

A New Genus and Two New Species of the Family Aulopidae (Aulopiformes), Commonly Referred to as Aulopus, Flagfins, Sergeant Bakers or Threadsails, in Australasian Waters

Martin F. Gomon^{1,3}, Carl D. Struthers² and Andrew L. Stewart²

¹ Ichthyology, Sciences Department, Museum Victoria, GPO Box 666, Melbourne, Victoria 3001, Australia
E-mail: mgomon@museum.vic.gov.au

² Museum of New Zealand Te Papa Tongarewa, PO Box 467, Wellington, New Zealand
E-mail: carls@tepapa.govt.nz (CDS); andrews@tepapa.govt.nz (ALS)

³ Corresponding author

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Two new species of the aulopiform family Aulopidae are described from waters off northern New Zealand, eastern Australia and the Tasman Sea. *Hime pyrhistion* sp. nov., previously confused with *Hime japonica* (Günther, 1877), differs from that species in having a higher dorsal fin in both males and females, together with slight differences in colouration. Specific recognition of the two is supported by genetic evidence, with genetic distances of CO1 separating the two of a similar magnitude as distances between *H. curtirostris* (Thomson, 1967), *H. diactithrix* (Prokofiev, 2008) and *H. japonica*. A morphological redescription of *H. japonica* is provided for comparison. A new genus *Leptaulopus* is erected for *Aulopus damasi* Tanaka, 1915 and a second new species *L. erythrozonatus* sp. nov. is described from four specimens collected in northern New Zealand and eastern Australian waters. *Leptaulopus* is distinguishable from the other three genera of the family, *Aulopus* Cloquet, 1816, *Hime* Starks, 1924 and *Latropiscis* Whitley, 1931, most noticeably in having a more slender body, a more posteriorly placed dorsal fin, and finer, more cardiform teeth in the jaws, as well as relatively great genetic distances of CO1. The new species is separable from *L. damasi* by its more numerous dorsal fin rays (15 or 16 vs 13 or 14), lateral line scales (44 vs 33–37) and vertebrae (44 vs 36), smaller eye and longer, more depressed snout. A neotype is designated for *L. damasi*, and a revised description of the species is provided.

Key Words: New Zealand, Australia, *Hime*, *Leptaulopus* gen. nov., CO1, redescription.

Introduction

The number of genera of the aulopiform family Aulopidae has been a subject of recent debate by a number of authors, some recognizing only the single genus *Aulopus* within the family (Mead 1966; Sulak 1977; Lee and Chao 1994; Baldwin and Johnson 1996; Prokofiev 2008) and others arguing that variation between species is sufficient to recognise more than one: *Aulopus* Cloquet, 1816, *Hime* Starks, 1924 and perhaps *Latropiscis* Whitley, 1931 (Thomson 1967; Parin and Kotlyar 1989; Thompson 1998). In 1989, Shimizu and Yamakawa presented a poster at an international conference supporting the recognition of four genera, one undescribed, and eight western Pacific species, four of which were at that time also undescribed. Prior to his death in January 2007, Thompson gathered morphological evidence supporting the view of Shimizu and Yamakawa, which he presented as a poster at a major North American conference in 2006 (Thompson and Stewart 2006). Although both studies remain unpublished, information provided in Thompson's (1998) publication was sufficient for the recognition in recent species and faunal treatments of *Hime* as the valid generic reference for many of the western Pacific spe-

cies (Hoese, Bray and Gates, in Hoese *et al.* 2006; Randall 2007; Fricke *et al.* 2011; Eschmeyer 2012). At present, up to seven nominal species, *Hime curtirostris* (Thomson, 1967), *Hime damasi* (Tanaka, 1915), *Hime diactithrix* (Prokofiev, 2008), *Hime formosanus* (Lee and Chao, 1994), *Hime japonica* (Günther, 1877), *Hime microps* Parin and Kotlyar, 1989, and *Hime purpurissatus* (Richardson, 1843), are regarded as valid *Hime* congeners in the Pacific and eastern Indian Ocean. Several others recognised in the literature remain to be described.

A review of descriptions in the literature of western Pacific species referable to *Hime* reveals little interspecific variation in meristic characters. All species described since *Hime japonica* have prominent modifications of the dorsal fin, at least in males, or distinctly smaller eyes that readily separate them from the latter. Lee and Chao (1994) relied on electrophoretic techniques to verify that males of their *H. formosanus* with filamentous second dorsal fin rays were the same species as females, which have a more typical *H. japonica*-like form. Likewise, *H. curtirostris* and *H. diactithrix* have decidedly prolonged anterior dorsal fin rays in one or both sexes that set them apart from *H. japonica*. The Australasian species of *Hime* described below, though lacking filamentous projections, has a noticeably higher and more

colourful dorsal fin in males that distinguishes it from *H. japonica*, even if it appears to have been confused with that species by Parin and Kotlyar (1989).

The initial purpose of this contribution was to provide names for the two New Zealand species identified by both Shimizu and Yamakawa (1989) and Thompson and Stewart (2006) for inclusion in a forthcoming field guide to New Zealand fishes (Roberts *et al.*, in press). One of these appeared in the literature more than 20 years ago (Shimizu in Amaoka *et al.* 1990). In the course of gathering information for these descriptions, characters were observed in two of the species examined that justify their reassignment to a new genus as proposed by the same sets of authors.

We take pleasure in proposing Thompson's manuscript names, which he kindly provided to us prior to his death. We do so to acknowledge the author's valuable contribution to the understanding of the diversity of the family. Accordingly, species with short snouts, which comprise the majority of western Pacific aulopids, are referred to the genus *Hime* as fully justified by Thompson (1998).

