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The Australian Museum Lord Howe Island Expedition 2017—Coleoptera

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Abstract. A survey of Lord Howe Island Coleoptera was conducted by a team from the Australian Museum and the Natural History Museum of Denmark (University of Copenhagen), in February 2017. The primary purpose of the survey was to assess the status of larger species, with the assumption that these are more vulnerable to predation by the introduced rodent *Rattus rattus*. Critical size was arbitrarily designated 1 cm or more in length. The 32 large species collected are listed here with comments on both their status on the islands and their taxonomy. Nine of these species are newly recorded from the island. The small number of large beetle species collected by a second Australian Museum group working on Balls Pyramid, 22 km from the main island, is also included here. The cerambycid *Oricopis insulana* (Olliff, 1889) is recorded for the first time since its original collection in the early 1880s.

Keywords: Lord Howe Island; Coleoptera

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Introduction

The Coleoptera (beetle) component of the Australian Museum's 2017 expeditions to Lord Howe had four aims: *(a)* to search for large beetles, large enough to be threatened by predation by *Rattus rattus*; *(b)* to collect fern-feeding flea beetles; *(c)* to survey the beetles of Balls Pyramid; and *(d)* to find as many species as possible besides the above. The large beetles are discussed here. The fern feeding flea beetles will be treated elsewhere. The survey of Balls Pyramid produced very few specimens as the conditions were so dry. Most specimens collected on Balls Pyramid were large, so these are included in the discussion below. The bulk of the Coleoptera collected remains to be studied. Approximately 3000 specimens of 270 species were collected.

Large beetles

There is some evidence that large terrestrial invertebrates on Lord Howe have suffered extinction or greatly reduced populations in the last 100 years (snails, Köhler & Hyman, 2018; phasmids, Priddel *et al.,* 2003). The status of the larger beetles is less well documented, although *Hybomorphus melanosomus* Saunders & Jekel, 1855, is listed under New South Wales legislation as an extinct species, as it has not been collected alive since the 1860s, coincident with the arrival of house mice (*Musca domestica*) (Olliffff, 1889; Hutton *et al*., 2007). Much of the loss immediately postdates the inadvertent introduction of Black Rats *Rattus rattus* in 1918 (Hutton *et al*., 2007). The diet of Black Rat is primarily plant material, especially seeds, but *R. rattus* is an omnivore

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Figure 1. Josh Jenkins Shaw, one of the three coleopterists on the Australian Museum Lord Howe Island Expedition 2017. Photo by Arn Jensen.

Figure 2. Arn Jensen, one of the three coleopterists on the Australian Museum Lord Howe Island Expedition 2017. Photo by Josh Jenkins Shaw.

and will eat what is easily accessible (Banks & Hughes, 2012). The typical impact of Black Rats on an island fauna and flora is rapid loss of easily eaten fauna followed by gradual loss of plants with edible seeds (Banks & Hughes, 2012). Remarkably little is known of the diet of Black Rat in Australian lowland forest, however, it is unlikely to differ from studies elsewhere. Most such studies have focussed on impacts on island endemics, particularly offshore islands of New Zealand (St Clair, 2011). Several New Zealand studies have shown that Black Rat invasions have led to loss or decline of larger terrestrial invertebrates, including Lepidoptera, Orthoptera and Coleoptera (St Clair, 2011). The beetles involved included a 9–17 mm weevil (Kuschel & Worthy, 1996) and a 16–44 mm stag beetle (Holloway, 2007).

The Lord Howe beetle fauna has been explored since the 1850s. From the 1880s most of this work has been done by Australian Museum expeditions, however there have been significant surveys by Arthur Lea (1916, in the South Australian Museum), Geoff Monteith (1979, in the Queensland Museum) and the staff of the Australian National Insect Collection (especially 1980s and 1990s). All of this material has been examined by CR. The total beetle fauna of Lord Howe is approximately 530 species but most of these species are very small in size. For assessment of the impact of Black Rat (and its proposed eradication) on beetles we have used the evidence of overseas studies (St Clair, 2011) to somewhat arbitrarily only include species 1 cm of more in length. This restricted sample happily has the added bonus of mostly including described and relatively well-sampled species. There are approximately 70 species of beetle 1 cm or more in length known from Lord Howe Island, either published or in collections. About 20 of these species are flightless and therefore, unless well protected chemically, must be considered particularly vulnerable to extinction by rats.

The Australian Museum expedition endeavoured to find as many of the "large" (i.e. 10 mm or more in length) Coleoptera as possible, especially the flightless species. Altogether 32 large species were found including 9 not previously recorded from the islands. The collecting circumstances, island history and taxonomic status of each of these, are discussed below.

Collecting methods

Main island of Lord Howe. The three authors spent two weeks on the main island, 12–19 February 2017 (Figs 1–4), based at Stevens Reserve in the centre of the lowlands. Our collecting techniques included: Malaise and pitfall traps, Winkler bags (Figs 5–10), sweeping, beating and hand picking (including at night). Light traps were not used. On arrival it was immediately apparent that the island was

Figure 3. Chris Reid, one of the three coleopterists on the Australian Museum Lord Howe Island Expedition 2017—writing up the collection of *Rhantus suturalis* from a pothole. Photo by Arn Jensen.

Figure 4. Arn Jensen and Chris Reid setting out to climb Mount Gower, in distance, with Mount Lidgbird to the left. Photo by Josh Jenkins Shaw.

Figure 5. Chris Reid and Josh Jenkins Shaw at Malaise trap on the mid-elevation shelf on Mount Lidgbird. Photo by Ian Hutton.

