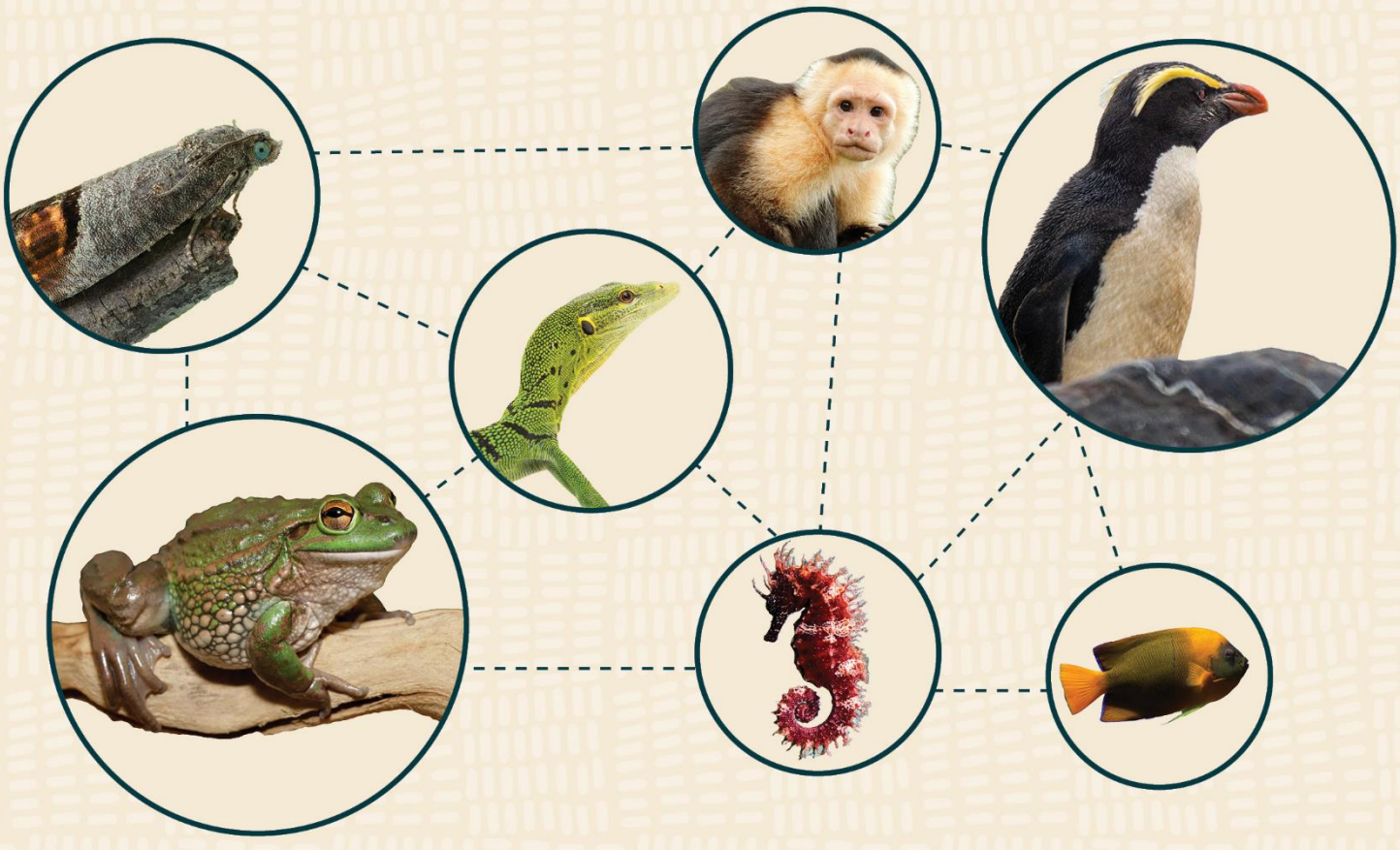
Australian Government

Department of Climate Change, Energy, the Environment and Water

Assessment of the Relevant Impacts of 14 species of dung beetle (from the Scarabaeidae and Geotrupidae families) on the Environment (Assessment Report)

Consideration of an application under the Environment Protection and Biodiversity Conservation Act 1999 to amend the List of Specimens taken to be Suitable for Live Import

February 2023



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Acknowledgement of Country

The Australian Government acknowledges the Traditional Custodians of Australia and their continuing connection to land and sea, waters, environment and community. We pay our respects to the Traditional Custodians of the lands we live and work on, their culture, and their Elders past and present.

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Acronyms and abbreviations

CDCP - Centre for Disease Control and Prevention
CITES – Convention on International Trade in Endangered Species of Wild Fauna and Flora
CSIRO - The Commonwealth Scientific and Industrial Research Organisation
DCCEEW – Department of Climate Change, Energy, the Environment and Water
EPBC – Environment Protection and Biodiversity Conservation Act 1999
GISD – Global Invasive Species Database
IUCN – International Union for Conservation of Nature
mm – Millimetres
m – metres

Executive summary

An application, prepared in accordance with Section 303EE of the EPBC Act, to amend the Live Import List to include 14 species of dung beetles (from the Scarabaeidae and Geotrupidae families) was submitted to the then Department of Agriculture, Water and the Environment. The applicant indicated that the purpose was to 'to enhance dung burial and bush fly control in the major sheep, beef and milk producing areas of Australia to fill existing seasonal and geographical gaps in dung beetle activity

A risk assessment was undertaken to evaluate the likelihood of establishment and spread in Australia, and the potential consequences of these impact(s) on the Australian environment. Several factors were considered during the assessment, including, but not limited to, available scientific evidence, biological and ecological traits of the species, environmental conditions for establishment (current and potential distribution of the species), conservation status, and potential impacts in the event of the establishment or spread of the species.

Four of the species are listed on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species as of 'Least Concern' – *Ateuchetus laticollis, Cheironitis scabrosus, Gymnopleurus humanus* and *Onthophagus opacicollis*.

None of the 14 species is considered an invasive pest outside their natural range.

Results from the risk assessment indicate that none of the 14 species of dung beetle pose a risk to the Australian environment.

After critically examining and reviewing all available evidence and information, the department **recommends** listing all 14 species of dung beetles *(Ateuchetus laticollis, Cheironitis scabrosus, Copri incertus, Copris integer, Copris lunaris, Euoniticellus triangulatus, Geotrupes stercorarius, Gymnopleurus humanus, Onitis minutus, Onthophagus medius, Onthophagus nuchicornis, Onthophagus opacicollis, Scarabaeus sacer* and *Sisyphus schaefferi)* on Part 1 of the Live Import List.

1. Introduction

Purpose of the proposed import

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) seeks to import 14 beetle species from the Scarabaeidae and Geotrupidae families into Australia as part of the large Rural Research and Development for Profit program 'to enhance dung burial and bush fly control in the major sheep, beef and milk producing areas of Australia to fill existing seasonal and geographical gaps in dung beetle activity' (application). The proposed species are *Ateuchetus laticollis, Cheironitis scabrosus, Copris incertus, Copris integer, Copris lunaris, Euoniticellus triangulatus, Geotrupes stercorarius, Gymnopleurus humanus, Onitis minutus, Onthophagus medius, Onthophagus nuchicornis, Onthophagus opacicollis, Scarabaeus sacer* and *Sisyphus schaefferi*.

There are over 7 000 species of dung beetle worldwide. Dung beetles have preferences based on vegetative cover, dung type, soil type, flight times (diurnal, twilight or nocturnal), climate and season (Doube & Marshall, 2014).

The purpose of introducing the 14 species is to fill the current seasonal and geographic gaps in dung beetle activity in southern Australia. The 14 dung beetle species will be bred to large numbers (8 000+) then released into the environment at targeted sites to enhance dung dispersal and burial and to limit bush fly larvae survival in major sheep, beef and milk producing areas of southern Australia.

Adult beetles will be collected from various locations in south-western Europe and Africa and New Zealand and air-freighted to Australia (up to 500 pairs per consignment). The beetles will be held in an Approved Arrangement site (quarantine) in Canberra. Their eggs will be treated with disinfecting agent (Virkon®), removed from quarantine, reared to adulthood and released at targeted sites and/or used for the establishment of mass-rearing colonies, the progeny of which will be released. Release numbers will vary according to the numbers reared, but at any given site, the aim will be to release a minimum of 500 male-female pairs of each species.

Background on the Act

Under section 303EC of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the responsible Minister may amend the List of Specimens taken to be suitable for live import (Live Import List) by, relevantly, including a specimen on the list. Section 303EB of the EPBC Act dictates two parts to the Live Import List:

- Part 1 comprises specimens that can be imported without a permit under the EPBC Act. Part 1 must not include any organism listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2018); and
- Part 2 comprises specimens that require a permit under the EPBC Act to be imported. For each specimen included in Part 2 of the list there is to be a notation regarding whether the inclusion is subject to restrictions or conditions. Restrictions or conditions may relate to a quantitative limit, the circumstances of import, the source of the specimen or the circumstances in which it was taken. Additional conditions may also be applied when the permit for import is issued.

