



# Wilinggin-Charnley River Bush Blitz

## *Molluscs*

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*We thank the Ngarinyin people for opportunity to work together on country to improve biodiversity knowledge of lands and waters*

Nomenclature and taxonomy used in this report is consistent with:

The Australian Faunal Directory (AFD)

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

Lucid Key to Australian Freshwater Molluscs

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

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## List of contributors

List of contributors to this report.			
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<b>Corey Whisson</b>	<b>Western Australian Museum</b>	<b>Mollusc expert, especially land snails</b>	<b>Land snail identifications in the lab, final preservation of land snails with curation of samples upon return from field, database management and report contribution</b>
<b>Winston Ponder</b>	<b>Curator Emeritus, Australian Museum</b>	<b>Mollusc expert, with a current focus on Australian freshwater snails</b>	<b>Review of collections at WAM from the expedition as final ID</b>
<b>Michael Klunzinger</b>	<b>Western Australian Museum Research Associate and post doctoral fellow at Griffiths University</b>	<b>Mollusc expert, especially freshwater mussels</b>	<b>Freshwater mussel confirmation of IDs and report contribution</b>



Assistance from scientist Dr. Karen Young (AWC) (left) and teacher Sarah Lacey (Earthwatch) (right) enabled this important rediscovery of *Stimulator consetti* in Western Australia.

## Abstract

One hundred and seven lots of freshwater and terrestrial molluscs were collected on the expedition, primarily gastropods. Highlights include rediscovery of the Australian endemic freshwater limpet genus *Stimulator consetti* not sampled near the type locality since it was first described by Tom Iredale in 1944. Nothing is known of its biology or life history so samples from three populations will enable redescription of the species and genetic and morphological comparison with another Australian limpet in the genus *Ferrissia*. Sampling of two live specimens of two species of northern Australian freshwater mussel *Velesunio* cf. *wilsonii* and *V. cf. angasi* from Dalmanyi or Bell Gorge over the course of fieldwork was notable. These mussels can be especially difficult to sample live as they can be cryptic and difficult to locate in freshwater river and creek systems. *Velesunio* cf. *wilsonii* is known from the Kimberley, coastal and inland Queensland and northeast parts of South Australia, ranging across to northern NSW, recent records are sparse. The other freshwater mussel species, *Lortiella froggatti* was a notable regional endemic, found only in the Western Kimberley and north-east corner of the Pilbara region and nowhere else. Post-survey processing of leaf litter samples collected from a rich vine thicket site revealed many live-collected miniscule land snail species, as well as juveniles of larger bodied species. Land snail biodiversity documented at this special site totaled thirteen species and this is an excellent outcome given the dry conditions encountered during the survey. Outcomes of this expedition were especially significant for the freshwater malacofauna, with individuals of *Thiara australis*, *Notopala ampullaroides* and *Bullastra vinosa* sampled. These live collected animals are significant as some will be utilised in broader phylogeographic studies to determine if putative widespread species inferred to be highly connected are instead comprised of more regionally structured and potentially cryptic species.



*Thiara australis* live collected from sandy sediments in large river systems on the Bush Blitz (left) and Hayley Ricardo (DBCA) (right) collecting samples from a Charnley River site on 20 July 2022.

## 1. Introduction

This Bush Blitz expedition covered complex terrain and an enormous total area of Western Australia's central Kimberley plateau region on Wilinggin Country. The areas visited are operated by a number of different groups, which were involved in the incredible fieldwork, and these are: 1) Charnley River-Artesian Range Wildlife Sanctuary, managed by Australian Wildlife Conservancy (AWC). The Base Camp was situated at the Charnley River homestead



area, 2) Parts of the Wilinggin Indigenous Protected Area that wrap around the western, northern and eastern boundaries of the Sanctuary, managed by Wilinggin Aboriginal Corporation (Wilinggin AC) and 3) Wunaamin Conservation Park, managed by WA Parks and Wildlife Service which is part of the WA Department of Biodiversity, Conservation and Attractions (DBCA).

Mollusc research in the area was moderately extensive for land snails, with a total of 77 registered lots in the WAM Collection. These collections comprised macro and micro landsnails, predominantly found by Vince Kessner during the 1987 Kimberley Rainforest Survey (Solem 1991), and more recently (2010) during a DBCA Kimberley Islands Project.

