF RED RAINBOWFISH FOR ORNAMENTAL PURPOSES".** Published by the Australian Government, available at: http://www.daff.gov.au/SiteCollectionDocuments/ba/memos/2009/2009-30.pdf Downloaded 17 Jul 2015.

Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11.a the containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

Reference:

Biosecurity Act 2015 as in force 25 march 2020, available on Federal Register of Legislation at Universal Resource Locator https://www.legislation.gov.au/Details/C2020C00127 Accessed 24 march 2021

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Glossolepis* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Glossolepis pseudoincisus* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Glossolepis pseudoincisus* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available at - http://www.agriculture.gov.au/import/goods/live- animals/importing-live-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

References:

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Aquagreen, Aquarium and Pond Keepers Code of Conduct – available at URL - https://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

12. Provide information on all other Commonwealth, state and territory legislative controls on the species, including:
the species' current quarantine status, or
pest or noxious status, or
whether it is prohibited or controlled by permit or licence in any state or territory.

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species , there are no references or instances of *Glossolepis* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Glossolepis pseudoincisus* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade

will not allow *Glossolepis pseudoincisus* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows *Glossolepis pseudoincisus* is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-freshwater/list-of-noxious-fish, and shows no *Glossolepis* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called "Restricted Matter" comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. *Glossolepis pseudoincisus* is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 and can be accessed at:
https://www.daf.qld.gov.au/_data/assets/pdf_file/0008/1398842/prohibited-restricted-invasive-fish.pdf , and there are no *Glossolepis* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Glossolepis pseudoincisus* is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at,
http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Glossolepis* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Glossolepis* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. *Glossolepis pseudoincisus* is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish, and shows no *Glossolepis* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. *Glossolepis pseudoincisus* does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *Glossolepis* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp **(*Cyprinus carpio*)** mosquito fish **(*Gambusia* spp.)** Didymo a freshwater algae **(*Didymosphenia geminata*)** and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *Glossolepis* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is ‘reckless’ about whether the animal is a prohibited animal and is also ‘reckless’ about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at

https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-Animals-Declaration-ACCESS-3.pdf . There are no *Glossolepis* species listed.

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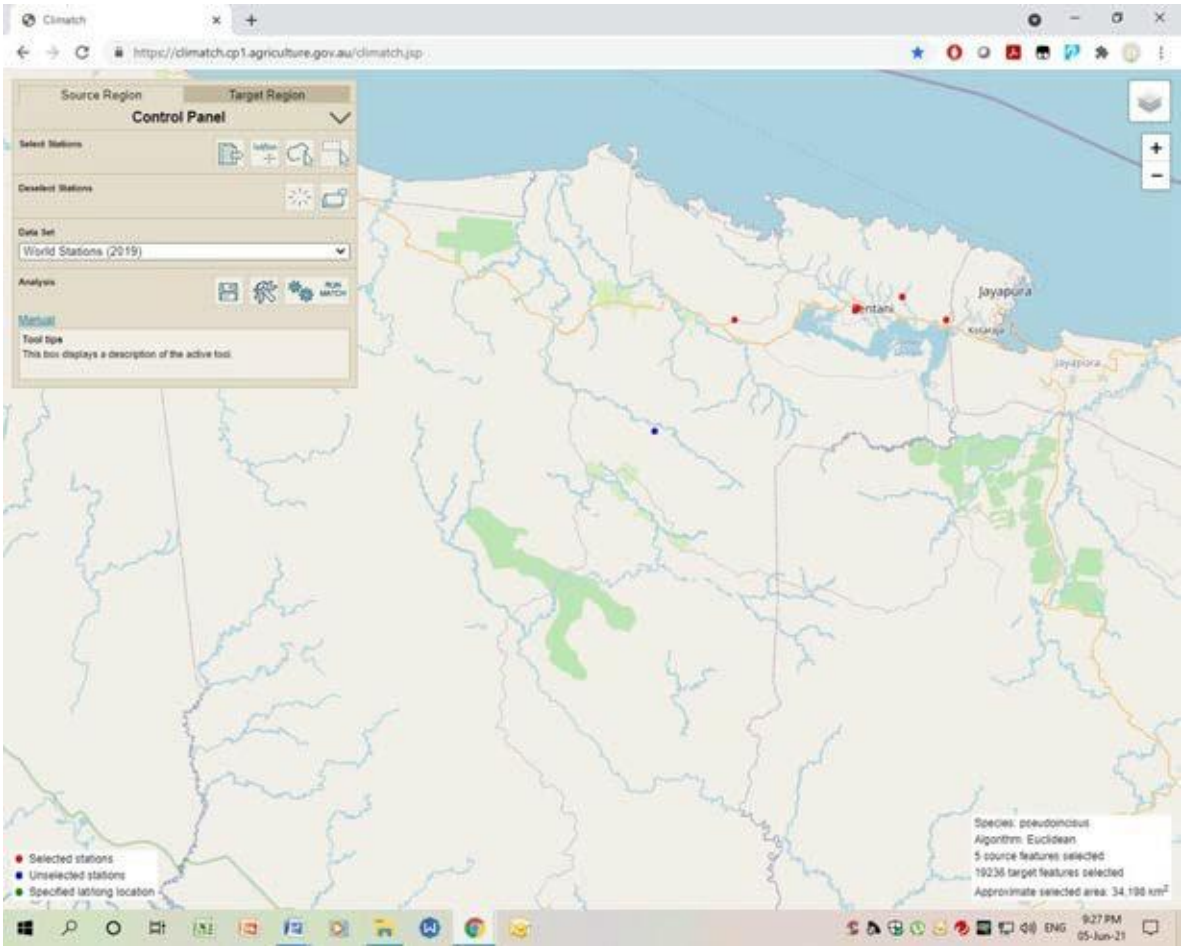
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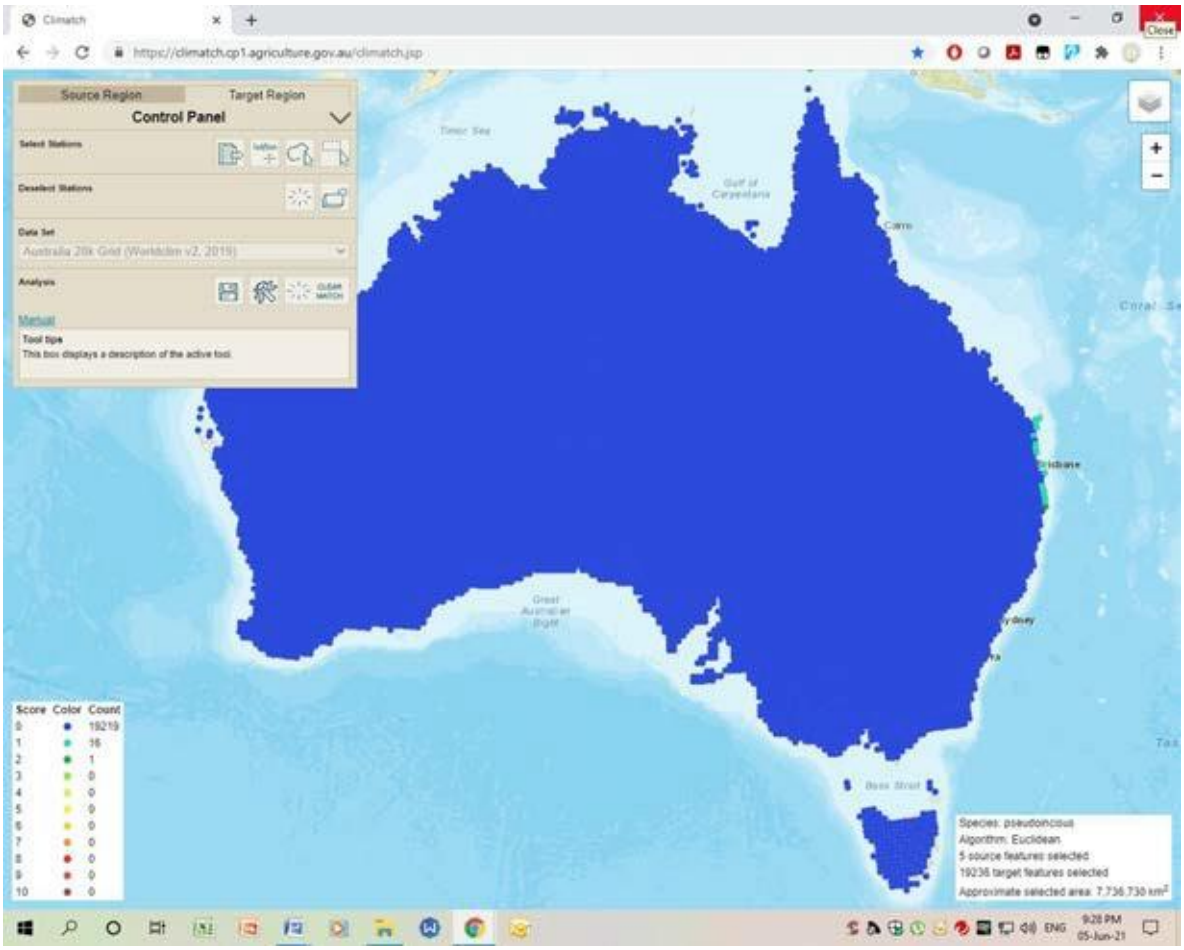
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APPENDIX A – calculation of climate from *Glossolepis pseudoincisus* distribution climate to Australian Climate.





Attachment B

BOMFORD ASSESSMENT

SPECIES: Glossolepis pseudoincisus

Score A. Climate Match (0-8)

Number of squares within 60% of the mean:	(No. 5)	0
Number of squares within 50% of the mean:	(No. 6)	0
Number of squares within 40% of the mean:	(No. 7)	0
Number of squares within 30% of the mean:	(No. 8)	0
Number of squares within 20% of the mean:	(No. 9)	0
Number of squares within 10% of the mean:	(No. 10)	0

Total = <3
Score: 1 (Ref: fishbase.org, PC CLIMATE)

Score B. Overseas Range

Number of 1° x 1° grids in which species occurs overseas.
No. of squares : <3
Score: 0 (Ref: fishbase.org, googleearth.com)

Score C. Establishment

Locations of establishment incidence: nil - never introduced
Score: 1 (Ref: fishbase.org)

Score D. Introduction Success

Percentage of Introduction events that have been successful

Introductions	nil	
Successful:	nil	
Score:	**1**	(Ref: fishbase.org)

Score E. Taxa risk

Genus:	Glossolepis	
Introductions:	0	
Successful:	0	
Score:	0	(Ref: fishbase.org / M. Bomford)

Family:	Melanotaeniidae (Rainbowfishes)	
Introductions:	5	
Successful:	0	unknown
Score:	**0**	(Ref: fishbase.org / M. Bomford)

Total: 3 (VERY LOW)

The score of 3 according to the assessment model gives the fish a very low chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

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A report to address the “Terms of Reference” for an application to include *Glossolepis ramuensis* onto the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.

