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New species of *Laetmonice* (Aphroditidae, Annelida) from bathyal and abyssal depths around Australia

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Abstract. Research voyages on board RV *'Investigator'* between 2015 and 2022 sampled benthic communities of Australia's Eastern and Southern continental margins from the slope down to abyssal depths (463–5000 m) as well as the seamounts off the Australian Indian Ocean Territories (IOT) that include Christmas Island and Cocos (Keeling) Islands. Over 500 specimens of the annelid family Aphroditidae were collected during the voyages. Some of the most common aphroditids collected during these voyages belonged to the large-bodied members of the genus *Laetmonice*. We used fragments of *COI* and *16S* genes to investigate the diversity of the genus. Phylogenetic studies revealed the presence of at least nine distinct mitochondrial genetic lineages within *Laetmonice*, four of which have been described here as *Laetmonice hutchingsae* sp. nov., *L. murrayae* sp. nov., *L. mensahaedorum* sp. nov. and *L. paxtonae* sp. nov. The new taxa are clearly structured by their bathymetric distributions. These results argue against eurybathic distribution within the genus *Laetmonice* and demonstrate the existence of genetically divergent taxa isolated by bathymetric environmental gradients.

Introduction

Biological communities of the continental slope, abyssal plains and seamounts around Australia have recently been rigorously sampled for the first time, investigations made possible by the commissioning of the Australian research vessel (RV) *Investigator* in late 2014. Voyages conducted between 2015 and 2022 examined patterns of deep-sea biodiversity in the Great Australian Bight, seamounts off Tasmania, Commonwealth Marine Reserves (CMR) of the Eastern Australian Abyss, Australia's Indian Ocean Territories (Christmas Island and Cocos (Keeling) Island Marine Parks), and most recently, Gascoyne Marine Park off Western Australia. Of particular interest in terms of species diversity and abundance of discovered macroinvertebrates were the "Sampling the abyss" expedition that examined the lower slope and abyss of Australia's eastern margin from off mid-Tasmania (42°S) to the Coral Sea (23°S) (O'Hara *et al.*, 2020) and "Investigating the IOT" expedition that studied remote western Indian Ocean localities in the new Christmas Island and Cocos (Keeling) Island Marine Parks.

Polychaetes constitute a macrobenthic group of great abundance and diversity in all marine ecosystems and are typically a dominant macrofauna in deep-sea soft sediments (Herring, 2010; Rex & Etter, 2010). Polychaetes have been well represented in the samples collected during the expeditions cited above: in total, over 6000 specimens were collected during the 2017 expedition (Gunton *et al*., 2021) and 463 during the 2021 and 2022 expeditions.

Keywords: scale worms, bathymetric distribution, seamounts
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Among the most abundant polychaete taxa collected were scale worms of the family Aphroditidae. These animals have been sampled in abundance across a wide bathymetric and geographical range, likely because they are easily caught in both trawls and grabs on account of their often large (up to 7 cm long) body size (Gunton *et al*., 2021).

Collectively known by the common name "scale worms", the order Aphrodytiformia is characterised by the shared presence of distinct dorsal elytra (scales), and is comprised of six families: Acoetidae, Aphroditidae, Eulepethidae, Iphionidae, Polynoidae, and Sigalionidae (Gonzalez *et al*., 2018). These animals are abundant and diverse at all depths from the intertidal to the abyss and constitute an important component of deep-sea communities (Wiklund *et al*., 2005; Norlinder *et al.*, 2012).

Members of the family Aphroditidae are typically large and highly conspicuous annelids that are predominantly found in deep-water environments. The family is comprised of seven genera including *Aphrodita* Linnaeus, 1758; *Aphrogenia* Kinberg, 1856; *Hermionopsis* Seidler, 1923; *Heteraphrodita* Pettibone, 1966; *Laetmonice* Kinberg, 1856; *Palmyra* Savigny, 1818; and *Pontogenia* Claparède, 1868. Aphroditidae is monophyletic based on molecular data (Wiklund *et al*., 2005, Gonzalez *et al*., 2018) and its monophyly is supported by morphological features, such as felt-like dorsal chaetae (absent in *Palmyra*) and the presence of stalked eyes (Norlinder *et al*., 2012). However, the family is poorly known and has not been revised since it was erected by Malmgren (1867).

The genus *Laetmonice* is characterised by having distally tapering harpoon notochaetae with several recurved fangs on distal margins (Wu *et al*., 2021). All species of *Laetmonice* possess simple acicular notochaetae, which vary along the body. The genus has been poorly studied; of its 28 species currently considered valid, nine were described before 1900, 16 between 1900 and 2000 and only two (*Laetmonice tunicata* Barnich, Beuck & Freiwald, 2013 from Gulf of Mexico and *L. iocasica* Wu, Hutchings, Murray & Xu, 2021 from Caroline Ridge in the tropical Western Pacific) have been described since 2000.

In Australia, the family Aphroditidae was studied by Hutchings and McRae (1993) who provide a key to 13 Indo-Pacific (mostly Indonesian) species of *Laetmonice*, including six species up to date reported as occurring in Australian waters. These include three subtidal species from northern Australia: *Laetmonice brachyceras* (Haswell, 1883) and *L. dolichoceras* (Haswell, 1883) with type locality in Queensland, as well as *L. moluccana* (Horst, 1916), the only species of *Laetmonice* reported from both the Indonesian Archipelago and Australia. Hutchings and McRae (1993) further described two species from southern Australia, *Laetmonice wonda* with type locality in Western Australia (256–283 m) and *L. yarramba* with the type locality in Botany Bay, New South Wales (60–102 m).

Laetmonice producta Grube, 1877 was originally described from sub-Antarctic Kerguelen Islands, but subsequently McIntosh (1885, 1900) described four varieties within the nominal species ranging from the Azores to Antarctic waters. Horst (1917) suggests that because *L. producta* has a wide geographical distribution and is found at different depths, existence of several varieties is not surprising. Hutchings and McRae (1993) who reported nominal *L. producta* from South-east Australia (Sandy Cape, Tasmania to Broken Bay, NSW) in 457–2486 m depth, suggested that if varieties from elsewhere in the nominal range were examined in detail they would be found to belong to separate species.

Wu *et al.* (2021) evaluated the taxonomic status of the species *Laetmonice producta* and its varieties and subspecies, which were recorded in the Indian, Pacific, Atlantic, and Southern Oceans. The authors concluded that although their newly described *L. iocasica* closely resembles *L. producta sensu* Hutchings and McRae (1993), they belong to separate species due to their distinct distribution, habitats and the genetic distance of the mitochondrial cytochrome oxidase I (*COI*) sequences. Wu *et al.* (2021) agree with Hartman (1959, 1965) that distribution of *Laetmonice producta* is probably restricted to the Southern Ocean and the Antarctic and thus, *L. producta sensu* Hutchings and McRae (1993) is likely to be an undescribed species.

All specimens in this study were tentatively identified on board as *Laetmonice yarramba* Hutchings & McRae, 1993. Subsequent following of the morphology key in Hutchings and McRae (1993) agrees with this placement, except for AM W.53419, AM W.54522 and AM W.54523, whose morphology more closely follow *L. wonda*. *Laetmonice yarramba* type material was described from coastal Sydney and Lake Macquarie, NSW at depths from 60–146 m, with additional material from off Sydney as well as Shark Bay, WA at depths from 130–523 m. Thus, it is unlikely that the newly collected specimens from such a wide bathymetric and geographic distribution spanning over the Southern, Pacific and Indian Oceans (Fig. 1), belong to *L. yarramba*. This study analyses these samples of *Laetmonice* collected from Australian waters at depths 400–5000 m. The aims of this study were to investigate genetic and morphological variability between *Laetmonice* specimens recently collected in Australia, and to describe any new species found to be present.

Material and methods

Sample collection

Samples of *Laetmonice* were collected during eight surveys by research staff on board the RV *Investigator* in 2015–2022, using 4 m beam trawl (CSIRO, 2017a, 2017b, 2018a, 2018b, 2019, 2022, 2023; Fig. 1) from the Great Australian Bight (GAB), Bass Strait, Tasmania, the East and West Australian continental margin and abyss, and the seamounts off the Indian Ocean Territories at depths 463–5000 m. Two surveys formed part of the Great Australian Bight Deep-Water Geological and Benthic Ecology Program (IN2015_C01; CSIRO, 2017a and IN2017_C01; CSIRO, 2018a), one survey was part of the Great Australian Bight Deep-Water Pelagic and Benthic Ecosystem Study (IN2015_C02; CSIRO, 2017b). The 'Sampling the Abyss' voyage (IN2017_V03; CSIRO, 2018b) was supported by the Marine National Facility, CSIRO and Museums Victoria, 'Seamount coral survey' by the Marine National Facility and CSIRO (IN2018_V06; CSIRO, 2019), two voyages "Investigating the Australia's Indian Ocean Territories" (IN2021_V04 and IN2022_V08; CSIRO, 2022) by the Marine National Facility, CSIRO, Bush Blitz, Museums Victoria, and the voyage "Valuing Australia's new Gascoyne Marine Park" (IN2022_V09; CSIRO 2023) by the Marine National Facility, CSIRO and Western Australia Museum.