Materials and Methods

Counts and measurements mostly follow Thompson (1998), who adopted the methodology of Hubbs and Lagler (1947) and repeated the measurements of Mead (1958). The last caudal vertebra counted is a complex element comprising more than one modified centrum, in combination articulating with hypurals; gill raker counts exclude rudiments. Measurements are direct, those from the snout are from the anterior tip of the retracted upper jaw; body depths were taken at the dorsal fin origin and adipose fin origin; individual fin rays in the dorsal and anal fins were measured as stated to compare relative fin sizes; the length of the pelvic fin was measured from the base of the first fin ray to the tip of the longest ray. Standard length and head length in mm are expressed throughout as SL and HL respectively. Descriptions of the new species are based on the holotype with ranges observed in paratypes enclosed in parentheses. Where observed, sexually dimorphic variations are provided for males and females separately. In lists of specimens examined, numbers of specimens, their standard lengths in mm, and sex if known, are placed in parentheses after registration numbers, except for lots containing only a single specimen where only the length and sex is presented. Institution abbreviations follow Sabaj Pérez (2013).

Genetic material and sequences. Genetic analysis of mitochondrial cytochrome oxidase subunit I (COI) gene was carried out on 59 muscle tissues, representing 11 terminal taxa of Aulopidae (see Appendix 1 for list of material and BOLD and GenBank accession numbers). These included 10 specimens of *Hime curtirostris* from eastern Australia, 4 *H. diactithrix* from northwestern Australia and southern Japan, 3 *H. formosanus* from Japan, 2 *H. japonica* from Japan and Taiwan, 8 *H. cf. japonica* from southern Indonesia, 15 *H. pyrhition* sp. nov. from northern New Zealand and eastern Australia, 3 *Latropiscis purpurissatus* from

southern Australia, 5 *Leptaulopus damasi* from Japan and Taiwan, 2 *L. erythrozonatus* sp. nov. from northern New Zealand, 4 *Aulopus filamentosus* from Italy and Bermuda and 1 of an unnamed species of *Aulopus* from the eastern Pacific (M. Davis and H. J. Walker, pers. comm.), and an outgroup of Paraulopidae, comprising 3 *Paraulopus nigripinnis* from New Zealand. The data set included 34 sequences obtained from the BOLD database (www.boldsystems.org), GenBank (www.ncbi.nlm.nih.gov) and generous colleagues.

An additional 25 sequences were derived from fresh samples taken from voucher specimens acquired to document described and undescribed species absent from the databases or species represented by sequences for which vouchers were unavailable and therefore identities could not be verified. Genomic DNA was extracted from ethanol-preserved muscle tissue using either a DNeasy blood and tissue kit (Qiagen). A fragment of the COI gene was PCR amplified and sequenced using thermocycling conditions and primers (FishF2 and FishR1) from Ward *et al.* (2005). PCR products were purified by digestion with ExoProStar (Illustra) or with Zymo DNA Clean and Concentrator (Zymo Research, USA), following the manufacturer's instructions. PCR products were sequenced in both directions on an ABI-3730 (Massey University Genome Service, Palmerston North, New Zealand or Macrogen, Seoul, South Korea). Newly generated sequences have been deposited in BOLD and GenBank (see Appendix 1 for a list of voucher specimens and their accession numbers).

Phylogenetic analyses. All 59 sequences were individually aligned in ClustalW, using the software Geneious v6.0.5. The COI alignment contained no indels (insertions and deletions). Both neighbour-joining (NJ) and maximum-likelihood (ML) trees were used to visualise distance relationships within and between species; node support was assessed with 1,000 bootstrap replications of each tree. For the ML analyses, the most appropriate model of sequence evolution for each dataset was determined using the Akaike Information Criterion in ModelTest, and the TN93+ Γ +G model was selected (Tamura and Nei 1993), as it was the best performing of 24 different nucleotide substitution models tested in the Model Selection option of MEGA 5.2. A discrete Gamma distribution was used to model evolutionary rate differences among sites [3 categories (+G, parameter = 1.6560)], and this model allowed some sites to be evolutionarily invariable (59.6% sites). In addition, an NJ tree was estimated using p-distance (uncorrected distances). This distance is the proportion (p) of nucleotide sites at which two sequences being compared are different. It is obtained by dividing the number of nucleotide differences by the total number of nucleotides compared. It does not make any correction for multiple substitutions at the same site, substitution rate biases (for example, differences in the transitional and transversal rates), or differences in evolutionary rates among sites.

Indo-West Pacific Aulopidae

The aulopiform family Aulopidae is distributed throughout tropical and subtropical regions of the Atlantic and Pacific oceans, but appears to be absent from the Indian Ocean, except along the northwestern coast of Australia (Gloerfelt-Tarp and Kailola 1984) and southern side of Indonesia (W. White pers. comm.). Of the family's 16 nominal species, 9 in two genera are currently recognised as valid in the Pacific. With the increasing use of mitochondrial DNA for the identification of cryptic species (e.g., Ward *et al.* 2007; Smith *et al.* 2008; Zemlak *et al.* 2009) the technique was identified as an obvious tool for testing the identity of the presumed new Australasian species mentioned above, as well as other populations throughout the western Pacific that might similarly differ. The rapidly growing documentation of CO1 sequences for the Australasian region (Ward *et al.* 2009) provided a comprehensive resource for such a comparison and similarly expanding tissue collections of world museums allowed many of the gaps in sequence data sets to be filled with minimal effort. It was noted in the course of aggregating sequences and tissues for this analysis that the identities for many of the sequences recorded in the BOLD database were questioned in some fashion (e.g., *Hime* cf. *japonica*, *Hime* sp. nov.).

Genetic results. The three best supported trees (TN93+G+I/NJ, TN93+G+I/ML and p-distance/NJ) have the same overall tree topology, differing only in some basal relationships. Rather than providing all three trees we have chosen to present the TN93+G+I/NJ tree (Fig. 1) with bootstrap values exceeding 70% for all three genetic models at each relevant node.

