

Tjiwarl Country (Leinster) Bush Blitz

Terrestrial Molluscs

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Nomenclature and taxonomy used in this report is consistent with:

World Register of Marine Species

<https://www.marinespecies.org/index.php>

The Australian Faunal Directory (AFD)

<http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/home>

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Abstract

A total of 30 sites were sampled across the Tjiwarl determination area, and of these, only 10 yielded non-marine molluscs. No molluscs were collected at the standard survey sites. A total of 27 records were documented across four families in the class Gastropoda. No bivalve molluscs were found. Five taxa were found comprising the aquatic families Planorbidae and Tomichiidae; and the terrestrial families Gastrocoptidae and Pupillidae. All taxa are regarded as native. Two of the taxa in the aquatic families Planorbidae and Tomichiidae are potentially un-named. Records for each of the five taxa provided a significant infill to distribution or range extension, and this likely reflects low sampling of the area previously. The low diversity of terrestrial molluscs found on this survey is not surprising given the low rainfall and the near desert location. However, not all topographic features were thoroughly sampled or visited, meaning the presence of further terrestrial taxa cannot be dismissed. This is an important consideration given the survey was conducted during dry conditions, which is not ideal as land snails are buried and aestivating. Conversely, the freshwater molluscan fauna was more prevalent than expected, likely the result of relatively recent rainfall.

Of the non-marine molluscs collected, 27 specimen lots, comprising 206 specimens have been registered and deposited in the Western Australian Museum Mollusc collection. Nineteen of these lots contain material suitable for genetic sequencing. Data associated with these specimens will be uploaded to the Atlas of Living Australia (ALA).

1. Introduction

Bush Blitz is an Australian-wide biodiversity discovery partnership program, co-funded through the Department of Climate Change, Energy, the Environment and Water, Parks Australia, BHP and Earthwatch Australia (<https://bushblitz.org.au/>). Since the program began in 2010, more than 1,800 species of plants, animals and fungi have been identified as having been previously unknown to science. The program has also enhanced critical knowledge gaps in documenting Australia's biodiversity assets in often remote, regionally, and culturally significant regions. Bush Blitz engages expert scientists to undertake field expeditions in partnership and collaboration with Indigenous people (Traditional Owners), land managers and governments and disseminates much of this knowledge through Earthwatch Australia educational programs (<https://earthwatch.org.au/>), social media, technical reporting and peer-reviewed literature (e.g., Preece et al. 2014).

A Bush Blitz Expedition was undertaken during August and September 2023, in partnership with the Tjiwarl Aboriginal Corporation (<https://tjiwarl.org.au/>), BHP, the Western Australian Department of Biodiversity, Conservation & Attractions Parks & Wildlife Service, the Western Australian Museum, the Western Australian Herbarium, Parks Australia and additional scientists from the South Australian Museum. The survey area for the expedition focussed on the Tjiwarl determination area, in the W.A. Northern Goldfields region. The area is situated between Wiluna and Leinster and includes Wanjarri Nature Reserve.

This report summarises the results of a two-week targeted survey of non-marine molluscs.

2. Methods

2.1 Site selection

Sites were restricted to the Tjiwarl determination area. Initial sites were chosen based on prominent topographic features (outcrops, mountains and hills) and associated gullies. Secondly, sites across a range of healthy, remnant vegetation were selected. These were chosen primarily using Google Earth satellite imagery. When on-site at Leinster, additional

locations were chosen with the local knowledge of Tjiwarl Rangers. This included, for example, several waterhole locations. Some sites were chosen in the field where suitable habitat or topography was encountered.

2.2 Survey techniques

Live-taken molluscs were the primary goal of collecting. However, shells are often only encountered during collecting.

Terrestrial molluscs (live or dead) were sampled by two main methods.

For macro-molluscs (>10mm), a minimum of 30 mins was spent hand-searching under rocks, litter or fallen vegetation (logs, bark and branches), usually with the assistance of small hand rakes. If shells were encountered, time and effort was given to digging for live snails, using a small spade in the vicinity of fresh-dead shells (e.g. under shrubs, roots or rock piles).

For micro-molluscs, a minimum of 30 mins was spent taking leaf litter/soil samples at various micro-habitats. Samples were then sifted through 2mm and 0.5mm sieves. Both fractions were examined on-site using a hand-lens, and if land snails were encountered, a minimum of half-litre of soil/leaf litter was taken back to the field laboratory for further study using a Carl Zeiss dissecting microscope.

For aquatic molluscs, a minimum of 30 mins was spent hand-searching in shallow water, usually under/on rocks, litter or fallen vegetation. If any aquatic molluscs were encountered, a small amount of vegetation or algae was placed in a vial overnight with lid, an inspected in the morning. This is known as the “crawl off” method, where any aquatic molluscs would make their way to the lid surface and be collected.