Figure 6. Sampling the contents of a dead Shearwater, habitat of *Creophilus erythrocephalus* (Fabricius, 1775), at Clear Place. Photo by Arn Jensen.

affected by a severe drought, especially in the north and lowlands. At the time of the visit, this drought had lasted for almost 3 months (Anonymous, 2018a). Sites such as Stephens Reserve, which had been prolific for foliaceous and leaf litter Coleoptera in 2000–2003, were extremely depauperate. However the two southern mountains were still receiving some rain and cloud cover, providing damp conditions. We therefore decided to concentrate our collecting efforts on sites from Intermediate Hill southwards. We also made a day visit to Blackburn Island at the edge of the lagoon, which is rat-free.

Balls Pyramid. None of the authors visited Balls Pyramid. Instead, because of the nature of the terrain, a climbing expedition was organised which stayed on Balls Pyramid from 21 March 2017 to 26 March 2017. The climbers were given basic training in searching for insects and were accompanied by one of our colleagues from the Australian Museum, the terrestrial gastropod taxonomist Frank Köhler. The climbers took samples of low vegetation for sifting by Köhler and also went spotlighting at night. Balls Pyramid had also suffered from drought and conditions were extremely dry during the visit.

The species records are arranged by family in alphabetic order, then species in alphabetic order. All co-ordinates and altitudes from the 2017 expedition were obtained by GPS in situ. In the list below we have used the abbreviation AME2017 for the Australian Museum Expeditions in February and March 2017.

Figure 7. Chris Reid at 475 m on Mount Lidgbird. Photo by Ian Hutton.

Figure 8. Josh Jenkins Shaw and Chris Reid setting up a Malaise trap at 475 m on Mount Lidgbird. Photo by Arn Jensen.

Figure 9. Josh Jenkins Shaw using Winkler apparatus at 475 m on Mount Lidgbird. Photo by Arn Jensen.

Figure 10. Malaise trap habitat Josh Jenkins Shaw and Chris Reid. Photo by Arn Jensen.

Results

Approximately 3000 specimens of Coleoptera were collected by participants of AME 2017, including at least 270 species. The 32 species with length ≥1 cm are listed below. The larvae of some species are easily identifiable so these specimens are also included.

Family Belidae

Belids are long cylindrical weevils with an interesting southern hemisphere distribution worldwide. Larvae of most species inhabit living wood.

Isacantha inculta Olliff, 1889

1/ betw Res Sta & Banyan Appts, 31°31'31"S 159°04'10"E, 40 m, at light, 6.ii.2017, Reid.

Isacantha inculta is endemic to the main island of Lord Howe where it is restricted to lowland forest, between Neds Beach and the field station south of Stephens Reserve. A possible host, from label data attached to a single specimen, is *Cryptocarya triplinervis*, a common endemic lowland tree (Wilson, 1994). Length 10–20 mm.

Family Cantharidae

Cantharids are often brightly coloured soldier beetles.

Chauliognathus apterus (Olliff, 1889)

Fig. 11

4 adults, 1 larva/ ridge to Gower, 31.5843°S 159.0793°E, 800 m, low veg, 11.ii.2017 Reid; 9 adults, 2 larvae/ Mt Gower, 31°34.999'S 159°04.852'E, 704 m, hand coll, 11.ii.2017, Jenkins Shaw & Jensen; 3 larvae/ Mt Gower, Flat Place, 31.5813°S 159.0744°E, sifting palm/*Dracophyllum* litter, 12.ii.2017, Jenkins Shaw & Jensen; 2 larvae/ Mt Gower, nr igloo, 31.5859°S 159.0764°E, 831 m, general coll., 11.ii.2017 Reid; 2 larvae/ Mt Gower, gully by igloo, 31.5853°S 159.0760°E, 803 m, pitfalls 12–13.ii.2017, Jenkins Shaw & Jensen; 1 larva/ Mt Gower, lookout, 31.5845°S 159.0774°E, 830 m, swept low veg, 12.ii.2017 Reid; 1/ Mt Gower, S end plateau, 31.5894°S 159.0725°E, 861 m, swept ferns etc, 12.ii.2017, Reid; 1 larva/ Mt Gower, visitors book, 31.5849°S 159.0784°E, 850 m, beating *Blechnum howeanum*, 12.ii.2017, Reid; 1 larva/ Lidgbird E shelf, 31.5638°S 159.0878°E, 487 m, dead palm fronds etc, 16.ii.2017, Reid; 1 larva/ Mt Lidgbird, E shelf, 31°33.826'S 159°05.271'E, 486 m, FIT/malaise, 9–16.ii.2017, Jenkins Shaw & Jensen;1 larva/ 1, ditto, except: *Dracophyllum* leaf litter, 9.ii.2017, Reid.

Larvae are as distinctive and visibly active as adults, therefore we have included both stages in our survey. *Chauliognathuis apterus* is endemic to the main island of Lord Howe. It is notable that this conspicuous and usually abundant species was only seen on Mounts Lidgbird and Gower during AME2017, although it has historically been collected throughout the island. This reduction in range is likely to be due to the prolonged summer drought of 2016/2017. *Chauliognathus apterus* is commonly found crawling on the ground and on shrubs and bushes, the adults often as a pair in copula. Adult length 8–18 mm.

Family Carabidae

Carabids are generally known as ground beetles, although many Australian species are arboreal. The two species discussed here are terrestrial.

Figure 11. *Chauliognathus apterus* (Olliff, 1889), dead specimens in copula AM K.185298. Photo by Matt Bulbert.

Eurystomis castelnaui Chaudoir, 1878

1[fragment]/ Stevens Res, 31°31.445'S 159°03.940'E, 23 m, sifting leaflitter 5.ii.2017, Jenkins Shaw & Jensen.