Glossolepis ramuensis



Photograph - © C. Mailliet, permission to use image obtained 17 March 2021

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that the Ramu River Rainbowfish *Glossolepis ramuensis* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented in the witness box for the prosecutor by the author of this report, however the accused offender pleaded guilty.

Disease
Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species
Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat
Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species
Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes
Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

References:

Clements, Valentin, Rankin, Baker, Gee, Snellgrove, Sloman (2019) "*The effects of interacting with fish in aquariums on human health and well-being: A systematic review*" published by Institute of Biomedical and Environmental Health Research, School of Health and Life Sciences, University of the West of Scotland, Paisley, United Kingdom.

Cracknell, White, Pahl, Nichols & Depledge. 2016 "*Marine Biota and Psychological Well-Being: A Preliminary Examination of Dose–Response Effects in an Aquarium Setting*" published by Environment and Behavior2016, Vol. 48(10) 1242 –1269© 2015 SAGE Publications

Allen, G.R. 1985. Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea. *Revue française d'Aquariologie Herpétologie* 12(2): 53-62.

Froese, R. and D. Pauly. Editors. 2020. FishBase. www.fishbase.org, version (12/2020). https://www.fishbase.in/summary/Glossolepis-ramuensis.html



Ramu River © Tok Pisin (New Guinea Pidgin) English Bilingual Dictionary & Encyclopaedia of Papua New Guinea

Terms of Reference

1. Provide information on the taxonomy of the species.

Overview: The rainbowfish genus *Glossolepis* consists of nine species occurring only in the northern half of New Guinea. The name *Glossolepis* consists of two words from the Greek language: “glossa” = tongue “lepis” = scale and refers to the tongue-shaped scale margins.

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Chilatherina* are:

- tongue-shaped scales,
- increased number of gill rakers,
- first spine of the second dorsal fin stronger than the first spine of the first dorsal fin and
- relatively elongated pectoral fins and enlarged teeth in the lateral wing of the remaxillary.

-



Fig. 1: Distribution of the genus *Glossolepis*. Map: Creative commons, modified.

Information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Glossolepis* (origin - *Glossolepis*: Greek, "glossa" = tongue, and "lepis" = scale which refers to the tongue shaped scale margins
Species: *Glossolepis ramuensis* (Allen 2005), Ramu Rainbowfish.

Etymology: *Glossolepis:* Greek, glossa = tongue + Greek, lepis = scale,
- ensis: suffix denoting place: Ramu River system, Papua New Guinea, type locality.

Reference:

Allen, G.R. 1985. Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea. *Revue française d'Aquariologie Herpétologie* 12(2): 53-62.



Glossolepis ramuensis © Silke Prinage

2. Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES). For example, is the species listed on CITES Appendix I, II or III, and if so, are there any specific restrictions on the movement of this species? Include information on the conservation value of the species.

A search of the International Union for the Conservation Red List web site assessed the Ramu River Rainbowfish, *Glossolepis ramuensis as vulnerable.* This species occurs in the Ramu and Gogol river systems of northern Papua New Guinea. It has an extent of occurrence (EOO) of 5,050 km^2. Each river system represents a separate location based on the threats of oil palm plantations, mining and invasive species. There are continuing declines in habitat based on these threats. Introduced fish species pose a threat. In the Ramu River, oil palm plantations and mining operations are also found. In the Gogol River, there has been historic logging and so the habitat is primarily regrowth and gardens. (Accessed 28 May 2021). Any specimens imported if the application is improved will be from aquaculture in the USA or Europe. No wild collections will be made.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 9 species of Glossolepis listed.

Glossolepis dorityi listed as critically endangered
https://www.iucnredlist.org/species/161080437/161080455

Glossolepis incisus listed as endangered
https://www.iucnredlist.org/species/9268/147681075

Glossolepis leggetti listed as least concern
https://www.iucnredlist.org/species/161080708/161080713

Glossolepis kabia listed as least concern
https://www.iucnredlist.org/species/161080469/161080528

Glossolepis maculosus listed as endangered
https://www.iucnredlist.org/species/9269/147681182

Glossolepis multisquamata listed as least concern
https://www.iucnredlist.org/species/169502/147681206

Glossolepis ramuensis listed as vulnerable
https://www.iucnredlist.org/species/9271/147681464

Glossolepis pseudoincisus listed as vulnerable
https://www.iucnredlist.org/species/9270/147681435

Glossolepis wanamensis listed as critically endangered
https://www.iucnredlist.org/species/9272/147681490

References:

The **Cites** Species website with lists and search facility URL
http://www.cites.org/eng/disc/species.php

The **IUCN Red List** search facility locate at URL http://www.iucnredlist.org/search

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

Remarks:

Glossolepis ramuensis is most closely related to *G. maculosus* known from the Markham, Ramu and Sepik river systems. Both species have crenulated scale margins and a small premaxillary with relatively few teeth, typical features of the genus. However, they differ from the other *Glossolepis* species with respect to a reduced number of gill rakers and scales. *Glossolepis ramuensis* differs from *G. maculosus* only with respect to colour pattern and a slightly higher number of vertical scale rows (38 vs. 34-36).

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Glossolepis ramuensis was described on the basis of a single 55mm SL male specimen, found in October 1983 by Dr Allen, and R. Steene, in a 1metre wide tributary of the Ramu River in Papua New Guinea, about 3kn south of Walium village (approximately 5º37'S, 145 º28'E). The species was named '*ramuensis*' with reference to the river system of the type locality. This species can grow to a maximum size of about 6.5 cm SL

References:

Allen, G.R. 1985. Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea. *Revue française d'Aquariologie Herpétologie* 12(2): 53-62.

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.c The natural geographic range.

This species occurs in the Ramu and Gogol river systems of northern Papua New Guinea. It has an extent of occurrence (EOO) of 5,050 km^2. Each river system represents a separate location based on the threats of oil palm plantations, mining and invasive species. There are continuing declines in habitat based on these threats.

References:

Allen, G.R. 1985. Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea. *Revue française d'Aquariologie Herpétologie* 12(2): 53-62.

Boeseman, M. (1963) Notes on the fishes of western New Guinea 1. Zool. Mededelingen, 38(14); 221-242.

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

3.d Habitat.

This species has been recorded in small rainforest creeks with clear water, gravel bottoms, and few aquatic plants. It occurs in deeper pools, often among fallen tree debris. This species can grow to a maximum size of about 6.5 cm SL . The water was exceptionally clear with gravel bottom and very few aquatic plants except in occasional sunlit pools. Temperature and pH readings of 28.5°C and 7.8 were recorded at the collecting site. The stream was inhabited by large numbers of *Chilatherina campsi* and a few *Melanotaenia affinis*.

References:

Allen, G.R. and Cross, N.J. 1980. Descriptions of five new rainbowfishes (Melanotaeniidae) from New Guinea. *Records of the Western Australian Museum* 8(3): 377-396.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Glossolepis ramuensis* was not recorded by Allen (1985) but the diet of other members of the *Glossolepis* genus are well recorded. All rainbowfishes of the family Melanotaeniidae are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

References:

Allen, G.R. and Cross, N.J. 1980. Descriptions of five new rainbowfishes (Melanotaeniidae) from New Guinea. *Records of the Western Australian Museum* 8(3): 377-396.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.f Social behaviour and groupings

Allen (1991) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. The habits of other members of *Glossolepis* genus in captivity are well documented. Behavioural observations for *Glossolepis* are typical for most rainbowfishes and may be considered indicative of the behaviour of *Glossolepis ramuensis*. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; “Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac.”

References:

Allen, G.R. and Cross, N.J. 1980. Descriptions of five new rainbowfishes (Melanotaeniidae) from New Guinea. *Records of the Western Australian Museum* 8(3): 377-396.

Allen, G.R. & Cross, N.J. (1982) “*Rainbowfishes of Australia and Papua New Guinea”*. Published by Angus and Robertson

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) “*Rainbowfishes, their care and keeping in captivity*” available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as “dither fish” to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References:

Allen, G.R. & Cross, N.J. (1982) “*Rainbowfishes of Australia and Papua New Guinea”*. Published by Angus and Robertson

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried Glossolepis for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

Reference:

https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

3.i characteristics that may cause harm to humans and other species.

There are no really sharp spines or any toxins or venom in any member of the Melanotaeniidae family.

References:

Fishbase: https://www.fishbase.de/summary/Glossolepis-ramuensis.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4. Provide information on the reproductive biology of the species, including

There are no scientific records of any work done on the reproductive biology of *Glossolepis ramuensis. Glossolepis ramuensis* is most closely related to *G. maculosus* known from the Markham, Ramu and Sepik river systems. Both species have crenulated scale margins and a small premaxillary with relatively few teeth, typical features of the genus. However, they differ from the other *Glossolepis* species with respect to a reduced number of gill rakers and scales. *Glossolepis ramuensis* differs from *G. maculosus* only with respect to colour pattern and a slightly higher number of vertical scale rows (38 vs. 34-36).

Allan G.R (2001) states that it is closely related to *G. maculosus,. which* is a species that is well known in the aquarium trade and has been kept and bred by the authors since 1983 from stock obtained from Melbourne. Six *Glossolepis* species are well known in Australia; *G. incisus, G. kabia, G. maculosus, G. multisquamata, G. ramuensis* and *G. wanamensis*. The members of this genus were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

References:

Allen, G.R. and Cross, N.J. 1980. Descriptions of five new rainbowfishes (Melanotaeniidae) from New Guinea. *Records of the Western Australian Museum* 8(3): 377-396.

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Glossolepis ramuensis* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b how frequently breeding occurs

The authors could find no record or observation for *Glossolepis ramuensis* but closely related *Glossolepis* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Glossolepis ramuensis* but closely related *Glossolepis* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992) but there are no known naturally occurring hybrids between *Glossolepis* sp. and *Melanotaenia* sp.. There are no naturally occurring *Glossoplepis* species in Australia. Despite the fact that some species of *Glossolepis* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species of *Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *Glossolepis incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to

establish “aquarium” strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under “pseudo-scientific” names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a “Code of Conduct” that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by the Authors.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

ANGFA “Code of Conduct”
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) “*Rainbowfishes, their care and keeping in captivity*” available on the world wide web as a portable document format (PDF) at universal resource locator http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There is no record of *Glossolepis ramuensis* being hybridized in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Glossolepis* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. an Australian fish importer tried to make a more colourful hybrid between Melanotaenia praecox and Glossolepis incisus, they produced an hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family Melanotaeniidae was sufficiently close for them all to hybridise. Author 1 called an expert in the field of rainbowfish for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different Rainbowfish *Melanotaenia splendida splendida* has been introduced to a different Rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

References:

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific Chromosomal Diversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Glossolepis* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Glossolepis ramuensis* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/new-legislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-1-84971-228-6

Froese, R. and D. Pauly. Editors. 2020. FishBase. www.fishbase.org, version (12/2020). Accessed 04 Apr 2021. https://www.fishbase.de/summary/Glossolepis-ramuensis.html

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

G. incisus, has been assessed for and on behalf of the Pet Industry Association of Australia. *G. leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005) **https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text**

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator; https://www.baphiq.gov.tw/public/Data/910614193571.pdf , or http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/2009-24a-1_red_rainbowfish_attachment.pdf

7. Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control. Include at least the following factors:

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of *Glossolepis ramuensis* into the Australian environment should it be released or escape effective human control. Author 1 contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with *Glossolepis ramuensis* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 at attachment B.