All twelve terminal clades were supported by high bootstrap support with both ML and NJ (100%) methods. Intra-group variation was low and bootstrap values exceeded 85%, supporting morphological evidence that these clades represent single species. Sequence divergence values between the six species clades of *Hime* and two species of *Leptaulopus* (Table 1) were low (0.072–0.126 and 0.218 respectively), with higher values between genera (*Aulopus* vs *Hime* 0.273–0.338; *Hime* vs *Leptaulopus* 0.246–0.341; *Hime* vs *Latropiscis* 0.220–0.273; *Leptaulopus* vs *Aulopus* 0.236–0.274; *Aulopus* vs *Latropiscis* 0.333–0.337). The highest within genus divergence was between the two species of *Leptaulopus* (0.218) also reflected in the considerable divergence of several meristic values for the two. Four of the six presumed species level clades in the terminal cluster comprise individuals verified as *Hime curtirostris*, *H. formosanus*, *H. japonica*, and the trans-Tasman new species of *Hime* described below. A fifth based on female specimens alone collected off northwestern Australia and southern Japan matches the description of *H. diactithrix* and is assumed to be that species. Despite Prokofiev's (2012) reassessment of the validity of this species and resultant reassignment of it to subspecies status, genetic data implies a divergence equivalent to other recognised species of *Hime* and supports a hypothesis of a more distant relationship with *H. formosanus* within the genus

than indicated. Recognition of the clade at species level is supported by morphological evidence in the form of relative dorsal fin ray lengths and associated fin form that are commensurate with characters identified below as diagnostic for the new species of *Hime*. The sixth clade represents a separate morphologically distinguishable species that is the subject of an ongoing study. All six agree with Thompson's (1998) diagnosis of the genus *Hime*.

Although this analysis is not fully reliable from a phylogenetic perspective since it uses only a single, mitochondrial marker, the basal three aulopid clades each have considerably longer branches than those of *Hime* species, supporting a morphologically based hypothesis that they represent the separate genera discussed below. Vouchers for these three sequence clusters are identifiable as the Atlantic *Aulopus filamentosus*, the second new species described below and a taxon we regard as *Latropiscis purpurissatus*, a southern Australia endemic. The generic allocation for the last, though not examined further here, was endorsed by Shimizu and Yamakawa (1989) and Thompson and Stewart (2006) and is supported by morphological evidence.

Genus *Hime* Starks, 1924

Hime Starks, 1924: 30 (type species *Aulopus japonicus* Günther 1877, by original designation); Parin and Kotlyar 1989: 407; Thompson 1998: 50; Mundy 2005: 192; Hoese Bray and Gates in Hoese *et al.* 2006: 464; Fricke *et al.* 2011: 358; Eschmeyer 2012.

Aulopus nec Cloquet, 1816: Mead 1966: 22; Sulak 1977: 53; Shen 1984: 15; Yamakawa in Masuda *et al.* 1984: 60; Hoese and Hanley in Paxton *et al.* 1989: 227; Lee and Chao 1994: 211; Baldwin and Johnson 1996: 358; Okamura and Amaoka 1997: 109; Paxton and Niem 1999: 1919; Nakabo in Nakabo 2000: 349; Prokofiev 2008: 141.

Diagnosis. Dorsal fin with 15–17 rays; pectoral fin with 10–12 (mostly 11) rays; total vertebrae 40–43; lateral line scales 39–43. Head moderately large, length 29.7–33.7% SL; snout short, 7.9–9.9% SL and 25.8–30.3% HL; eye moderately large 7.1–10.8% SL and 22.5–35.5% HL; predorsal of moderate length 34.4–37.1% SL; anal fin to anus 11.7–15.7% SL; pyloric caeca present or absent. Nasal flap arising from septum between anterior and posterior nasal openings lanceolate (Fig. 2A). Teeth in jaws short canines, in about two to four rows; about two rows of small canines on palatines and traversing vomer. Dorsal fin originating just in advance of vertical through pelvic fin origin, dorsal fin base of moderate length, 28.6–32.6% SL, height variable with distinct sexual dimorphism in form in most species, second to fifth rays longest, 20.4–51.5% SL, subsequent rays progressively shorter or subequal, posterior lobe reaching between little more than half way to hypural crease in females to almost reaching hypural crease in males; length of dorsal fin base 1.34–1.98 times distance from dorsal fin insertion to origin of adipose fin; distinct sexual dimorphism in form of anal fin in most species with fin usually distinctly larger in males than females, posterior lobe variably reaching much

