Australian Museum, 1 William Street, Sydney

ISSN 1835-4211 (online)

Technical Reports of the Australian Museum

# The Australian Museum Lord Howe Island Expedition 2017



AUSTRALIAN MUSEUM

190 YEARS 1827 > 2017

NSW GOVERNMENT

*Technical Reports of the Australian Museum, Online* (2018) No. 26, pp. 69–76.
ISSN 1835-4211 (online)
https://doi.org/10.3853/j.1835-4211.26.2018.1702
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# The Australian Museum Lord Howe Island Expedition 2017—Freshwater Fishes

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Abstract. Historically, three species of freshwater fishes have been recorded from Lord Howe Island, Longfin Eel, *Anguilla reinhardtii*, Southern Shortfin Eel, *Anguilla australis* and Common Galaxias, *Galaxias maculatus*. Both eel species are widespread throughout the island. The Common Galaxias was collected in 1889 (Australian Museum record) and 1962 (Allen *et al*., 1976). In 1989, Common Galaxias was recorded in the lagoon seaward of Soldiers Creek by Ian Hutton (pers. comm.). During the Australian Museum Expedition in 2017, both eel species were recorded however Common Galaxias were not found. Sampling for fishes was conducted in all known freshwater creeks and drainages on the Island, except for Erskine Valley and an unnamed creek on the eastern side of Mt Lidgbird.

Keywords. Freshwater; Fishes; Eel; *Galaxias*.

Reader, Sally E., Amanda C. Hay, and Mark A. McGrouther. 2018. The Australian Museum Lord Howe Island Expedition 2017—freshwater fishes. *Technical Reports of the Australian Museum, Online* 26: 69–76. https://doi.org/10.3853/j.1835-4211.26.2018.1702

## Introduction

During the week of 4–11 March, 2017, Australian Museum Ichthyology staff, Amanda Hay, Mark McGrouther and Sally Reader, surveyed the freshwater fishes of Lord Howe Island. The waterways are typified by short coastal streams, (some with steep inclines initially) and erratic flows often reliant on seasonal rainfall. Many of the upper reaches of streams consist of a series of pools with the substrate often of rock, gravel and sand. The upper catchments are heavily timbered, the watercourses shaded and large amounts of organic matter may be present in the streams. Waterways flowing onto the coastal plain, such as Soldiers Creek on the western side of the island, are characterized by muddy substrates. The lower catchment vegetation is typified by open forest, cattle grazing pasture and grasslands. As the streams reach the coast, tidal influence causes salinity fluctuations.

Previous surveys of the fishes of Lord Howe Island have focused solely on marine species (Allen *et al*., 1976). The 2017 expedition was the first attempt at a comprehensive survey of all accessible freshwater streams.

## Materials and methods

Fishes were collected using backpack electrofisher, dip nets, single-operator seine, two-person fine-mesh seine and baited minnow traps. A representative of each species of fish was retained from most creeks. When identifications were unable to be made in situ the specimens were retained and identified in the laboratory. Additional fishes were identified and quickly returned to the capture location. Fishes retained as museum vouchers were euthanized in accordance with Australian Museum Animal Care and Ethics Approval

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Published online only 17 May 2018

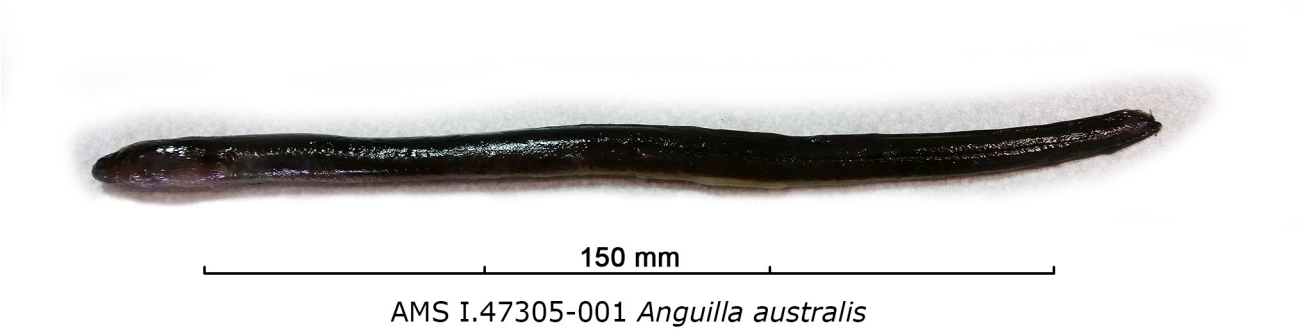


Figure 1. *Anguilla australis* collected at site 18, Boat Harbour (south).