Substrate and larger specimens from each catch were transferred to the wet laboratory on board in containers filled with chilled seawater (5°C) and material was roughly sorted on seawater ice into higher taxonomic categories. Larger clumps of substrate were broken with a hammer, and smaller animals were picked from the pieces. Selected specimens were photographed. Prior to fixation, all specimens were registered and assigned labels with operation and accession numbers. The majority of the catch was preserved in 95% ethanol, the remainder in 10% buffered formalin. When time allowed, tissue samples from selected specimens were taken and fixed in ethanol, while the voucher specimens were fixed in formalin. Larger samples containing numerous annelid tubes were split, half was fixed in ethanol and half in formalin. During the 2021 and 2022 IOT voyages, scale worms, which tend to lose scales after fixation, were fixed in individual vials.

Annelid specimens collected during the voyages were shipped to the Australian Museum, Sydney (**AM**), Museums Victoria (formerly National Museum of Victoria), Melbourne (**NMV**), and Western Australian Museum (**WAM**) where they were assigned permanent registration numbers (Appendix 1).

Additional *COI* and *16S* sequences were obtained from Genbank for *Laetmonice filicornis* Kinberg, 1856 (from Norlinder *et al.,* 2012), *Laetmonice hystrix* Savigny in Lamarck, 1818 (from Gonzalez *et al*., 2018), *Laetmonice iocasica* (from Wu *et al*., 2021), *Laetmonice producta* (from Zhang *et al*., 2018), *Laetmonice* sp. (from Bribiesca-Contreras *et al.,* 2022) and outgroup *Aphrodita australis* Baird, 1865 (from Wang *et al*., 2019).

Morphological examination

Samples containing Aphroditidae were examined at the Australian Museum under Olympus stereo microscope SZX7 and specimens of *Laetmonice* were selected for further study. Chaetae were examined under Olympus compound microscope BX53. Stack images were taken using a Canon EOS 5DS and Helicon Remote StackShot and assembled in Zerene Stacker. The character selection and terminology followed Hutchings and McRae (1993). Specimens deposited in **NMV** and **WAM** were borrowed from those institutions.

In total, 108 specimens of the genus *Laetmonice* have been examined in this study (Appendix 1): GAB: IN2015_C01 (5 spec), IN2015_C02 (12 spec), IN2017_C01 (2 spec), IN2018_V06 (3 spec); Eastern Abyss: IN2017_V03 (35 spec); IOT: IN2021_V04 and IN2022_V08 (49 spec); Western Australia: IN2022_V09 (2 spec).

DNA extraction, amplification, and sequencing

A parapodium from each of 108 specimens was removed and used for DNA extraction. Total DNA was extracted using Isolate II Genomic DNA kit (Bioline) following the protocol provided by the manufacturer. Approximately 680 bp of *COI* and 515 bp of *16S* were amplified using the primers and PCR protocols listed in Table 1. PCR was performed using Taq DNA Polymerase Qiagen Kit in 20 µL mixtures, containing: 2 µL of 10X PCR Buffer, 1.5 µL of $MgCl_2$ (25 mM) solution, 1.5 µL of PCR nucleotide mix, 0.4 µL of each primer, 0.1 µL of Taq DNA Polymerase (5 U/µL), 1 µL template DNA and 13.1 µL of nuclease-free water. Amplified product was run through 1% agarose gel stained with GelRed® to test the

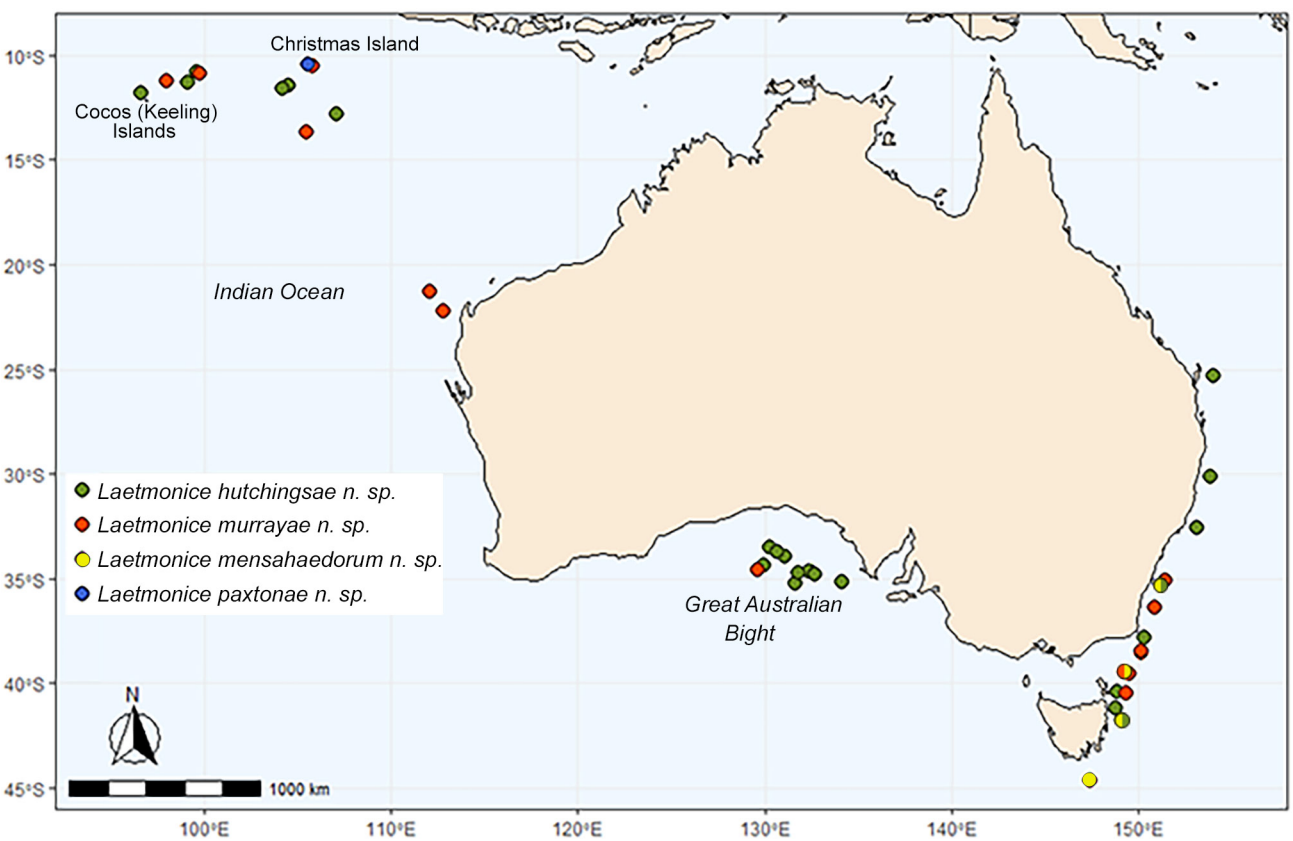

Figure 1. Map of sampling sites of *Laetmonice* spp. collected during RV *Investigator* voyages between 2015 and 2022.

success of the PCR, before being sent to Macrogen Korea for Sanger sequencing.

Phylogenetic analyses

Available sequences of *COI* and *16S* for members of the genus *Laetmonice* (*L. filicornis*, *L. hystrix*, *L. iocasica*, *L. producta*) were downloaded from GenBank, as well as for one species of outgroup genus *Aphrodita* Linnaeus, 1758. Outgroup selection was based on a previous phylogenetic assessment of Aphroditiformia, which placed *Aphrodita* as sister genus to *Laetmonice* within Aphroditidae (Gonzalez *et al.*, 2018).

In total, 102 sequences of *COI* and 107 sequences of *16S* were obtained from specimens of *Laetmonice* and 10 additional aphroditid sequences from GenBank, comprising six sequences of *COI* and four sequences of *16S* (Appendix 1). All sequences were aligned in Geneious Prime 2023.0 (https://www.geneious.com) using the MAFFT plugin and default settings. The two sequence alignments were concatenated to produce a single alignment containing all sequences for both genes. Pairwise distances within and between species of *Laetmonice* were calculated for *COI* and *16S* separately, using the Kimura 2-parameter model in MEGA-X 10.2.6 (Kumar *et al.*, 2018). Interspecific pairwise distances are displayed in Table 2.

The phylogenetic relationships were inferred using both Maximum Likelihood analysis in IQ-TREE 2.1.3 (Minh *et al.*, 2020) and Bayesian inference in MrBayes 3.2.7 (Ronquist *et al*., 2012). Using the Bayesian information criterion in ModelFinder (Kalyaanamoorthy *et al.*, 2017), a separate substitution model was selected for each of the two genes for Maximum Likelihood analysis: HKY+G for *COI* and TIM+G for *16S*. Branch support was estimated using 1000 ultrafast bootstraps (Hoang *et al.*, 2018). For the Bayesian analysis, ModelGenerator v0.85 (Keane *et al*., 2006) was used to select substitution model HKY+G for *COI* and TIM+G for *16S*. To estimate the posterior distribution of the tree and model parameters, a Markov chain Monte Carlo analysis was run for 10 million generations, with samples drawn every 1000 generations, and the first 1000 samples were removed as burn-in. Nodal support is indicated by posterior probabilities. The species delineation produced by phylogenetic methods was verified using the Poisson Tree Processes (PTP) model (Zhang *et al.,* 2013) and the Assemble species by Automatic Partitioning (ASAP) model (Puillandre *et al.,* 2020).