For salt-lake molluscs, a minimum of 30 mins was spent hand-searching for shells. If encountered, several clay samples were taken to a depth of 150mm using calico bags. These were washed through 2mm and 0.5mm sieves in the field laboratory and inspected for live snails.

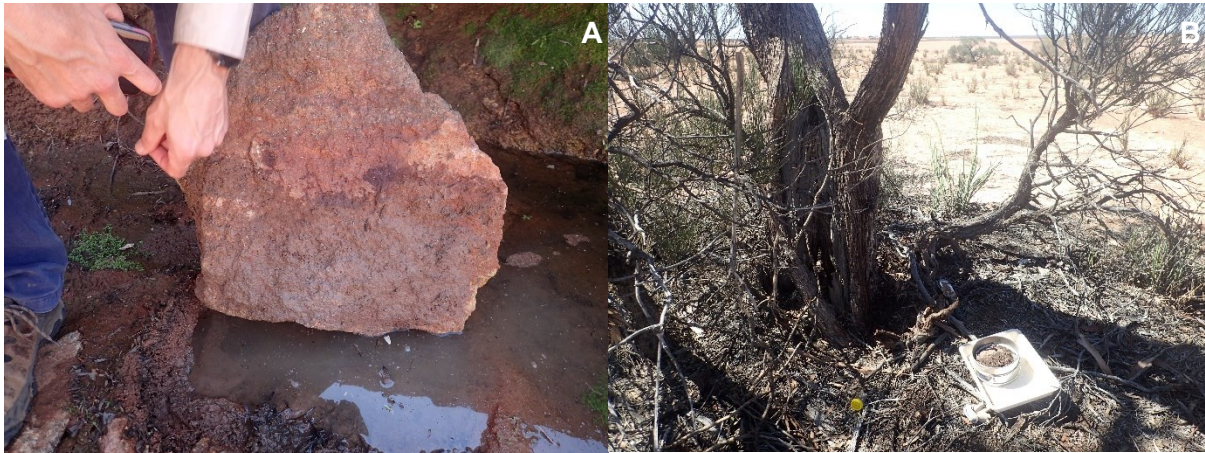
Images were taken of every site where molluscs were encountered using a Canon 6D camera. For crawling snails, images were taken using Dino-Lite Digital Microscope in the field laboratory.

All live taken specimens were preserved in 100% ethanol which is appropriate for genetic work. Most live specimens were placed directly into 100% ethanol, but some were covered in boiling water briefly to keep the animal extended from shell before preservation in 100% ethanol.

All specimens were registered and deposited with the WA Museum (Appendix 1).

2.2.1 Methods used at standard survey sites

The methods used at the standard survey sites were the same as 2.2 above.



Images of some of the survey techniques and equipment used during the Tjiwarl Country Bush Blitz surveys **A)** Rock-turning for aquatic molluscs, Site TJ011, Dingo Pool Lower **B)** Leaf litter sieving for terrestrial micro-molluscs., Site TJ017, Lake Miranda area

2.3 Identifying the collections

Identification of specimens were made primarily by the senior author, initially in the field and then in the WA Museum laboratory using a Leica stereo microscope. Specimens were identified to species level using available literature, primarily Stanistic et al. (2017), Pokryszko (1996) and Ponder et al. (2023). Unless stated, the taxonomy is primarily consistent with the World Register of Marine Species (WoRMS Editorial Board 2024) and if taxa are absent, then the Australian Faunal Directory (AFD)(ABRS 2020).

3. Results and Discussion

A total of 30 sites were sampled during this survey, and of these, only 10 yielded non-marine molluscs. No molluscs were collected at the standard survey sites. A total of 27 records were documented across four families in the class Gastropoda. No molluscs in the class Bivalvia were found. Five taxa were found comprising the aquatic families Planorbidae and Tomichiidae; and the terrestrial families Gastrocoptidae and Pupillidae. All taxa are regarded as native. Two of the taxa in the aquatic families Planorbidae and Tomichiidae are potentially un-named. Records for each of the five taxa provided a significant infill to distribution or range extension, and this likely reflects low sampling of the area previously.

The low diversity of terrestrial molluscs found on this survey is not surprising given low rainfall at the time and the near desert location of the determination area. However, not all litho-refugial areas or vegetation types were thoroughly sampled or visited. Therefore, the presence of further terrestrial taxa cannot be dismissed, especially given the survey was conducted during dry conditions, when land snails are underground aestivating. Conversely, the freshwater molluscan fauna was more prevalent than expected, likely the result of relatively recent rainfall leading to favourable conditions and habitat (i.e. waterholes) for this fauna.