Before amending the Live Import List, the Minister must consult with appropriate state, territory and Commonwealth ministers and may consult other persons, and consider a report assessing the

potential environmental impacts of the proposed amendment (section 303EC of the EPBC Act). When submitting an application to the department to amend the Live Import List, all applicants are required to provide an accompanying draft assessment report that addresses specific terms of reference published on the department website.

The department undertakes an assessment of the potential environmental impacts of the proposed amendment using the information in the applicant's draft report and any other sources of relevant information. The department also considers comments and information received through the public consultation process (including states and territories). The application and accompanying draft report for the proposed import of 14 species of dung beetle was released for public comment between 20 January and 18 March 2022. This assessment report on the potential environmental impacts of listing the species was prepared in accordance with Section 303EE of the EPBC Act. Under Section 303EC(5)(a) the Minister must consider this report before amending the list.

2. Biology And Ecology

Description

All 14 species of dung beetle have an expected lifespan of at least one year with some species living for 2 years (application – Table 3) with some having two breeding seasons and some only one. Their lengths range from 5 to 27mm and weigh up to 671mg (see Table 4 of the application) and species physical characteristics are described at length in Table 5 of the application.

Taxonomy

The 14 species of dung beetle are from the Order Coleoptera and the Geotrupidae and Scarabaeidae families - see Table 1:

Table 1 Taxonomy of the selected species

Family	Genus	Species	Taxonomic Reference
Geotrupidae	*Geotrupes*	*stercorarius* (Linnaeus, 1758)	(GBIF, 2021a)
Scarabaeidae	*Ateuchetus*	*laticollis* (Linnaeus, 1767)	(GBIF, 2021b) (Lobo, et al., 2015)
Scarabaeidae	*Cheironitis*	*scabrosus* (Fabricius, 1776)	(GBIF, 2021c)
Scarabaeidae	*Copris*	*incertus* (Say, 1835)	(GBIF, 2021d)
Scarabaeidae	*Copris*	*integer* (Reiche, 1847)	(GBIF, 2021e) (Nguyen-Phung & Cambefort, 1986)
Scarabaeidae	*Copris*	*lunaris* (Linnaeus, 1758)	(GBIF, 2021f)
Scarabaeidae	*Euoniticellus*	*triangulatus* (Harold, 1873)	(GBIF, 2021g)
Scarabaeidae	*Gymnopleurus*	*humanus* (MacLeay, 1821)	(Davis & Génier, 2007) (Davis, et al., 2020) (GBIF, 2021h)
Scarabaeidae	*Onitis*	*minutus* (Lansberge, 1875)	(Davis, et al., 2020) (GBIF, 2021i)
Scarabaeidae	*Onthophagus*	*medius* (Kugelann, 1792)	(GBIF, 2021j)
Scarabaeidae	*Onthophagus*	*nuchicornis* (Linnaeus, 1758)	(GBIF, 2021k)
Scarabaeidae	*Onthophagus*	*opacicollis* (Reitter, 1892)	(GBIF, 2021m)
Scarabaeidae	*Scarabaeus*	*sacer* (Linnaeus, 1758)	(GBIF, 2021n)
Scarabaeidae	*Sisyphus*	*schaefferi* (Linnaeus, 1758)	(GBIF, 2021p)

The applicant states that common English names for species that have them are as follows:

1) *Ateuchetus laticollis* is also known as the scarab dung beetle (UniProt, 2021)

2) *Geotrupes stercorarius* is also known as the dor beetle, dung beetle or lousy watchman beetle in the United Kingdom (NatureSpot, 2021; Kington, 2009)

3) *Copris incertus* is known as the black dung beetle or uncertain dung beetle in Hawaii (Dunlap, et al., 2015); and is referred to as the Mexican dung beetle in New Zealand (Blank, et al., 1983) (Forgie, 2021)

4) *Copris lunaris* is also called the horned dung beetle (UKBeetles, 2021) (NationalBiodiversityNetworkTrust, 2021) (UKBeetleRecording, 2021)

5) *Onthophagus nuchicornis* is also known as the small black and brown dung beetle (Dunlap, et al., 2015)

6) *Scarabaeus sacer* is also known as the sacred scarab beetle (Davis, et al., 2008)

Life cycle

The 14 species of dung beetle are either rollers (*A. laticollis, G. humanus, S. sacer and S. schaefferi),* or tunnellers *(G. stercorarius, C. scabrosus, C. incertus, C. integer, C. lunaris, E. triangulatus, O. minutus, O. medius, O. nuchicornis, O. opacicollis*).

Rollers roll dung into a ball and roll them away from the dung pat. When they find a suitable place, a roller will excavate under the ball to sink it into the soil or under a tussock then lay its eggs into the ball.

Tunnellers nest in soil beneath dung pats – tunnelling directly into the soil beneath or very close to the pat to create deep chambers (up to 50 cm deep for *G. stercorarius* (UKBeetles, 2021) (Brussaard, 1983)) into which they place dung balls or sausages and into which they lay their eggs. Each species has a unique tunnel design, and generally each dung ball will contain one egg.

When hatched the larvae feed on dung solids eating their way through the ball and along the tunnels whilst growing into adults. This can take anything from six weeks to several years depending on the species and conditions. Newly emerged adults walk or fly in search of fresh dung on which to feed and mature whilst excavating shallow tunnels in which they feed on the juices of buried dung for several weeks.

Once mature, beetles will bury their dung deeper than immature feeding beetles and lay eggs while continuing to feed on dung juices. The adults will continue to create brood balls and tunnels in which to lay their eggs until the dung pat is all gone. They will then walk or fly to the next dung pat (Doube & Marshall, 2014).

While they are not migratory, dung beetles disperse to find the resources that they need to survive – dung pats. *S. schaefferi* is able to fly upwind for 40-60 m (Halffter, 1991). The dispersal rates for the 14 species are currently unknown however dung beetles previously introduced into Australia and North America *Digitonthophagus gazella*, *Onthophagus taurus* and *Euonticellus intermedius* were recorded to spread up to 100 km a year from the location of their introduction. Not all dung beetles disperse such distances; *Copris hispanus* has dispersed only 20 km from its release location in Western Australia in 20 years (Doube & Marshall, 2014).

Many species of dung beetle require a period of diapause at some time in their life cycle (Hanski & Cambefort, 1991).Table 2 below (Table 8 of the application) outlines the information available for all 14 species regarding hibernation, aestivation and surviving adverse conditions and at which stage of their lifecycle they overwinter – either larva or adult.

Table 2 Ability to hibernate, aestivate and survive adverse conditions.

Species	Overwintering stage	Information on hibernation, aestivation and surviving adverse conditions	References
Geotrupes stercorarius	Larva and adult	Third instar larvae overwinter before pupating in summer; adults emerge in fall and overwinter	(UKBeetles, 2021) (Lumaret, 1990) (Howden & Cartwright, 1963)
Ateuchetus laticollis	Adult		(Lumaret, 1990) (Lumaret & Kirk, 1991)
Cheironitis scabrosus	Unknown	Adults only collected during the dry season (April, May and September) in northern South Africa, implying that there is overwintering and/or aestivation and/or decreased activity in other months	(Endrödy-Younga, 1982)
Copris incertus	Larva and adult	Adults emerge in spring in New Zealand, and can cease activity in hot, dry conditions. Adults generally emerge in spring from overwintering third instar larvae in New Zealand, and adults emerging in late summer can also overwinter	(Blank, et al., 1983) (SA Forgie, pers. comm.)
Copris integer	N/A	Found year round in Kenya, suggesting there is no aestivation or overwintering	(Gordon & Barbero, 2008)
Copris lunaris	Adult	Adults remain inactive underground in winter, but will feed on days where it is warm enough	(UKBeetles, 2021) (Lumaret, 1990) (Lumaret, 1980) (Lumaret & Kirk, 1991) (Galante, et al., 1995) (Klemperer, 1982)
Euoniticellus triangulatus	N/A	Present at all sampling times, suggesting there is no aestivation or overwintering	(Davis, 1987) (Churu, et al., 2018)
Gymnopleurus humanus	Unknown	Adults only active November to April in northern South Africa, implying an overwintering or inactive period	(Endrödy-Younga, 1982)
Onitis minutus	Unknown	Autumn-active species therefore likely to have some kind of developmental pause in its lifecycle	(Caveney, et al., 1995)

Species	Overwintering stage	Information on hibernation, aestivation and surviving adverse conditions	References
Onthophagus medius	Adults	Adults overwinter in the soil	(Rössner, et al., 2010)
Onthophagus nuchicornis	Adult	Obligatory winter diapause of adults required for reproduction	(Manning & Cutler, 2020)
Onthophagus opacicollis	Unknown	Adults trapped throughout the year in western Spain (Salamanca), but with much lower numbers in winter. No adults trapped in autumn or winter in southwest Spain (Olivenza) Adults have reduced activity in dry period of summer in France	(Galante, et al., 1995) (Ridsdill-Smith & Kirk, 1985) (Lumaret, 1990)
Scarabaeus sacer	Adult	No adults trapped in winter	(Lumaret, 1990) (Galante, et al., 1995) (Hidalgo, et al., 1998) (Lobo, et al., 2011)
Sisyphus schaefferi	Adult	Adults overwinter Adults may shelter under logs or among litter during bad weather	(Lumaret, 1990) (Kirk & Wallace, 1990) (Lumaret & Kirk, 1987) (Rizzotto, et al., 2021) (UKBeetles, 2021)

In their natural geographic range dung beetles are predated on by owls, buzzards, larks, badgers and small rodents (Young, 2015).