Results

Phylogenetic results

Both Maximum Likelihood and Bayesian phylogenetic analyses resulted in the same tree topology (Fig. 2). The phylogenetic analyses placed the newly sequenced specimens of *Laetmonice* into four strongly supported clades (ML bootstrap 91–100%, posterior probability 0.74–1). Clade 1 comprised 60 specimens (described below as *Laetmonice hutchingsae* sp. nov.), including *L.* sp. (ON400687) from the Clarion-Clipperton Zone, and was most closely related to *L. filicornis*. Clade 2 included 43 specimens (*Laetmonice murrayae* sp. nov.) and formed the sister group with clade 3 (four specimens of *Laetmonice*

Table 1. Primers and PCR protocols used in this study.

Marker	Primers	Reference	PCR settings
COI	PolyLCO (F)	Carr *et al.*, 2011	(1) at 94°C for 3 min; (2) 5 cycles at 94°C for 40 s, 45°C for 40 s, and 72°C for 1 min; (3)
	PolyHCO (R)	Carr *et al.*, 2011	35 cycles at 94°C for 40 s, 51°C for 40 s, and 72°C for 1 min; and (4) 72°C for 5 min.
16S	16Sar-L (F)	Palumbi *et al.*, 1991	(1) at 95°C for 3 min; (2) 35 cycles at 94°C for 30 s, 50°C for 30 s and 72°C for 90 sec;
	16SAN-R (R)	Zanol *et al.*, 2010	and (3) 72°C for 7 min.
	16SAnnF (F)	Sjölin *et al.*, 2005	(1) at 95°C for 4 min; (2) 35 cycles at 94°C for 30 s, 52°C for 1 min and 72°C for 75
	16SbrH (R)	Palumbi *et al.*, 1991	(3) 72°C for 8 min.

Table 2. Mean substitutions per site (± standard error) between species of *Laetmonice* based on Kimura 2-parameter for *COI* (below diagonal) and *16S* (above diagonal).

	L. mensahaedorum	*L. hutchingsae*	*L. murrayae*	*L. paxtonae*	*L. filicornis*	*L. hystrix*	*L. producta*
L. mensahaedorum	—	0.088 ± 0.000	0.027 ± 0.000	0.098 ± 0.000	0.099 ± 0.001	0.177 ± 0.001	0.123 ± 0.001
L. hutchingsae	0.195 ± 0.000	—	0.100 ± 0.000	0.096 ± 0.000	0.042 ± 0.000	0.196 ± 0.001	0.121 ± 0.001
L. murrayae	0.111 ± 0.000	0.158 ± 0.000	—	0.110 ± 0.001	0.113 ± 0.002	0.185 ± 0.003	0.136 ± 0.003
L. paxtonae	0.238 ± 0.001	0.211 ± 0.001	0.220 ± 0.001	—	0.109 ± 0.000	0.172 ± 0.000	0.082 ± 0.000
L. filicornis	0.186 ± 0.002	0.100 ± 0.000	0.167 ± 0.000	0.214 ± 0.000	—	0.187	0.126
L. hystrix	0.280 ± 0.006	0.235 ± 0.001	0.228 ± 0.001	0.240 ± 0.000	0.233	—	0.199
L. producta	0.217 ± 0.001	0.168 ± 0.001	0.196 ± 0.001	0.177 ± 0.001	0.182	0.227	—
L. iocasica	0.217 ± 0.001	0.171 ± 0.001	0.198 ± 0.000	0.176 ± 0.000	0.182	0.207	0.113

mensahaedorum sp. nov.). Clade 4 included three specimens (*Laetmonice paxtonae* sp. nov.) and was recovered in the basal position to the clade including the two aforementioned sister clades. *Laetmonice iocasica* was recovered in the sister relationship with *L. producta* separate from the clade containing all new specimens from this study. *Laetmonice hystrix* was recovered outside the clade containing all remaining species of *Laetmonice*.

Pairwise genetic distances were greater between the clades (0.09–0.247 and 0.02–0.299 substitutions/site for *COI* and *16S*, respectively, see Table 2) than within the clades (0.0–0.043 and 0.0–0.017 substitutions/site for *COI* and *16S*, respectively), thus supporting the phylogenetic delineation in Fig. 2. Both methods of delineation analysis (ASAP and PTP) produced the same phylogeny as the phylogenetic methods, with high support (F-values 0.863–0.998), however the PTP method further split *L. hutchingsae* sp. nov. and *L. murrayae* sp. nov. into two groups based on their localities, but with low support (F-values 0.49 and 0.14, respectively).

Taxonomy

Phylum Annelida Lamarck, 1802

Class Polychaeta Grube, 1850

Subclass Errantia Audouin & H. Milne Edwards, 1832

Order Phyllodocida Dales, 1962

Suborder Aphroditiformia Levinsen, 1884

Family Aphroditidae Malmgren, 1867

Family diagnosis (from Beesley *et al*., 2000). Oval body distinctly segmented. Felt-forming notochaetae present. Prostomium with a median antenna and facial tubercle. Body with palps and two pairs of tentacular cirri on first segment. First segment with uniramous parapodia and subsequent parapodia biramous.

Genus *Laetmonice* Kinberg, 1856

Type species. *Laetmonice filicornis* Kinberg, 1856

Generic diagnosis (from Barnich *et al*., 2013). Body dorsoventrally flattened; about 35 to 45 segments. Prostomium globular, with median antenna and one pair of stalked eyes; papillate facial tubercle present, situated below base of palps. Elytra up to 20 pairs on segments 2, 4, 5, 7 to 25, then on every third segment. Elytra not covered or covered by dorsal felt (formed by capillary notochaetae). Notochaetae of three kinds: (1) upper group: acicular tapering to fine tip; (2) middle group: slender, capillary; and (3) lower group: very stout, acicular with harpoon-shaped tip (sometimes hooded, missing in cirrigerous parapodia). Neurochaetae of two kinds: (1) stout, with lateral spine subdistally and inner recurved surface smooth, or with few denticles, or with row of numerous filamentous hairs; and (2) bipinnate, tapering to slender tips (only in segments 2 and 3). Pharynx without jaws.

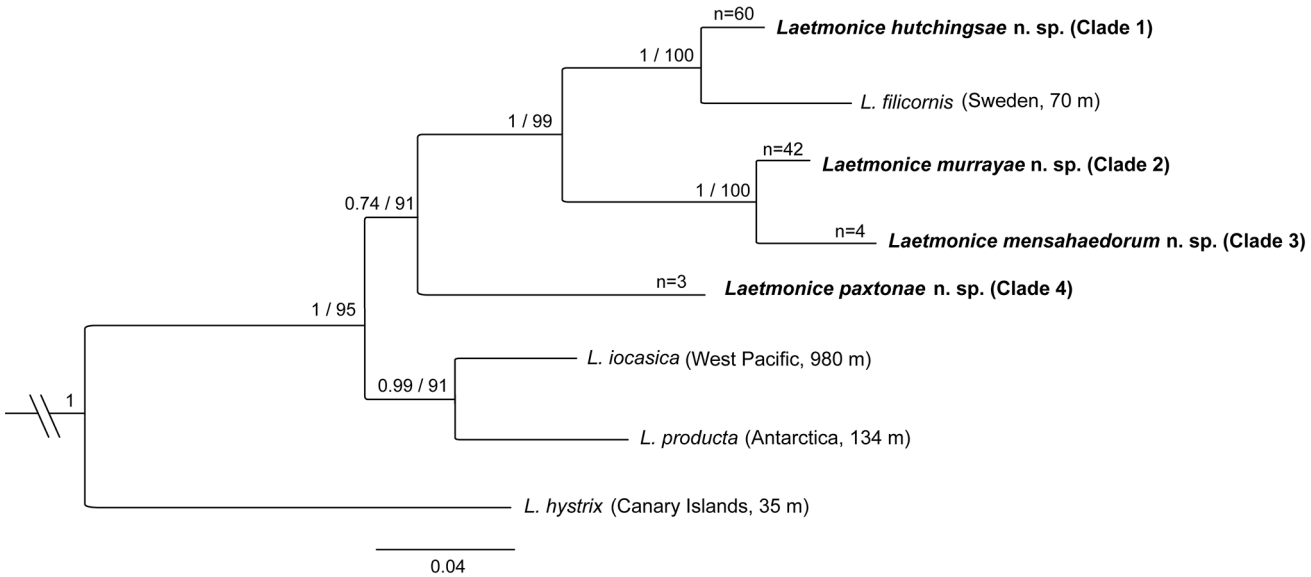

Figure 2. Phylogenetic tree inferred using maximum likelihood, showing the estimated evolutionary relationships between specimens of *Laetmonice*, based on concatenated *COI* and *16S* sequences. Four new species are shown. Numbers at the nodes represent Bayesian posterior probability (left) / ML bootstrap value (right). The scale bar indicates 0.04 substitutions/site.

Laetmonice hutchingsae sp. nov.

urn:lsid:zoobank.org:act:CCF42BF8-4722-4472-892C-6902B9B87EB1

Figs. 3a, 4a

Material examined. Holotype: AM W.53946, Jervis CMR, 2650 m, 29 May 2017. Paratypes: AM W.53947, Jervis CMR, 2650 m, 29 May 2017; AM W.53945, Jervis CMR, 2650 m, 29 May 2017. Additional material is listed in Appendix 1.

Description. Holotype (Fig. 3a), with 34 segments, length 46 mm, maximum width 25 mm (including chaetae) and 19 mm (excluding chaetae). Body ovate to elongate, dorsoventrally flattened, dorsal felt absent. Ventral surface cream-coloured, covered with fine papillae.