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Glossolepis ramuensis is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment at Appendix B. There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville, Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland

Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

7c. ability to find shelter

Allen (1979), describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron.

References:

Allen, G.R. 1985. Three new rainbowfishes (Melanotaeniidae) from Irian Jaya and Papua New Guinea. *Revue française d'Aquariologie Herpétologie* 12(2): 53-62.
References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7d. rate of reproducing

Glossolepis ramuensis is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus and has been here, and popular, for more than 40 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in “Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models” A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using Climatch software, results in a score of 3 for *Glossolepis ramuensis* indicating a very low chance of survival in Australian water ways, attached as Appendix A..

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Glossolepis ramuensis* were to escape, effective control is where the likelihood of accidental or intentional release is greatest. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to one of the possible suitable natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Glossolepis ramuensis* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution.

It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats. *Glossolepis* have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020 Available at: https://climatch.cp1.agriculture.gov.au/

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

Glossolepis ramuensis is only found in the Ramu and Gogol river systems of northern Papua New Guinea in a few small areas in West Papua. The IUCN list it as vulnerable It has an extent of occurrence (EOO) of 5,050 km^2. Each river system represents a separate location based on the threats of oil palm plantations, mining and invasive species. There are continuing declines in habitat based on these threats. Therefore, it is assessed as Vulnerable. Introduced feral species such as tilapia and others. It has been mentioned that a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References ;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Glossolepis ramuensis* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or inter-breeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Glossolepis ramuensis* is similar other members of the *Glossolepis* genus the behaviour will be similar. Aquarium observations worldwide of *Glossolepis ramuensis* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

Reference:

Aqua-fish.net – since 2005 - https://en.aqua-fish.net/fish/ramu-rainbowfish

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Glossolepis ramuensis* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 55 mm (Allen 1981)

References:

Allen, G.R. and Cross, N.J. 1980. Descriptions of five new rainbowfishes (Melanotaeniidae) from New Guinea. *Records of the Western Australian Museum* 8(3): 377-396.

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, J. 2010. The genus Glossolepis: Special Edition no. 1 of the “Rainbowfish” International Rainbowfish Association (IRG) © 2010 Internationale Gesellschaft für Regenbogenfische, Dompfaffweg 53, D-42659 Solingen ISBN 978-3-936616-64-4

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

8.c habitat and local environmental conditions

Glossolepis ramuensis are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Glossolepis* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Glossolepis ramuensis* (Fishbase records diseases in other *Glossolepis* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. located at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Glossolepis,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations)

because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

References :

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, J. 2010. The genus Glossolepis: Special Edition no. 1 of the “Rainbowfish” International Rainbowfish Association (IRG) © 2010 Internationale Gesellschaft für Regenbogenfische, Dompfaffweg 53, D-42659 Solingen ISBN 978-3-936616-64-4

Hardy-Smith P., Jones R. and Kailola P. (2007) “Scientific review of the biosecurity risks associated with the importation of rainbowfish for ornamental purposes” - Prepared for Biosecurity Australia by Panaquatic® Health Solutions Pty Ltd

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

Kahn, S.A., Wilson, P.W., Pereira, R.P., Hayder, H. and Gerrity, S.E. 1999. *Import Risk analysis on live ornamental finfish*. Canberra: Australian Quarantine and Inspection Service. 172 p.

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *G. incisus, G. kabia*, *G. maculosus*, *G. multisquamata, G. ramuensis* and *G. wanamensis* have been in Australia, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Glossolepis ramuensis* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from European and North American breeders and then from commercial facilities to which these captive bred stocks are distributed

Glossolepis ramuensis poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp*. (G. incisus,* and *G. leggetti)* currently permitted for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for “fresh” wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Glossolepis ramuensis* will be used in the live fish ornamental aquarium display trade. *Glossolepis ramuensis* are to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish. Six of the nine species of *Glossolepis* have been in Australia prior to 1983, two *G. incisus* and G. *leggetti* appear on the 'List of Specimens Suitable for Live Import' under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act. Rainbowfish of the genus *Glossolepis* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960's.

If *Glossolepis ramuensis is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

References:

Biosecurity Australia. (2009) " **BIOSECURITY AUSTRALIA ADVICE 2009/30 EXTENSION OF POLICY TO INCLUDE THE IMPORTATION OF RED RAINBOWFISH FOR ORNAMENTAL PURPOSES".** Published by the Australian Government, available at: http://www.daff.gov.au/SiteCollectionDocuments/ba/memos/2009/2009-30.pdf Downloaded 17 Jul 2015.

Tappin, Adrian. (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity Second Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

11.a the containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

Reference:

Biosecurity Act 2015 as in force 25 march 2020, available on Federal Register of Legislation at Universal Resource Locator https://www.legislation.gov.au/Details/C2020C00127 Accessed 24 march 2021

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Glossolepis* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Glossolepis ramuensis* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Glossolepis ramuensis* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Government Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available at - http://www.agriculture.gov.au/import/goods/live-animals/importing- live-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

References:

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Aquagreen, Aquarium and Pond Keepers Code of Conduct – available at URL - https://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAA-CodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

12. Provide information on all other Commonwealth, state and territory legislative controls on the species, including: the species' current quarantine status, or pest or noxious status, or whether it is prohibited or controlled by permit or licence in any state or territory.

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species , there are no references or instances of *Glossolepis* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Glossolepis ramuensis* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow *Glossolepis ramuensis* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows *Glossolepis ramuensis* is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-and-freshwater/list-of-noxious-fish, and shows no *Glossolepis* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called "Restricted Matter" comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. *Glossolepis ramuensis* is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 and can be accessed at:
https://www.daf.qld.gov.au/_data/assets/pdf_file/0008/1398842/prohibited-restricted-invasive-fish.pdf , and there are no *Glossolepis* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Glossolepis ramuensis* is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at,
http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Glossolepis* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Glossolepis* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. *Glossolepis ramuensis* is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at
https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish , and shows no *Glossolepis* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. *Glossolepis ramuensis* does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at
https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *Glossolepis* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp (*Cyprinus carpio*) mosquito fish (*Gambusia* spp.) Didymo a freshwater algae (*Didymosphenia geminata*) and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species . there are no *Glossolepis* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is 'reckless' about whether the animal is a prohibited animal and is also 'reckless' about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at
https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-Animals-Declaration-ACCESS-3.pdf . There are no *Glossolepis* species listed.

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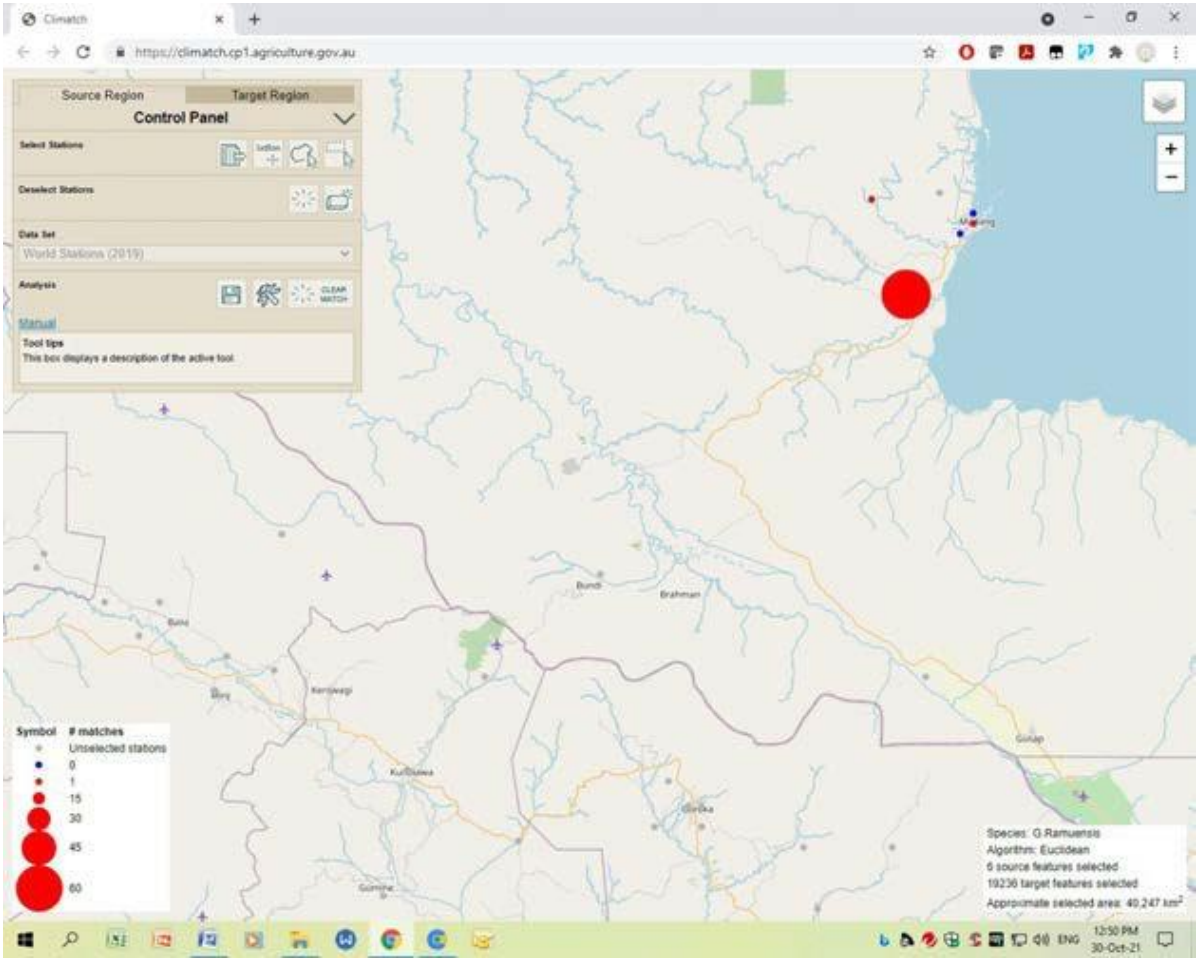
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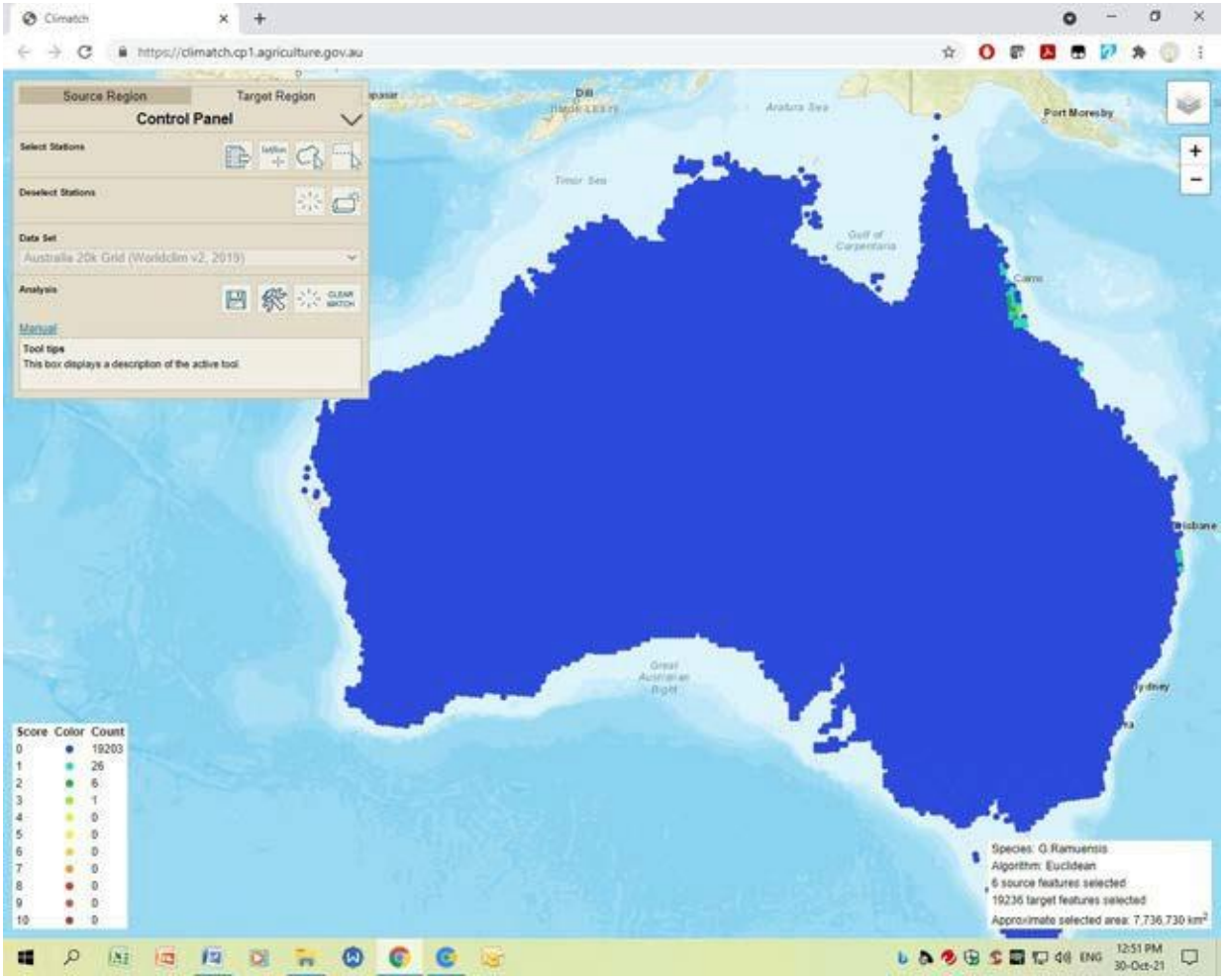
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APPENDIX A – calculation of climate from *Glossolepis ramuensis* distribution climate to Australian Climate.