Of the non-marine molluscs collected, 27 specimen lots, comprising 206 specimens have been registered and deposited in the Western Australian Museum Mollusc collection. Nineteen of these lots contain live-taken snails and are suitable for genetic sequencing. Data associated with these specimens will be uploaded to the Atlas of Living Australia (ALA).



Some of the non-marine molluscs collected during the Tjiwarl Country Bush Blitz survey **A)** Crawling *Isidorella* cf. *newcombi* from Site TJ011, Dingo Pool Lower, S117306 **B)** Site TJ011, waterhole at Dingo Pool Lower, *Isidorella* cf. *newcombi* was found mainly around the damp edges. **C)** Shell of *Gastrocopta* cf. *margaretae* from Site TJ007, Logan Spring, S117300 **D)** Site TJ007, Logan Spring, looking eastward, where *Gastrocopta* cf. *margaretae* was collected among deep leaf litter **E)** Live *Pupoides* cf. *myoporinae* from Site TJ017, Lake Miranda area, S117314 **F)** Site TJ017, calcrete rise adjacent to Lake Miranda, live *Pupoides* cf. *myoporinae* was found sealed to buried tree root.

3.1 Un-named or not formalised taxa

No un-named taxa were known from Tjiwarl Country prior to this survey.

3.2 Putative new species (new to science)

In this report, 'putative new species' means an un-named species that, as far as can be ascertained, was identified as a new species as a direct result of this Bush Blitz. Two taxa were discovered during this survey that are potentially un-named.

Shells of the salt-lake gastropod *Coxiella* aff. *gilesi* were found at Lake Miranda which is a new record for this lake. Recent molecular work suggests that *Coxiella gilesi* is a species complex comprising many undescribed species (Lawrie et al. 2023). Given the Lake Miranda specimens are a new record and are 230km from the nearest un-named lineage, genetic sequencing will likely confirm the lake Miranda population as new. From the limited sampling on this survey, *Coxiella* was restricted to a small pocket in the north-east section of Lake Miranda.

The minute freshwater limpet *Ferrissia* sp. was collected from one site at Dingo Pool Lower, a new record for the area. It was discovered after inspecting a vial of submerged algae overnight, known as the "crawl off" method. The taxonomy of this group needs revision (Ponder et. al. 2023), but given this record is 538km from other records, it is potentially new.

Unfortunately, *Coxiella* were dead taken so genetic sequencing will not be possible. Collecting live specimens is advised when significant rainfall occurs. However, sequencing of *Ferrissia* will be possible. If proven new to science, these species can then be formally described through the peer review process. Species descriptions will be done in consultation with project partners, namely Traditional Owners.

Table 2. Putative new species (new to science)

| Species | Comment |
|--|---|
| <i>Coxiella</i> aff. <i>gilesi</i> n.sp. | Dry specimens only (shells). Will require live specimens and genetic sequencing |
| <i>Ferrissia</i> sp. | Live specimens. Will require genetic sequencing |



One of the newly discovered, potentially un-named non-marine molluscs collected during the Tjiwarl Bush Blitz survey, with select habitat shot. **A)** Shell of *Coxiella* aff. *gilesi* from Lake Miranda, S117312 **B)** Site TJ016, Lake Miranda, where shells of *Coxiella* aff. *gilesi* was collected in high numbers in near shore accumulation zones.

3.3 Exotic and pest species

No exotic species of non-marine molluscs were collected during this survey.

3.4 Threatened species

Although no threatened species were collected during this survey, the putative new species of *Coxiella* is of interest as it is known to contain short-range endemic (SRE) species (Lawrie et. al. 2023). From the limited sampling on this survey, *Coxiella* was restricted to a small pocket in the north-east section of Lake Miranda.

3.5 Range extensions

| Species | Location sighted/observed | Distance from nearest known record (km) | Comments |
|--|--|---|--|
| <i>Coxiella</i> aff. <i>gilesi</i> n.sp. | Lake Miranda | 98 | Significant Infill. First record for Lake Miranda. Nearest museum record for <i>Coxiella</i> (WAMS73465) is 98km northward |
| <i>Gastrocopta</i> cf. <i>margaretae</i> (J. C. Cox, 1868) | Logan Spring | 50 | Infill. Nearest museum record for this species (WAMS60350) is 50km eastward |
| <i>Isidorella</i> cf. <i>newcombi</i> (A. Adams & Angas, 1864) | Dingo Pool Lower; Dingo Pool Upper; Albion Downs; Daisy Pool | 58 | Significant Infill. Nearest museum record for <i>Isidorella</i> (SAMD60231) is 58km northward |
| <i>Ferrissia</i> sp. | Dingo Pool Lower | 538 | Significant range extension. Nearest museum record for <i>Ferrissia</i> (AMC406741) is 538km northward |
| <i>Pupoides</i> cf. <i>myoporinae</i> (Tate, 1880) | Lake Miranda; Lake Mason East | 75 | Significant Infill. Nearest museum record for this species (WAMS83203) is 75km eastward |

3.6 Genetic information

All live-taken specimens were subsampled and/or preserved in 100% ethanol, and these are suitable for genetic work in the future. A total of 19 lots are available, comprising 76 specimens.