Eurystomis castelnaui is endemic to the main island of Lord Howe. It is primarily a lowland forest species, recorded from the east slope of Phillip Point to the southeast slope of Mount Lidgbird (at unknown elevation). Our records show that it is commonly collected in Stephens Reserve, but in AME2017 we found only remains of a single dead specimen. This scarcity is probably due to the drought. Length 8–10 mm.

Notoplatynus hilaris (Olliff, 1889)

2/ Balls Pyramid, 31°45'23"S 159°15'16"E, 130 m, Gannet Green, 21–26.iii.2017; 1[elytron]/ Blackburn Island, 31°32'04"S 159°03'37"E [Google], 6 m, under rocks/logs & beating Lagunaria/Cassinia/fig, 18.ii.2017, Reid; 5/ Mt Lidgbird E shelf, 31°33.826'S 159°05.271'E, 486 m, FIT/malaise, 9–16.ii.2017, Jenkins Shaw & Jensen; 1/ Soldiers Ck, 31°33.161'S 159°04.902'E, 43 m, FIT/malaise, in trays, 14.ii.2017 Reid.

Notoplatynus hilaris is endemic to Lord Howe where it is widespread and common. Here it is newly recorded from Balls Pyramid and Blackburn Island. Length 8–11 mm.

Family Cerambycidae

Cerambycids are longhorn beetles, usually with larvae that bore tunnels in dead or dying wood.

Agrianome spinicollis (MacLeay, 1826)

Fig. 15

1 [fragment]/ Blackburn Id, 31°32'04"S 159°03'37"E [Google], 6 m, under rocks/logs & beating *Lagunaria*/*Cassinia*/fig, 18.ii.2017 Reid.

Agrianome spinicollis is the largest beetle on the island and first described from there in 1860 (Olliff, 1889). The larvae are generally common in dead wood throughout the lowland forests. However, perhaps because of the drought, no adults or larvae were seen on the main island during AME2017. Instead a fragment of a single specimen was collected on Blackburn Island. *Agrianome* is important to the re-establishment of the giant phasmid to Lord Howe as the beetle exit holes in dead figs were used as shelters by the phasmids (Lea, 1916). There is some debate about the taxonomic status of *A. spinicollis* on the island. Length 35–50 mm.

Coptocercus multitrichus Wang, 1995

1/ Mt Gower, at igloo, 31.585°S 159.076°E, 862 m, in flight, 11.ii.2017, Jensen.

The prettily marked *Coptocercus multitrichus* is found in eastern Australia and also on Lord Howe Island, where it is probably an introduced species (Wang, 1995). On the island it is scarce but widespread. The larvae attack dead or dying myrtaceous trees (Slipinski & Escallona 2016). Length 15–20 mm.

Meton digglesi Pascoe, 1859 new record

1/ Mt Lidgbird E shelf, 31°33.826'S 159°05.271'E, 486 m, hand coll, 9.ii.2017 Jenkins Shaw & Jensen; 1/ Goat Cave track, 2nd 200 m, 31°33.457'S 159°05.183'E, 170 m, beating dead branches/vines, 14.ii.2017 Reid.

Meton digglesi is widespread in northeastern New South Wales and Queensland. The species was not recorded during the Museum's intensive surveys of 2000–2003 so it is most likely this large and distinctively marked species is a recent accidental introduction to the island rather than a long overlooked native. *Meton* larvae breed in dead wood (Slipinski & Escallona, 2013). Length 16–18 mm.

Oricopis insulana (Olliff, 1890)

Figs 12–13

1/ Stevens Reserve, 31.5241°S 159.0655°E, 30 m, under sheath *H. kentiae* frond, 13.ii.2017, Köhler.

Oricopis insulana is endemic to Lord Howe and was hitherto only known from the holotype (Fig. 12). The biology of the genus is unknown but the larvae almost certainly inhabit dead wood (Slipinski & Escallona, 2013). The

Figure 12. *Oricopis insulana* (Olliff, 1890) holotype (K.36494) in Australian Museum. Photo by Max Beatson.

Figure 13. *Oricopis insulana* (Olliff, 1890), specimen collected during the expedition (February 2017) (AM K.463344). Photo by Max Beatson.

collection site was close to a large fallen fig tree, so a malaise trap was placed beside the main trunk of this tree for 7 days, but it failed to catch any more specimens. Our discovery is important confirmation of the presence of a species that had appeared to be extinct. Length 14–17 mm.

Rhytiphora sp 1 new record

1/ Balls Pyramid, 31°45'S 159°15'E, unspecified locality, 21–26.iii.2017 AM Balls Pyramid exped.

The genus *Rhytiphora* includes several hundred species in Australia, New Guinea and the Pacific (Slipinski & Escallona, 2013) and we are currently unable to identify this species. However it is certainly a new generic record for the Lord Howe Islands and it may represent un undescribed endemic species. Larvae inhabit a wide variety of hosts, including dead wood and the living stems of herbs (Slipinski & Escallona, 2013). Length 13 mm.

Stenellipsis sp 1 new record

1/ Mt Lidgbird E shelf, 31°33.826'S 159°05.271'E, 486 m, hand coll, 9.ii.2017 Jenkins Shaw & Jensen.

The genus *Stenellipsis* includes several species from eastern Australia and the west Pacific (Slipinski & Escallona, 2013) but has not been previously recorded from Lord Howe. This possibly undescribed and endemic species is represented in the Australian Museum collection by material dating back to 1923 and from several lowland localities. Length 7–11 mm.

Family Chrysomelidae

Chrysomelids are leaf beetles, with adults usually feeding on leaves and larvae on leaves, stems or roots.