Number 17-02. Collected specimens were transported back to the Lord Howe Island Research Station where they were allocated registration numbers, measured, and fixed in 10% formalin. Prior to fixation, a sample of muscle tissue was taken and fixed in DMSO. Upon return to the Australian Museum the fishes were transferred into 70% ethanol, registered into the ichthyology collection database (EMu) and housed in the ichthyology wet collection with muscle tissue being accessioned into the frozen tissue collection. All frozen tissue samples were subsequently sequenced at the Australian Museum to confirm the identifications.

### Sites

Collecting was undertaken at 20 sampling sites (Table 1, Fig. 10). Sampling was conducted in all known freshwater creeks and drainages on the Island, except for Erskine Valley and an unnamed creek on the eastern side of Mt Lidgbird that flows to the sea south of Red Point. The weather was very rough during the times when a guide was available and it was considered too dangerous to access these more remote areas.

## Species accounts

## Anguillidae—freshwater eels

Long, slender, snake-like fishes with small fan shaped pectoral fins and no pelvic fins. As adults they inhabit freshwater streams and lakes and feed on crustaceans, fishes and other aquatic vertebrates. Freshwater eels have a catadromous life cycle—at the onset of sexual maturity adults migrate downstream and swim, often huge distances, to deep oceanic breeding sites. They spawn at depths of 300 meters or more and die shortly thereafter. The newly hatched leaf-shaped leptocephalus larvae drift on oceanic currents back to coastal areas before metamorphosing into elvers, which are small, semi-transparent and eel-like. As the elvers migrate upstream into freshwaters they gradually develop the more typical body shape and colouration of the adult. Freshwater eels are long-lived; most species attaining sexual maturity at between 10–25 years. There are 15 species of *Anguilla* known world-wide, 4 of which occur in Australia, with 2 species recorded from Lord Howe Island (Allen *et al*., 2002).

### *Anguilla australis* Richardson, 1841
### Southern Shortfin Eel

Uniform golden to olive-green becoming paler ventrally. Inhabits freshwater lakes, swamps and streams often preferring still turbid water. Common in Southeastern Australia and also widespread throughout the western Pacific. Sexual maturity is attained in 14 years for males and 18–24 years for females. Spawning migrations occur from summer to autumn when they head to the Coral Sea, (near New Caledonia). The elvers commence their upstream migration between October and January (Allen *et al*., 2002; McDowall, 1996; Merrick & Schmida, 1984) (Fig. 1).

The Australian Museum has five records of this species from Lord Howe Island, made between 1887 and 1973. In March 2017, *A. australis* was recorded at sites 12 and 18 (Table 1, Fig. 10).

### *Anguilla reinhardtii* Steindachner, 1867
### Longfin Eel

Distinctive dark blotching on an olive or brownish background. Paler ventrally with dark brown median fins. Inhabits freshwater streams, lakes and swamps with a preference for flowing water. Commonly occurs in eastern Australian coastal drainages. Also found in Papua New Guinea and New Caledonia. Spawning migrations are similar to those described above for *A. australis* (Allen *et al*., 2002;


Figure 2. *Anguilla reinhardtii* collected at site 12, Soldiers Creek.

Figure 3. *Anguilla reinhardtii* collected and released at site 17, Boat Harbour (north).

McDowall, 1996; Merrick & Schmida, 1984) (Figs. 2, 3).

The Australian Museum has seven collection event records from Lord Howe Island for this species, with collections made between 1889 and 1973. In March 2017 *A. reinhardtii* was recorded at sites 10, 12, 13, 17 and 20 (Table 1, Figs 2, 3, 10).

## Galaxiidae—Galaxias

Small, scaleless, elongate fishes—about 20 species occur in Australia with only one species recorded from Lord Howe Island.

### *Galaxias maculatus* (Jenyns, 1842) Common Galaxias

A slender-bodied galaxiid, olive grey to brownish with variable darker bars, spots and mottling on the sides. It is found in a variety of habitats but most commonly in still or gently flowing water at low elevations and around lake and lagoon margins. It is the most widely distributed galaxiid both within southern Australia and throughout the Southern Hemisphere.