Prostomium rounded, with a large pair of anterolateral cylindrical ocular peduncles equivalent in length to prostomium, with a gap between them, eyes absent. Ceratophore of median antenna large (approximately length of prostomium) located posteriorly to ocular peduncles (Fig. 4a); style slender with a bulbous tip, four times as long as prostomium (absent from holotype, observed from NMV F 313504). Palps finely papillated, extending to segment 15. Nuchal flaps absent. Facial tubercle located below ocular peduncles with long papillae.

Elytra 15 pairs, attached to elytrophores on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 28 and 31, completely covering dorsum; elytra rounded, white in colour and densely covered in brown spotted pigmentation, without tubercles or papillae on surface and margins. Dorsal cirri present on segments without elytra; cirrophores short and cylindrical, styles with bulbous tips, three to four times length of parapodia.

First segment with elongated uniramous parapodia, inserted anterolaterally to prostomium; three tufts of fine, golden acicular chaetae, extending from dorsal, ventral and anterior margins of parapodia. Each with a pair of long dorsal and ventral tentacular cirri, extending laterally with bulbous tips.

Following segments with biramous parapodia. Segments 2–4 notopodia with pointed aciculum and fans of fine acicular chaetae. Neuropodium conical, with two tiers of neurochaetae; lower tier with numerous golden bipinnate neurochaetae, upper tier with 1–2 neurochaetae, with basal spur and distal fringe of hairs. Neuropodia from segment 5 to posterior end elongated, cylindrical with inflated base; three to four golden yellow neurochaetae with basal spur and distal fringe of hairs. Ventral cirri long, reaching distal tip of neuropodia on anterior four segments, attached on ventral base of neuropodia on segment 2, posteriorly gradually shifting to middle position of ventral surface of neuropodia.

Elytrigerous notopodia with tuft of up to 14 golden acicular notochaetae, tapering with pointed tip, projecting from triangular acicular lobe. Posterior to acicular notochaetae, between four and nine dark brown harpoon notochaetae (observed from AM W.54324), tuberculated with three to five recurved fangs and approximately double body width in length.

Cirrigerous notopodia with supra-acicular lobe on dorsal margin and three to four tufts of notochaetae; short, fine capillary chaetae extending from supra-acicular lobe; long, fine, pale acicular chaetae on anterior and ventral margins; stiff, golden acicular chaetae on posterior margin. Anterior margin of acicular lobe curved, cirrophore and aciculum located on posterior margin, oriented posterior-laterally.

Variation. Body length 13–46 mm, number of segments 32–34, and number of elytra pairs 14–16. Brown speckled pigmentation on elytra varies in density from faint to dense. Larger specimens with longer ventral cirri on segments 2–4, reaching distal tip of neuropodia.

Diagnosis. As for the genus; with a combination of 28–34 segments, 14–15 elytra pairs, ocular peduncles large, half the length of the prostomium, median antenna located posterior to ocular peduncles, palps extending to segment 15, 4–9 harpoon chaetae per notopodium, with tuberculate shafts

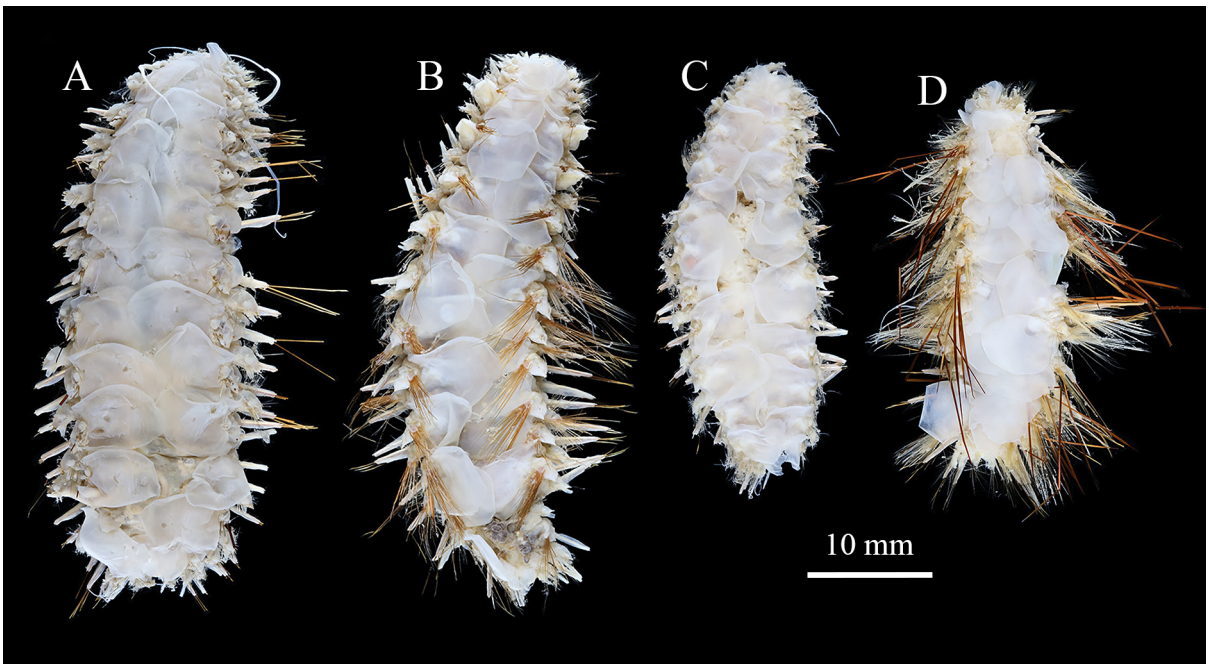

Figure 3. Dorsal view of holotypes of *Laetmonice hutchingsae* sp. nov. (AM W. 53946, A), *L. murrayae* sp. nov. (AM W.54337, B), *L. mensahaedorum* sp. nov. (AM W.53953, C) and *L. paxtonae* sp. nov. (AM W.53419, D).

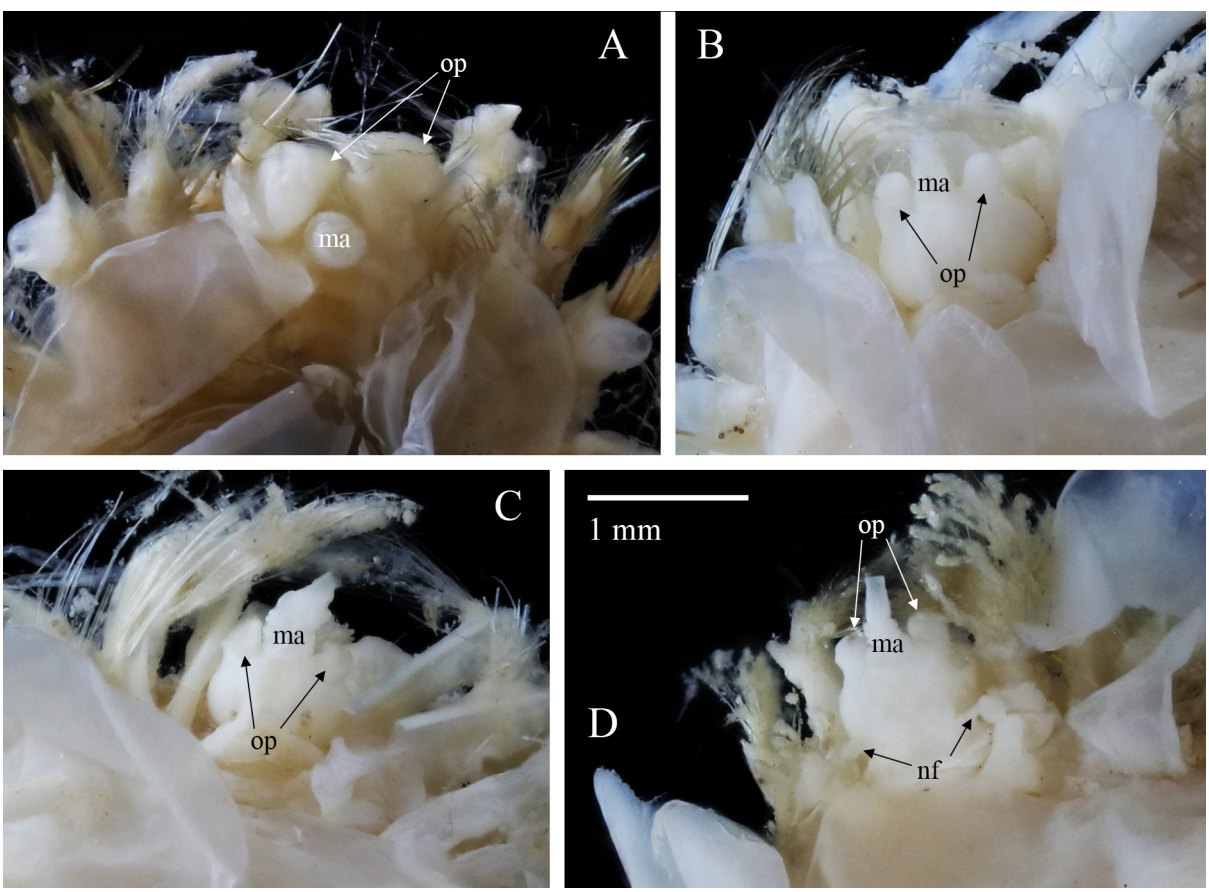

Figure 4. Dorsal view of prostomium; (A) *L. hutchingsae* sp. nov. (AM W.54324) with large ocular peduncles and median antenna behind, (B) *L. murrayae* sp. nov. (AM W.55156) with median antenna between ocular peduncles, (C) *L. mensahaedorum* sp. nov. with median antenna between ocular peduncles, and (D) *L. paxtonae* sp. nov. (AM W.53419) with median antenna behind ocular peduncles. Abbreviations: ma: median antenna, nf: nuchal flaps, op: ocular peduncles.

and three to five recurved fangs. Most similar to *Laetmonice yarramba*.