Mollusc research in the area was less well known for freshwater molluscs, including mussels and snails. Freshwater molluscs have only been studied incidentally with nothing comprehensive completed, as has been conducted recently for the Daly River (Willan and Kessner, 2021). For *Velesunio cf. wilsonii*, for example, 21 records were present in the WA Museum collections prior to this expedition and of these, 19 were live-taken, with the last record from over 28 years ago, during a 1995 Pilbara Biological Survey. Of these records, approximately half are from the Pilbara and half from the Kimberley.

Impacts via a number of threatening processes of relevance to the malacofauna in the greater area are extensive (e.g. Walker et al. 2014). For example, Charnley Station and surrounds have been subject to impacts from cattle, feral pigs and cats and cane toads with frequent wildfires prior to active management by AWC. Except for isolated rugged refugial rainforest areas, Charnley currently does not support the same high level of wildlife richness and abundance relative to the Artesian Range and other parts of the north-west Kimberley. These impacts were notable at several sites, including Standard Survey Sites.

Dry conditions leading up to the expedition while necessary for freshwater sampling, made locating live land snails challenging. While land snails have been the focus of a number of collecting expeditions over the last several decades, much less is known about the freshwater molluscs in the area. The lack of a comprehensive baseline is especially relevant given a drying climate. This expedition with a focus on freshwater drainages for fish survey thus represented an excellent opportunity to focus on the freshwater mollusc faunal component to achieve a more comprehensive understanding of the total malacofauna and to discover new species, report on new records and infill distributional records for existing species and monitor for pest species, which fulfils the aim of the activity. This report summarises the results of a two-week targeted survey of molluscs in the Wilinggin-West Kimberley area, with emphasis on freshwater molluscs in gorges, gullies and streams.



*Notopala ampullaroides* live collected in large river systems on the Bush Blitz (left) and Lisa Kirkendale (WAM) (right) collecting samples from a Charnley River site on 27 July 2022.

## 2. Methods

### 2.1 Site selection

Sampling sites were generally chosen in collaboration with the Fish team for freshwater sites and were distributed at different drainages across the landscape. Sites were chosen to represent larger gorge systems as well as smaller tributaries and creeks. Similarly, terrestrial sites were chosen in tandem with other land-based faunal teams, such as the arachnology team, with a focus on rainforest gullies and areas that retained moisture in the dry season. Site locations were partly determined by accessibility via 4WD or helicopter and OHS requirements.

### 2.2 Survey techniques

#### Field

Molluscs were sampled by several methods. The first method of sampling was targeted hand collection via rock turning and litter flipping both at terrestrial and freshwater sites. Careful inspection of the underside of rocks and/or the underside of dead leaves using a hand lens or light was important. Specimens were plucked from the rocks or leaves by forceps into vials and kept alive. This allowed collection of small cryptic species as well as larger species. The second method was indirect and involved collecting leaf litter into calico bags for later sorting back at the WA Museum.

#### Laboratory

Macromolluscs were sorted, provisionally identified, labelled, imaged, and preserved in 70 or 100% ethanol and/or formalin (with tissue subsamples in 100% ethanol), and placed in field plastics then packed for transport. Data was entered into field notebook that were later transcribed into a database input form, and imported into the main database at WAM.



Microscopic freshwater snails from the genus *Gyraulus* sampled during the Bush Blitz at various sites.

#### 2.2.1 Methods used at standard survey sites

Sampling at standard survey sites was led by terrestrial teams. Conditions were quite dry at chosen sites and were also disturbed with evidence of cattle trampling. See 2.2 above for terrestrial snail collection methods.

## 2.3 Identifying the collections

Identification of vouchered specimens was made by survey participants, initially in the field and then all retained vouchers were identified in the laboratory by the authors, using the preserved specimens or dead dried specimens, microscopes, fresh colour photographs, available literature and museum collections. Primary literature sources included Stanisic et al. 2018 (land snails) and Lucid Key to Australian Freshwater molluscs for freshwater fauna (Ponder et al. 2023)), supplemented with additional resources (McMichael & Hiscock, 1958; Brown 1981, 2001; Stoddart et al. 1982; Smith 1992; Glaubrecht et al. 2009; Braby et al. 2011; Köhler et al. 2012)..



Sampling site at Dalmanyi or Bell Gorge main pool where freshwater mussels and a population of *Corbicula australis* were found.

## 3. Results and Discussion

Appendix 1 lists all molluscs recorded during the Bush Blitz. Collections made during this Bush Blitz will result in 107 lots being added to public collections and all of these records added to publicly accessible databases, specifically Atlas of Living Australia.