APPENDIX B:

Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020 the following calculations were done to provide a score against the provisions in the assessment process.(accessed 6th June 2021.)

BOMFORD ASSESSMENT

SPECIES: Glossolepis ramuensis

Score A. Climate Match (0-8)

Number of squares within 60% of the mean:	(No. 5)	0
Number of squares within 50% of the mean:	(No. 6)	0
Number of squares within 40% of the mean:	(No. 7)	0
Number of squares within 30% of the mean:	(No. 8)	0
Number of squares within 20% of the mean:	(No. 9)	0
Number of squares within 10% of the mean:	(No. 10)	0

Total = <3
Score: 1 (Ref: fishbase.org, PC CLIMATE)

Score B. Overseas Range

Number of 1° x 1° grids in which species occurs overseas. (3)
No. of squares : <4

Score: 0 (Ref: fishbase.org, googleearth.com)

Score C. Establishment

Locations of establishment incidence: nil - never introduced
Score: 1 (Ref: fishbase.org)

Score D. Introduction Success

Percentage of Introduction events that have been successful
Introductions nil
Successful: nil
Score: 1 (Ref: fishbase.org)

Score E. Taxa risk

Genus: Glossolepis
Introductions: 0
Successful: 0
Score: 0 (Ref: fishbase.org / M. Bomford)

Family: Melanotaeniidae (Rainbowfishes)
Introductions: 5
Successful: 0 unknown
Score: 0 (Ref: fishbase.org / M. Bomford)

Total: 3 (VERY LOW)

The score of 3 according to the assessment model gives the fish a very low chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

Bomford, Mary (2006) "Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models" A report produced for the Department of the Environment and Heritage, Commonwealth of Australia

Bomford, Mary and Glover, Julie (June 2004) "*Risk assessment model for the import and keeping of exotic freshwater and estuarine finfish*", A report produced by the Bureau of Rural Sciences for The Department of Environment and Heritage.

Phelong, P.C. (1996b) "Climex: a system to predict the distribution of an organism based on climate preferences". Available at: http://www.agric.wa.gov.au

A report to address the “Terms of Reference” for an application to include *Glossolepis wanamensis* onto the allowable live imports list under the provisions of Section 303 EB, Environment Protection Biodiversity Conservation Act, 1999.

Glossolepis Wanamensis



Photograph - © Neil Armstrong, permission to use image obtained 2000

Introduction

The keeping of tropical fish species in aquaria is growing in popularity and has been booming during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that the Lake Wanam Rainbowfish *Glossolepis wanamensis* does not possess any of the aspects of an organism that will cause problems should it escape effective human control. These aspects are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented for the prosecutor in the witness box by the author of this report, however the accused offender pleaded guilty.

Disease
Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species
Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat
Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants and contributing to erosion.

Dangerous species
Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes
Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

References:

Allen, G.R. and Kailola, P.J. (1979). Glossolepis wanamensis, a new species of freshwater rainbowfish (Melanotaeniidae) from New Guinea. Rev. fr. Aquariol. 6 (2): 39-44

Clements, Valentin, Rankin, Baker, Gee, Snellgrove, Sloman (2019) "*The effects of interacting with fish in aquariums on human health and well-being: A systematic review*" published by Institute of Biomedical and Environmental Health Research, School of Health and Life Sciences, University of the West of Scotland, Paisley, United Kingdom.

Cracknell, White, Pahl, Nichols & Depledge. 2016 "*Marine Biota and Psychological WellBeing: A Preliminary Examination of Dose–Response Effects in an Aquarium Setting*" published by Environment and Behavior2016, Vol. 48(10) 1242 –1269© 2015 SAGE Publications

Froese, R. and D. Pauly. Editors. 2020. FishBase**. www.fishbase.org, version (12/2020).** https://www.fishbase.se/summary/Glossolepiswanamensis.html



Photograph - © Neil Armstrong, permission to use image obtained 2000

Terms of Reference

1. Provide information on the taxonomy of the species.

Overview: The rainbowfish genus *Glossolepis* consists of nine species occurring only in the northern half of New Guinea. The name *Glossolepis* consists of two words from the greek language: "glossa" = tongue "lepis" = scale and refers to the tongue-shaped scale margins.

Characteristic differences to the closely related Rainbowfish genera *Melanotaenia* and *Chilatherina* are:

- tongue-shaped scales,
- increased number of gill rakers,
- first spine of the second dorsal fin stronger than the first spine of the first dorsal fin and
- relatively elongated pectoral fins and enlarged teeth in the lateral wing of the remaxillary.



Fig. 1: Distribution of the genus *Glossolepis*. Map: Creative commons, modified.

Species summary

Generally, the body colour of adult males of *Glossolepis wanamensis* is an overall greenish colour with a rosy flush on the breast. The anterior scale rows below the lateral line are marked with narrow orange lines becoming green or bluish towards the tail. The upper half of the body often shows a metallic green colouration. The anal fin of the male is very large and elongated reaching a depth of nearly 3 cm. Females are generally a dull greenish colour, have shorter fins and rather drab compared to the males. Males are easily distinguished from females by their brighter colours and the extremely large anal fin. Males may reach a maximum size of 10 cm, but females are usually less than 8 cm. With a body depth of 4-5 cm, adults become very deep bodied especially the males.

Distribution & Habitat

Glossolepis wanamensis has only been found in Lake Wanam. They were collected in shallow, clear, sunlit water around sub-surface vegetation, submerged logs, and branches, or among reeds and other shoreline vegetation. The temperature and pH recorded at the lake was 28° Celsius and pH 7.0-7.8. Lake Wanam is a freshwater lake centred on 6° 38'S and 146° 47'E, and located in the vicinity of Mount Ngaroneno, at the southern margin of the lower Markham Valley, near Oomsis, Morobe Province about 25 km inland from the Huon Gulf. It has an irregular outline and, with a maximum width of about 3 km, is the largest of a number of lakes and swamps in the vicinity.

As there is no permanent stream inflow into the lake much of its water is derived by precipitation directly onto the lake surface. The lake has a maximum depth of around 19 metres, and is subject to seasonal fluctuations in level. The only outflow of the lake is a small channel in the extreme south-west corner of the basin that runs into Oomsis Creek. This flows only intermittently and often dries out completely in the dry season when the level of the lake becomes lower. This channel also serves as an inflow when the creek is in flood. Oomsis Creek is the only permanent watercourse in this locality but it too may cease flowing under seasonal conditions of sustained dry weather.

Remarks

Lake Wanam is home to two rainbowfishes, *Glossolepis wanamensis* and *Chilatherina fasciata*. *Glossolepis wanamensis* was first collected by C. Ellway in 1975 but it wasn't until 1979 that they were scientifically described. This followed their collection by Gerald Allen and Brian Parkinson in October 1978. Brian Parkinson had previously collected specimens there and sent them to Patricia Kailola, then working for the Fisheries Department at Port Moresby. Fifty-five specimens of *Glossolepis wanamensis* and four specimens of *Chilatherina fasciata* were collected. After just two days there were only five survivors and of these only two made it back to Australia.

Barry Crockford brought more live specimens to Australia in 1980. Five survived, which included 2 females. A year later further live specimens were collected. The fish collected on these two trips formed the breeding stock of all *Glossolepis wanamensis* in Australia to the present day. Water conditions at the time were reported as pH 7.6, temperature 28°C and hardness 80 ppm.