In Australia, dung beetles are predated on by magpies, ibis, ravens, kookaburras, foxes and bats (Doube & Marshall, 2014).

Habitat/special adaptions

Each of the 14 dung beetle species have a strongly preferred habitat and soil type – outlined in Table 3 below (application).

Table 3 Habitat and soil type for each species

Species	Habitat	Soil type
Geotrupes stercorarius	Pasture (NatureSpot, 2021; Lumaret, 1990; Perrin, 2020), Forest/woodland (NatureSpot, 2021; Lumaret, 1990)	Varied soil types, but often heavy and clay rich (Lumaret, 1990, p. 372)
Ateuchetus laticollis	Pasture and light woodland (Lumaret, 1990, p. 26) (Lumaret & Kirk, 1987) and (Romero Samper, 2009, pp.	Little preference for soil type (Lobo, et al., 2015) (Lumaret, 1990, p. 26) (Lumaret, 1980, p. 92) (Lumaret & Kirk, 1987, p.

	36-37)	23) (Lumaret & Kirk, 1991, p. 105)
Cheironitis scabrosus	Grassland and shrubland (Davis, et al., 2020) (Davis, 2013a) (Davis, 1987) (Davis, 1997) and Crop fields (Davis, et al., 2020)	Primarily sand (Davis, 1997; Davis & Scholtz, 2004)
Copris incertus	Pasture (Martínez-M. & C. Huerta, 1997)	Volcanic and clay soils (Blank, et al., 1983), Clays and loams (Forgie, 2021).
Copris integer	Savanna (Gordon & Barbero, 2008)	Sandy to clay soils (Gordon & Barbero, 2008) (Davis & Dewhurst, 1993)
Copris lunaris	Open pasture, woodland, moor and heathland (UKBeetles, 2021; Galante, et al., 1995)	Deep, humid soils (Lumaret, 1980) Sandy clay (Lumaret & Kirk, 1987) Sandy or chalky soils (UKBeetles, 2021)
Euoniticellus triangulatus	Grassland (Davis, et al., 2020) (Davis, 1987) (Churu, et al., 2018) (Walter, 1977). Only rarely in wetland (Churu, et al., 2018)	Sandy soils (Davis, et al., 2020) (Davis, 1987) (Davis & Dewhurst, 1993) (Churu, et al., 2018) (Davis, 1997), Clay soils (Davis, et al., 2020) (Davis & Dewhurst, 1993)
Gymnopleurus humanus	Grassland and shrubland (Davis, et al., 2020) (Davis, 2013b)	Primarily sandy type soils (Davis, 2013b) Deep stony soils (Davis, et al., 2008)
Onitis minutus	Grassland, scrub, shrubland, pasture and fallow crop fields (Davis, et al., 2020)	Mostly sandy loam with few records on sand, sandy clay and clay (Davis, et al., 2020)
Onthophagus medius	Pasture and meadow (Koren & Trkov, 2014) Floodplains (UKBeetles, 2021)	Sandy soils (Koren & Trkov, 2014) Alluvial soils (UKBeetles, 2021)
Onthophagus nuchicornis	Rangeland and grassland (UKBeetles, 2021) (Manning & Cutler, 2020) (Floate, et al., 2015) (Macqueen & Beirne, 1975) Coastal dunes and open areas (Lumaret, 1990) (UKBeetles, 2021)	Sandy soils (Lumaret, 1990) (UKBeetles, 2021); (Lumaret & Kirk, 1987)
Onthophagus opacicollis	Grassland/pasture (Lumaret, 1990) (Perrin, 2020) (Romero Samper, 2009) (Koren & Trkov, 2014) Shrubland/woodland (Lumaret, 1990) (Romero Samper, 2009) (Micó, et al., 1998) (Martín-Piera & Lobo, 1996) wetlands; (Kirk & Ridsdill-Smith, 1986) (Micó, et al., 1998) (Martín-Piera & Lobo, 1996)	Limestone sediments (Koren & Trkov, 2014) Light to heavy soils (Lumaret, 1990) (Abbas, 2015)
Scarabaeus sacer	Exclusively in open environments (Romero	Light sandy clay and silty sands (Lumaret, 1990) (Lumaret,

	Samper, 2009), including lawns, dune ridges and river banks (Lumaret, 1990) (Abbas, 2015) Shrubland and marsh (Martín-Piera & Lobo, 1996)	1980) (Lumaret & Kirk, 1987) (Lumaret & Kirk, 1991) (Hidalgo, et al., 1998) (Martín-Piera & Lobo, 1996)
Sisyphus schaefferi	Pasture and light woodland (Lumaret, 1990) (Lumaret & Kirk, 1987) (Romero Samper, 2009) (Rizzotto & Barbero, 2016)	Mostly on clay soils (Lumaret, 1990) (Lumaret & Kirk, 1987) (Lumaret & Kirk, 1991) (Rizzotto & Barbero, 2016)

Diet

Adult dung beetles do not have the mouthpieces to eat solid or dried dung and live on the juices of moist dung. The dung juices provide nutrition in the form of microorganisms native to the mammalian gut such as yeast, bacteria, fungi and protozoa (Doube & Marshall, 2014). Adults lay their eggs in brood balls made of solid dung on which the larvae then feed.

As outlined and referenced in Table 9 of the application – and presented below (Table 4), each species utilises a distinct range of dung – and cannot survive on the dung of any other species.

Table 4 Dung utilised by each species

Species	**Dung utilised**
Geotrupes stercorarius	Cow, sheep, horse, human, goat, fox and deer (UKBeetles, 2021) (Lumaret, 1990) (Howden, 1955) (Perrin, 2020) (Mowlavi, et al., 2008)
Ateuchetus laticollis	Cow, sheep, horse, human, dog (Lumaret, 1990) (Kirk & Wallace, 1990) (Micó, et al., 1998) (Lobo, et al., 2015)
Cheironitis scabrosus	Cow, sheep, horse, goat, gemsbok, blesbok and springbok (Davis, et al., 2020) (Davis, 2013a) (Davis, 1987) (Davis & Scholtz, 2004) (Endrödy-Younga, 1982) (Simelane, 2010)
Copris incertus	Cow, sheep, horse, alpaca, human and pig (Blank, et al., 1983) (Forgie, 2021) (Darling & Génier, 2018)
Copris integer	Generalist (Gordon & Barbero, 2008)
Copris lunaris	Cow, sheep, horse (Klemperer, 1982) (Galante, et al., 1995) (Koren & Trkov, 2014) (UKBeetles, 2021) (Mowlavi, et al., 2008) (Lumaret, 1990) (Kirk & Wallace, 1990) (Lumaret, 1980) (Lumaret & Kirk, 1987)
Euoniticellus triangulatus	Cow, horse and buffalo (Davis, et al., 2020) (Davis, 1987) (Churu, et al., 2018)
Gymnopleurus humanus	Wide range of dung types - cow, sheep, horse, donkey, zebra, baboon, pig (Davis, et al., 2020) (Davis, 2013b) (Davis, et al., 2008)
Onitis minutus	Cow (Davis, et al., 2020)
Onthophagus medius	Cow, sheep, horse, donkey (Koren & Trkov, 2014) (UKBeetles, 2021)
Onthophagus nuchicornis	Generalist, cow, sheep, horse, human (Lumaret, 1990) (Lumaret & Kirk, 1987) (Manning & Cutler, 2020) (Howden & Cartwright, 1963) (Floate, et al., 2015)
Onthophagus opacicollis	Cow, sheep, horse, human, wild boar, dog, fallow deer (Lumaret, 1990) (Galante, et al., 1995) (Micó, et al., 1998) (Micó, et al., 1998) (Martín-Piera & Lobo, 1996) (Kirk & Ridsdill-Smith, 1986)
Scarabaeus sacer	Diverse, cow, sheep, horse, dog, human, deer (Lumaret, 1990) (Galante, et al., 1995) (Lumaret & Kirk, 1987) (Hidalgo, et al., 1998) (Martín-Piera & Lobo, 1996) (Verdú, et al., 2004)

Sisyphus schaefferi	Cow, sheep, goat, horse, human, fox, badger, red deer, wild boar, deer (Mowlavi, et al., 2008) (Lumaret, 1990) (Koren & Trkov, 2014) (Lumaret & Kirk, 1987) (Rizzotto & Barbero, 2016) (UKBeetles, 2021) (Errouissi, et al., 2004) (Zunino, 2017)

As the 14 species only consume dung, they will not feed on agricultural or native plants or animals.

Dung beetles are not social but will be found in large groups when feeding on a dung pat (Doube & Marshall, 2014). Breeding pairs of some species co-operate during nesting (Halffter & Edmonds, 1982) but it is unknown if pairs from different species work together.

Climate

Each of the 14 dung beetle species have evolved to inhabit a very specialised climatic conditions – as described in the application – and Table 5 below.