Etymology. This species is named after Dr Pat Hutchings (Australian Museum) for her remarkable dedication and invaluable contributions to taxonomy of polychaetes in Australia and world-wide.

Distribution. The Great Australian Bight and the Eastern Australian Abyss from off Tasmania (41° S) up to Fraser Island (25° S). Seamounts of the Indian Ocean Territories. Clarion-Clipperton Zone, Pacific Ocean. Bathyal-abyssal (1010–3096 m).

Laetmonice mensahaedorum sp. nov.

urn:lsid:zoobank.org:act:6E9AB321-13BC-4DD6-B878-AC34DB4C2F95

Figs. 3c, 4c

Material examined. Holotype: AM W.53953, Jervis CMR, 2650 m, 29 May 2017. Paratypes: AM W.53951, Bass Strait, 2760 m, 22 May 2017; AM W.53952, Freycinet CMR, 2820 m, 18 May 2017, NMV F 271067, 2806 m, 23 October 2015.

Description. Holotype (Fig. 3c) with 32 segments, length 33 mm, maximum width 15 mm (most chaetae absent). Body ovate to elongate, dorsoventrally flattened, dorsal felt absent. Ventral surface cream-coloured, covered with fine papillae.

Prostomium rounded and small (one fifth of body width at its widest point), with a small pair of anterolateral cylindrical ocular peduncles, one third length of prostomium, eyes absent. Ceratophore of median antenna large (slightly longer in length than prostomium and greater in width than ocular peduncles) located between ocular peduncles (Fig. 4c); style missing. Palps finely papillated, extending to segment 13. Nuchal flaps absent. Facial tubercle located below ocular peduncles with long papillae.

Elytra 15 pairs, attached to elytrophores on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 28 and 31, completely covering dorsum; elytra rounded, smooth, translucent white, without tubercles or papillae on surface and margins. Dorsal cirri present on segments without elytra; cirrophores large, styles with bulbous tips, four to five times length of parapodia (observed from AM W.53952).

First segment with papillated rectangular elongated uniramous parapodia, compressed laterally, with two tufts of fine, golden acicular chaetae, extending from dorsal and ventral margins of parapodia. Each with a pair of long dorsal and ventral tentacular cirri, with large cirrophores and extending laterally with bulbous tips.

Following segments with biramous parapodia. Segments 2–4 notopodia with pointed aciculum and bunch of fine acicular chaetae on dorsal surface. Segment 2 compressed laterally with approximately 25 fine, translucent medial oriented chaetae. Neuropodium conical, with two tiers of neurochaetae; lower tier with numerous golden bipinnate neurochaetae, upper tier neurochaetae missing on all specimens. Neuropodia from segment 5 to posterior end elongated, cylindrical with inflated base; three golden yellow neurochaetae with basal spur and distal fringe of hairs. Ventral cirri on segment 2 reaching base of bipinnate neurochaetae, attached on ventral base of neuropodium. From segment 3 onwards, ventral cirri short and attached halfway along ventral side of neuropodia.

Elytrigerous notopodia with tuft of approximately 10 translucent acicular notochaetae, tapering with fine, pointed tip, medially oriented from triangular acicular lobe. Posterio-laterally to acicular notochaetae, four harpoon notochaetae (observed from chaetal scars), finely tuberculated with three fangs (observed from AM W.53951).

Cirrigerous notopodia with sharply rounded anterior margin, pointed acicular lobe and three tufts of notochaetae; fine capillary chaetae on anterior and ventral margins of acicular lobe; and approximately 12 long stiff, translucent acicular chaetae projecting from posterior margin. Large cirrophore and aciculum located on posterior margin, oriented posterio-laterally.

Variation. Body length 14–33 mm, number of segments 30–32 and number of elytra pairs 14–15.

Diagnosis. As for the genus; with a combination of 30–32 segments, 14–15 elytra pairs, ocular peduncles small, one third the length of median antennal ceratophore, median antenna ceratophore located between ocular peduncles, palps extending to segment 13, four harpoon chaetae per notopodium with finely tuberculate shafts and three fangs. Most similar to *Laetmonice yarramba*.

Etymology. The name *mensahaedorum* came from *mensa haedorum* meaning "kid's table" in Latin. This species is named after the self-proclaimed "kids table" at the 2023 Australian Museum Foundation Gala Dinner, by Australian Museum Foundation director Massimo Belgiorno-Nettis and his guests. The group at the table made a generous donation to the foundation and this species is named in their honour.

Distribution. Western Tasman Sea from south of Tasmania (44°S) up to Jervis Bay (35°S), abyssal (2650– 2820 m).

Laetmonice murrayae sp. nov.

urn:lsid:zoobank.org:act:B16F0BB5-1F1A-4CFB-AF0E-D5B6CE6746B1

Figs. 3b, 4b

Material examined. Holotype: AM W.54337, Scrooge Seamount, 2900 m, 10 October 2022. Paratype: AM W.54335, Scrooge Seamount, 2900 m, 10 October 2022. Additional material is listed in Appendix 1.

Description. Holotype (Fig. 3b), with 34 segments, length 43 mm, maximum width 23 mm (including chaetae) and 17 mm (excluding chaetae). Body ovate to elongate, dorsoventrally flattened, dorsal felt absent. Ventral surface cream-coloured, covered with minute papillae.

Prostomium rounded, with a small pair of anterolateral cylindrical ocular peduncles, one third length of prostomium, eyes absent. Ceratophore of median antenna large (length of prostomium) located between ocular peduncles (Fig. 4b); style slender with a bulbous tip, five to six times length of prostomium (observed from AM W.54524). Palps finely papillated, extending to segment 13 (observed from AM W.53964). Nuchal flaps absent. Facial tubercle located below ocular peduncles with long papillae.

Elytra 15 pairs, attached to elytrophores on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 28 and 31, completely covering dorsum; elytra rounded, white in colour with patches of brown speckled pigmentation, without tubercles

or papillae on surface and margins. Dorsal cirri present on segments without elytra; cirrophores short and cylindrical, styles with blunt tips, four to five times length of parapodia (observed from AM W.55156; a specimen in good condition, though PCR was unsuccessful and therefore is not listed in Appendix 1).

First segment with elongated uniramous parapodia, inserted anterolaterally to prostomium; two tufts of fine, golden acicular chaetae, extending from dorsal and ventral margins of parapodia. Each with a pair of dorsal and ventral tentacular cirri, with large cirrophores, extending laterally with bulbous tips.

Following segments with biramous parapodia. Segments 2–4 notopodia with pointed aciculum and fans of fine acicular chaetae. Segment 2 with approximately 11 stiff yellow medial oriented acicular chaetae. Neuropodium conical, with two tiers of neurochaetae; lower tier with numerous golden bipinnate neurochaetae, upper tier with approximately five neurochaetae, with basal spur and distal fringe of hairs. Neuropodia from segment 5 to posterior end elongated, cylindrical with inflated base; three golden yellow neurochaetae with basal spur and distal fringe of hairs. Ventral cirri on segment 2 reaching base of bipinnate neurochaetae, attached on ventral base of neuropodium. From segment 3 onwards, ventral cirri are short and attached halfway along ventral side of neuropodia.

Elytrigerous notopodia enlarged with tuft of up to 22 golden acicular notochaetae, tapering with fine, pointed tip, medially oriented from triangular acicular lobe. Posterio-laterally to acicular notochaetae, up to 10 (observed from chaetal scars) notochaetae, tuberculated with four recurved fangs (observed from AM W.55155 and AM W.53440).

Cirrigerous notopodia dorsoventrally flattened with pointed acicular lobe and three tufts of notochaetae; fine capillary chaetae on ventral margin of acicular lobe; approximately 30 fine, pale golden acicular chaetae along rounded anterior margin; approximately 14 long stiff, golden acicular chaetae projecting posterio-laterally from dorsal margin. Large cirrophore and aciculum located on posterior margin, oriented posterio-laterally.

Variation. Body length of examined specimens ranged from 24 to 44 mm, number of segments from 32 to 34, and number of elytra pairs from 14 to 15. Brown speckled pigmentation faint or absent in some specimens. Ventral papillae extremely fine on some specimens, some appear smooth. Up to 25 stiff yellow medial oriented acicular chaetae found on segment 2.

Diagnosis. As for the genus; with a combination of 32–34 segments, 14–15 elytra pairs, ocular peduncles distinctly small, one third the length of the prostomium; median antenna located between ocular peduncles; palps extending to segment 13, up to 10 harpoon chaetae per notopodium with tuberculate shafts and four recurved fangs. Most similar to *Laetmonice yarramba*.

Etymology. This species is named in honour of Anna Murray (Australian Museum) to recognise her important contributions to the taxonomy of polychaetes, especially of scale worms.

Distribution. The Great Australian Bight and the Eastern Australian abyss from off Tasmania (40° S) up to Bermagui, Southern NSW (36° S). Off Australian West coast and seamounts of the Indian Ocean Territories. Abyssal (2760–5000 m).