Adults typically mature at one year of age, mature fish migrate downstream into estuaries to spawn on fringing vegetation during autumn high spring tides. Eggs are left high and dry to develop for about two weeks before hatching on the arrival of the next spring tide. Newly hatched larvae (about 7mm long) spend their first five to six months at sea before returning to fresh waters the following spring as slender transparent juveniles. Their life history indicates a high tolerance to varied habitat conditions including extreme salinity levels (Allen *et al*., 2002; McDowall, 1996; Merrick & Schmida, 1984) (Fig. 4).

The Australian Museum has two records of *G. maculatus* collected at Lord Howe Island—two specimens in 1889 and one in 1962. Queensland Museum has one record collected in May 1989. Ian Hutton, Director of the Lord Howe Island Museum also collected and photographed a specimen in 1989. Despite intense collecting both day and night, at the sites where *G. maculatus* has previously been sighted and collected, no specimens were found.

## Discussion

The species of freshwater fishes that occur on Lord Howe Island are well known in the literature and by many residents, however, this is the first time that a comprehensive survey of all accessible streams, creeks and watercourses had been undertaken. Unfortunately weather conditions for this expedition were not always favourable. Prior to the expedition in early March 2017 rainfall on Lord Howe Island for the months November 2016 to February 2017 was well below average for that time of year (Fig. 9), resulting in the streams being low or even dry, in turn limiting the ability to sample a number of the watercourses. Part way through the expedition the weather deteriorated. Heavy rainfall resulted in some creeks and streams that had previously been dry,

Figure 4. *Galaxias maculatus* collected by Ian Hutton lagoon seaward of Soldiers Creek, site 11 in 1989. The fish was photographed in an aquarium. Photo courtesy of Ian Hutton.

filling with water. Storm conditions also meant that access to two sites, Erskine Valley and an unnamed creek on the eastern side of Mt Lidgbird was not possible due to dangerous conditions.

The remoteness and topography of Lord Howe Island coupled with the ephemeral nature of many of the watercourses makes it impossible for most freshwater fish species to form established populations. The three species of fishes that have been recorded on the Lord Howe Island (2 in the current survey) all have marine larval phases. Hence, if adult populations of these fishes died out, as may have happened in the past, given favourable conditions the island could potentially be recolonized by elvers and juveniles of these three species being transported by ocean currents. The Island lies in the path of the East Australian Current, which flows from the north along the eastern seaboard of the Australian continent, then swings offshore in pulses from about September to December before either returning north or dissipating after shedding warm core eddies (Nilsson & Cresswell, 1980).

The holdings of Lord Howe Island fishes from the major Australian fish collections were mapped using the Atlas of Living Australia website. This revealed that the Longfin and Shortfin Eels collected at Boat Harbour are the first records of any fish species collected from this locality.

During his February 2017 field trip to Lord Howe Island to survey insects, Dr Chris Reid of the Australian Museum climbed Mt Lidgbird and photographed an eel in a small pool above the waterfall in Erskine Creek. The authors later identified the eel from the photographs as a Longfin Eel. No fish records are currently recorded in the Atlas of Living Australia from this locality.

DNA was successfully extracted from the Lord Howe Island samples using Isolate 11 Genomic DNA Kit from Bioline (BIO-52067). A partial Cytochrome c oxidase I mitochondrial (mtDNA) gene region was sequenced and compared to published data (Minegishi *et al*., 2005; Ward *et al*., 2005) to confirm species identification.

Acknowledgments. We thank Ian Hutton (Lord Howe Island Museum) for his assistance in sampling at night in the lagoon seaward of Soldiers Creek (Site 11). Sallyann Gudge (Lord Howe Island Marine Park) and Hank Bower (Lord Howe Island Board) are both acknowledged for their enthusiastic support before, during and after the survey. Andrew King from Australian Centre for Wildlife Genomics at the Australian Museum Research Institute is acknowledged for sequencing and identifying the frozen tissues.

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Figures 5, 6. Lord Howe Island collecting sites. *(5)* Old Settlement Creek (Site 4), sampling with a two-person fine-mesh seine; *(6)* Creek to east of Lagoon Road (Site 10), single-person seine.



Figures 7, 8. Lord Howe Island collecting sites. *(7)* Lagoon seaward of Soldiers Creek (Site 11), two person fine-mesh seine. *(8)* Boat Harbour, North (Site 17), backpack electrofishing.