The land snail collecting during this survey yielded 15 taxa across 48 lots, taking the total number of registered land snails in the WAM collection to 127 lots from this area. Over a third of these total records are now from this survey. Many of the land snail species recorded during this survey were non-camaenid snails, recorded previously from the area (Kohler et al 2012).

Many taxa or species recorded during this survey were represented by only a few records from the area on ALA or in Koehler et al. (2012), and not recorded in the WAM database. This included the micro land snails *Kaliella microconus* (WAM S112349); an unidentified *Pupisoma* (WAM S112348); *Gastrocopta* cf. *macdonnelli* (WAM S112321); *Gastrocopta* cf. *pediculus* (WAM S112325) and an unidentified *Gastrocopta* (WAM S112303). It also included the macro land snails, an unidentified *Setobaudinia* species (WAM S112337); an unidentified *Rhagada* (WAM S112311) and an unidentified *Globorhagada* (WAM S112312). The latter two taxa were taken from the Artesian Hut location and may prove significant with further work. The presence of shells indicates a live population should be in the vicinity. The collection of live material is best conducted during the wet season when snails are active and not aestivating.

### 3.1 Un-named or not formalised taxa

Some specimens were only collected as shell fragments so full identification was not possible, especially as key characters were missing (e.g., hinge in freshwater mussels). Other taxa are in a state of taxonomic flux with species level revisionary work required in some freshwater gastropods. Some land snails are challenging to identify and will require more study for definitive identification.

<b>Taxon</b>	<b>Comment</b>
Hyriidae incertae sedis	Cannot measure shell fragments and no hinge teeth present, so cannot determine taxon.
<i>Gastrocopta</i> cf. <i>macdonnelli</i>	
<i>Gastrocopta</i> cf. <i>pediculus</i>	
<i>Gastrocopta</i> sp.	
<i>Setobaudinia</i> sp.	
<i>Rhagada</i> sp.	
<i>Globorhagada</i> sp.	
<i>Amplirhagada</i> cf. <i>carinata</i>	
<i>Gyraulus</i> sp.	
<i>Pupisoma</i> sp.	

### 3.2 Putative new species (new to science)

<b>Species</b>	<b>Comment</b>
<i>Rhagada</i> sp.	The <i>Rhagada</i> specimen could not be confidently assigned to any named species. Very few records of <i>Rhagada</i> exist within the Charney River Private NR and surrounds. Given the short-range endemism of this macro land snail genus, the species may prove new to science

### 3.3 Exotic and pest species

No exotic or pest molluscan species were collected or observed during the Bush Blitz.

### 3.4 Threatened species

No threatened molluscan species were collected or observed during the Bush Blitz.

### 3.5 Range extensions

<b>Species</b>	<b>Location sighted/observed</b>	<b>Distance from nearest known record (km)</b>	<b>Comments</b>
<i>Lortiella froggatti</i>	Isdell River, F-18B, 16.5678°S; 124.92744°E		New record for Isdell River 26/07/2022. Recorded previously from Lennard and Fitzroy Rivers.
<i>Corbicula australis</i>	Charnley River, 16.337618°S; 125.265404°E		New record for Charnley River, 20/07/2022



### 3.6 Genetic information- potential for future study

The Bush Blitz expedition samples represent the first sampled of *Velesunio* from the Dalmanyi or Bell Gorge collected by and deposited in the WA Museum collections. The only other collections made in Dalmanyi or Bell Gorge are from 1989 (likely not genetic friendly) and deposited at the Australian Museum (AM) for *V. wilsonii*. Sparse additional populations exist in AM collections from a nearby drainage (e.g., 45 km west of Lennard River crossing along Gibb River Rd from 2003 in 95% alcohol/live collected). These are the most recently collected samples from the greater area after Bush Blitz material. The exciting aspect of recent live collected samples are that they can be used in genetic, specifically phylogeographic, analyses. What becomes evident when you examine existing samples of this species in Western Australia is a clear divide between Pilbara and Kimberley (see map right). Whether this is indicative of geographic structuring within a single wide-ranging species or cryptic speciation remains to be tested.



However, as a large study of the Hyriidae is underway, with sampling from Pilbara populations completed, it will be quite straightforward to test this hypothesis with existing samples from the Bush Blitz expedition as well as AM material from Lennard River.