Dematochroma picea (Baly, 1864)

1/ Boatharbour, in palm/*Pandanus* behind beach, 14.ii.2017, Hyman & Köhler; 1/ Mt Lidgbird E shelf, 31°33.826'S 159°05.271'E, 486 m, FIT/malaise, 9–16.ii.2017 Jenkins Shaw & Jensen; 1/ ditto except 31.5638°S 159.0897°E, 455 m, on dracophyllum tuft, 9.ii.2017, Reid; 3/ Red Point track at corner mark, 31.5651°S 159.0939°E, 215 m, swept/beaten ex *Dryptes deplanchei*, 15.ii.217, Reid; 1[elytron only]/ Red

Point track, 31.5566°S 159.0874°E, 120 m, grass tufts/dry palm fronds, 15.ii.2017 Reid; 1/ forest at back of Salmon Beach, 31°33.564'S 159°04.604'E, 50 m, sifting leaf litter, damp forest, 8.ii.2017 Jenkins Shaw & Jensen; 1/ Soldiers Ck, 31.5627°S 159.0823°E, 22 m, malaise trap, 7–15.ii.2017 Reid; 1/ ditto except sweeping/beating, 7.i.2017; 1/ Soldiers Ck, 31°33.161'S 159°04.902'E, 43 m, in trays at FIT/malaise, 14.ii.2017, Reid.

The leaf beetle *Dematochroma picea* is endemic to Lord Howe where it is evidently widespread in mid and low elevation forest. The hostplant appears to be *Dryptes deplanchei*. *Dematochroma picea* is the type species of the genus, which is otherwise only known from New Caledonia, however genera in the subfamily Eumolpinae are poorly delimited. Larvae of Eumolpinae inhabit soil, feeding on roots. Length 8–12 mm.

Family Cleridae

Clerids are generally small but aggressive predatory beetles running around on flowers and foliage.

Omadius prasinus Westwood, 1852

2/ Goat Cave track, 31°33.432'S 159°05.136'E, 165 m, FIT/malaise, 7–15.ii.2017, Jenkins Shaw & Jensen; 2/ Lidgbird E shelf, 31°33.826'S 159°05.271'E, 486 m, FIT/malaise, 9–16.ii.2017 Reid.

This relatively large clerid is widespread in southeastern Australia and also recorded from Lord Howe (Olliff, 1889). It appears to be rarely collected on the island, but is found in low and mid elevation forests. *Omadius* is a widespread genus in the West Pacific, Australopapua and southeast Asia (Gerstmeier, 2009). Length 11–15 mm.

Family Dytiscidae

Dytiscids are water beetles that are predatory as both adults and larvae.

Rhantus suturalis (MacLeay, 1825) new record

1/ Erskine Valley R Xing, 31.5770°S 159.0790°E, 160 m, leaf filled pool, 11.ii.2017 Reid.

Rhantus suturalis is one of the most widespread species of Dytiscidae in the world, occurring from western Asia to Norfolk Island (Balke *et al*., 2009). It is a characteristic species of temporary water bodies. Our new record may indicate a recent arrival, but it is also possible that this species has been overlooked on Lord Howe as there has been little research on the freshwater fauna of the Erskine Valley. Length 10–13 mm.

Family Elateridae

Elaterids are click-beetles, with larvae that are usually either in dead wood or in soil feeding on roots.

Conoderus striatus (Macleay, 1872)

1/ Goat Cave track, 2nd 200 m, 31.5570°S 159.0864°E, 165 m, malaise trap, 7–15.ii.2017 Reid; 1, ditto except: FIT/malaise, Jenkins Shaw & Jensen; 2/ Goat Cave track, 31°33.432'S 159°05.136'E, 165 m, 14.ii.2017 Reid; 1/ Goat Cave track, 3rd 200 m, 31°33.682'S 159°05.254'E, 350 m, beating vines, 6.ii.2017 Reid; 4/ betw Res Sta & Banyan Appts, 31°31'31"S 159°04'10"E, 40 m, at light, 6.ii.2017 Reid; 1/ Research Sta, at light, 27.iii.2017 Köhler; 1/ forest behind Salmon Beach, 31°33.564'S 159°04.604'E, 50 m sifting leaflitter,17.ii.2017 Jenkins Shaw & Jensen; 1/ Stevens Res, 31.5241°S 159.0655°E, 30 m, malaise at fallen tree, 16–18.ii.2017, Reid; 2/ Far Flats, 250 m E of 31.5667°S 159.0754°E, 30 m, palm/fig forest, beating palm fronds, 10.ii.2017 Reid; 2/ Soldiers Ck, 31°33.194'S 159°04.986'E, 45 m, sifting in/around dry ck, 7.ii.2017 Jenkins Shaw & Jensen; 2/ Soldiers Ck, 31°33.161'S 159°04.902'E, 43 m, beating dead branches/palm fronds, 14.ii.2017 Reid.

Conderus striatus is a widespread species in Eastern Australia. It was first recorded from Lord Howe by Olliff (1889) who also noted it on Norfolk Island. Larvae of *Conoderus* are recorded feeding in leaf litter, on plant roots and also as predators of fly larvae (Calder, 1996). *Conoderus striatus* is widespread and common in the lowlands of Lord Howe Island, where it occurs in both disturbed and natural habitats. Length 8–15 m.

Ochosternus howensis Lea, 1929

1[fragments]/ Far Flats, 250 m E of 31.5667°S 159.0754°E, 30 m, under bark dead tree, 10.ii.2017 Reid; 1 adult, 2 larvae/ Goat Cave track, 1st 200 m, 31°33.376'S 159°05.185'E, 160 m, under bark dead tree, 14.ii.2017 Reid; 1/ Goat Cave track, 2nd 200 m, 31°33.457'S 159°05.183'E, 170 m, beating dead branches/vines, 14.ii.2017 Reid.