In 1992, Heiko Bleher collected live specimens from the lake and introduced them to the European hobby. He again collected in 1994 and reported that "An exhaustive search produced just one small group of rainbowfishes, adults 2-3 years old, seven males and a single elderly female. No juveniles, no eggs. The water was murky from surface to substrate, with tilapias as far as the eye could see." He returned in 1995 and noted that Tilapia infestation of the Lake had increased even further and only two very old male specimens were collected. He reported in Aqua Geðgraphia (1998), that *Glossolepis wanamensis* was becoming extinct in the Lake. It was thought that the introduction of carp, tilapia, and gambusia may have caused this drastic and worrying reduction in numbers. *Oreochromis mossambica* were introduced into the lake by the Department of Agriculture, Stock and Fisheries reportedly during 1966, and their increasing population may have made some impact on the lake's ecosystem.

During the 1998 Australia New Guinea Fishes Association (ANGFA) Convention in Brisbane, discussions were held with Heiko Bleher about the situation at Lake Wanam and it was decided that further survey work would need to be undertaken. It was felt that the endemic Lake Wanam rainbowfish was in such low numbers as to cause concern for its future in the wild. Matt Vincent and Gary Slater from the Melbourne Zoo travelled to PNG to discuss the problem with Peter Clarke, Director of the Rainforest Habitat in Lae. These discussions led to the setting up of a tripartite agreement between ANGFA, Melbourne Zoo and the Rainforest Habitat. These three bodies formed the Lake Wanam Management Project on 21 December 1998.

An extensive survey of Lake Wanam was undertaken in June of 1999. The results of this survey can be found in *Fishes of Sahul* 13(3): 621-629. This survey found that *Glossolepis wanamensis* were in reasonably large numbers in the lake, but that the *Chilatherina fasciata* found in the lake on previous collecting trips had all but disappeared. Despite extensive sampling of areas known to contain hundreds of specimens in the past, not a single fish was collected. However, among all the *Glossolepis wanamensis* collected only two juvenile specimens were noted. The remainder of the *Glossolepis wanamensis* were approximately two years of age. The survey team noted small groups of fry but was concerned by the low numbers within these groups (approx 20 specimens).

It was thought that during a severe El Niño drought in 1997, when water levels fell by 11.2 metres, it caused a massive fish kill in the lake. Apparently dead fish were floating everywhere and thick on the shoreline. *Glossolepis wanamensis* are known to withstand high temperatures and perhaps this event allowed the population to recover temporarily. However this fluctuation in population numbers did highlight the vulnerability of this species and it was decided to establish a separate breeding population at the Rainforest Habitat in Lae.

About eighty *Glossolepis wanamensis* were collected from Lake Wanam. Oomsis Creek was also surveyed and about twenty *Chilatherina campsi* were collected. Both collections were taken back to the Rainforest Habitat. *Glossolepis wanamensis* did not travel well and some losses occurred. The fish were placed into a tank and treated with medication. *Chilatherina campsi* travelled better and most of these were released directly into the ponds at the Rainforest Habitat. The following day the fish seemed to have improved, but more losses occurred (mostly females). About ten *Glossolepis wanamensis* were released into a pond in the Butterfly House and these improved dramatically so it was decided to select the best and fittest females from the tank and place these in that pond. It appeared at the time that the pond fish were surviving and that a breeding colony would be achieved. However, the current situation at the Rainforest Habitat and its rainbowfish breeding program is unknown.

The current situation in Lake Wanam and its rainbowfish inhabitants is also unknown. Very little information on the lake and the health of its ecosystem is available. However, small captive populations of *Glossolepis wanamensis* and *Chilatherina fasciata* from Lake Wanam still exist in the Australian hobby and internationally.

Information on the taxonomy of the species.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Glossolepis* (origin - *Glossolepis*: Greek, "glossa" = tongue, and "lepis" = scale which refers to the tongue shaped scale margins
Species: *Glossolepis wanamensis* (Allen & Kailola 1979), Lake Wanam Rainbowfish

Etymology: *Glossolepis:* Greek, glossa = tongue + Greek, lepis = scale,

Reference:

Allen, G.R. and Kailola, P.J. (1979). Glossolepis wanamensis, a new species of freshwater rainbowfish (Melanotaeniidae) from New Guinea. Rev. fr. Aquariol. 6 (2): 39-44



Lake Wanam Photograph - © Aquapress - Bleher, permission to use image obtained 2021

2. Provide information on the status of the species under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES).

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “Glossolepis” revealed no results for those entities. (accessed 21 April 2021).

A search of the International Union for the Conservation Red List web site indicated the Lake Wanam Rainbowfish *Glossolepis wanamensis* as critically endangered. It is endemic to a single lake with an area of occupancy (AOO) of only 4 km^2. Introduction of non-native species into the lake has resulted in declines in population size, and there is one location based on this threat. Conservation actions have been undertaken but it is unclear if these have been successful and monitoring is recommended. The introduction of exotic species, such as tilapia, carp and gambusia, into the lake over the last few decades have threatened this species. Individuals were moved from the lake into rainforest habitat in Lae in 1999, but there is no current information on the persistence of this population. Monitoring of the status of this population, as well as individuals in the native range, is recommended. Any specimens imported if the application is improved will be from aquaculture in the USA or Europe. No wild collections will be made.

A search of the International Union for the Conservation of Nature (IUCN) Red List indicated there are 9 species of Glossolepis listed.

Glossolepis dorityi listed as critically endangered
https://www.iucnredlist.org/species/161080437/161080455

Glossolepis incisus listed as endangered
https://www.iucnredlist.org/species/9268/147681075

Glossolepis leggetti listed as least concern
https://www.iucnredlist.org/species/161080708/161080713

Glossolepis kabia listed as least concern
https://www.iucnredlist.org/species/161080469/161080528

Glossolepis maculosus listed as endangered
https://www.iucnredlist.org/species/9269/147681182

Glossolepis multisquamata listed as least concern
https://www.iucnredlist.org/species/169502/147681206

Glossolepis ramuensis listed as vulnerable
https://www.iucnredlist.org/species/9271/147681464

Glossolepis pseudoincisus listed as vulnerable
https://www.iucnredlist.org/species/9270/147681435

Glossolepis wanamensis listed as critically endangered
https://www.iucnredlist.org/species/9272/147681490

References:

The Cites Species website with lists and search facility URL
http://www.cites.org/eng/disc/species.php

The IUCN Red List search facility locate at URL http://www.iucnredlist.org/search

3. Provide information about the ecology of the species. Include, but do not restrict your response to:

3.a Lifespan of the species.

Rainbowfishes, *Melanotaenia, Glossolepis* and *Chilatherina* are treated as one entity in regard to lifespan by Allen and Cross, they are said to live approximately 4 years in the natural location but can live up to 8 years when in captivity. (Allen and Cross 1982). Tappin 2011 suggested rainbowfishes from temperate waters have a longer life span than rainbowfishes from warm tropical areas.

References:

Allen, G.R. and Kailola, P.J. (1979). Glossolepis wanamensis, a new species of freshwater rainbowfish (Melanotaeniidae) from New Guinea. Rev. fr. Aquariol. 6 (2): 39-44

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.b Size and weight range.

Allen, (1979), records the Holotype of the species as being 80.5mm standard length, and 48 paratypes as being between 57.0 and 82.8mm standard length, collected from Lake Wanam 6° 39'S and 146° 46'E, using a 10 metre seine net by G. Allen, B. Parkinson and J. Tait on 7th October 1978

References:

Allen, G.R. and Kailola, P.J. (1979). Glossolepis wanamensis, a new species of freshwater rainbowfish (Melanotaeniidae) from New Guinea. Rev. fr. Aquariol. 6 (2): 39-44

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.c The natural geographic range.

This species is endemic to Lake Wanam, a small 2 km wide, roughly circular lake situated on a small plateau above the Markham Valley at an elevation of about 45 m, 24 km west of Lae, Papua New Guinea.

References:

Allen, G.R. and Kailola, P.J. (1979). Glossolepis wanamensis, a new species of freshwater rainbowfish (Melanotaeniidae) from New Guinea. Rev. fr. Aquariol. 6 (2): 39-44

Boeseman, M. (1963) Notes on the fishes of western New Guinea 1. Zool. Mededelingen, 38(14); 221-242.

3.d Habitat.

Glossolepis wanamensis has only been found in Lake Wanam. They were collected in shallow, clear, sunlit water around subsurface vegetation, submerged logs, and branches, or among

reeds and other shoreline vegetation. The temperature and pH recorded at the lake was 28° Celsius and pH 7.0–7.8. Lake Wanam is a freshwater lake centred on 6° 38'S and 146° 47'E, and located in the vicinity of Mount Ngaroneno, at the southern margin of the lower Markham Valley, near Oomsis, Morobe Province about 25 km inland from the Huon Gulf. It has an irregular outline and, with a maximum width of about 3 km, is the largest of a number of lakes and swamps in the vicinity.

As there is no permanent stream inflow into the lake much of its water is derived by precipitation directly onto the lake surface. The lake has a maximum depth of around 19 metres, and is subject to seasonal fluctuations in level. The only outflow of the lake is a small channel in the extreme south-west corner of the basin that runs into Oomsis Creek. This flows only intermittently and often dries out completely in the dry season when the level of the lake becomes lower. This channel also serves as an inflow when the creek is in flood. Oomsis Creek is the only permanent watercourse in this locality but it too may cease flowing under seasonal conditions of sustained dry weather.

References:

Allen, G.R. and Kailola, P.J. (1979). Glossolepis wanamensis, a new species of freshwater rainbowfish (Melanotaeniidae) from New Guinea. Rev. fr. Aquariol. 6 (2): 39-44

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf



Lake Wanam Habitat of Glossolepis wanamensis - © Aquapress - Bleher, permission to use image obtained 2021

3.e Diet, including potential to feed on agricultural plants

The specific diet of *Glossolepis wanamensis* was not recorded by Allen (1979) but the diet of other members of the *Glossolepis* genus are well recorded. All rainbowfishes of the family Melanotaeniidae are reasonably similar in their dietary preferences. They are omnivores,

eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.f Social behaviour and groupings

This species was reportedly abundant when first collected in the 1970s, but was difficult to find during searches carried out in 1994-1995. There was a large fish kill (including of invasive tilapia) as the result of an El Nino event in 1997 when the water level fell by 11 m. Following this, reasonably large numbers of individuals were collected in 1999, although the species is still not considered common and the current population trend is unknown. It has been collected recently, within approximately the last five years (P. Unmack pers. comm. 2019)

Allen (1991) describes the general behaviour of rainbowfishes as small schooling fishes generally less than 12 cm in length and common in most habitats below 1500m elevation. The habits of other members of *Glossolepis* genus in captivity are well documented. Behavioural observations for *Glossolepis* are typical for most rainbowfishes and may be considered indicative of the behaviour of *Glossolepis wanamensis*. Tappin (2005) gives the following general descriptions of rainbowfish behaviour in the aquarium ; "Rainbowfishes have very similar breeding habits, their food requirements are similar, and water that suits one particular species will suit all. All are of good-natured temperament and will live harmoniously, more or less, with one another. Rainbowfishes are a schooling fish, living in the midwater to the surface zone, often adjacent aquatic and emergent vegetation or snags in deeper water and in the quieter parts of streams at the head and bottom of riffles and rapids. From first light to mid morning dominant males will intensify in colour, select a feature such as a prominent piece of aquatic vegetation or small snag then attempt to lure and chase females into the area at the same time displaying erect fins to other nearby males trying to attract the same females. Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Females generally select the male they mate with and the pair quiver side by side for a few seconds near the chosen feature before a simultaneous release of eggs and sperm. The pair split apart in a rapid burst, scattering the fertilized eggs into the vegetation. The eggs have sticky filaments and are generally caught in the vegetation where they remain for 5 to 11 days before hatching into well formed larvae with very small yolk sac."