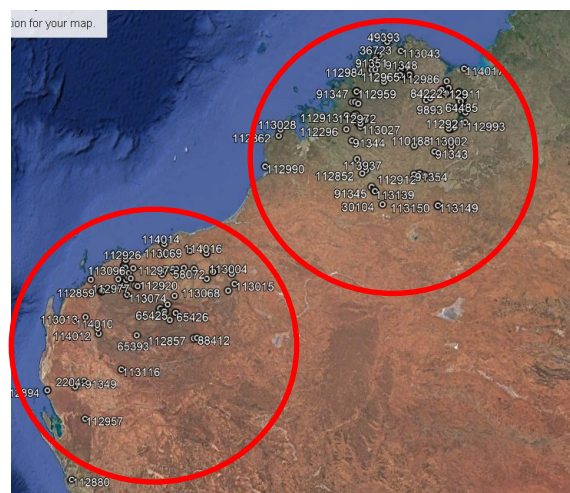
*Velesunio* specimen hand collected via snorkel in 0.5 m during the BushBlitz from Dalmanyi or Bell Gorge. Both *V. cf. wilsonii* and *V. cf. angasi* were collected from this site and a juvenile specimen was also observed (but not collected) indicating different cohorts are present.

*Bullastra vinosa* records in the WA Museum total 201, with 144 live taken and 57 dead taken records. While *B. vinosa* is a widespread top end species, with potential for unappreciated phylogeographic structure from east in the Kimberley to west in northern Queensland, in WA it also extends to the Pilbara. *B. vinosa* shows a similar pattern as reported above for *V. cf. wilsonii* and *V. cf. angasi* with a pronounced biogeographic break between the Kimberley and the Pilbara regions. Whether this is indicative of geographic structuring within a single wide-ranging species or cryptic speciation remains to be tested.



*Bullastra vinosa* on a floating dead *Pandanus* leaf (left). The species was live collected from a wide range of freshwater habitats, including medium sized pools above waterfalls on the Bush Blitz (Lisa Kirkendale (WAM) collecting samples from a Charnley River site on 27 July 2022). Photo (above right) by Dr. Karen Young (AWC). Map (below, right) showing two non-overlapping specimen records of *B. vinosa*.

Existing WAM collections consisted of largely dry material, or when wet (live-taken), were generally singletons that were preserved appropriately for genetic work. Material from this survey increased the number of lots available for genetic work across many macro land snail species: *Eremopeas interioris* (n=1); *Amplirhagada cf. carinata* (n=12) and *Pleuropoma walkeri* (n=6). For some species, this survey provided the first genetic material from the area: *Gastrocopta cf. macdonnelli* (n=1); cf. *Setobaudinia* sp. (n=1); unidentified *Gastrocopta* (n=1) and *Westracystis lissus* (n=5).







*Amplirhagada cf. carinata* juvenile collected from Charnley River site A6 during the Bush Blitz. Like, *Pleuropoma walkeri*, it was a common macromolluscan species found at this site.

Overall, tissue samples were taken from selected molluscs. Some will be used to aid in identification and for large scale phylogenetic and phylogeographic work on certain groups. All samples were preserved (100% ethanol preservation of a tissue sample or entire voucher) to facilitate genetic work in the future.

#### **4. Information on species lists**

Please see attached species lists for breakdown of taxonomic trends for species sampled.

#### **5. Information for land managers**

##### *Wilinggin Aboriginal Corporation*

Throughout large drainages of surveyed freshwater areas *Thiara australis* and *Notopala ampullaroides* are expected to be present. Additionally, in lower flow ephemeral ponds adjacent to large drainages populations of *Bullastra vinosa* in vegetated areas, but also *Corbicula australis* in rocky (gorge) areas are expected. Freshwater mussels are expected to be alive and living near to where dead shells were located, although transport in large drainages and gorges is expected.

##### *Charnley River-Artesian Range Wildlife Sanctuary*

Areas around the campsite, especially near the roads, were highly disturbed with evidence of cattle trampling sensitive flora.

##### *Wunaamin Conservation Park- Dalmanyi Bell Gorge also Silent Grove (SS1)*

The standard survey sites were highly disturbed with evidence of cattle trampling sensitive flora.

The areas surveyed around Dalmanyi or Bell Gorge held two live collected species of freshwater mussel (*Velesunio cf. angasi* and *V. cf. wilsonii*) and a live collected clam, *Corbicula australis*.