Table 5 Climatic requirements within natural habitat

Species	Climate/Temperature	Seasonality/Activity
Geotrupes stercorarius	Requires sufficiently high annual rainfall and low annual average temperatures (Lumaret, 1990), snowy winters and mild summers (Perrin, 2020)	Spring to autumn (Lumaret & Kirk, 1991)
Ateuchetus laticollis	Mediterranean climate (Lobo, et al., 2015) (Lumaret, 1990) (Kirk & Wallace, 1990) (Lumaret & Kirk, 1987) (Lumaret & Kirk, 1991) (Micó, et al., 1998)	February to November, with reduced activity in August (dry) (Lumaret, 1990) Primarily autumn; minor activity in spring in Morocco (Romero Samper, 2009) Activity (ball-rolling implied) occurs between 22-30 °C, (Halffter & Matthews, 1966)
Cheironitis scabrosus	Mediterranean climate (IUCN, 2021). Found in areas of winter, bimodal and late summer rainfall (Davis, 1997). Arid ecoregions (Davis, 2013a) (Davis & Scholtz, 2004). Annual rainfall to 510 mm, annual mean temperature between 11-21 °C (Davis, et al., 2020)	Dry season (Davis, 1987). Spring to autumn (Sept-Apr), but primarily in summer (rainy or dry) (Davis, et al., 2020)
Copris incertus	Native distribution is in tropical (equatorial) climates, based on Köppen-Geiger climate classification (Kottek, et al., 2006) (Beck, et al., 2018). Temperate wet areas (e.g., New Zealand) (Blank, et al., 1983) (Forgie, 2021)	Associated with high rainfall; able to cease activity in hot, dry conditions (Blank, et al., 1983). Spring to early summer and late summer to autumn in New Zealand; in mild winters will breed in July (SA Forgie, pers. comm.)
Copris integer	Semi-arid climate (Gordon & Barbero, 2008). Annual rainfall to 2 000 mm (Davis & Dewhurst, 1993)	Found year round in Kenya (Gordon & Barbero, 2008)

Copris lunaris	Mediterranean to temperate climate (UKBeetles, 2021) (Kirk & Wallace, 1990) (Lumaret & Kirk, 1991) (Galante, et al., 1995) (Kerman, et al., 2018) (Koren & Trkov, 2014). Moderate climate, with average temperature of 8 °C in winter and 25 °C in summer (Bunalski, et al., 2016)	Spring, with a little activity in summer (Galante, et al., 1995). Summer (Kirk & Wallace, 1990) (Lumaret & Kirk, 1991)
Euoniticellus triangulatus	Found in areas of winter, bimodal, and midsummer (highveld to northeast subtropical and tropical) rainfall (Davis, 1997). Annual rainfall < 1 200 mm, annual mean temperature between 4-25 °C (Davis, et al., 2020) (Churu, et al., 2018)	Found year round (Davis, 1987) (Churu, et al., 2018). Greatest abundance from late spring to early autumn (Davis, et al., 2020)
Gymnopleurus humanus	Annual rainfall < 800 mm (Davis & Génier, 2007) (Davis, 2013b) (Davis, et al., 2008). Annual mean temperature between 11-23 °C (Davis, et al., 2020) (Davis, 2013b)	Late summer rainy season (Davis, et al., 2020)
Onitis minutus	Annual rainfall < 500 mm, annual mean temperature between 14-20 °C (Davis, et al., 2020)	October, May and June (Davis, et al., 2020)
Onthophagus medius	Mediterranean climate (Koren & Trkov, 2014). Humid and temperate climate (UKBeetles, 2021) (Rössner, et al., 2010)	Peak in May, short activity period in summer (Rössner, et al., 2010). April to autumn, with peaks in May and September (UKBeetles, 2021)
Onthophagus nuchicornis	Temperate (Dunlap, et al., 2015) (Howden & Cartwright, 1963). Cold temperate regions (Macqueen & Beirne, 1975). Egg to adult development occurs between 16-30 °C (Floate, et al., 2015)	April to September, with spring and autumn peaks (UKBeetles, 2021)
Onthophagus opacicollis	Mediterranean climate (Galante, et al., 1995) (Koren & Trkov, 2014) (Micó, et al., 1998)	Primarily in spring and autumn, reduced activity in summer and winter (Galante, et al., 1995). Decreased activity in driest periods of summer (Lumaret, 1990)
Scarabaeus sacer	Mediterranean climate (Galante, et al., 1995) (Verdú, et al., 2004) (Hidalgo, et al., 1998) (Martín-Piera & Lobo, 1996). Annual rainfall between 200-800 mm (Verdú, et al., 2004)	Spring to autumn, depending on the country and its climate (Lumaret, 1990) (Romero Samper, 2009) (Galante, et al., 1995) (Verdú, et al., 2004) (Lobo, et al., 2011) (Hidalgo, et al., 1998) (Martín-Piera & Lobo, 1996). Activity (ball-rolling implied) occurs between 22-30 °C (Halffter & Matthews, 1966)

Sisyphus schaefferi	Mediterranean climate (Kirk & Wallace, 1990) (Lumaret & Kirk, 1987) (UKBeetles, 2021) (Koren & Trkov, 2014)	Spring to autumn (Lumaret, 1990) (Kirk & Wallace, 1990) (Romero Samper, 2009) (Rizzotto & Barbero, 2016) (Rizzotto, et al., 2021) (Anlaş, et al., 2011). Ball-rolling begins at 20°C, peaking between 25-30°C (Halffter & Matthews, 1966)

Range Description:

The 14 species of dung beetle naturally occur within the limited range described in Table 6 (from Table 7 of the application). This does not include regions where the species has been introduced and established outside of its natural range.

Table 6 Geographic range for each species of dung beetle

Species	Natural geographic range
Geotrupes stercorarius	From Great Britain to Russia (GBIF, 2021a) (UKBeetles, 2021) (Howden, 1955) (Baraud, 1992), China and Japan (Sun, et al., 2018)
Ateuchetus laticollis	Northern Africa and Europe: Morocco, Algeria, Spain, Portugal, France, Italy, Corsica, Sardinia (GBIF, 2021b) (Lobo, et al., 2015) (Lumaret, 1990) (Baraud, 1992)
Cheironitis scabrosus	South Africa and Namibia (Davis, et al., 2020)
Copris incertus	Eastern Mexico (Darling & Génier, 2018)
Copris integer	East Africa: Burkina Faso (Zidek, 2020), Burundi (GBIF, 2021e) (Zidek, 2020), Democratic Republic of Congo (Zidek, 2020), Ethiopia (Nguyen-Phung & Cambefort, 1986) (Zidek, 2020), Malawi (GBIF, 2021e), Rwanda (GBIF, 2021e) (Zidek, 2020), Kenya, Tanzania (GBIF, 2021e) (Nguyen-Phung & Cambefort, 1986) (Zidek, 2020) (Gordon & Barbero, 2008) (Davis & Dewhurst, 1993), Uganda (Nguyen-Phung & Cambefort, 1986) (Gordon & Barbero, 2008) and Zimbabwe (Zidek, 2020)
Copris lunaris	All of Europe (except for the northern regions), extending westwards to Iran, Kazakhstan and western Asia (Lumaret, 1990) (Zidek, 2020), into Russia (GBIF, 2021f) and extending from southern Siberia to China (UKBeetles, 2021)
Euoniticellus triangulatus	East and southern Africa: Kenya (Davis & Dewhurst, 1993) (Churu, et al., 2018), Mozambique (Daniel & Génier, 2019), South Africa (Davis, 1987) (Davis, 1997), Tanzania (GBIF, 2021g) (Davis & Dewhurst, 1993) and Zaire (Walter, 1977), Angola, Botswana, Ghana, Lesotho, Malawi and Namibia (GBIF, 2021g)
Gymnopleurus humanus	Angola, Namibia and South Africa (Davis, et al., 2020)
Onitis minutus	South Africa (Davis, et al., 2020)
Onthophagus medius	Europe; absent from Mediterranean islands; extending eastwards into Turkey, Iran, Kazakhstan and Russia (UKBeetles, 2021) (Rössner, et al., 2010)
Onthophagus nuchicornis	Europe; from Portugal to the northern provinces of Fennoscandia; through Asia Minor and Russia to China (Dunlap, et al., 2015) (Lumaret, 1990) (UKBeetles, 2021) (Abbas, 2015)
Onthophagus opacicollis	Southern Europe, Asia Minor, Syria, Iran and North Africa (Lumaret, 1990) (Koren & Trkov, 2014)

Scarabaeus sacer	North Africa, Europe, Asia and Middle East: Afghanistan, Ethiopia, France, Hungary, northern India, Iran, Israel, Kazakhstan, Romania; Palestine, Portugal, Russia and Spain (Abbas, 2015), Albania, Bulgaria, Greece and Montenegro (Lobo, et al., 2011), Arabia, Armenia, Corsica, Cyprus, Italy (including Sardinia and Sicily), Syria, Turkey and Yugoslavia (Baraud, 1992)
Sisyphus schaefferi	From northern Africa and the Iberian Peninsula to China and Korea (Kirk & Wallace, 1990) (Rizzotto & Barbero, 2016) (Koren & Trkov, 2014) (Mowlavi, et al., 2008) (Anlaş, et al., 2011) (Rozner & Rozner, 2009). Does not extend into northern regions, including the UK (UKBeetles, 2021)

Disease transmission

The applicant describes a process for starving and cleaning the collected beetles prior to shipping and keeping the imported adults in an Approved Arrangements (Quarantine) facility for the duration of the project. Only the eggs, which will have been treated with a disinfecting agent (Virkon®), will be allowed out of the quarantine facility.