References :

Allen, G.R. and Kailola, P.J. (1979). Glossolepis wanamensis, a new species of freshwater rainbowfish (Melanotaeniidae) from New Guinea. Rev. fr. Aquariol. 6 (2): 39-44

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

IUCN Red List at: https://www.fishbase.de/summary/Glossolepis-wanamensis.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.g territorial and aggressive behaviours

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylized display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as "dither fish" to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References:

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

3.h natural predators

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. The fish markets in Jayapura have dried Glossolepis for sale and they are eaten like biscuits. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae. List compiled from Fishbase April 2021.

https://www.fishbase.se/country/CountryChecklist.php?resultPage=8&what=list&trpp=50&c_code=598&cpresence=Reported&sortby=alpha&ext_CL=on&ext_pic=on&vhabitat=fresh

3.i characteristics that may cause harm to humans and other species.

There are no really sharp spines or any toxins or venom in any member of the Melanotaeniidae family.

References:

Fishbase: https://www.fishbase.de/summary/Glossolepis-wanamensis.html

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available as a (PDF) at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4. Provide information on the reproductive biology of the species, including

There are no scientific records of any work done on the reproductive biology of *Glossolepis wanamensis* but the description of the *Glossolepis wanamensis* by Allan G.R (1979) states that

it is closely related to *G. multisquamatus. Both* species that is well known in the aquarium trade and has been kept and bred by the authors since 1983 from stock obtained from Melbourne. Six *Glossolepis* species are well known in Australia; *G. incisus, G. kabia, G. maculosus, G. multisquamata, G. ramuensis, and G. wanamensis*. The members of this genus were imported by various individuals from wild New Guinea populations up until 1986 when further import controls were placed on live ornamental fish importations.

References :

Allen, G.R. and Kailola, P.J. (1979). Glossolepis wanamensis, a new species of freshwater rainbowfish (Melanotaeniidae) from New Guinea. Rev. fr. Aquariol. 6 (2): 39-44

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.a The age at maturity (first breeding)

The authors could find no record of this information for *Glossolepis wanamensis* but generally Rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.b how frequently breeding occurs

The authors could find no record or observation for *Glossolepis wanamensis* but closely related *Glossolepis* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.c if the female can store sperm

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.d how many eggs or live-born young are produced at each breeding event

The authors could find no record or observation for *Glossolepis wanamensis* but closely related *Glossolepis* species will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.e if the species has hybridised with other species (both in the wild and in captivity) or has the potential to hybridise with any other species

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera *Melanotaenia* and *Chilatherina* can be found in Allen & Cross (1992) but there are no known naturally occurring hybrids between *Glossolepis* sp. and *Melanotaenia* sp.. There are no naturally occurring *Glossoplepis* species in Australia. Despite the fact that some species of *Glossolepis* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations in Australia.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between

the various species of *Melanotaenia, Glossolepis, Chilatherina* and *Rhadinocentrus* as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions within captivity.

There was no record or mention from Dr Allen of any hybrids of this species in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *G. incisus* was hybridized with a *Melanotaenia praecox* by an Australian fish importer in an attempt to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish "aquarium" strains of hybrids between various *Melanotaenia* species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (in Europe) and ANGFA here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under "pseudo-scientific" names such as *Melanotaenia marcii* etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a "Code of Conduct" that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together if hybridisation was common or easy there would only be one species with the features of the original 4 or 5 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata, M.exquisita, M.nigrans and M.splendida inornata*. No hybrids have been found there during many collections by the authors.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

ANGFA "Code of Conduct"
https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

Caughey, A. and Armstrong, N. (1993). A code of ethics for ANGFA fishkeepers. *Fishes of Sahul* **7(4),** 332–334.

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAACodeofPractice.pdf

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available on the world wide web as a portable document format (PDF) at universal resource locator http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

4.f Fertility of Hybrid Progeny

There is no record of *Glossolepis wanamensis* being hybridized in captivity nor any observations of hybrids in their natural habitat. Hybrids of other *Glossolepis* with *Melanotaenia* produce infertile offspring. Recent Scientific Genetic studies are inconclusive regarding the possible fertility of hybrid offspring. An Australian fish importer tried to make a more colourful hybrid between Melanotaenia praecox and G. incisus, they produced hybrids but were unable to breed further fish from the hybrid, concluding it was infertile.

Majtánová and all, 2020, concluded that their DNA in the family Melanotaeniidae was sufficiently close for them all to hybridise. Author 1 called an expert in the field of rainbowfish

for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different Rainbowfish *Melanotaenia splendida splendida* has been introduced to a different Rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related.

Reference:

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific Chromosomal Diversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

There are no records of this fish being translocated to another place. Despite the fact that some species of *Glossolepis* have been kept as aquarium fish in Australia for several decades this genus has never established feral populations here. *Glossolepis wanamensis* has been introduced to Europe and North America and has not established feral populations.

References:

http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/newlegislation/submission/terrestrial-ecosystems.pdf

Francis, Robert A. (2012) A Handbook of Global Freshwater Invasive Species ISBN 978-184971-228-6

Froese, R. and D. Pauly. Editors. 2020.FishBase. www.fishbase.org, version (12/2020). Accessed 04 Apr 2021 https://www.fishbase.de/summary/Glossolepis-wanamensis.html

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken by Biosecurity Australia.

G. incisus, has been assessed by Patricia Kialola for and on behalf of the Pet Industry Association of Australia. *G. leggetti* has been assessed by author 1 and was advised by email on 8th October 2020 that the fish has been approved and has been added to the allowable import list as created by S.303EB of the Environment Protection Biodiversity Conservation Act of 1999.

Panaquatic Health Solutions Pty Ltd conducted a review of the health risks associated with the importation of Rainbowfish for ornamental purposes.

References:

Amendment - List of Specimens Taken to be Suitable for Live Import (11/04/2005) https://www.legislation.gov.au/Details/F2005L00922/Explanatory%20Statement/Text

Panaquatic® Health Solutions Pty Ltd, 2009, "*Scientific review of the Biosecurity risks associated with the importation of rainbowfish for ornamental purposes*", available as an electronic publication on World Wide Web Universal Resource Locator; https://www.baphiq.gov.tw/public/Data/910614193571.pdf
, or

http://www.agriculture.gov.au/SiteCollectionDocuments/ba/animal/horsesubmissions/200924a-1_red_rainbowfish_attachment.pdf

The 2006 refined model for risk assessment has been used to assess the possibility of establishment of *Glossolepis wanamensis* into the Australian environment should it be released or escape effective human control. Author 1 contacted Mary Bomford after publication of the risk assessment calculator in 2004. A spreadsheet for scoring was produced and is reproduced and is attached with *Glossolepis wanamensis* data below as Appendix B. Using Climatch v2.0 for PC (Australian Bureau of Agriculture and Resource Economics and Sciences - ABARES) November 2020.

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020

7a. ability to find food sources

Glossolepis wanamensis is a small forage species that lives at the margins of its natural habitat, from near the surface to the bottom in 1 to 1.5 meters of clear water. It will have a similar diet to all other Melanotaeniidae that is an omnivorous consisting of small terrestrial insects fallen in the water, aquatic insects, small aquatic crustaceans and algae. The whole family has small villiform teeth designed to scrape periphyton form hard submerged surfaces. The species will be ok in any environment with suitable water quality along with other small forage fishes with a similar diet.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7b. ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)

There is very little climate match between West Irian and the Australian continent. See Bomford risk assessment score attached as appendix B. There are few places where a large population is near a suitable aquatic environment for this species. Perhaps near Townville, Cairns and Darwin there maybe waters that will enable this fish to survive. There are people in these places putting tropical exotic species in ponds that are in flood prone areas. 72 species of exotic aquarium fish were released into the Katherine River in the 1999 floods that put nearly 4 meters of water through the main street emptying the aquariums in the local pet shop. There have been no reports of ferals establishing in that river.

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

7c. ability to find shelter

Allen (1979), describes the fish as swimming in loose groups near the edge not at the surface nor near the bottom but all levels of mid water in 1 to 1.5 meters depth. This to me indicates that its habits are similar to all other members of the Melanotaeniidae family. They are relaxed, spread out and swim in loose groups during a normal day, form schools if attacked by predators or when travelling. A personal observation from Author 1, at night most rainbowfishes are hard against the bank in very shallow water away from nocturnal hunters in the deep water. This makes them an easy meal for Night Heron.

References :

Allen, G.R. and Kailola, P.J. (1979). Glossolepis wanamensis, a new species of freshwater rainbowfish (Melanotaeniidae) from New Guinea. Rev. fr. Aquariol. 6 (2): 39-44

Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7d. rate of reproducing

Glossolepis wanamensis is similar to other members of that genus, producing between 40 and 200 eggs several days in a row during a two week period in a time of good conditions. Fry survival would depend on the availability of small natural foods such as plankton, both zooplankton and phytoplankton.

References:

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, Johannes. (2010) The genus *Glossolepis* International Rainbowfish Association (IRG) Special Edition no 1. of the "Rainbowfish" ISBN 978-3-936616-64-4

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

7e. any characteristics that the species has which could increase its chance of survival in the Australian environment.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus and has been here, and popular, for more than 40 years (and other New Guinea rainbowfishes are cultivated here also).

The risk assessment process for estimating the ability of a fish species establishing within the Australian environment was prepared by Mary Bomford in 2004 Using the provisions in “Risk assessment for the establishment of exotic vertebrates in Australia: recalibration and refinement of models” A report produced for the Department of the Environment and Heritage, Commonwealth of Australia 2004. Using Climatch software, results in a score of 3 for *Glossolepis wanamensis* indicating a very low chance of survival in Australian water ways, attached as Appendix A..

The natural spread of this species would occur similar to other rainbowfishes. Some of the spread mechanisms for rainbowfishes are upstream and downstream migrations especially in times of greater flow during wet season floods. Barriers such as waterfalls will prevent upstream migrations of rainbowfishes and the marine environment is devoid of rainbowfishes so the estuaries of rivers prevent rainbowfishes from moving to new rivers via the sea (Allen 1995).

If *Glossolepis wanamensis* were to escape, effective control is where the likelihood of accidental or intentional release is greatest. Since the most likely scenario for release into the wild will be by aquarium escape into the disturbed habitats surrounding major centres of population the survival of this species is extremely unlikely.

Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging

Even if somebody was prepared to transport expensive broodstock (plastic bags, oxygen, styrofoam boxes etc) to one of the possible suitable natural habitats (e.g. Lake Argyle in W.A. or Lawn Hill Gorge National Park in Queensland) and these conspicuous emerald green fish were to avoid the formidable spectrum of natural predators (an array of waterbirds, an even larger array of predatory fish such as barramundi, grunters etc, file snakes, and so on) and the species became established it is most likely that it would peacefully co-exist with the other small forage species, just as several species of native rainbowfishes, glassfishes, hardyheads and small gudgeons peacefully co-exist in many other habitats in Northern Australia. The naturally small restricted habitat of *Glossolepis wanamensis* tends to suggest its behaviour is that of low invasiveness because it is not already widespread despite suitable habitat surrounding its natural distribution. It is also possible that locally predators in that area are efficient in controlling its numbers and reducing its spread into adjacent habitats. *Glossolepis* have no demonstrated salt tolerance therefore no tendency to invade other drainages via estuary migration (Allen and Cross 1982, Allen 1989, Allen 1991, Allen 1995, Allen et al 2002, Herbert and Peeters 1995, Lake 1978, Larson and Martin 1990, Leggett and Merrick 1987, Lever 1996, Merrick and Schmida 1984).

References:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8. Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species

It is apparent that Glossolepis wanamensis is only found in Lake Wanam. The IUCN list it as critically endangered This species is endemic to Lake Wanam, a small 2 km wide, roughly circular lake situated on a small plateau above the Markham Valley at an elevation of about 45 m, 24 km west of Lae, Papua New Guinea. The introduction of exotic species, such as tilapia, carp and gambusia, into the lake over the last few decades have threatened this species. Allen mentions a local practise of using crushed root compounds to poison fish. In the NT local use roots of *Derris trifoliata* and Freshwater Mangrove, *Barrintonia acutangular*, both these plants occur in New Guinea and through SE Asia, many of these species that have bark and roots that are used to kill fish are common in North Australia and New Guinea.

References ;

Brock (1998) "*Top End Native Plants*" published by John Brock.

Cowie, Short, Osterkamp-Madsen (2000) "*Floodplain Flora*" published by Environment Australia and NT Parks and Wildlife

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

8.a similar niche species (ie. competition with other species for food, shelter etc.)

If *Glossolepis wanamensis* were to establish in natural waterways, it would mix with the similar forage fishes and most likely school with local rainbowfishes, glassfishes, hardyheads, gudgeons and other similar species. It would be competing with the other small omnivores that eat small crustaceans, aquatic insects, terrestrial insects and algae. In some river systems in Australia, up to four species of rainbowfish coexist without either obvious competition or interbreeding (e.g. Mary River, N.T., Jardine River, Qld.). It can be assumed that because *Glossolepis wanamensis* is similar other members of the *Glossolepis* genus the behaviour will be similar. Aquarium observations worldwide of *Glossolepis wanamensis* have been recorded to be similar to other related fish from this genera are mid to surface dwellers, exhibiting little aggression toward other fish except from breeding males and this aggression is stylized display that is harmless and generally ignored by fishes of other species and mostly ignored by their own species except other males trying to attract available females.

References:

Fishbase - https://www.fishbase.de/summary/Glossolepis-wanamensis.html

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

Larson, H.K. and K.C. Martin (1990). Freshwater Fishes of the Northern Territory. Northern Territory Museum, Darwin.

Morgan, David L., Allen, Gerald R., Pusey, Bradley J., and Burrows, Damien W. (2011) *A review of the freshwater fishes of the Kimberley region of Western Australia.* Zootaxa, 2816. pp. 1-64.

8.b probable prey/food sources

Generally rainbowfishes are omnivorous eating mainly algae which they scrape from harder surfaces with their villiform teeth that extend to the outside of the jaws. They will also take advantage of small crustaceans, aquatic and terrestrial insects when available. *Glossolepis wanamensis* is a small omnivore, a second order consumer that itself would form part of the diet of larger predatory fishes. It is a species with a maximum recorded length of 55 mm (Allen 1981)

References:

Allen, G.R. and Kailola, P.J. (1979). Glossolepis wanamensis, a new species of freshwater rainbowfish (Melanotaeniidae) from New Guinea. Rev. fr. Aquariol. 6 (2): 39-44

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, J. 2010. The genus Glossolepis: Special Edition no. 1 of the “Rainbowfish” International Rainbowfish Association (IRG) © 2010 Internationale Gesellschaft für Regenbogenfische, Dompfaffweg 53, D-42659 Solingen ISBN 978-3-936616-64-4

Herbert, B. and J. Peters (1995). Freshwater Fishes of Far North Queensland Department of Primary Industries, Queensland.

8.c habitat and local environmental conditions

Glossolepis wanamensis are mid water swimmer and thus cause no disturbance to the substrate or cause water turbidity. Their dietary components (algae and aquatic organisms) are abundant in any healthy ecosystem. This species breeds by laying eggs on aquatic vegetation or debris and does not damage the habitat doing so. They exhibit no parental care so have no extra biological advantage over other rainbowfish or other egg laying species.

The introduction of disease from the introduction of a *Glossolepis* sp. into the natural environment is unlikely to pose any further risk than other endemic freshwater fish species as there are no known fish diseases or strains specific to *Melanotaeniids*. Any diseases that are carried into native waters by escaped *Glossolepis wanamensis* (Fishbase records diseases in other *Glossolepis* species such as fin rot, flukes and general bacterial infections) are unlikely to be more lethal to Australian rainbowfishes than would diseases they may already by carrying. In particular, with Mycobacteriosis, a common captive disease of rainbowfish worldwide, there is no *Mycobacterium* species specific to melanotaeniids (ANGFA, 2002). Kahn et al. (1999) stated that mycobacteriosis equally affects a wide range of freshwater and marine aquarium fish in Australia.

Reference:

Walstad, Diana (2017) Mycobacteriosis in Aquarium Fish. located at: http://dianawalstad.com

There is no firm evidence, from all of the areas where other *Glossolepis,* are raised, that it has formed or will form feral populations. In the unlikely event that it would in northern Australia, those populations would be more likely to be under pressure from native Australian aquatic predators than would populations of other small exotic fishes (such as those of guppies and swordtails which are a permitted import to Australia and have formed feral populations) because their habits would be more 'familiar' to predators. There is no information that describes any control or eradication of this genus.

A disease import risk assessment report was prepared by Panaquatic Health Solutions for Biosecurity Australia concluded there were 4 diseases of concern but revealed that all these diseases also occur in Australian waters.

References :

Allen, G.R. and Cross, Norbert J.(1982) Rainbowfishes of Australia and New Guinea. Angus and Robertson Publishers. ISBN 0-207-14604-7 (pp9-16)

Graf, J. 2010. The genus Glossolepis: Special Edition no. 1 of the “Rainbowfish” International Rainbowfish Association (IRG) © 2010 Internationale Gesellschaft für Regenbogenfische, Dompfaffweg 53, D-42659 Solingen ISBN 978-3-936616-64-4

Hardy-Smith P., Jones R. and Kailola P. (2007) “Scientific review of the biosecurity risks associated with the importation of rainbowfish for ornamental purposes” - Prepared for Biosecurity Australia by Panaquatic® Health Solutions Pty Ltd

IUCN red list of Threatened Species URL - https://www.iucnredlist.org/

Kahn, S.A., Wilson, P.W., Pereira, R.P., Hayder, H. and Gerrity, S.E. 1999. *Import Risk analysis on live ornamental finfish*. Canberra: Australian Quarantine and Inspection Service. 172 p.

9. What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports).

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, *G. incisus, G. kabia*, *G. maculosus*, *G. multisquamata, G. ramuensis* and *G. wanamensis* have been here, and popular, for more than 35 years (and other New Guinea rainbowfishes are cultivated here also). Permitting *Glossolepis wanamensis* into Australia would not create undue pressure on the populations in their native habitat as all stocks would come initially from European and North American breeders and then from commercial facilities to which these captive bred stocks are distributed

Glossolepis wanamensis poses no greater threat to Australian aquatic biodiversity than does the *Glossolepis* sp*. (G. incisus,* and *G. leggetti)* currently permitted for import. The distinctive colouration of this species, likely popularity of this species among hobbyists, and expectant relatively high price should together mitigate against any likelihood of accidental establishment of feral populations. It is unknown whether this species has any distinctive features that would make it readily identifiable at a small size, rainbowfish fry at 10 millimetres are relatively difficult to differentiate to a species level. It is therefore recommended that any importation of these fish should be a minimum length of 4 centimetres for ease of identification.

Retailers/traders should be encouraged to engage in "best practice" and to provide relevant information brochures to buyers of this species. At present, there are numerous *Melanotaeniidae* species being kept in Australia that have been derived from very small numbers of fish, imported pre-1986 and surviving despite very narrow genetic variability. The genetic basis of this species will be considerably wider and thus the need for “fresh” wild stock imports at a later date will be unlikely. Importation of single sex or reproductively altered individuals would not be of any value to the recipient aquaculture business.

References:

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry

PIAA (2008) Pet Industry Association of Australia (PIAA) National Code of Practice, (Accessed 17 April 2021) at: http://piaa.net.au/wp-content/uploads/2015/03/PIAACodeofPractice.pdf

10. Provide a summary of the proposed activity, including the intended use of the species (e.g. pet, commercial, scientific).

If accepted for import, *Glossolepis wanamensis* will be used in the live fish ornamental aquarium display trade. *Glossolepis wanamensis* are to be added to the live import list to legitimise the use of the species within Australia as an ornamental aquarium fish. Six of the nine species of *Glossolepis* have been in Australia prior to 1983, two *G. incisus* and G. *leggetti* appear on the 'List of Specimens Suitable for Live Import' under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act. A third species, *G. dorityi*, is currently being assessed for importation by the department. Rainbowfish of the genus *Glossolepis* have been used as an ornamental species within the aquarium hobby and aquarium trade in Australia ever since their introduction in the 1960's.

If *Glossolepis wanamensis is* added to the allowable import list it is logical that aquarium fish importers will most likely import this species as part of the normal numbers of species imported from the usual foreign sources of ornamental aquarium fishes that are acceptable to the conditions imposed by the Biosecurity Act 1915.

11. Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia. You must include:

The fish will be transported as per the conditions set down by the International Air Transport Association (IATA) guidelines and the provisions of AQIS policy document 99/2750a (AQIS 1999). The importation of the species will adhere to provisions of Biosecurity Australia advice 2009/24 issued 02 October 2009. Keeping in captivity, husbandry information is well documented by Tappin 2005.

References:

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11.a the containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen

The specimens if approved for import will be imported under the same provisions and disease protocols as used for other ornamental fishes imported by Aquarium Importers and the current quarantine practices as outlined by Biosecurity Australia Advice 2009/24 of 2 October 2009. They will be kept in aquariums with lids inside buildings.