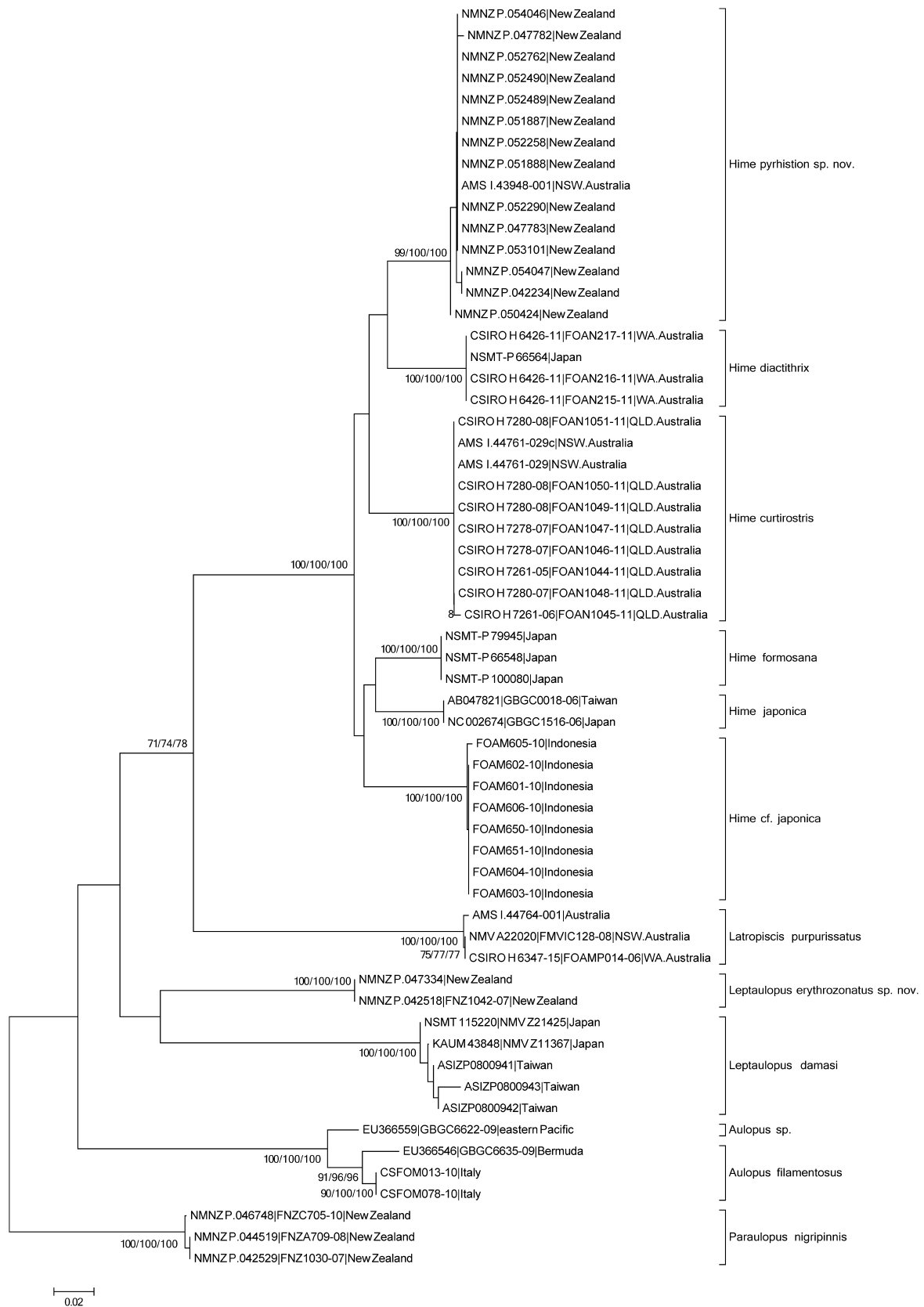


Fig. 1. TN93 neighbour-joining tree of 59 COI sequences from 4 purported genera and 11 purported species of Aulopidae, as well as sequences for an outgroup species, *Paraulopus nigripinnis*. Percent bootstrap values are given for all well supported nodes ($>70\%$), followed by bootstrap values for these nodes in a TN93 maximum likelihood and a p-distance neighbour joining tree. See text. Specimen numbers are registration numbers of vouchers or those of the Barcode of Life Database (BOLD, www.barcodinglife.org) or GenBank (www.ncbi.nlm.nih.gov).

Table 1. Estimates of Evolutionary Divergence over Sequence Pairs within (left) and between (right) groups. TN93 genetic distances as averages over all sequence pairs within species are in the left column, with Standard error estimates on the right (left table). Genetic distances as averages over all sequence pairs between species are below the diagonal with Standard error estimates above it (right table). Asterisk denotes single sequence.

Species	Within Species		Between Species											
	Distance	Standard Error	Distance below and Standard Error above diagonal											
			<i>L dam</i>	<i>A fil</i>	<i>A sp</i>	<i>H c jap</i>	<i>H cur</i>	<i>H dia</i>	<i>H for</i>	<i>H jap</i>	<i>H pyr</i>	<i>L pur</i>	<i>L ery</i>	<i>P nig</i>
<i>Leptaulopus damasi</i>	0.005	0.002		0.039	0.041	0.041	0.049	0.045	0.041	0.040	0.042	0.045	0.033	0.042
<i>Aulopus filamentosus</i>	0.017	0.006	0.267		0.011	0.045	0.048	0.045	0.051	0.049	0.045	0.047	0.035	0.038
<i>Aulopus</i> sp.	—*	—*	0.274	0.043		0.042	0.044	0.042	0.047	0.047	0.045	0.048	0.036	0.042
<i>Hime</i> cf. <i>japonica</i>	0.001	0.001	0.279	0.296	0.278		0.021	0.023	0.018	0.017	0.019	0.041	0.043	0.044
<i>Hime curtirostris</i>	0.001	0.001	0.341	0.323	0.291	0.109		0.017	0.019	0.017	0.017	0.034	0.042	0.047
<i>Hime diactithrix</i>	0.000	0.000	0.310	0.302	0.273	0.126	0.083		0.019	0.021	0.015	0.039	0.039	0.046
<i>Hime formosana</i>	0.000	0.000	0.290	0.338	0.308	0.090	0.090	0.090		0.015	0.018	0.036	0.039	0.048
<i>Hime japonica</i>	0.000	0.000	0.262	0.322	0.308	0.083	0.083	0.113	0.065		0.018	0.036	0.038	0.049
<i>Hime pyrhition</i> sp. nov.	0.002	0.001	0.288	0.306	0.300	0.101	0.083	0.072	0.089	0.089		0.038	0.037	0.045
<i>Latropiscis purpurissatus</i>	0.002	0.002	0.321	0.333	0.337	0.273	0.220	0.246	0.230	0.235	0.256		0.039	0.040
<i>Leptaulopus erythrozonatus</i> sp. nov.	0.000	0.000	0.218	0.236	0.241	0.296	0.279	0.257	0.257	0.246	0.246	0.262		0.047
<i>Paraulopus nigripinnis</i>	0.002	0.002	0.282	0.253	0.273	0.284	0.312	0.305	0.317	0.323	0.297	0.271	0.310	