Ochosternus howensis is endemic to Lord Howe Island, where it is rarely collected but widespread in lowland forest and associated with dead wood (larvae were found in a rotting log). The genus is restricted to the southwest Pacific and is absent from mainland Australia (Calder, 1996). Length 13–20 mm.

Family Lucanidae

Lucanids are stag beetles, usually with greatly enlarged male mandibles. However males and females of *Figulus* species are almost identical.

Figulus nitens Waterhouse, 1874

1 adult, 1 larva/ Far Flats, 250 m E of 31.5667°S 159.0754°E, 30 m, under bark dead tree, 10.ii.2017 Reid; 1 + 1 [fragments] / forest behind Salmon Beach, 31°33.962'S 159°04.333'E, 29 m under bark fallen tree10.ii.2017 Jenkins Shaw & Jensen; 1 + 1 [fragments]/ Stevens Res, 31°31.445'S 159°03.940'E, 23 m sifting leaflitter 5.ii.2017 Jenkins Shaw & Jensen.

The *Figulus* species on Lord Howe was originally identified as *F. regularis* (Olliff, 1889) and later described as an endemic, *F. howei* de Lisle, 1967. Recently it has been placed in synonymy with *F. nitens*, a widespread species in eastern Australia (Monte, Bartolozzi & Zilioli 2017). Larvae are usually commonly found in the lowlands of the island, in fallen timber and palm trunks, but were only seen in Far Flats on this trip. Length 10–13 mm.

Lamprima insularis Macleay, 1885

1/ forest behind Salmon Beach 31°33.748'S 159°04.549'E, 16 m hand coll,10.ii.2017 Jenkins Shaw & Jensen; 1[fragment]/ forest behind Salmon Beach 31°33.564'S 159°04.604'E, 50 m sifting leaflitter,17.ii.2017 Jenkins Shaw & Jensen; 1/ Soldiers Ck, 31.5527°S 159.0823°E, 22 m, malaise trap, 7–15.ii.2017 Reid; 2/ Soldiers Ck, 31.5527°S 159.0827°E, 34 m rotting *H. belmoreana* stem, 7.ii.2017 Reid; 1/ Stevens

Figure 14. *Ptomaphila perlata* Kraatz, 1876 (AM K.188146). Photo by Matt Bulbert.

Res, 31.5257°S 159.0668°E, 25 m, under *Araucaria* bark, cut log, 18.ii.2017 Reid; 1 [fragment]/ Stevens Res, 31°31.445'S 159°03.940'E, 23 m sifting leaflitter 5.ii.2017 Jenkins Shaw & Jensen.

Lamprima insularis is endemic to the main island of Lord Howe. Its status, biology and distribution within the island were recently reviewed (Reid *et al*., 2018). Larvae are usually commonly encountered in large logs, including exotic species, in the lowlands. It was notable that *Lamprima* larvae and adults were absent from smaller diameter branches and palm trunks in most of the lowlands during AME2017. Larvae of this species and *Figulus* had been frequently seen in the summers of 2000–2003 in Stevens Reserve and the forest near Settlement Beach. Their absence in AME2017 probably reflects the extremely dry conditions in these areas at that time. Length 16–33 mm.