*Corbicula australis* from Charnley River site (left) approx. 1 cm and from Dalmanyi or Bell Gorge (right) approx...3 cm.

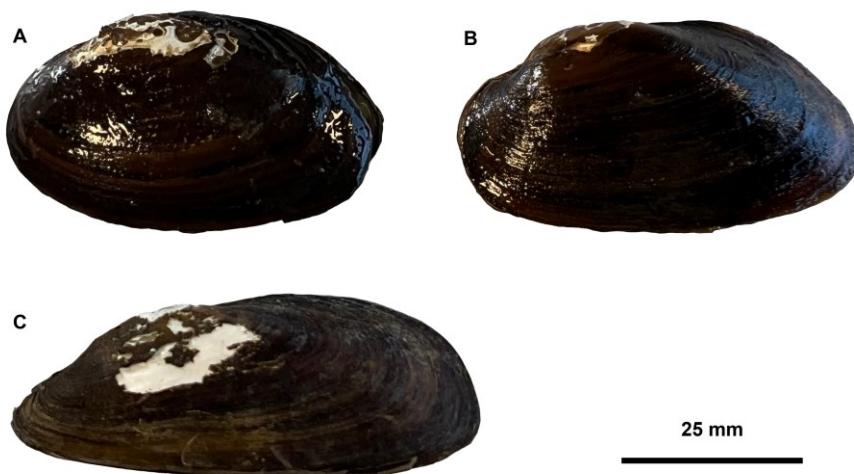
## 6. Other significant findings

The importance of collecting leaf litter in the dry at vine thicket sites cannot be underestimated for insight into wet season biodiversity. Post-survey processing of leaf litter samples collected from a rich vine thicket site revealed many live-collected miniscule land snail species. Even if processing is not possible during the course of fieldwork, review of collections post survey can indicate otherwise undocumented diversity.

Another significant aspect of this work is that even if many species are already known from the general area, they might not have been collected for some time. These new ‘chrono-records’ are critical components of the fieldwork conducted by survey teams and supported by Bush Blitz and might be underappreciated. Additionally, some shelled mollusc specimens may have never been collected live before. These new live records are highly important as they indicate species have lived in the exact location where the record was found. This is a different type of record, from dead/empty shells that can be transported either by birds or by water (e.g. in the wet). They enable future study utilizing genetic methods not possible with dry shell records.

## 7. Conclusions

This expedition drew on an enormous area and revealed significant molluscan finds at a dry time of year. Of the over one hundred lots collected, highlights include the recency of these collections, given that previous expeditions have not taken place for several decades. The impact of the samples is certainly that live collected material is now available for genetic work and will be integrated



The three freshwater mussel species captured during the Willingin-Charnley River Bush Blitz Expedition. A) *Velesunio cf. angasi*, B) *Velesunio cf. wilsonii*, C) *Lortiella froggatti*



into current and future phylogeographic studies to test species boundaries. The rediscovery of the Australian endemic freshwater limpet genus *Stimulator consetti* not sampled near the type locality since it was first described by Iredale in 1944 was the most important find. These samples will be immediately integrated into an ongoing study of freshwater limpets in the family Ancyliidae. Dalmanyi or Bell Gorge was sampled and yielded two species of freshwater mussel, *Velesunio cf. angasi* and *V. cf. wilsonii*, as well as the juveniles of the freshwater bivalve *Corbicula australis*, extending range in the area for the latter species considerably. The collection of the freshwater mussel *Lortiella froggatti* also represents a considerable range extension, although not surprising given a record of the species from upper Walcott Inlet exists in Australian Museum collections, a site receiving drainage from Isdell (Charnley) River where the species was found during this expedition. Post-survey processing of leaf litter samples collected from a rich vine thicket site revealed many live-collected miniscule land snail species, including putative new species of *Pupisoma*. Land snail biodiversity documented at this special site totaled thirteen species and this is an excellent outcome given the dry conditions encountered during the survey. Live individuals of *Thiara australis*, *Notopala ampullaroides* and *Bullastra vinosa* will be utilized in broader phylogeographic studies to determine if putative widespread species are instead comprised of more regionally structured and potentially cryptic species. There is still much more research to do to in this rich and heterogeneous area, with so many different habitat types. Distribution ranges of freshwater mollusc species in the Kimberley and Pilbara regions are largely deficient in data and this expedition was clearly beneficial for uncovering regionally endemic species, including freshwater molluscs, highlighted here. More expeditions like this one will continue to benefit our understanding of Australia's unique array of plants and animals.