less than half way to hypural crease in females and nearly to hypural crease in some males; caudal fin with deep fork, shortest rays at middle of fin little more than a third length of longest rays to corners; ray on ventral edge of caudal fin without fleshy covering; pectoral fin origin just in advance of vertical through dorsal fin origin; first four rays of pelvic fin slightly thickened and cylindrical with fleshy dermal covering distally in large individuals. Males and females usually with separate colour patterns, males frequently with distinct broad yellow stripe on anal fin in life that is absent in females.

Remarks. Thompson (1998) distinguished *Hime* from *Aulopus* by its more anteriorly positioned anus (anus to anal fin origin 11–17% SL vs 5–11% SL) with longest pelvic fin rays reaching to or past the anus (versus not reaching anus), possession of 44 or fewer vertebrae (usually 41 or 42 vs 46 or more, usually 48–52), presence or absence of pyloric caeca (vs lacking pyloric caeca), more anteriorly placed dorsal fin with the pelvic fin origin under or posterior to the dorsal fin origin (vs more posteriorly placed dorsal fin with pelvic fin origin anterior to dorsal fin origin), the eye diameter greater than the snout length (vs eye diameter varying from less to slightly more than snout length) and more posteriorly placed anal fin (snout to anal fin origin 71–77% of SL, vs more anteriorly placed anal fin with snout to anal fin origin 69–73% of SL). Data gathered in the course of this study mostly agree with these observations. Thompson initially regarded the genus as comprising *H. curtirostris*, *H. damasi*, *H. formosanus*, *H. japonicus*, *H. microps*, and *H. purpurissatus*, but subsequently changed his mind (pers. comm.) and, like Shimizu and Yamakawa (1989), referred *H. purpurissatus* to *Latropiscis* and considered *H. damasi* to warrant placement in a separate unnamed genus. The description of *H. diactithrix* brought the number of valid nominal species of *Hime* to five. Current studies indicate that species in addition to those treated here await description.

Members of the genus are confined to the central, south-eastern and western Pacific, extending into the Indian Ocean along the northwestern coast of Australia (Glorefelt-Tarp and Kailola 1984). One species, *H. japonica*, has been reported to reach eastward to Hawaii (Mundy 2005), but it is unlikely that this identity of the Hawaiian species is correct (Randall 1976; ongoing study), and a second, *H. microps*, was described from deepwater on the Nazca Ridge in the eastern Pacific (25°43'S, 85°29'W).

Hime japonica (Günther, 1877)

[Japanese name: Hime]

(Fig. 1; Tables 2, 3)

Aulopus japonicus Günther, 1877: 444, Yokohama market, Japan; Jordan *et al.* 1913: 49, fig. 27; Jordan and Thompson 1914: 212, pl. XL, fig. 1; Yamakawa in Okamura and Kitajima 1984: 159, 342; Yamakawa in Masuda *et al.* 1984: 60; Yu 1988: 25; Paulin *et al.* 1989: 104; Nakabo 1993: 300; Mok 1993: 156; Lee and Chao 1994: 211; Baldwin and Johnson 1996: 358; Okamura and Amaoka 1997: 109; Paxton and Niem 1999: 1920; Nakabo in Nakabo 2000: 349; Paxton in Randall and Lim 2000: 591; Kawaguchi *et al.* 2001: 213; Shinohara *et al.* 2001: 299; Chen 2002: 86; Nakabo in Nakabo 2002: 349; Shinohara *et al.* 2005: 407; Senou *et al.* 2006: 415; Yamada *et al.* 2007: 245; Prokofiev 2008: 134; Matsunuma *et al.* 2008: 71, fig. 2; Shinohara *et al.* 2011: 39; Hata *et al.* 2012: 9; Nakabo and Kai in Nakabo 2013: 421.

Hime japonica: Starks 1924: 30; Mori 1952: 42 (Fusan, Korea); Masuda *et al.* 1975: 174, pl. 20-A; Parin and Kotlyar 1989: 407 (in part); Thompson 1998: 50; Mundy 2005: 192 (in part); Hoese, Bray and Gates, in Hoese *et al.* 2006: 464 (in part).

Hime japonicus: Youn 2002: 199, 532.