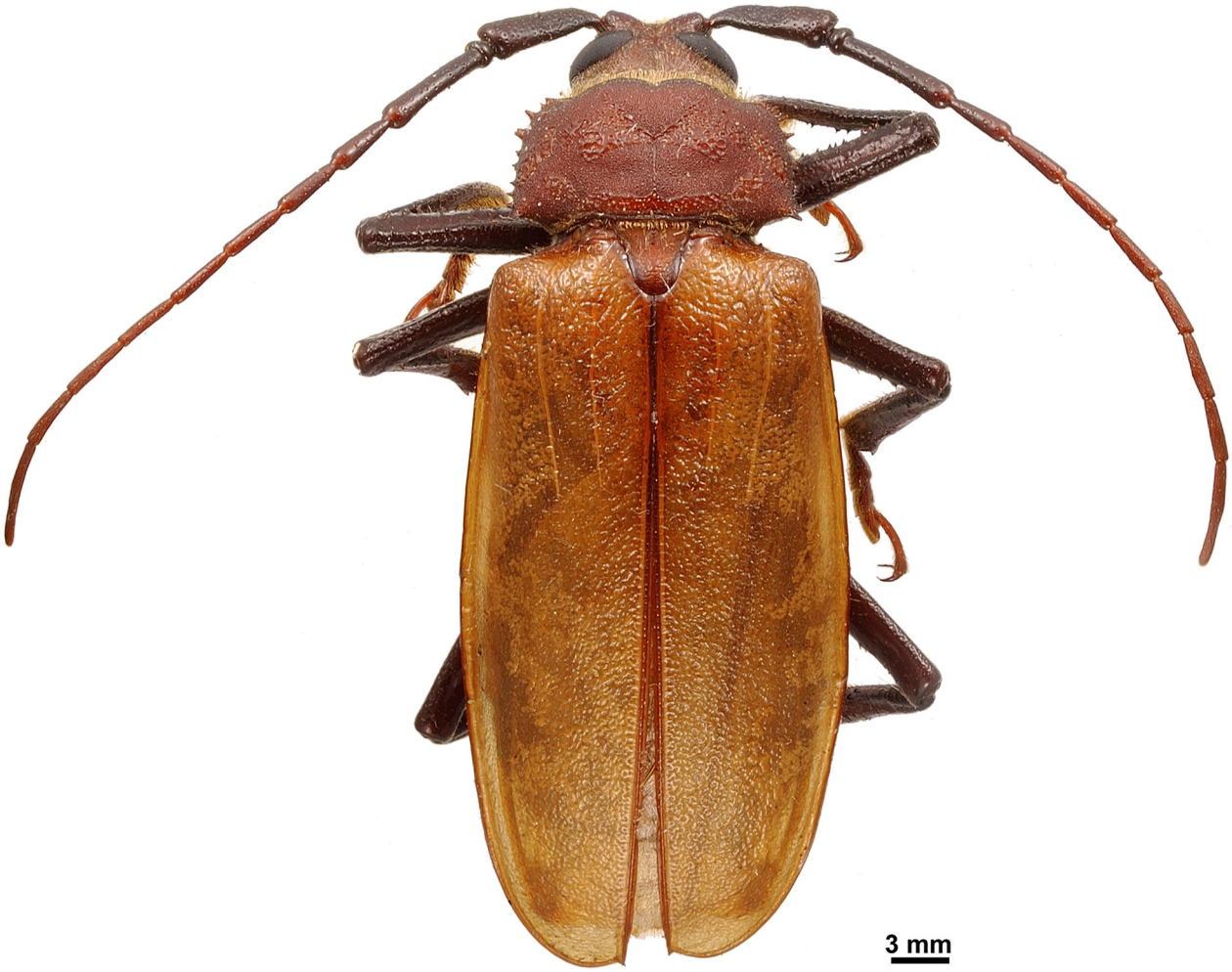

Figure 15. *Agrianome spinicollis* (MacLeay, 1826) (AM K.185570). Photo by Matt Bulbert.

Syndesus cornutus (Fabricius, 1801) new record

2 [fragments, including 2 pronota]/ Stevens Res, 31°31.445'S 159°03.940'E, 23 m sifting leaflitter 5.ii.2017 Jenkins Shaw & Jensen.

Syndesus cornutus is widespread in eastern Australia, where it is an occasional pest of damp timber (Lawrence, 1981; Hangay & de Keyzer, 2017). This may explain the presence of *S. cornutus* on Norfolk Island (Moore & Cassis, 1992) and our discovery on Lord Howe. *Syndesus cornutus* was not recorded in the Australian Museum surveys of 2001–2003 so we think this is a recent incursion, due to importation of timber from mainland Australia. The fragments are in relatively fresh condition so are likely to belong to individuals alive in the summer of 2016–2017. We are unable to determine whether this species is established on the island. Length 9–15 mm.

Family Scarabaeidae

This diverse family includes scarabs, dung beetles and chafers.

Cryptodus tasmannianus Westwood, 1841

1[missing limbs] / Balls Pyramid, 31°45'24"S 159°15'17"E, Pillars of Porteous, 380 m, 21–26.iii.2017 AM Balls Pyr Exped; 1/ Balls Pyramid, 31°45'24"S 159°15'17"E, radio cave, 80 m, 21–26.iii.2017 AM Balls Pyr Exped.

Cryptodus tasmannianus is a common and widespread species in eastern Australia, first recorded from Lord Howe by Carne (1957). However it is unclear if it was ever collected on the main island. All material in the Australian Museum is from Balls Pyramid, where it is associated with sedges (*Cyperus lucidus*), the larva probably feeding on their roots. The presence of this mainland Australian species on only Balls Pyramid is a mystery, but it may have been eliminated by rats from the main island. Length 17–22 mm.

Digitonthophagus gazella (Fabricius, 1787) new record

1/ Transit Hill track 31.5283°S 159.0726°E, 30 m, cow dung in pasture, 8.ii.2017 Reid.

Digitonthophagus (until recently *Onthophagus*) *gazella* is one of a suite of African dung beetles introduced to Australia by CSIRO in the 1960s and 1970s (Tyndale-Biscoe, 1990). This species does not seem to have been recorded from Lord Howe. Specimens from the island in the Australian Museum collection date back to 2000. It may have been deliberately introduced from the Norfolk Island population, established before 1978. It is specific to bovine dung and therefore dependent on the presence of cows on the island. Length 9–12 mm.

Figure 16. *Promethis sterrha* (Olliff, 1889). An old specimen in the Australian Museum, collected from the main island in 1916 (AM K.40618 and AM K.115600). Photo by Max Beatson.

Heteronychus arator (Fabricius, 1775) new record

1/ [edge of] forest at back of Salmon Beach 31°33.921'S 159°04.544'E, 10 m, 8.ii.2017, Jenkins Shaw & Jensen.

Heteronychus arator is known as the African Black Beetle in Australia where it is a serious lawn pest and occasional crop pest on the east coast (Carne, 1957). It originates from South Africa. *Heteronychus arator* is likely to have been accidentally introduced with lawn turf from New South Wales. The oldest specimens in the Australia Museum date from 2000 and it is now widespread in the cultivated parts of the island. Length 10–12 mm.

Pimelopus fischeri (Montrouzier, 1860)

1 + 1[fragment]/ betw Res Sta & Banyan Appts, 31°31'31"S 159°04'10"E, 40 m, at light, 6.ii.2017 Reid.

Pimelopus fischeri is restricted to the southwest Pacific in New Caledonia, Norfolk Island and Lord Howe Island (Carne, 1957). It is a common but patchily distributed species in lowland forest on Lord Howe. Length 16–20 mm.

Pimelopus noctis (Olliff, 1889)

2[elytra only]/ N end Neds Beach, 31°31.079'S 159°03.858'E, 2 m, beating *Cakile edentula*, 5.ii.2017, Reid.

Pimelopus noctis is endemic to Lord Howe. It is rarely collected and appears to be restricted to the sandy coastal margins of the lowlands. Length 15–20 mm.