4. Information on species lists

All non-marine molluscs collected during this survey are regarded as native. The freshwater genera *Isidorella* and *Ferrissia* require taxonomic revision (Ponder et. al. 2023). The low diversity of terrestrial molluscs is not unexpected given the arid inland location.

5. Information for land managers

Many localities were not examined during this survey because of time or access limitations. For those that were sampled, habitat disturbance, presumably by cattle, was noted at most sites outside of the Wanjarrri NR. At one site, Logan Spring, exotic paddy melons were seen.

It would be advantageous to better protect those sites associated with high shade and moisture from exotic animals and vegetation, to help in the conservation of non-marine molluscs and associated flora and fauna.

6. Other significant findings

Opportunistic collecting of Crustacean specimens was also undertaken by the senior author, and later identified by Dr. Andrew Hosie, Western Australian Museum. Dry clam shrimps collected from Lake Miranda, Dingo Pool Lower and Daisy Pool were identified as family Cyzicidae, the latter two locations to genus *Ozestheria*. An Isopod collected from the southern end of Boolygoo Range was identified as genus *Buddelundia* and might be undescribed.

7. Conclusions

Despite the arid geographic location of the survey, 10 sites yielded non-marine molluscs. Five native taxa were found comprising the aquatic families Planorbidae and Tomichiidae; and the terrestrial families Gastrocoptidae and Pupillidae.

Whilst the diversity of non-marine molluscs was low, there were significant collections, some which may be new species. It was surprising to encounter so many live populations of freshwater snails, likely the result of relatively recent rainfall. This includes the collection of the tiny freshwater limpet *Ferrissia* sp., which was a significant range extension for the genus and may prove to be un-named. A significant discovery was the first record of the salt-lake snail *Coxiella* from Lake Miranda and could be un-named. This discovery is somewhat surprising given the size of the lake and likely historical surveys associated with mining activities. The minute *Gastrocopta* cf. *margaretae* was only collected from one site, in the shaded, deep leaf litter of Logan Springs. These habitats are favourable for land snails, but were sparingly encountered on this survey, emphasizing the importance of such locations for conservation management.

These collections reinforce that when a suitable habitat is encountered across the dry Tjiwarl Determination Area, non-marine molluscs do exist, some unique to the area. Given time and access restraints, not all topographic features were sampled or sampled thoroughly during this survey. It is recommended that future collecting for molluscs concentrate on litho-refugial areas that exhibit high shade, high leaf litter and moisture retention.

Results from this survey has enhanced the biodiversity knowledge of Tjiwarl Country. The collection of potentially undescribed species achieved the “species discovery” objective of the Bush Blitz program and follow-up work through the WA Museum will aim to formally describe the species in consultation with project partners.

Acknowledgements

We are particularly grateful to the Bush Blitz Team, especially Jo Harding, Kate Grarock and Helen Cross. We thank the Tjiwarl Aboriginal Corporation for providing access to the Tjiwarl Determination Area and providing valuable knowledge about country. It was a pleasure to work with our Tjiwarl hosts and hope the findings are mutually beneficial. We appreciate the sponsorship and accommodation provided by BHP and enjoyed working with their employees

in the field. We also thank Winston Ponder, Angus Lawrie and Michael Klunzinger for advice on mollusc identifications.

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Appendices

Appendix 1. List of Non-Marine Molluscs recorded during the Wudjari Country Bush Blitz

| Family | Species | Common name | Putative new species | Threatened (EPBC Act) | Threatened (State /Territory Act) | Exotic /pest |
|----------------|---|------------------------------|----------------------|-----------------------|-----------------------------------|--------------|
| GASTROCOPTIDAE | <i>Gastrocopta cf. margaretae</i> (J. C. Cox, 1868) | Margaret's Pupasnail | No | No | No | No |
| PLANORBIDAE | <i>Ferrissia</i> sp. | Freshwater Limpet | Yes | No | No | No |
| PLANORBIDAE | <i>Isidorella cf. newcombi</i> (A. Adams & Angas, 1864) | Newcombs Pouch Snail | No | No | No | No |
| PUPILLIDAE | <i>Pupoides cf. myoporinae</i> (Tate, 1880) | Southern Sinistral Pupasnail | No | No | No | No |
| TOMICHIIDAE | <i>Coxiella</i> aff. <i>gilesi</i> n.sp. | Salt Lake Snail | Yes | No | No | No |