By burying and dispersing dung and through digestion dung beetles have been found to destroy pathogens including *Cryptosporidium parvum* and *Escherichia coli*, both of which pose a risk to humans (Mathison & Ditrich, 1999) (Ryan, et al., 2011) (Jones, et al., 2015), and livestock intestinal worms such as those in the Trichostrongylus family (Doube & Marshall, 2014).

Ball rolling may disperse pathogens onto the soil (Xu, et al., 2003) however, ball rolling dung beetles do not roll their dung balls far from the dung pat so the pathogens would remain in the pasture from which they originated.

Any pathogens that survive the intestinal tract of dung beetles or attach to their bodies have the potential to be passed on to people. The Centre for Disease Control and Prevention (CDCP, 2009) recommends that people should take precautions and not handle dung, dung beetles or pasture soil.

Establishment

The successful establishment of the 14 species of dung beetle in Australia is the purpose of this application.

The applicants report includes maps of the predicted Australian range of each species modelled using CLIMEX, based on its current range (Figure 2, under ‘Climate Match’ below). Each of the 14 species has been selected for its compatibility with the relevant Australian environment where it is needed.

3. CURRENT STATUS IN AUSTRALIA

History in Australia

CSIRO have imported 50 species of dung beetle into Australia since 1960 to attempt to find those most suitable. The following 23 species have established to varying degrees within their expected range. *Bubas bison, Copris elphanor, Copris hispanus, Euoniticellus africanus, Euoniticellus fulvus,*

Euoniticellus intermedius, Euoniticellus pallipes, Geotrupes spiniger, Liatongus militaris, Onitis alexis, Onitis aygulus, Onitis caffer, Onitis pecuarius, Onitis vanderkelleni, Onitis viridulus, Onthophagus binodis, Onthophagus gazella, Onthophagus nigriventris, Onthophagus obliquus, Onthophagus sagittarius, Onthophagus taurus, Sisyphus rubrus and *Sisyphus spinipes.*

Four of the species in this application have failed to establish in past introductions in Australia prior to 1982. *Cheironitis* sp. nr *scabrosus, Copris incertus, Copris luniaris* and *Onthophagus opacicollis* were unsuccessful due to the low number released, the lack of suitable dung at the release sites, or the release sites being located in areas climatically marginal for that species (application).

The records of current observed dung beetle activity in grazed agricultural land vary depending on the season of the year. The application identifies 'a need for species that can withstand both summer and winter in more arid conditions, as many of the currently established species cannot withstand prolonged hot and dry conditions' and that 'during the recent drought, dung beetle populations were observed to plummet'.

The following five major seasonal activity/geographical gaps have been identified in the application:

Gap A: winter active species in wet summer, dry winter rainfall zone

Gap B: winter active species in wet summer, low winter rainfall zone

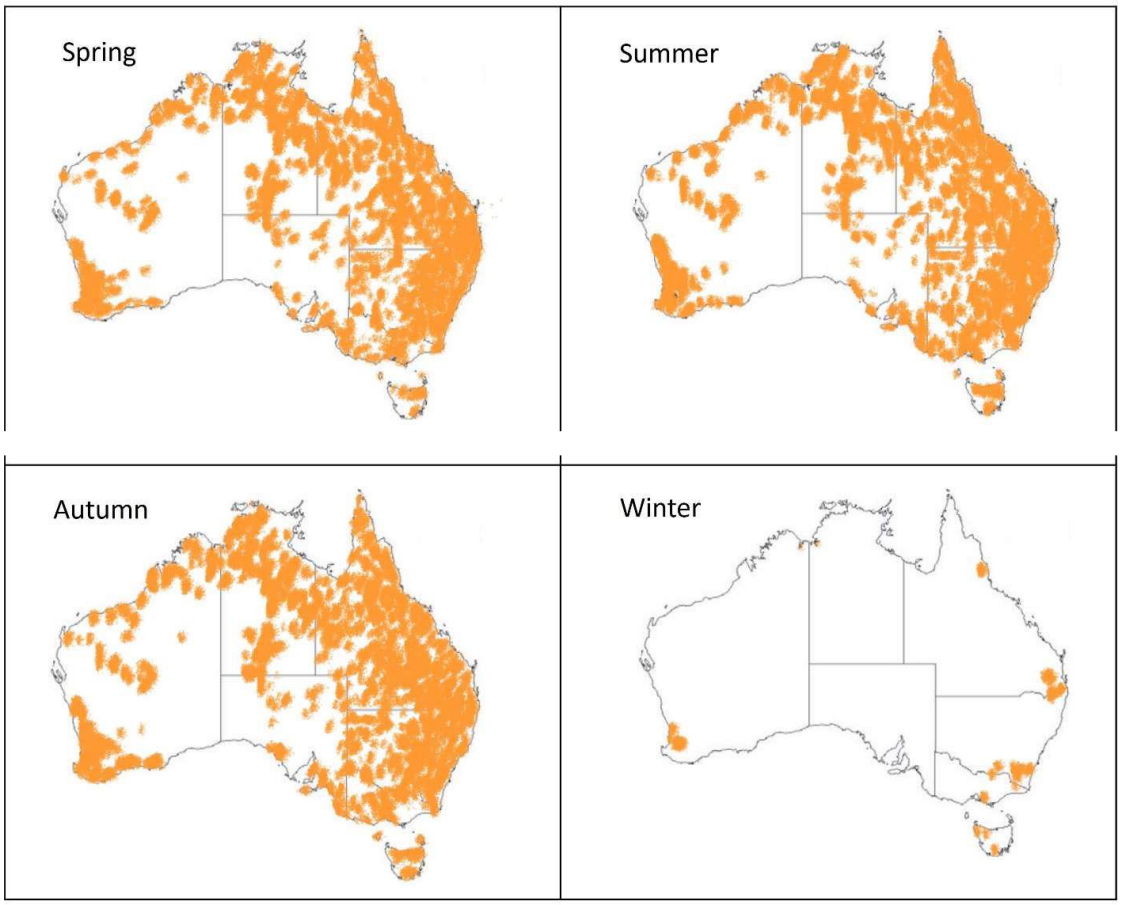
Gap C: winter active species in wet winter, low summer rainfall zone

Gap D: winter active species in arid rainfall zone

Gap E: summer active species in arid rainfall zone

Error! Reference source not found.Error! Reference source not found., shows how introduced dung beetle activity in Australia is highest in spring and autumn, slightly lower in some areas in summer and almost completely absent in most areas in winter.

Figure 1 Dung beetle survey maps, showing seasons of peak activity (application)



Related species on the Live Import List

Six species of dung beetle are listed in Part 1 of the Live Import List - *Bubas bubalus, Copris hispanus, Euonthophagus crocatus, Gymnopleurus sturmi, Onthophagus marginalis spp. andalusicus* and *Onthophagus vacca*. This allows live specimens to be imported without requiring a permit.

Two species of dung beetle are listed in Part 2 of the Live Import List - *Bubas bison* and *Onitis belial* – both requiring a permit with the conditions 'Eligible non-commercial purpose only, excluding household pets. High security facilities only'.

Conservation status

None of the 14 species is listed on the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) appendices.

Four of the species are listed on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species as of 'Least Concern' – see Table 7.

Table 7 Species on the IUCN Red List of Threatened Species

Species	Assessment Date	Notes	Reference
Ateuchetus laticollis	22 July 2014	Wide distribution, locally abundant subpopulations	(Lobo, et al., 2015)
Cheironitis scabrosus	30 July 2013	Widely distributed in southwest southern Africa; regularly found in	(Davis, 2013a)

		cattle dung; unlikely to be threatened as farming is common in its range	
Gymnopleurus humanus	30 July 2013	Dominant member of assemblages within its range; found with a wide range of dung types	(Davis, 2013b)
Onthophagus opacicollis	23 July 2014	Wide distribution; associated with sheep and cattle dung; only considered rare in Italy; elsewhere abundant and frequent	(Arriaga, et al., 2015)

4. RISK ASSESSMENT

The Bomford Risk Assessment Model

Assessing the risk of the potential of introducing a new organism into the environment involves assessing the risk of it becoming established and spreading and the likely impacts if establishment occurs.

There are no accepted risk assessment models that can be used to calculate the establishment risk of invertebrates in Australia. Bomford (2008) found that for vertebrates, the level of risk can be assumed in accordance with the four key factors of establishment success. These factors are:

- Propagule pressure – the release of large numbers of animals at different times and places enhances the chance of successful establishment
- Climate match – introduction to an area with a climate that closely matches that of the species' original range
- History of establishment elsewhere – previous successful establishment
- Taxonomic group – belonging to a family or genus which has a high establishment success rate.

Although these factors apply to vertebrates, they have been used as a guide for this risk assessment of the 14 species of dung beetle. In addition, using the information compiled from research into the above factors for the 14 species of dung beetle the potential impacts of establishment of feral populations can also be assumed.