Sericesthis geminata Boisduval, 1835 new record

1/ Boatharbour, in palm/*Pandanus* behind beach, 14.ii.2017, Hyman & Köhler; 1[fragments]/ Mt Gower, 31°34.999'S 159°04.852'E, 704 m, hand coll, 11.ii.2017, Jenkins Shaw & Jensen.

Sericesthis geminata is an abundant native species on the east coast of Australia, where it is a pest of lawns and vegetables (Britton, 1987), similar to the exotic *Heteronychus arator* (see above). However, our recent records suggest it is not restricted to disturbed or cultivated habitats on the island. The earliest material in the Australian Museum dates from 2000, when it had probably recently arrived in turf or plant material. Length 14–18 mm.

Family Silphidae

Australian silphids are carrion beetles, with adults and larvae that feed on rotting flesh.

Ptomaphila perlata Kraatz, 1876

Fig. 14

2/ Goat Cave track, 31°33.432'S 159°05.136'E, 165 m, FIT/malaise, 14.ii.2017, Reid; 1, ditto except: 7–15.ii.2017 Jenkins Shaw & Jensen; 3/ Lidgbird E shelf, 31°33.826'S 159°05.271'E, 486 m, FIT/malaise, 9–16.ii.2017, Reid; 11 adults, 5 larvae/ ditto except: Jenkins Shaw & Jensen; 2/ Soldiers Ck, 31°33.161'S 159°04.902'E, 43 m, in trays at FIT/malaise, 14.ii.2017, Reid; 1, ditto except: in dead tern; 1/ Soldiers Ck, 31.5627°S 159.0823°E, 22 m, malaise trap, 7–15.ii.2017 Reid.

Ptomaphila perlata is widespread in eastern Australian rainforests (Peck, 2001). It seems to be a recent immigrant to Lord Howe Island, where it was first collected in 1962 (Peck, 2001). *Ptomaphila perlata* is now an abundant species in carrion in low and mid elevation forests. Length 14–25 mm.

Family Staphylinidae

The larger species of staphylinids, or rove beetles, are active predators, particularly of fly maggots.

Creophilus erythrocephalus (Fabricius, 1775)

2/ Clear Place track, 31°31.695'S 159°04.753'E, 28 m, dead shearwater, 8.ii.2017 Jenkins Shaw & Jensen.

Creophilus erythrocephalus is a widespread species, found throughout Australia, New Guinea, the southwest Pacific and southern South America (Clarke, 2011). It was first recorded on Lord Howe by Olliff (1889) and is a maggot feeder, attracted to carrion. Length 12–18 mm.

Hesperus pacificus Olliff, 1887

2/ Goat Cave track, 31°33.432'S 159°05.136'E, c165 m, in trays, FIT/malaise,14.ii.2017, Reid; 8/ ditto, except: 7–15.ii.2017, Jenkins Shaw & Jensen; 1/ Mt Gower, nr igloo, 31°35.145'S 159°04.621'E, 839 m, sifting from bird burrows, 11.ii.2017 Jenkins Shaw & Jensen; 1/ Mt Lidgbird E shelf, 31°33.826'S 159°05.271'E, 486 m, FIT/malaise, 9–16.ii.2017, Jenkins Shaw & Jensen; 1/ 31.5637°S 159.0885°E, 448 m, malaise trap, 9–16.ii.2017, Reid; 12/ forest at back of Salmon Beach 31°33.564'S 159°04.604'E, 50 m, FIT damp forest, 8–15.ii.2017, Jenkins Shaw & Jensen; 5/ Soldiers Ck, 31°33.168'S 159°04.965'E, 39 m, FIT/malaise, 7–15.ii.2017, Jenkins Shaw & Jensen; 13/ Soldiers Ck, 31°33.161'S 159°04.902'E, 43 m, FIT/malaise, in trays, 14.ii.2017 Reid.

Hesperus pacificus is endemic to Lord Howe Island, where it is a common species at all elevations, and usually associated with carrion. Length 10–14 mm.

Family Tenebrionidae

Tenebrionids include darkling beetles and wireworms. Most species on Lord Howe are flightless.

Celibe exulans (Pascoe, 1866)

1/ Balls Pyramid, 31°45'S 159°15'E, unspecified locality, 21–26.iii.2017, AM Balls Pyr Exped; 1/ Blackburn Id, 31°32'04"S 159°03'34"E[Google], 10 m, under rocks & beating *Lagunaria*/*Cassinia*, 18.ii.2017 Reid; 4/ Blackburn Id, 31°32'04"S 159°03'37"E[Google], 6 m, under rocks/logs & beating *Lagunaria*/*Cassinia*/fig, 18.ii.2017 Reid; 4, ditto except: under rocks, Jenkins Shaw & Jensen.

Celibe exulans is a morphologically variable flightless species, endemic to Lord Howe (Matthews, 1993). It is found throughout the lowlands and also on Blackburn Island and Balls Pyramid. The larvae of this genus inhabit soil. Length 7–17 mm.

Homotrysis sp 1 new record

1/ Goat Cave track, 2nd 200 m, 31.5570°S 159.0864°E, c165 m, malaise trap, 7–15.ii.2017, Reid; 1/ Soldiers Ck, 31.5527°S 159.0823°E, 22 m, malaise trap, 7–15.ii.2017 Reid.

Homotrysis is a widespread genus in Australia, with numerous species (Matthews & Bouchard, 2008). These have arboreal and volant adults, unlike other Lord Howe tenebrionids. The species on Lord Howe may be a relatively recent arrival, as the earliest material we have seen (in Australian Museum) dates back to 2001. It has only been found in lowland forest. Length 9–12 mm.