Reference:

Biosecurity Act 2015 as in force 25 march 2020, available on Federal Register of Legislation at Universal Resource Locator https://www.legislation.gov.au/Details/C2020C00127 Accessed 24 march 2021

11.b the disposal options for surplus specimens

The species will be kept under the same conditions as any other members of the same genus would be kept in Aquaria. The Aquarium trade will treat this fish in a similar to other members of the genus *Glossolepis* which have been bred and traded in Australia since the 1970's when they were first imported legally by Barry Crockford of Melbourne, and continuously imported until 1986 when the importation of New Guinea rainbowfishes ceased. The importers of this fish will comply with provisions under conditions as outlined in advice 2009/24 issued by Biosecurity Australia 02 October 2009. *Glossolepis wanamensis* will be kept under conditions that mimic the water quality and diet that are as close as possible to the limited knowledge of its natural habitat.

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Glossolepis wanamensis* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture, Water and the Environment. Australian Government Department of Agriculture, Water and the Environment, conditions for importing live ornamental fish into Australia available at - http://www.agriculture.gov.au/import/goods/live-animals/importinglive-fish-aus

If application is successful and Author 1 is able to farm this species any surplus production will be handled as any other excess fish. Unwanted fish are euthanised by overdose of anaesthetic and used as aquatic plant fertiliser.

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12. Provide information on all other Commonwealth, state and territory legislative controls on the species, including:

- **the species' current quarantine status, or**
- **pest or noxious status, or**
- **whether it is prohibited or controlled by permit or licence in any state or territory.**

In the book by Robert Francis (2012) A Handbook of Global Freshwater Invasive Species , there are no references or instances of *Glossolepis* being an invasive or noxious species, anywhere in the world.

12.a The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and *Glossolepis wanamensis* is not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 21/04/2021 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 21/04/2021. The Federal Department that changes its name regularly and is responsible for the administration of these acts this week is The Department of Agriculture, Water and the Environment which was established on 1 February 2020.

12.b The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow *Glossolepis wanamensis* across its border unless it has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed on 21/04/2021 shows *Glossolepis wanamensis* is not listed on this schedule as noxious fish https://nt.gov.au/marine/for-all-harbour-and-boat-users/aquatic-pests-marine-andfreshwater/list-of-noxious-fish, and shows no *Glossolepis* on that list

12.c The Queensland Government

The Queensland legislation to control possession of noxious fish called “Restricted Matter” comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. *Glossolepis wanamensis* is not listed on this schedule as noxious fish or listed in the restricted matter schedule.

The most current version of Queensland Biosecurity Act 2014 accessed on 21/04/2021 and can be accessed https://www.daf.qld.gov.au/__data/assets/pdf_file/0008/1398842/prohibitedrestricted-invasive-fish.pdf , and there are no *Glossolepis* on the list.

12.d The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1995, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as

noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. *Glossolepis wanamensis* is not listed as noxious or restricted in Western Australia.

West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 21/04/2021 at, http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Glossolepis* on that list.

12.e The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act.

The South Australian Government of noxious fish list accessed 21/04/2021, is available at http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Glossolepis* on that list.

12.f The New South Wales Government

New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state. Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious. *Glossolepis wanamensis* is not listed as noxious in this Regulation.

The New South Wales noxious fish list accessed on 21/04/2021, is available at https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwaterpests/freshwater-finfish , and shows no *Glossolepis* on that list

12.g The Victorian Government

Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. *Glossolepis wanamensis* does not appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 21/04/2021 is available at https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria and shows no *Glossolepis* on that list.

12.h Tasmania

To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp **(*Cyprinus carpio*)** mosquito fish **(*Gambusia* spp.)** Didymo a freshwater algae **(*Didymosphenia geminata*)** and freshwater turtles.

The Tasmanian noxious list accessed on 21/04/2021 can be found at:

http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *Glossolepis* listed on the page.

12.i Australian Capital Territory

Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies nonnative animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is 'reckless' about whether the animal is a prohibited animal and is also 'reckless' about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 21/04/2021. It can be found at
https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/3115/5807/4536/Proposed-Amendments-to-the-Pest-Plants-and-AnimalsDeclaration-ACCESS-3.pdf . There are no *Glossolepis* species listed.

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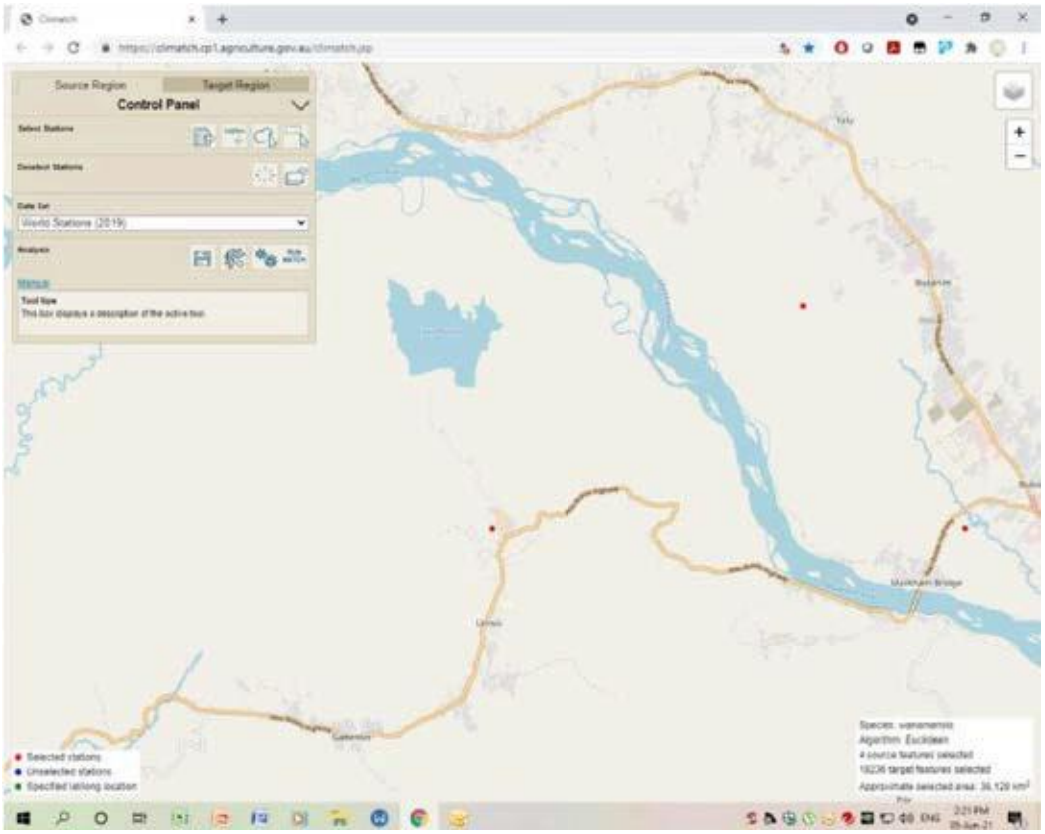
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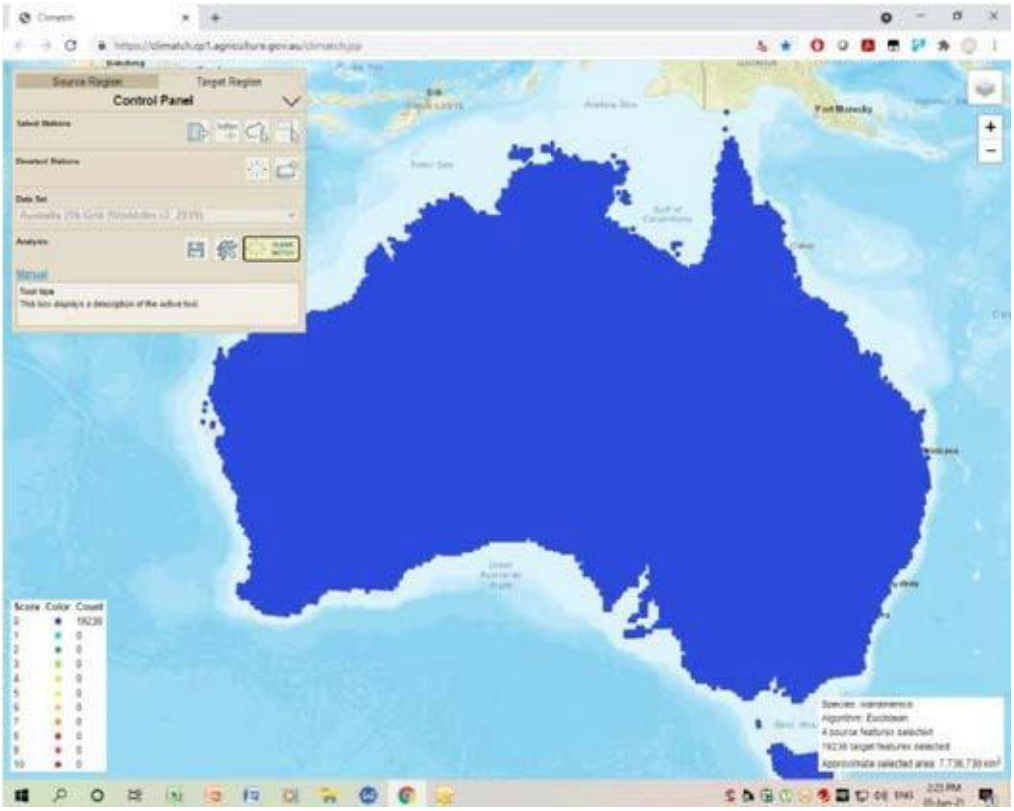
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APPENDIX A – calculation of climate from *Glossolepis wanamensis* distribution climate to Australian Climate.





APPENDIX B:

BOMFORD ASSESSMENT

SPECIES: Glossolepis wanamensis

Score A. Climate Match (0-8)

Number of squares within 60% of the mean: (No. 5)	0
Number of squares within 50% of the mean: (No. 6)	0
Number of squares within 40% of the mean: (No. 7)	0
Number of squares within 30% of the mean: (No. 8)	0
Number of squares within 20% of the mean: (No. 9)	0
Number of squares within 10% of the mean: (No. 10)	0

Total = <3
Score: 1 (Ref: fishbase.org, PC CLIMATE)

Score B, Overseas Range

Number of 1° x 1° grids in which species occurs overseas.
No. of squares : <4
Score: 0 (Ref: fishbase.org, googleearth.com)

Score C, Establishment

Locations of establishment incidence: nil - never introduced
Score: 1 (Ref: fishbase.org)

Score D, Introduction Success

Percentage of Introduction events that have been successful

Introductions	nil	
Successful:	nil	
Score:	**1**	(Ref: fishbase.org)

Score E, Taxa risk

Genus:	Glossolepis	
Introductions:	0	
Successful:	0	
Score:	0	(Ref: fishbase.org / M. Bomford)

Family:	Melanotaeniidae (Rainbowfishes)	
Introductions:	5	
Successful:	0	unknown
Score:	**0**	(Ref: fishbase.org / M. Bomford)

Total: 3 (VERY LOW)

The score of 3 according to the assessment model gives the fish a very low chance of establishment.

Establishment Risk Rank	Establishment Risk Score
Extreme	**13**
Very High	**11–12**
High	**9–10**
Moderate	**6–8**
Low	**4–5**
Very Low	**≤ 3**

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