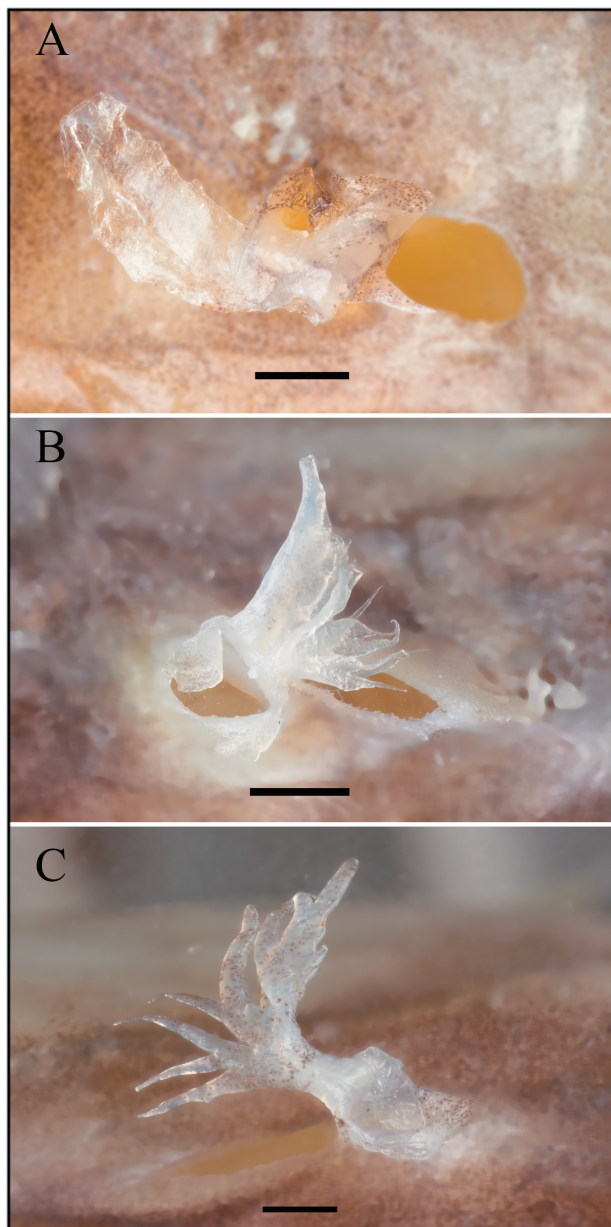


Fig. 2. Nasal flap: A) *Hime pyrhistion* sp. nov. NMNZ P.054047, holotype; B) *Leptaulopus damasi* NSMT-P. 115220, neotype; and, C) *Leptaulopus erythrozonatus* sp. nov. NMNZ P.042518, holotype.

Material examined. 12 specimens, 135–178 mm SL. **JAPAN:** NSMT-P 61775, 158 mm SL, female, Honshu, Tokyo Bay, 29 July 1984; NSMT-P 67548, 2, 136–148 mm SL, males, 135 mm SL, female, East China Sea, 30°32.83'N, 127°48.41'E to 30°31.62'N, 127°47.69'E, 194–204 m, 5 November 2003; NSMT-P 73444, 149 mm SL, male, Honshu, Fukushima Prefecture, Iwaki, Onahama, 1931–1935; NSMT-P 96491, 160 mm SL, male, 143 mm SL, female, East China Sea, 26 June 1984; NSMT-P 101791, 2, 152–160 mm SL, males, 3, 168–178 mm SL, females, Suruga Bay, Honshu, Shizuoka Prefecture, Seno-umi, 50–60 m, 22 June 1981, hook and line.

Diagnosis. Dorsal fin rays 16, rarely 15; anal fin rays 10, rarely 9; pectoral fin rays 11, rarely 12; vertebrae 41–43; total gill rakers 20 or 21, rarely 19 or 22; lateral line scales

42 or 43, rarely 41; pyloric caeca 11. Dorsal fin large anteriorly in males, membranes deeply incised but none of the rays filamentous, third or fourth rays longest, reaching 25.7% SL, decreasing in length to middle of fin with posterior rays progressively longer, reaching 19.5% SL, posterior lobe reaching to or past adipose fin origin; anterior end of fin lower in females, membranes deeply incised with rays decreasing in length to middle of fin, lengths of subsequent rays subequal; posterior lobe reaching little more than half way to adipose fin. Anal fin relatively deep in males, posterior lobe approaching hypural crease in large individuals; fin smaller in females, posterior lobe reaching little more than half way to hypural crease (see Tables 2 and 3 for additional meristic and morphometric values). Males with prominent, large orange to red blotch or markings anteriorly and yellow spots posteriorly in dorsal fin, three broad bands on side with wide dark brown margins dorsally, wide yellow stripes on each lobe of caudal fin and white pelvic and anal fins, pelvics somewhat orange basally and anal with broad yellow stripe on basal half. Females with orange to red spots scattered on dorsal fin, similar but less defined pattern on side, mottled yellow to orange pattern on caudal fin, similar pelvic fin but no yellow on anal fin. Reaches a moderately small size for members of the genus, largest specimen known 196 mm SL.

Distribution. Although reported from a number of areas in the western Pacific, this species is conclusively known only from Japan, Korea and the East China Sea south to Taiwan. In Japan, it is recorded from both the Sea of Japan and western Pacific coasts south of northern Honshu (Yamada *et al.* 2007: 245). It apparently inhabits the outer half of the continental shelf at depths of about 100–200 m. Judging from the collection method for many of the specimens examined, the species likely inhabits hard bottom environments where trawling is rarely undertaken.

Remarks. Although the type of *H. japonica* was not examined for this study, there is no doubt to which species the name applies as only a single species referable to the genus occurs in the vicinity of the type locality (Yokohama) and Japanese literature has been consistent in its application. A number of authors (Strasburg 1966; Struhsaker 1973; Borets 1986; Boehlert and Mundy 1992; Chave and Mundy 1994; Randall 2007) recorded this species from ridges and seamounts associated with the Hawaiian Island chain, but we are sceptical of these identifications, as were Struhsaker (1973), Randall (1976, 1981) and Tinker (1982, appendix), who regarded the species occurring in this area as being undescribed. Recent acquisition of loan material confirms this scepticism and the species is the subject of an ongoing study. Reports of *H. japonica* from the Australasian region (Parin and Kotlyar 1989: 407, in part; Hoese Bray and Gates in Hoese *et al.* 2006: 464; Fricke *et al.* 2011: 358) are confirmed misidentifications.

Excellent images of the male and female forms of this species may be found in Matsunuma *et al.* (2008, fig. 2). Ranges for meristic and morphometric characters are provided in Table 2 and agree with those provided by the above authors.

Table 2. Selected counts for a series of *Hime japonica*, types of *H. pyrhistion* sp. nov., neotype and other specimens of *Leptaulopus damasi* and types of *L. erythrozonatus* sp. nov.