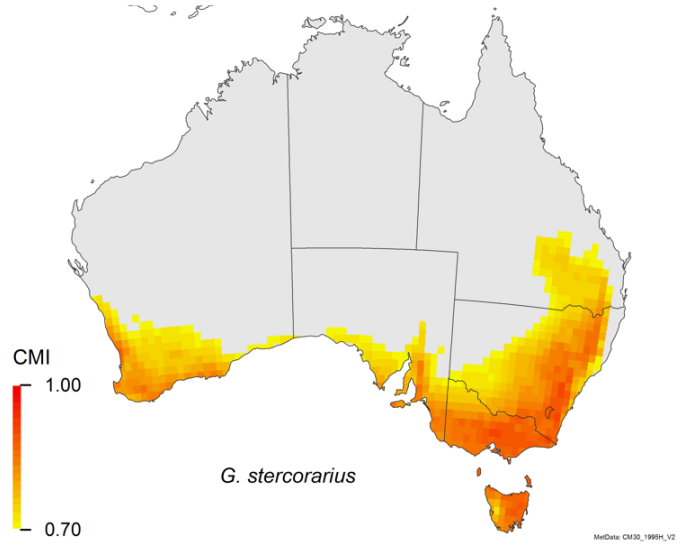
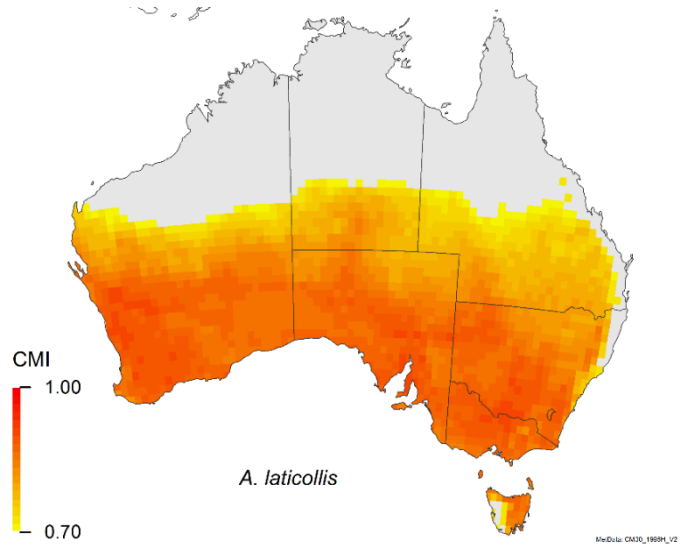
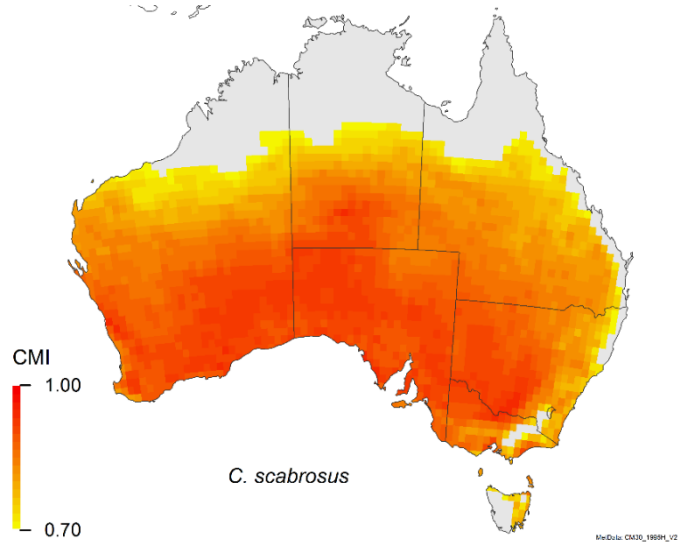
Propagule pressure

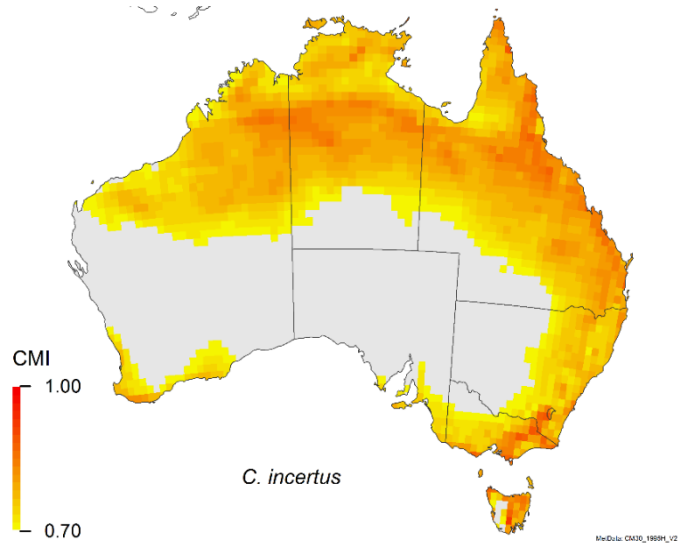
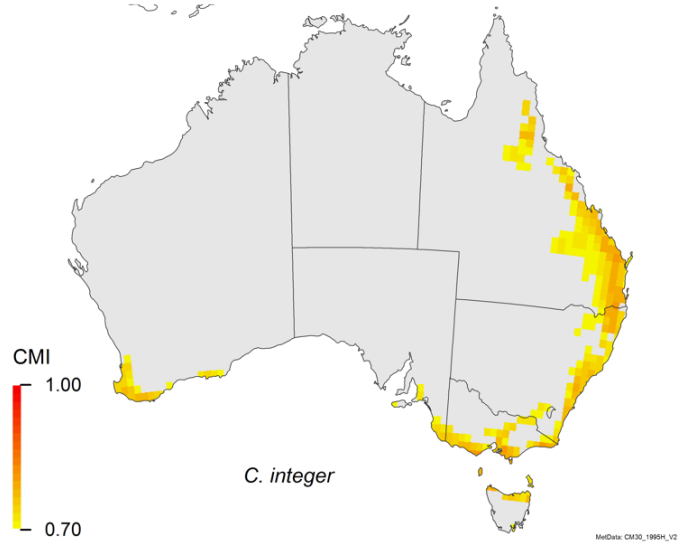
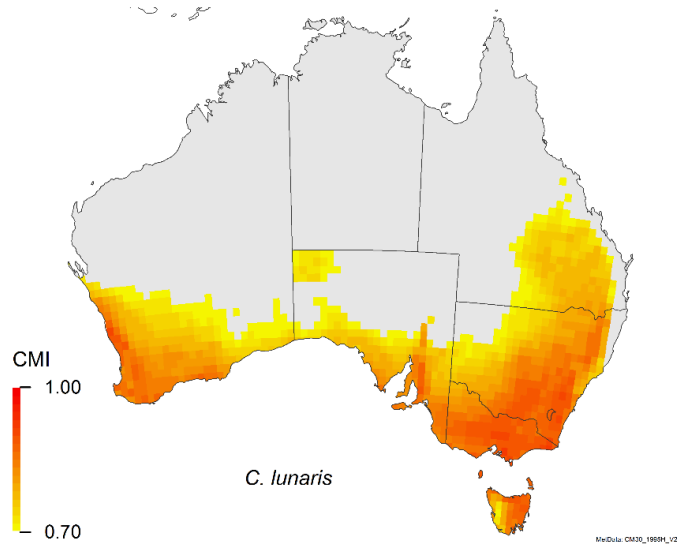
As the aim of the importation is to establish viable populations of dung beetles an increase of propagule pressure would be compatible with the aims of the project and enhance the chance of successful establishment of each species.