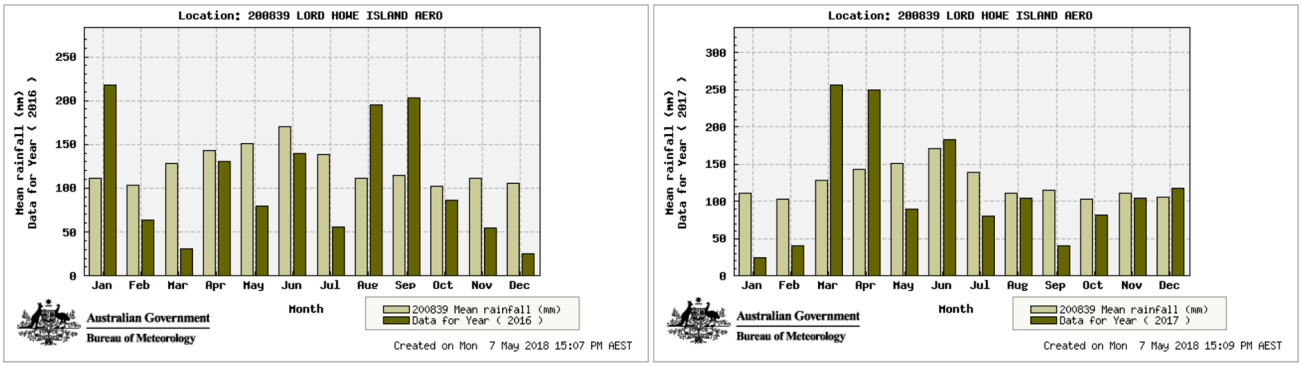


Figure 9. Mean rainfall figures for 2016 and 2017 showing the extended period of low precipitation prior to the March 2017 survey. Source: Australian Government Bureau of Meteorology website. http://www.bom.gov.au


Figure 10. Map of Lord Howe Island showing sampling sites, refer also to Table 1.

**Table 1**. Sampling sites from north to south with details of conditions and catches.

| site | sampling sites (N to S) | creek condition | fishes |
|---|---|---|---|
| 1 | Creeks at central, west and east end of North Beach | dry | no |
| 2 | Small sink-hole on walk to Old Gulch | 3 m square 2 m deep hole, clear water surrounded by low grass, estuarine | no |
| 3 | Creek west end of Old Gulch | dry | no |
| 4 | Old Settlement Creek (Fig. 5) | trickle, isolated pools, grassed cattle pasture, freshwater | no |
| 5 | Old Settlement Creek | heavily overhung vegetated creek upstream of site 6, estuarine | no |
| 6 | Old Settlement Creek | beach-locked lagoon, estuarine | Sand Mullet (AMS I.47300) |
| 7 | Cobby's Creek | black, sulphurous narrow stream, estuarine | no |
| 8 | Cobby's Creek | beach-locked green "sheet" algae encrusted pool, estuarine | no |
| 9 | Creeks northwest of Mutton Bird Point | dry, short, high, watercourses | no |
| 10 | Creeks to E of Lagoon Rd between Capella Lodge and Soldier Ck | grassed cattle pasture to cattle grid, brackish | Longfin eels (AMS I.47303) |
| 11 | Lagoon seaward of Soldiers Creek (downstream of site 10) | creek flowing through mangroves to beach-locked lagoon, estuarine | day—Sand Mullet (AMS I.47302)<br>night—Sand Mullet and Flagtail Kuhlia (AMS I.47307) |
| 12 | Soldiers Creek | heavily forested narrow stream, freshwater | Longfin and Southern Shortfin eels (AMS I.47301) |
| 13 | Stream above Rocky Run | clean, flowing stream over dark rocky bed with separate pools and waterfall, Pandanus and detritus, freshwater | Longfin eels |
| 14 | Rocky Run | bare rock pools, freshwater | no |
| 15 | Stream between Boat Harbour and Rocky Run #1 | small steep stream with isolated pools, freshwater | no |
| 16 | Stream between Boat Harbour and Rocky Run #2 | *Pandanus* frond-clogged stream in thick *Pandanus* forest, freshwater | no |
| 17 | Boat Harbour (north) (Fig. 8) | small stream with isolated pools in steep "palm forest". Pools with considerable amount of leaf litter and snags on bottom. Very little flow, freshwater | Longfin eels (AMS I.47306) |
| 18 | Boat Harbour (south) | as above | Southern Shortfin eels (AMS I.47305) |
| 19 | Watercourse to Salmon Beach | dry, steep, short heavily vegetated | no |
| 20 | Erskine Creek | small pool, above the waterfall | Longfin eel |