	<i>Hime</i>					<i>Leptaulopus</i> gen. nov.						
	<i>H. japonica</i>		<i>H. pyrhistion</i> sp. nov.			<i>L. damasi</i>			<i>L. erythrozonatus</i> sp. nov.			
	<i>n</i> = 12		Holotype NMNZ P.054047	Paratypes <i>n</i> = 31		Neotype NSMT P 115220	Japan/Taiwan <i>n</i> = 18		Australia CSIRO H 651–10	Holotype NMNZ P.042518	Paratypes <i>n</i> = 3	
	range	mean		range	mean		range	mean			range	mean
Dorsal fin rays	15–16	15.9	16	15–17	16.0	14	13–14	13.9	14	16	15–16	15.7
Anal fin rays	9–10	9.8	10	9–11	10.0	9	8–9	8.9	9	11	10	10.0
Pectoral fin rays	11	11.0	11	10–11	10.9	12	12	12.0	12	12	12	12.0
Pelvic fin rays	9	9.0	9	9	9.0	9	9	9.0	9	9	9	9.0
Vertebrae												
–precaudal	26–28	26.9	27	26–28	27.2	20	20–21*	20.9	21	26	27	27.0
–caudal	14–16	15.2	15	14–16	14.9	16	15–16*	15.1	15	18	17	17.0
–total	41–43	42.2	42	42–43	42.1	36	36*	36.0	36	44	44	44.0
Gill rakers												
–upper	3–6	5.0	5	3–5	4.3	3	2–3	2.7	3	3	2–3	2.7
–lower	14–16	15.4	15	11–16	14.0	11	9–12	10.7	11	12	12	12.0
–total	19–22	20.4	20	15–20	18.3	14	11–15	13.3	14	15	14–15	14.7
Scales												
–lateral line	41–43	42.0	41	41–43	42.0	34	33–37	34.7	35	44	44	44.0
–above lateral line	4.5	4.5	4.5	4.5	4.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
–below lateral line	3.5–4.5	4.1	4.5	3.5–4.5	4.0	3.5	3.5	3.5	3.5	4.5	4.5	4.5
–predorsal	11–14	12.0	12	12–15	13.5	16	13–17	15.2	15	20	19–20	19.7
–anus to anal fin origin	9–10	9.4	9	7–11	8.5	7	6–8	6.6	7	8	8–11	9.3
–pelvic insertion to anus	11–14	12.1	13	10–13	11.8	13	11–13	12.4	14	14	13–14	13.3

* 10 specimens.

***Hime pyrhistion* sp. nov.**

[New English name: Flaming Flagfin]

(Figs 1–4; Tables 2, 3)

Aulopus japonicus nec Günther 1880: Paulin 1984: 63, fig. 1.*Aulopus ?japonicus* nec Günther 1880: Paulin *et al.* 1989: 104, fig. 37.1.*Hime* sp.: Shimizu in Amaoka *et al.* 1990: 126 (unnumbered fig.); Roberts *et al.* 2009: 530.*Hime* NFZ 1: Clark and Roberts 2008: appendix 4 (unnumbered fig.).**Holotype.** NMNZ P.054047, 236 mm SL, male, 35°28'S, 174°42'E, western side of Poor Knights Islands, New Zealand, 80 m, June 2012, E. Daysh, rod and line.**Paratypes.** 31 specimens, 171–268 mm SL. **NEW ZEALAND:** NMNZ P.012711, 234 mm SL, male, 35°00.00'S, 173°57.55'E, outside Cavalli Islands, 117 m, longline, July 1982, P. Tane; NMNZ P.016027, 242 mm SL, male, 35°33.75'S, 174°31.00'E, off Matapouri Bay, Tutukaka, 119 m, August 1984, P. Bendle, rod and line; NMNZ P.016187, 242 mm SL, male, 35°33.75'S, 174°31.00'E, off Matapouri Bay, Tutukaka, 119 m, August 1984, P. Bendle, rod and line; NMNZ P.023795, 225 mm SL, male, 35°00.00'S, 174°00.00'E, ca. 3.5 miles North of Castle Rock, Northland, depth unknown, April 1986, V. R. McNabb, rod and line; NMNZ P.033114, 268 mm SL, male, 37°18.00'S, 176°25.00'E, 94 Metre Knoll, 3 miles east of SE Bay, Mayor Island, Bay of Plenty, 94 m, February 1996, L. Sayer, rod

and line; NMNZ P.033853, 232 mm SL, male, 35°10.00'S, 174°23.00'E, north east of Cape Brett, depth unknown, October 1996, C. Worthington, rod and line; NMNZ P.033978, 248 mm SL, male, 37°15.00'S, 177°10.00'E, off White Island, Bay of Plenty, depth unknown, collector unknown; NMNZ P.034067, 253 mm SL, male, 37°15.00'S, 176°15.00'E, off Mayor Island, Bay of Plenty, depth unknown, S. Sneddon; NMNZ P.034195, 258 mm SL, male, 37°31.00'S, 177°08.00'E, White Island, Roys Reef, Bay of Plenty, 120 m, January 1997, G. Caw, rod and line; NMNZ P.037199, 220 mm SL, male, 37°31.00'S, 177°08.00'E, off Horseshoe Reef, White Island, Bay of Plenty, 210 m, 6 February 2000, S. Mossman, rod and line; NMNZ P.037272, 198 mm SL, male, 37°32.50'S, 177°11.00'E, off White Island, Bay of Plenty, 160 m, February 2000, S. Hollis-Johns, rod and line; NMNZ P.037984, 230 mm SL, male, 37°15.00'S, 177°02.00'E, Rangitira Knoll, 20 nautical miles NW of White Island, Bay of Plenty, 150 m, 20 November 2001, S. Mossman, rod and line; NMNZ P.038531, 228 mm SL, male, 35°15.00'S, 174°20.00'E, 8 nautical miles NNE of Whangaruru Harbour, Northland, 120 m, 18 October 2002, D. Brambley, rod and line; NMNZ P.039884, 184 mm SL, male, 37°31.00'S, 177°12.00'E, approximately 3 to 5 miles off White Island, Bay of Plenty, 150 m, 2003, R. Pollock, rod and line; NMNZ P.040556, 224 mm SL, male, 37°30.25'S, 177°08.00'E, pinacles south of the Volkner Rocks, off White Island, Bay of Plenty, 100 m, 4 March 2003, collector unknown, rod and line; NMNZ P.042234, 212 mm SL, female, 37°43'S, 177°15'E, between Opotiki and White Island, Bay of Plen-