Laetmonice paxtonae sp. nov.

urn:lsid:zoobank.org:act:9972720B-ECA3-48E0-BFC9-360169DD585A

Figs. 3d, 4d

Material examined. Holotype: AM W.53419, Christmas Island NW, 463 m, 8 July 2021. Paratypes: AM W.54522, 463 m, 8 July 2021; AM W.54523, 463 m, 8 July 2021.

Description. Holotype (Fig. 3d), with 33 segments, length 34 mm, maximum width 24 mm (including chaetae) and 12 mm (excluding chaetae). Body ovate to elongate, dorsoventrally flattened, dorsal felt absent. Ventral surface cream-coloured, covered with fine papillae.

Prostomium rounded and small (one fifth of body width at its widest point), with a small pair of anterolateral cylindrical ocular peduncles, one third length of prostomium, a gap between them and with two pairs of eyes. Ceratophore of median antenna elongated, located behind ocular peduncles (Fig. 4d); style missing. Palps missing. Nuchal flaps present (Fig. 4d). Facial tubercle located below ocular peduncles with long papillae.

Elytra 15 pairs, attached to elytrophores on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 28 and 31, completely covering dorsum; elytra large, rounded, smooth, semi-translucent white, without tubercles or papillae on surface and margins. Dorsal cirri present on segments without elytra; cirrophores large, styles missing.

First segment elongated conical uniramous parapodia, basally papillated, with four tufts of fine, pale golden acicular chaetae, extending from dorsal and ventral margins of parapodia, two anterior and two posterior. Each parapodia with a pair of long dorsal and ventral tentacular cirri, with large cirrophores and extending laterally (styles missing).

Following segments with biramous parapodia. Segments 2–4 notopodia with pointed aciculum and segment 2 with row of approximately 30 long acicular chaetae running dorsoventrally along the anterior margin. Neuropodium conical, with two tiers of neurochaetae; lower tier with numerous golden bipinnate neurochaetae, upper tier with one to two neurochaetae, with basal spur and distal fringe of hairs. Neuropodia from segment 5 to posterior end elongated, cylindrical with inflated base; three to four golden yellow neurochaetae with basal spur and distal fringe of hairs. Ventral cirri appear absent or missing from all specimens, however there are apparent scars on the middle of some neuropodia.

Elytrigerous notopodia with tuft of approximately 20 translucent acicular notochaetae, tapering with fine, pointed tip, posterio-laterally oriented from triangular acicular lobe. Lateral to acicular notochaetae, up to 12 harpoon notochaetae, with very fine tubercles and three to four fangs. Approximately 10 very fine, short acicular chaetae directly anterior of harpoon chaetae.

Cirrigerous notopodia elongated, with pointed acicular lobe and four tufts of notochaetae; two tufts (one dorsal, one ventral) of ~40 long golden acicular chaetae with fine pointed tips, then ~10 long stiff acicular chaetae posterior to aciculum, and ~60 short, fine chaetae fanning along posterior margin. Elongated cirrophore and aciculum located on posterior margin, oriented posterior-laterally.

Variation. Specimens range from 32 to 36 mm in body

length, number of segments from 33 to 35 and number of elytra pairs from 14 to 15.

Diagnosis. As for the genus; with a combination of: 33–35 segments, 14–15 elytra pairs, presence of prostomial nuchal flaps, two pairs of eyes, facial tubercle with long papillae, up to 12 harpoon chaetae per notopodium, with finely tuberculate shafts and three to four fangs, long acicular notochaetae equal in length to body width. Most similar to *Laetmonice wonda*.

Etymology. This species is named after Dr Hannelore Paxton (Macquarie University and Australian Museum), an expert in taxonomy of polychaetes, who has made numerous important contributions to taxonomy of polychaetes, especially those of the family Onuphidae.

Distribution. Only known from off the Northwest corner of Christmas Island seamount in 463 m.

Discussion

This study has shown that the numerous specimens attributed to *Laetmonice yarramba,* a species supposedly widespread around Australia and showing a remarkably wide bathymetric range of 60–3950 m (MacIntosh *et al*., 2018; Gunton *et al*., 2021: 26, fig. 6D, E), belong to a complex of morphologically similar species. Four of the species from *L*. cf. *yarramba* complex have been described here, with three inhabiting deep-sea (bathyal and abyssal) environments. Thus, the number of *Laetmonice* species reported from Australia is increased to 10. Moreover, for the first time, descriptions of the new Australian species of the genus are accompanied by DNA sequence data unequivocally linked with type material. Other aphroditid species collected during the RV *Investigator* voyages remain to be described.

It has been long established that distinct faunas are found above and below the continental shelf break (200–400 m), and another transitional boundary at roughly 1000 m separates the two faunistic zones within the deep sea: the slope (bathyal) and the abyssal (Ekman, 1953). In the deep sea the physical uniformity and lack of absolute barriers to faunal dispersal led to the concept of the abyss as a single zoogeographical province sharing many cosmopolitan species (Gage and Tyler, 1991). Nevertheless, many deep-sea taxa were reported to survive depths ranging from the shelf to the lower abyss (~100–6000 m) (see e.g., France & Kocher, 1996). Historically these 'eurybathic' species were defined using morphological features only (Glazier & Etter, 2014), but recently there has been growing recognition that using morphology alone can lead to underestimation of the number of species (Nygren, 2014) and that the wide-ranging distributions suggested by morphology are not always supported by genetic data (Schüller, 2010).

The results of this integrative (morphological and molecular) study do not support "eurybathic" distribution of *Laetmonice* spp. Phylogenetic analyses here showed the presence of four well supported clades (described here as new species) within the genus. The interspecific genetic distances among the new species are within the range (0.1–0.28 substitutions/site for *COI* and 0.027–0.199 for *16S*) reported (Wu *et al*., 2021) for an analysis of the genus *Laetmonice* using *COI* data (0.10–0.23). These distances are also comparable with mean interspecific distances (0.17) obtained in a large-scale barcoding study of polychaetes (Carr *et al.*, 2011). The results of delimitation analyses also provide strong support for the genetically divergent groups suggested by phylogeny (Fig. 2), even though PTP analysis detected some intraspecific genetic variation between populations from different localities within the most abundant *L. hutchingsae* sp. nov. and *L. murrayae* sp. nov.

Importantly, in addition to the genetic and morphological differences, the new taxa are clearly structured by their bathymetric distributions. *Laetmonice paxtonae* sp. nov. collected only from one locality off Christmas Island (463 m deep) is likely to be a shelf species that may not be uncommon or rare but inhabiting the depth range not targeted by the IOT voyages. Further collecting of the IOT shelf habitats is needed to determine whether it is endemic to the Christmas Island area. *Laetmonice hutchingsae* sp. nov. is a lower bathyal-abyssal species sampled in the highest abundance from 1010–3096 m, whereas both *L. murrayae* (2760–5000 m) and *L. mensahaedorum* sp. nov. (2650–2820 m) are distinctly abyssal species.

In accordance with recent genetic studies confirming extensive distribution ranges of some deep-sea polychaetes (e.g. Guggolz *et al*., 2020; Meißner *et al.*, 2023; Budaeva *et al.*, 2024), the two most abundant species of this study, *Laetmonice hutchingsae* sp. nov. and *L. murrayae* sp. nov., also show wide geographic distributions spanning from the GAB and Eastern Australian abyss to bathyal-abyssal depths of the IOT. The less abundant abyssal *L. mensahaedorum* sp. nov. has a range from Tasmania to Jervis Bay Commonwealth Marine Park off NSW.

In conclusion, the results of this study shed light on the poorly documented fauna of Australian deep-sea polychaetes. While providing support for wide geographic distributions of bathyal and abyssal representatives of the genus *Laetmonice*, these results strongly argue against "eurybathic" distribution within this group and demonstrate the existence of genetically divergent taxa isolated by bathymetric environmental gradients. Further studies addressing biodiversity and genetic connectivity of deep-sea organisms are needed to infer patterns of evolution along depth gradients.

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Appendix 1. Samples included in the phylogenetic part of this study, including specimen voucher numbers. Maximum depth is given. Holotype specimens are in bold. Abbreviations SMNH: Smithsonian National Museum of Natural History, MBM: Marine Biological Museum of Chinese Academy of Sciences.