Hydissus vulgaris (Olliff, 1889)

1/ Balls Pyramid, 31°45'S 159°15'E, unspecified locality, 21–26.iii.2017, AM Balls Pyr Exped; 1/ Balls Pyramid, 31°45'24"S 159°15'17"E, radio cave, 80 m, 21–26.iii.2017, AM Balls Pyr Exped; 1/ Balls Pyramid, 31°45'23"S 159°15'16"E, Gannet Green, 130 m, 21–26.iii.2017, AM Balls Pyr Exped; 1/ Blackburn Id, 31°32'04"S 159°03'34"E[Google], 10 m, under rocks & beating *Lagunaria*/*Cassinia*, 18.ii.2017 Reid; 1/ Mt Lidgbird E shelf, 31°33.826'S 159°05.271'E, 486 m, fogging rotten wood, 16.ii.2017 Jenkins Shaw & Jensen; 1/ Red Point track at corner mark, 31.5651°S 159.0939°E, 215 m, swept/beaten, 15.ii.2017 Reid; 2/ Soldiers Ck, 31.5530°S 159.0827°E, 34 m rotting *H. belmoreana* stem, 7.ii.2017 Reid; 1/ Soldiers Ck, 31°33.161'S 159°04.902'E, 34 m, rotting palm trunk, 6.ii.2017 Reid; 2, ditto except: rotten scalybark wood.

Hydissus vulgaris is a flightless species, endemic to Lord Howe. It is widespread in low and mid elevations, often found in rotting wood or under stones. Here we record it from Blackburn Island and Balls Pyramid for the first time. Length 8–13 mm.

Metisopus curtulus (Olliff, 1889)

3/ Balls Pyramid, 31°45'24"S 159°15'17"E, radio cave, 80 m, 21–26.iii.2017, AM Balls Pyr Exped; 4/ Blackburn Id, 31°32'04"S 159°03'37"E[Google], 6 m, under rocks/logs & beating *Lagunaria*/*Cassinia*/fig, 18.ii.2017 Reid; 2/ Goat Cave track, 31°33.432'S 159°05.136'E, c165 m, 14.ii.2017, Reid; 2/ Goat Cave track, 2nd 200 m, 31°33.457'S 159°05.183'E, c170 m, beating dead branches/vines,14.ii.2017, Reid; 1, ditto except: 6.ii.2017; 1/ Goat Cave track, 2nd 200 m, 31.5570°S 159.0864°E, c165 m, beating dead vines/branches,16.ii.2017, Reid; 3/ Mt Lidgbird E shelf, 31°33.826'S 159°05.271'E, 486 m, sifting leaflitter, 16.ii.2017 Jenkins Shaw & Jensen; 1, ditto, except: *Dracophyllum* leaf litter, 9.ii.2017, Reid; 3/ Mt Lidgbird E shelf, 31°33.817'S 159°05.378'E, 444 m, sifting *Dracophyllum* litter, 9.ii.2017 Jenkins Shaw & Jensen; 1/ North Beach, 31°31.021'S 159°02.722'E, sifting seaweed, hwm, 17.ii.2017, Jenkins Shaw & Jensen; 1/ Red Point track at corner mark, 31.5651°S 159.0939°E, 215 m, swept/beaten, 15.ii.2017 Reid; 1/ forest behind Salmon Beach, 31°33.962'S 159°04.333'E, 29 m, under bark, fallen tree, 10.ii.2017 Jenkins Shaw & Jensen; 1/ forest behind Salmon Beach, 31°33.564'S 159°04.604'E, 50 m, sifting leaflitter, 17.ii.2017 Jenkins Shaw & Jensen; 1/ Soldiers Ck, 31.5527°S 159.0827°E, 34 m rotting *H. belmoreana* stem, 7.ii.2017 Reid; 1/ Soldiers Ck, 31°33.194'S 159°04.986'E, 45 m, sifting in/around dry ck, 7.ii.2017 Jenkins Shaw & Jensen; 2/ Stevens Res, 31°31.445'S 159°03.940'E, 23 m sifting leaflitter 5.ii.2017 Jenkins Shaw & Jensen.

Metisopus curtulus is another flightless species, endemic to Lord Howe. Its distribution and habitats are similar to *H. vulgaris* and the species are often found together. This species is also recorded from Blackburn Island and Balls Pyramid for the first time. Length 7–10 mm.

Promethis sterrha (Olliff, 1889)

Fig. 16

1[fragments]/ Blackburn Id, 31°32'04"S 159°03'34"E [Google], 10 m, under rocks & beating *Lagunaria*/*Cassinia*, 18.ii.2017 Reid.

Promethis sterrha is also a flightless species, endemic to Lord Howe. This large species was described from the main island but appears to be extinct there and has only been collected from Blackburn Island in recent surveys. This is possibly a critically endangered species. We confirm its presence on Blackburn Island by discovery of fragments of one individual but its abundance and distribution on Blackburn Island urgently needs to be studied.

Discussion

Among beetles larger than or equal to 10 mm in size, 31 species were found. Remarkably, nine of these were previously unrecorded from the island, almost all of which appear to be relatively recent invasives. The effect of introduced beetle species on the island is unknown and perhaps unknowable, but unlikely to be positive. We strongly recommend stringent quarantine procedures between both Lord Howe and mainland Australia and Lord Howe and Norfolk Island. Our survey failed to find many known large species, and found several other species in considerably reduced ranges compared with previous surveys. These results may be due to the extremely dry conditions at the time of survey in 2017. We hope that this is a short term phenomenon rather than a permanent result of the predicted climate change (Anonymous, 2018b).

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