## Acknowledgements

We are extremely grateful to Bush Blitz, specifically Jo Harding, Kate Gillespie, Helen Cross and Courtney Webber for organizing this expedition and Robbie for keeping us well fed. We would like to recognize the role of Earthwatch Australia and Dr. Sabrina Trocini for general interest and lining up classroom experiences as well as the teachers who contributed to fieldwork, interest and outreach. LK would like to especially mention Sarah Lacey, teacher extraordinaire, who helped find new populations of *Stimulator consetti*. To Australian Wildlife Conservancy for their companionship and local expertise, LK would like to recognize Dr. Karen Young who helped find new populations *Stimulator consetti* and search for other species. The Department of Biodiversity and Conservation were incredible field biologists and shared their local experience with us, LK would like to thank Hayley Riccardo for assistance collecting mollusc samples from amazing Charnley River gorge sites. The expedition field sites across such an enormous landscape and challenging terrain would not have been possible without the incredible helicopter support we received. Thank you to BHP for their ongoing corporate support. Working on country with Traditional owners, Rangers and community is such a gift and we would like to recognize the skill and guidance of Wilinggin peoples during the course of this fieldwork. We are enormously grateful for this opportunity and to work with Traditional owners on country to improve estimates of Western Australia's biodiversity.

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Appendix 1. List of molluscs recorded during the Wilinggin-Charnley River Bush Blitz					
<b>Terrestrial snails</b>					
Family	Species	Putative new species	Threatened (EPBC Act)	Threatened (State/Territory)	Exotic/pest
Achatinidae	<i>Erelopeas interioris</i>	No	No	No	No
Camaenidae	<i>Amplirhagada cf. carinata</i>	No	No	No	No
Camaenidae	<i>cf. Globorhagada sp.</i>	No	No	No	No
Camaenidae	<i>cf. Rhagada sp.</i>	Yes	No	No	No
Camaenidae	<i>cf. Setobaudinia sp.</i>	No	No	No	No
Chronidae	<i>Kaliella microconus</i>	No	No	No	No
Gastrocoptidae	<i>Gastrocopta cf. macdonnelli</i>	No	No	No	No
Gastrocoptidae	<i>Gastrocopta cf. pediculus</i>	No	No	No	No
Gastrocoptidae	<i>Gastrocopta sp.</i>	No	No	No	No
Gastrocoptidae	<i>Pumilicopta kessneri</i>	No	No	No	No
Helicarionidae	<i>Westracystis lissus</i>	No	No	No	No
Helicinidae	<i>Pleuropoma walkeri</i>	No	No	No	No
Helicodiscidae	<i>Stenopylis coarctata</i>	No	No	No	
Pupillidae	<i>Pupoides pacificus</i>	No	No	No	
Valloniidae	<i>Pupisoma sp.</i>	No	No	No	No
<b>Freshwater snails</b>					
Family	Species	Putative new species	Threatened (EPBC Act)	Threatened (State/Territory Act)	Exotic/pest
Thiaridae	<i>Thiara australis</i>	No	No	No	
Viviparidae	<i>Notopala ampullaroides</i>	No	No	No	No
Lymnaeidae	<i>Bullastra vinosa</i>	No	No	No	
Planorbidae	<i>Bayardella johni</i>	No	No	No	No
Planorbidae	<i>Bayardella sp.</i>	No	No	No	No
Planorbidae	<i>Glyptophysa novaehollandica</i>	No	No	No	No
Planorbidae	<i>Gyraulus sp.</i>	No	No	No	No



Family	Species	Putative new species	Threatened (EPBC Act)	Threatened (State/Territory)	Exotic/pest
Planorbidae	<i>Stimulator consetti</i>	No	No	No	No
Planorbidae	<i>Ferrissia petterdi</i>	No	No	No	No
<b>Freshwater bivalves</b>					
Family	Species	Putative new species	Threatened (EPBC Act)	Threatened (State/Territory Act)	Exotic/pest
Cyrenidae	<i>Corbicula cf. australis</i>	No	No	No	No
Hyriidae	<i>Lortiella froggatti</i>	No	No	No	No
Hyriidae	<i>Velesunio cf. wilsonii</i>	No	No	No	No
Hyriidae	<i>Velesunio cf. angasi</i>	No	No	No	No