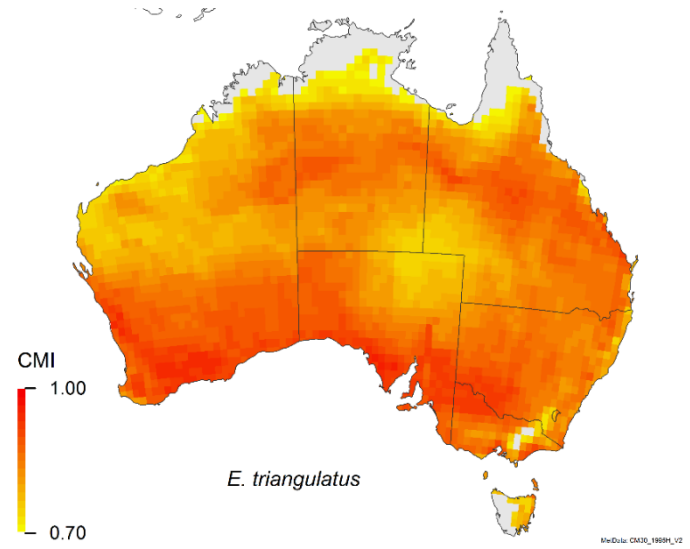
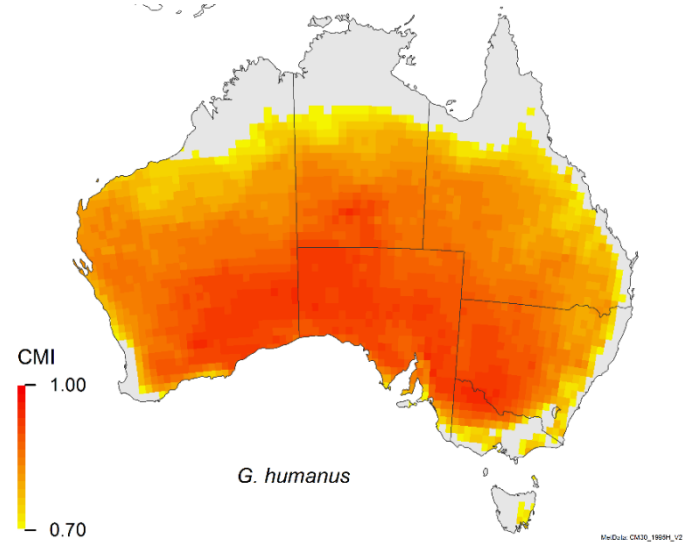
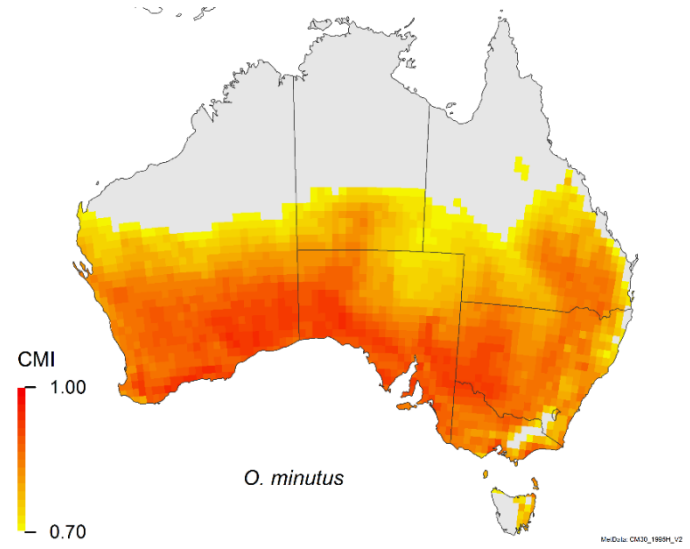
Climate match

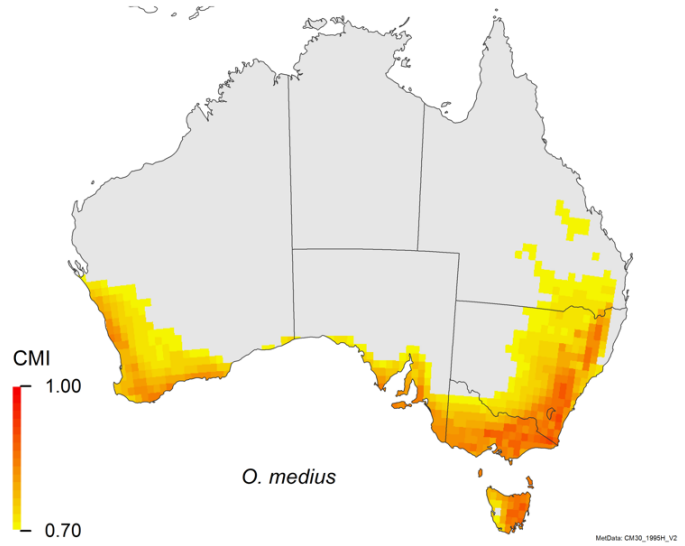
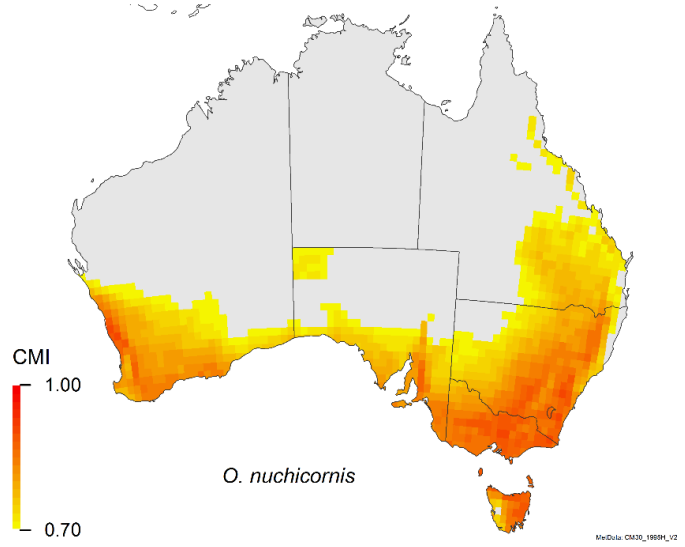
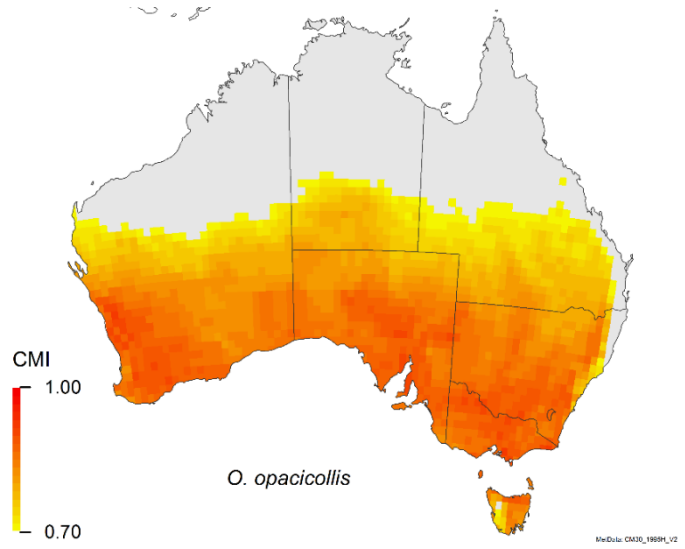
The climate of the native range of each species has been entered, by the applicant, into CLIMEX program, to determine which areas in Australia are climatically best suited to that species. The 14 species of beetles were then selected based on their high level of climate matching to fill the voids in the current extent of introduced dung beetle communities. Figure 2, below, shows the areas in Australia where each species is likely to be able to establish. The darker red areas are those where the climate match is the closest.

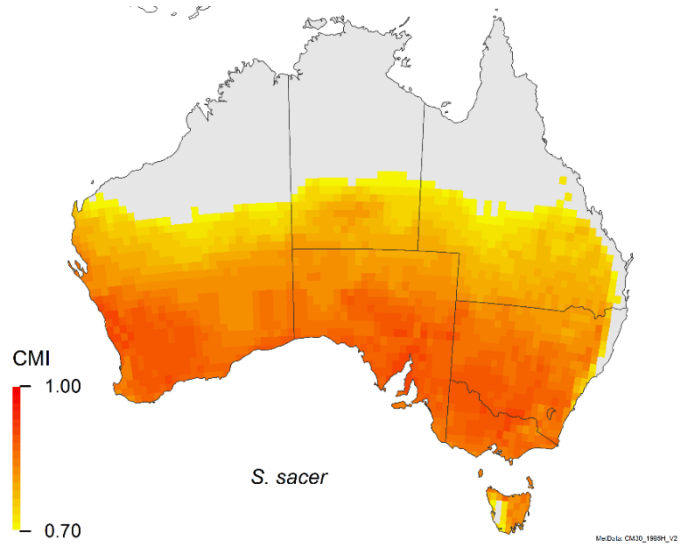
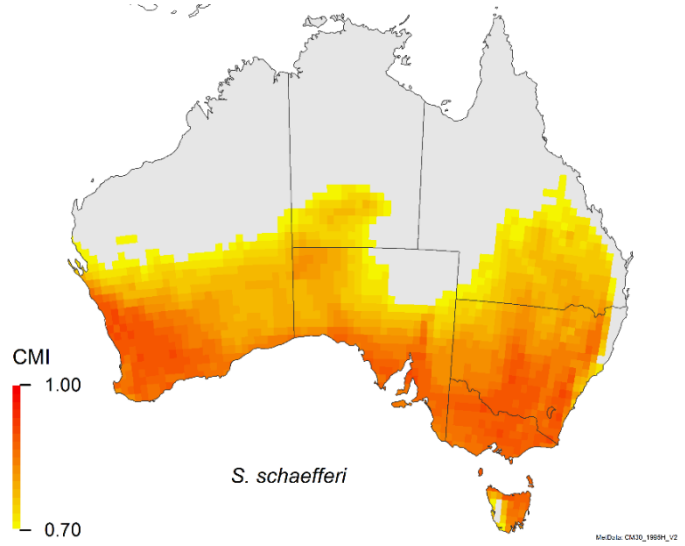
Figure 2 Areas in Australia where each species is likely to be able to persist, CLIMEX (application)

Regions of Australia matching the climate where the species is found. Climate Match Index (CMI) > 0.7	Source of species' location records and additional notes on data used
	GBIF.org (08 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.yj2evn 1804 duplicate records removed, based on country, latitude, longitude and altitude
	GBIF.org (08 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.9g2s33 601 duplicate records removed, based on country, latitude, longitude and altitude
	Adrian Davis; Pretoria, South Africa