Species	Voucher	RV *Investigator* numbers	Locality voyage code	Latitude	Longitude	Depth (m)	Genbank accession (*COI*)	GenBank accession (*16S*)
Laetmonice mensahaedorum sp. nov.	NMV F 271067	IN2015_C01	Tasmania	44°40'02"S	147°28'41"E	2806	PP713208	PP718117
Laetmonice mensahaedorum sp. nov.	AM W.53951	IN2017_V03	Bass Strait	39°27'43"S	149°16'34"E	2760	PP713163	PP718070
Laetmonice mensahaedorum sp. nov.	AM W.53952	IN2017_V03	Freycinet CMR	41°43'50"S	149°07'11"E	2820	PP713164	—
Laetmonice mensahaedorum sp. nov.	AM W.53953	IN2017_V03	Jervis CMR	35°19'59"S	151°15'29"E	2650	PP713165	PP718071
Laetmonice hutchingsae sp. nov.	NMV F 271068	IN2015_C01	GAB	34°40'27"S	132°28'46"E	1017	PP713209	PP718118
Laetmonice hutchingsae sp. nov.	NMV F 246387	IN2015_C02	GAB	34°37'46"S	132°21'22"E	1029	PP713204	PP718113
Laetmonice hutchingsae sp. nov.	NMV F 313485	IN2015_C02	GAB	34°37'46"S	132°21'22"E	1029	PP713213	PP718123
Laetmonice hutchingsae sp. nov.	NMV F 313486	IN2015_C02	GAB	33° 30'58"S	130°15'54"E	1013	PP713214	PP718123
Laetmonice hutchingsae sp. nov.	NMV F 313487	IN2015_C02	GAB	33°30'58"S	130°15'54"E	1013	PP713215	PP718125
Laetmonice hutchingsae sp. nov.	NMV F 313488	IN2015_C02	GAB	33° 30'58"S	130°15'54"E	1013	PP713216	PP718126
Laetmonice hutchingsae sp. nov.	NMV F 246392	IN2015_C02	GAB	33° 55'42"S	131°03'40"E	1033	PP713205	PP718114
Laetmonice hutchingsae sp. nov.	NMV F 313500	IN2015_C02	GAB	34°49'22"S	132°41'31"E	1015	PP713217	PP718127
Laetmonice hutchingsae sp. nov.	NMV F 313501	IN2015_C02	GAB	34°49'22"S	132°41'31"E	1015	PP713218	PP718128
Laetmonice hutchingsae sp. nov.	NMV F 313502	IN2015_C02	GAB	33°43'07"S	130°39'58"E	1010	PP713219	PP718129
Laetmonice hutchingsae sp. nov.	NMV F 313503	IN2015_C02	GAB	33°43'07"S	130°39'58"E	1010	PP713220	PP718130
Laetmonice hutchingsae sp. nov.	NMV F 305775	IN2015_C02	GAB	35°09'10"S	134°06'32"E	1077	PP713210	PP718119
Laetmonice hutchingsae sp. nov.	NMV F 313504	IN2015_C02	GAB	35°09'10"S	134°06'32"E	1077	PP713221	PP718131
Laetmonice hutchingsae sp. nov.	NMV F 305776	IN2015_C01	GAB	34°20'29"S	129°56'32"E	2080	—	PP718120
Laetmonice hutchingsae sp. nov.	AM W.53935	IN2017_V03	Fraser Island	25°19'31"S	154°04'06"E	2350	PP713150	PP718055
Laetmonice hutchingsae sp. nov.	AM W.53936	IN2017_V03	Fraser Island	25°19'31"S	154°04'06"E	2350	PP713151	PP718056
Laetmonice hutchingsae sp. nov.	AM W.53937	IN2017_V03	Flinders CMR	40°23'10"S	148°55'41"E	1151	—	PP718057
Laetmonice hutchingsae sp. nov.	AM W.53938	IN2017_V03	Bass Strait	39°27'43"S	149°16'34"E	2760	PP713152	PP718058
Laetmonice hutchingsae sp. nov.	AM W.53939	IN2017_V03	East Gippsland CMR	37°47'31"S	150°22'55"E	2581	PP713153	PP718059
Laetmonice hutchingsae sp. nov.	AM W.53940	IN2017_V03	East Gippsland CMR	37°47'31"S	150°22'55"E	2581	PP713154	PP718060
Laetmonice hutchingsae sp. nov.	AM W.53941	IN2017_V03	East Gippsland CMR	37°47'31"S	150°22'55"E	2581	PP713155	PP718061
Laetmonice hutchingsae sp. nov.	AM W.53942	IN2017_V03	Freycinet CMR	41°43'50"S	149°7'11"E	2820	PP713156	PP718062
Laetmonice hutchingsae sp. nov.	AM W.53944	IN2017_V03	Jervis CMR	35°19'59"S	151°15'29"E	2650	PP713157	PP718063
Laetmonice hutchingsae sp. nov.	NMV F 271065	IN2015_C01	GAB	35°12'06"S	131°37'46"E	1913	PP713206	PP718115
Laetmonice hutchingsae sp. nov.	AM W.53945	IN2017_V03	Jervis CMR	35°19' 59"S	151°15'29"E	2650	PP713158	PP718064
Laetmonice hutchingsae sp. nov.	AM W.53946	IN2017_V03	Jervis CMR	35°19'59"S	151°15'29"E	2650	PP713159	PP718065
Laetmonice hutchingsae sp. nov.	AM W.53947	IN2017_V03	Jervis CMR	35°19'59"S	151°15'29"E	2650	PP713160	PP718066
Laetmonice hutchingsae sp. nov.	AM W.53948	IN2017_V03	Hunter CMR	32°34'30"S	153°09'42"E	2595	PP713161	PP718067
Laetmonice hutchingsae sp. nov.	AM W.53949	IN2017_V03	Central Eastern CMR	30°05'52"S	153°53'55"E	2518	—	PP718068
Laetmonice hutchingsae sp. nov.	AM W.53950	IN2017_V03	Central Eastern CMR	30°05'52"S	153°53'55"E	2518	PP713162	PP718069
Laetmonice hutchingsae sp. nov.	NMV F 271066	IN2015_C01	GAB	34°43'54"S	131°50'31"E	1342	PP713207	PP718116
Laetmonice hutchingsae sp. nov.	AM W.54528	IN2018_V06	Tasmania	41°12'31"S	148°47'48"E	1221	—	PP718111
Laetmonice hutchingsae sp. nov.	AM W.54526	IN2018_V06	Tasmania	41°12'31"S	148°47'48"E	1221	PP713201	PP718109
Laetmonice hutchingsae sp. nov.	AM W.54527	IN2018_V06	Tasmania	41°12'31"S	148°47'48"E	1221	PP713202	PP718110
Laetmonice hutchingsae sp. nov.	AM W.53980	IN2017_V03	Bass Strait	39°27'43"S	149°16'34"E	2760	PP713179	PP718086

Appendix 1. *Continued* ...

Appendix 1. *Continued*.

Species	Voucher numbers	RV *Investigator* voyage code	Locality	Latitude	Longitude (m)	Depth	Genbank accession (*COI*)	GenBank accession (*16S*)
Laetmonice hutchingsae sp. nov.	AM W.53433	IN2021_V04	Karma Seamount	12°49'33"S	107°02'48"E	2850	PP713126	PP718031
Laetmonice hutchingsae sp. nov.	AM W.53434	IN2021_V04	Karma Seamount	12°49'33"S	107°02'48"E	2850	PP713127	PP718032
Laetmonice hutchingsae sp. nov.	AM W.53435	IN2021_V04	Karma Seamount	12°49'33"S	107°02'48"E	2850	PP713128	PP718033
Laetmonice hutchingsae sp. nov.	AM W.53436	IN2021_V04	Karma Seamount	12°49'33"S	107°02'48"E	2850	PP713129	PP718034
Laetmonice hutchingsae sp. nov.	AM W.53446	IN2021_V04	Karma Seamount	12°49'33"S	107°02'48"E	2850	PP713137	PP718042
Laetmonice hutchingsae sp. nov.	AM W.53448	IN2021_V04	Karma Seamount	12°49'33"S	107°02'48"E	2850	PP713139	PP718044
Laetmonice hutchingsae sp. nov.	AM W.53449	IN2021_V04	Karma Seamount	12°49'33"S	107°02'48"E	2850	PP713140	PP718045
Laetmonice hutchingsae sp. nov.	AM W.53450	IN2021_V04	Karma Seamount	12°49'33"S	107°02'48"E	2850	PP713141	PP718046
Laetmonice hutchingsae sp. nov.	AM W.53452	IN2021_V04	Karma Seamount	12°49'33"S	107°02'48"E	2850	PP713143	PP718048
Laetmonice hutchingsae sp. nov.	AM W.53495	IN2021_V04	Balthazar Seamount	11°27'03"S	104°30'07"E	2358	PP713148	PP718053
Laetmonice hutchingsae sp. nov.	AM W.53496	IN2021_V04	Balthazar Seamount	11°27'03"S	104°30'07"E	2358	PP713149	PP718054
Laetmonice hutchingsae sp. nov.	AM W.54331	IN2022_V08	Balthazar Seamount	11°38'13"S	104°10'56"E	2400	PP713188	PP718096
Laetmonice hutchingsae sp. nov.	AM W.54321	IN2022_V08	Scrooge Seamount	10°47'27"S	99°36'39"E	2000	PP713180	PP718088
Laetmonice hutchingsae sp. nov.	AM W.54333	IN2022_V08	Scrooge Seamount	10°47'27"S	99°36'39"E	2000	PP713190	PP718098
Laetmonice hutchingsae sp. nov.	AM W.54324	IN2022_V08	Rudist Seamount	11°19'32"S	99°07'24"E	1750	PP713183	PP718091
Laetmonice hutchingsae sp. nov.	AM W.54327	IN2022_V08	Rudist Seamount	11°19'32"S	99°07'24"E	1750	PP713184	PP718092
Laetmonice hutchingsae sp. nov.	AM W.54322	IN2022_V08	Rudist Seamount	11°19'32"S	99°07'24"E	1750	PP713181	PP718089
Laetmonice hutchingsae sp. nov.	AM W.54334	IN2022_V08	Rudist Seamount	11°19'32"S	99°07' 24"E	1750	PP713191	PP718099
Laetmonice hutchingsae sp. nov.	AM W.54332	IN2022_V08	Rudist Seamount	11°19'32"S	99°07' 24"E	1750	PP713189	PP718097
Laetmonice hutchingsae sp. nov.	AM W.54505	IN2022_V08	North Keeling Island W	11°49' 56"S	96° 37' 36"E	1800	PP713196	PP718104
Laetmonice hutchingsae sp. nov.	AM W.54330	IN2022_V08	North Keeling Island W	11°49'56"S	96° 37' 36"E	1800	PP713187	PP718095
Laetmonice hutchingsae sp. nov.	AM W.54328	IN2022_V08	North Keeling Island W	11°49'56"S	96° 37' 36"E	1800	PP713185	PP718093
Laetmonice hutchingsae sp. nov.	AM W.54323	IN2022_V08	North Keeling Island W	11°49'56"S	96° 37' 36"E	1800	PP713182	PP718090
Laetmonice hutchingsae sp. nov.	AM W.54329	IN2022_V08	North Keeling Island W	11°49'56"S	96° 37' 36"E	1800	PP713186	PP718094
Laetmonice hutchingsae sp. nov.	AM W.54423	IN2022_V08	North Keeling Island W	11°49'56"S	96° 37' 36"E	1800	PP713194	PP718102
Laetmonice murrayae sp. nov.	NMV F 313479	IN2017_C01	GAB	34°32'55"S	129° 36' 07"E	3540	PP713211	PP718121
Laetmonice murrayae sp. nov.	NMV F 313480	IN2017_C01	GAB	34°32'55"S	129° 36' 07"E	3540	PP713212	PP718122
Laetmonice murrayae sp. nov.	AM W.53400	IN2021_V04	Christmas Island SE	10°33'22"S	105° 45' 51"E	3345	PP713122	PP718027
Laetmonice murrayae sp. nov.	AM W.53402	IN2021_V04	Christmas Island SE	10°33'22"S	105° 45' 51"E	3345	PP713124	PP718029
Laetmonice murrayae sp. nov.	AM W.53439	IN2021_V04	Karma Seamount	12°49'33"S	107° 02' 48"E	2850	PP713130	PP718035
Laetmonice murrayae sp. nov.	AM W.53440	IN2021_V04	Karma Seamount	12°49'33"S	107° 02' 48"E	2850	PP713131	PP718036
Laetmonice murrayae sp. nov.	AM W.53441	IN2021_V04	Karma Seamount	12°49'33"S	107° 02' 48"E	2850	PP713132	PP718037
Laetmonice murrayae sp. nov.	AM W.53442	IN2021_V04	Karma Seamount	12°49'33"S	107° 02' 48"E	2850	PP713133	PP718038
Laetmonice murrayae sp. nov.	AM W.53443	IN2021_V04	Karma Seamount	12°49'33"S	107° 02' 48"E	2850	PP713134	PP718039
Laetmonice murrayae sp. nov.	AM W.53444	IN2021_V04	Karma Seamount	12°49'33"S	107° 02' 48"E	2850	PP713135	PP718040
Laetmonice murrayae sp. nov.	AM W.53445	IN2021_V04	Karma Seamount	12°49'33"S	107° 02' 48"E	2850	PP713136	PP718041
Laetmonice murrayae sp. nov.	AM W.53447	IN2021_V04	Karma Seamount	12°49'33"S	107° 02' 48"E	2850	PP713138	PP718043