Regions of Australia matching the climate where the species is found. Climate Match Index (CMI) > 0.7	Source of species' location records and additional notes on data used
	GBIF.org (08 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.5fx98h 1009 duplicate records removed, based on country, latitude, longitude and altitude 82 records removed as likely mis-identifications (Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Nicaragua, Panama and Peru) 3 records removed (Australia, Democratic Republic of Congo and Zaire) as unsuccessful introductions or the nature of establishment is unknown 28 records removed (Mexico) as not conforming to distribution in Darling and Génier [73] This analysis utilised location records from Hawaii, Mexico, New Zealand and Western Samoa
	GBIF.org (09 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.zabfqc 17 duplicate records removed, based on country, latitude, longitude and altitude
	GBIF.org (08 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.mve6nk 1643 duplicate records removed, based on country, latitude, longitude and altitude 36 records removed, as basis of record was invalid

Regions of Australia matching the climate where the species is found. Climate Match Index (CMI) > 0.7	Source of species' location records and additional notes on data used
	Adrian Davis; Pretoria, South Africa
	Adrian Davis; Pretoria, South Africa
	Adrian Davis; Pretoria, South Africa

Regions of Australia matching the climate where the species is found. Climate Match Index (CMI) > 0.7	Source of species' location records and additional notes on data used
	GBIF.org (8 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.uxcmed 432 duplicate records removed, based on country, latitude, longitude and altitude
	GBIF.org (08 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.4gw8e2 732 duplicate records removed, based on country, latitude, longitude and altitude 39 records removed, as basis of record was invalid 3 records (southern India) removed, as outliers for known distribution
	GBIF.org (08 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.j863n8 423 duplicate records removed, based on country, latitude, longitude and altitude

Regions of Australia matching the climate where the species is found. Climate Match Index (CMI) > 0.7	Source of species' location records and additional notes on data used
	GBIF.org (09 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.vwrxug 232 duplicate records removed, based on country, latitude, longitude and altitude 3 records (Africa) removed as outliers of known distribution and/or because of record issues
	GBIF.org (09 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.96tnsv 1030 duplicate records removed, based on country, latitude, longitude and altitude 38 records removed, as basis of record was invalid 3 records (South Africa, Morocco and Egypt) removed as outliers of known distribution and/or because of record issues

History of establishment elsewhere

Three of the species have been intentionally introduced elsewhere in the world and formed established populations, *Geotrupes stercorarius* in Canada (Lumaret, 1990), *Copris incertus* on many Pacific Islands (Dunlap, et al., 2015) (Darling & Génier, 2018), and *Onthophagus nuchicornis* in the northern United States and Canada (UKBeetles, 2021).

Five of the species, *Onthophagus nuchicornis, Cheironitis sp. nr scabrosus, Copris incertus, Copris lunaris* and *Onthophagus opacicollis* have been introduced into areas throughout the world but have failed to establish due to the low number of beetles released, the lack of suitable dung at the release sites, or the release sites being in areas climatically marginal for that species (application).

The specificity of the 14 individual species of dung beetle indicates that they will only establish in locations where the conditions meet their requirements for vegetative cover, dung type, and soil type, climate and season.

There have been instances where introduced dung beetles have dispersed and established in areas beyond their expected range (Montes de Oca & Halffter, 1998), (Mesquita Filho, et al., 2018) disrupting the composition and diversity of resident dung beetle species. This is not expected to occur in Australia as the introduced species are agricultural livestock dependent - that is cow, sheep, goat and horse, while the endemic species are adapted to marsupial dung with a preference for forest or woodland habitats (Doube, et al., 1991).

Likelihood of establishment

The application for the listing of the 14 species of dung beetle is to allow the import and release of the dung beetles for the control of cattle and sheep dung. All imports would be subject to an import permit from the Department of Agriculture, Fisheries and Forestry that would direct that any live dung beetle imported into Australia go into an Approved Arrangement (quarantine) site.

The likelihood of escape of live imported specimens from the Approved Arrangement (quarantine) site in Canberra is negligible. Quarantine facilities are required to have security measures in place to ensure that the movement of specimens in and out of the facility is tightly controlled and these measures should negate any chance of the specimens escaping.

If listed, and the CSIRO research deems them suitable, the 14 species would be bred to increase their numbers and released in areas that are climatically and environmentally suited to them. It is the applicant's goal to establish viable populations of the dung beetles that will spread and establish in the region.

Taxonomic group

Dung beetles have a long and extensive history of human assisted establishment worldwide in areas outside their native range as a tool to manage ruminant dung. In Australia, 47 species of dung beetles have been introduced, of which 23 have established populations to date (Doube, 2018).

The Scarabaeidae family has only one member regarded as highly invasive – *Oryctes rhinoceros* or Asiatic rhinoceros beetle – a coconut palm plant eater (GISD, 2019). This species is not one of the 14 species included in the current assessment.

5. Consequences For the Environment

None of the 14 species have been considered pests outside their natural range. Mesquita Filho (2018) has recorded that one species of dung beetle (*Digitonthophagus gazella*), introduced into livestock pastures in Brazil, is outcompeting native dung beetles that inhabit a similar niche. This is unlikely to occur in Australia as the native dung beetles occupy very different niches to the introduced dung beetles.

The purpose of introducing the 14 dung beetle species is to deliberately establish wild populations to assist with dung management activities and reduce the occurrence of the bush fly. All 14 species are likely to establish populations in Australia as they have been specifically chosen to be suitable for the individual climate and habitat in which they will be released. Doube (2018) states that cattle in Australia produce more than 250 million tonnes of dung per year – enough to cover over 200,000 hectares of pasture. Through rapidly burying dung the beetles will be beneficial to the Australian environment by reducing the area of dung smothered pasture, aerating the soil, increasing carbon input into the soil and recycling plant nutrients as well as reducing the populations of the bush fly.

The Department of Agriculture, Fisheries and Forestry would undertake a full assessment of the potential disease risks of the 14 dung beetles under the *Biosecurity Act 2015* if the species are listed.

6. Risk Summary And Mitigation Measures

Risk Rating

The CSIRO has a 50-year history of introducing dung beetles into the Australian environment. Forty-three species of dung beetle have been released since the 1960s. Of the 23 species that have established, no species is considered a threat to the environment or agriculture. The risk rating is considered to be very low.

Consultation – Concerns Raised

The department undertook consultation with relevant ministers (or their delegates), government agencies and the public from 21 January to 18 March 2022. One state government and one university responded – summarised as follows:

1) Victorian Government

The Victorian Government is supportive of the amendment but suggests the following:

- to state where each species is to be released and the intended target activity gap for each feeding preference, combined with current dung beetle activity, to give an overall picture of dung beetle presence in Australia.
- given 10 out of the 14 species chosen have subspecies it would be useful to know the significance of the subspecies status and if it has any bearing on the geographical location and conditions into which the species is intended to be released.

2) Federation University

Federation University has the following comments:

- Recognition of the possibility of the need for the removal of beetles if necessary.
- How do you predict how each species will respond to the new environment?
- Climate models need to reflect predicted climatic changes.
- Report does not address competition of native species (eg termites) that might use sheep dung as a resource.
- For species where information is scarce there needs to be more thoroughly researched and tested for suitability before release.
- Provide further detail on how over collecting of each species will be monitored and prevented.
- Voucher specimens of all stages of each species should be deposited in at least two museum collections and specimens be bar coded and the data added to GenBank.

A second consultation round seeking comment from state and territory government agencies on the applicants' reports and the department's updated Risk Assessment Report was undertaken from 2 to 31 March 2023. Only the NSW Government replied with the following comments:

- More detail is needed on the likelihood and potential impact of transmitting pathogens (e.g., viruses) to native wildlife (e.g., native beetles) be assessed.
- Detail regarding the effectiveness of Virkon as a disinfecting agent to ensure eggs and resulting adults are free of pathogens when released into the environment be provided.

The potential transmission of pathogens and the use of Virkon as a disinfecting agent is the responsibility of the Department of Agriculture, Fisheries and Forestry (DAFF). DAFF set the import conditions under which importers can import animals. Dung beetles are imported under the 'Live arthropods for in vitro research for release' import conditions.

7. Conclusion

The intention of the inclusion of the 14 species of dung beetles on the Live Import List is to enable their ultimate release into the Australian environment to process the dung of non-native agricultural livestock and reduce the success and abundance of bush flies. The applicant has specifically selected the 14 species to address gaps in dung beetle activity in Australia. The risk of impact on the environment is considered to be very low.

Past release history in Australia and around the world shows that to create a viable self-sustaining population of introduced dung beetles, the climate, amount of suitable dung available, time of year and number of individuals released all play a large part in their successful establishment.

The department has undertaken a risk analysis and reviewed the available information on *Geotrupes stercorarius, Ateuchetus laticollis, Cheironitis scabrosus, Copris incertus, Copris integer, Copris lunaris, Euoniticellus triangulatus, Gymnopleurus humanus, Onitis minutus, Onthophagus medius, Onthophagus nuchicornis, Onthophagus opacicollis, Scarabaeus sacer* and *Sisyphus schaefferi* with regards to including these species in the Live Import List.

The department concludes that the release of the 14 dung beetles poses negligible risk to the Australian environment. Accordingly, the department **recommends** that these species be added to Part 1 of the Live Import List.

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