Appendix 1. *Continued* ...

Appendix 1. *Continued*.

Species	Voucher numbers	RV *Investigator* voyage code	Locality	Latitude	Longitude	Depth (m)	Genbank accession (*COI*)	GenBank accession (*16S*)
Laetmonice murrayae sp. nov.	AM W.53451	IN2021_V04	Karma Seamount	12°49'33"S	107° 02' 48"E	2850	PP713142	PP718047
Laetmonice murrayae sp. nov.	AM W.53453	IN2021_V04	Karma Seamount	12°49'33"S	107° 02' 48"E	2850	PP713144	PP718049
Laetmonice murrayae sp. nov.	AM W.53454	IN2021_V04	Karma Seamount	12°49'33"S	107° 02' 48"E	2850	PP713145	PP718050
Laetmonice murrayae sp. nov.	AM W.53455	IN2021_V04	Karma Seamount	12°49'33"S	107° 02' 48"E	2850	PP713146	PP718051
Laetmonice murrayae sp. nov.	AM W.53463	IN2021_V04	Clara Marie Seamount	13°42'07"S	105° 25' 09"E	3100	PP713147	PP718052
Laetmonice murrayae sp. nov.	AM W.54524	IN2021_V04	Clara Marie Seamount	13°42'07"S	105° 25' 09"E	3100	PP713199	PP718107
Laetmonice murrayae sp. nov.	AM W.54525	IN2021_V04	Clara Marie Seamount	13°42'07"S	105° 25' 09"E	3100	PP713200	PP718108
Laetmonice murrayae sp. nov.	AM W.54337	IN2022_V08	Scrooge Seamount	10°54'41"S	99° 45' 35"E	2900	PP713193	PP718101
Laetmonice murrayae sp. nov.	AM W.54335	IN2022_V08	Scrooge Seamount	10°54'41"S	99° 45' 35"E	2900	PP713192	PP718100
Laetmonice murrayae sp. nov.	WAM V11717	IN2022_V09	Low Point	21°19'53"S	112° 03' 07"E	3464	PP713222	PP718132
Laetmonice murrayae sp. nov.	WAM V11732	IN2022_V09	Ningaloo Reef	22°13'58"S	112° 48' 28"E	2869	PP713223	PP718133
Laetmonice murrayae sp. nov.	AM W.55155	IN2017_V03	Bass Strait	39°33'07"S	149° 33' 11"E	4197	PP713203	PP718112
Laetmonice murrayae sp. nov.	AM W.53985	IN2017_V03	East Gippsland CMR	38°31'16"S	150° 12' 47"E	4107	—	PP718087
Laetmonice murrayae sp. nov.	AM W.53956	IN2017_V03	Flinders CMR	40°28'24"S	149° 23' 48"E	4139	PP713166	PP718072
Laetmonice murrayae sp. nov.	AM W.53957	IN2017_V03	Flinders CMR	40°28'24"S	149° 23' 48"E	4139	PP713167	PP718073
Laetmonice murrayae sp. nov.	AM W.53958	IN2017_V03	Flinders CMR	40°28'24"S	149° 23' 48"E	4139	PP713168	PP718074
Laetmonice murrayae sp. nov.	AM W.53959	IN2017_V03	Flinders CMR	40°28'24"S	149° 23' 48"E	4139	PP713169	PP718075
Laetmonice murrayae sp. nov.	AM W.53960	IN2017_V03	Bass Strait	39°27'43"S	149° 16' 34"E	2760	PP713170	PP718076
Laetmonice murrayae sp. nov.	AM W.53961	IN2017_V03	Bass Strait	39° 33'07"S	149° 33' 11"E	4197	PP713171	PP718077
Laetmonice murrayae sp. nov.	AM W.53962	IN2017_V03	East Gippsland CMR	38° 28'44"S	150° 11' 04"E	3853	PP713172	PP718078
Laetmonice murrayae sp. nov.	AM W.53963	IN2017_V03	East Gippsland CMR	38° 28'44"S	150° 11' 04"E	3853	PP713173	PP718079
Laetmonice murrayae sp. nov.	AM W.53964	IN2017_V03	Bermagui	36° 21'03"S	150° 54' 51"E	4800	PP713174	PP718080
Laetmonice murrayae sp. nov.	AM W.53965	IN2017_V03	Bermagui	36°21'03"S	150° 54' 51"E	4800	PP713175	PP718081
Laetmonice murrayae sp. nov.	AM W.53966	IN2017_V03	Jervis CMR	35°06'50"S	151° 28' 08"E	4011	PP713176	PP718082
Laetmonice murrayae sp. nov.	AM W.53967	IN2017_V03	Flinders CMR	40°27'47"S	149° 24' 54"E	4131	—	PP718083
Laetmonice murrayae sp. nov.	AM W.53968	IN2017_V03	Flinders CMR	40°27'47"S	149° 24' 54"E	4131	PP713177	PP718084
Laetmonice murrayae sp. nov.	AM W.53969	IN2017_V03	Flinders CMR	40°27'47"S	149° 24' 54"E	4131	PP713178	PP718085
Laetmonice murrayae sp. nov.	AM W.53401	IN2021_V04	Christmas Island SE	10°33'22"S	105° 45' 51"E	3345	PP713123	PP718028
Laetmonice murrayae sp. nov.	AM W.54424	IN2022_V08	Cocos Abyssal	11°15'23"S	97° 56' 56"E	5000	PP713195	PP718103
Laetmonice paxtonae sp. nov.	AM W.53419	IN2021_V04	Christmas Island NW	10°25'48"S	105° 32' 13"E	463	PP713125	PP718030
Laetmonice paxtonae sp. nov.	AM W.54522	IN2021_V04	Christmas Island NW	10°25'48"S	105° 32' 13"E	463	PP713197	PP718105
Laetmonice paxtonae sp. nov.	AM W.54523	IN2021_V04	Christmas Island NW	10°25'48"S	105° 32' 13"E	463	PP713198	PP718106
Laetmonice filicornis	SMNH118955	N/A	Sweden	—	—	70	JN852919	JN852883
Laetmonice hystrix	—	N/A	Canary Islands	—	—	35	KY823493	KY823477
Laetmonice iocasica	MBM286068	N/A	Tropical West Pacific	10°07' N	140° 14' E	980	MW164774	—
Laetmonice producta	—	N/A	Antarctica	53°34' 29"S	41° 40' 44"W	134	KY753833	KY753833
Laetmonice sp. (*hutchingsae* sp. nov.)	—	N/A	Clarion-Clipperton Zone	04°53' 23"N	141° 45' 00"W	3096	ON400687	—
Aphrodita australis	—	N/A	China	36°03' 00"N	120° 16' 12"E	70	MN334532	MN334532