Table 3. Selected proportional measurements for a series of *Hime japonica* and male holotype and paratypes of *H. pyrhiston* sp. nov.

	<i>Hime japonica</i>				Holotype NMNZ P.054047	<i>Hime pyrhistion</i> sp. nov.			
	Males <i>n</i> =6		Females <i>n</i> =6			Paratypes			
						Males <i>n</i> =21		Females <i>n</i> =10	
Standard Length (mm)	136–160		135–178		236	184–268		171–234	
% SL	range	mean ± s.d	range	mean ± s.d		range	mean ± s.d	range	mean ± s.d
Body depth–dorsal-fin origin	18.1–24.3	20.9±2.4	17.6–24.3	21.7±2.3	20	19.4–23.3	20.7±1.0	19.1–23.6	21.1±1.7
–anal-fin origin	10.4–11.2	10.8±0.3	9.1–11.4	10.5±0.8	10.6	10.4–11.9	11.1±0.4	9.3–11.4	10.7±0.7
Caudal peduncle length	16.8–18.7	18.1±0.8	16.9–19.1	17.7±0.8	17.1	15.8–20.8	18.1±1.0	15.9–19.4	17.1±1.0
Caudal peduncle depth (least)	7.1–7.6	7.4±0.2	6.4–7.5	7.1±0.4	7.7	6.9–8.2	7.6±0.3	6.8–8.3	7.6±0.5
Head length	29.1–30.6	29.9±0.7	29.6–31.5	30.7±0.7	29.7	29.7–31.1	30.4±0.5	30.3–33.7	31.4±1.1
Orbital diameter	8.4–10.0	9.2±0.6	9.0–10.5	9.8±0.6	8.1	7.3–8.9	8.2±0.4	8.3–10.8	9.4±0.8
Interorbital width	4.9–5.6	5.2±0.3	5.0–6.1	5.6±0.4	4.7	4.2–5.3	4.7±0.3	4.0–4.9	4.3±0.3
Postorbital length	13.1–14.6	13.7±0.5	13.3–15.0	14.3±0.4	14.7	13.7–16.0	30.4±0.5	13.7–16.8	14.7±0.9
Snout length	7.0–8.2	7.6±0.4	6.7–8.0	7.5±0.5	8.4	7.7–9.4	8.5±0.4	7.4–9.9	8.3±0.7
Upper-jaw length	13.5–14.9	14.1±0.5	13.7–14.6	14.3±0.4	15.1	14.3–15.4	14.8±0.3	14.5–15.6	15.1±0.4
Predorsal-fin length	34.2–36.1	35.2±0.7	34.6–36.9	35.6±0.9	34.3	33.6–36.9	35.0±0.8	34.7–37.1	35.9±0.8
Prepectoral-fin length	29.1–32.7	31.0±1.3	30.9–35.3	32.3±1.6	31.4	31.0–33.3	32.0±0.6	32.2–35.0	33.1±0.9
Prepelvic-fin length	30.4–38.9	35.5±3.3	34.8–41.9	37.7±2.4	38	36.3–39.3	38.2±0.9	37.0–41.0	39.2±1.2
Peanus length	57.9–60.9	59.9±1.3	60.1–63.6	61.8±1.3	60	57.9–61.9	59.8±1.1	45.5–65.2	59.9±5.5
Preanal-fin length	56.5–74.3	70.4±6.8	73.7–75.7	74.6±0.7	73.4	70.0–74.6	73.0±1.0	73.1–77.0	74.5±1.3
Anus to anal-fin length	12.1–15.4	13.7±1.4	12.6–13.9	13.3±0.6	13.4	11.7–15.6	13.4±1.2	10.0–15.7	13.7±1.8
Pelvic fin origin to anus	22.5–30.3	23.2±0.7	21.8–25.5	23.2±1.3	23.4	20.7–24.6*	22.9±1.3	19.4–26.8*	23.4±2.3
Dorsal-fin insertion to adipose origin	17.0–22.6	18.5±1.2	18.4–22.4	20.2±1.3	17.9	16.4–19.7	18.2±0.9	17.5–20.7	18.8±1.1
Dorsal-fin base length	29.1–31.0	30.1±0.7	28.4–30.2	29.4±0.8	30.6	28.6–32.8	30.7±1.2	28.7–32.0	29.9±1.1
Dorsal-fin length	45.2–48.8	46.7±1.4	39.3–45.0	41.7±2.0	49.3	46.4–52.3	49.4±1.9	40.1–44.1	41.8±1.5
Dorsal-fin ray length– 1st ray	9.7–12.3	10.9±1.0	7.6–13.3	10.8±2.0	13.2	10.0–15.2*	12.7±1.3	9.4–13.9	12.0±1.4
– 2nd ray	16.1–19.1	17.1±1.2	16.2–19.5	18.3±1.3	22.3	19.4–25.5*	22.0±1.8	17.9–21.5	19.5±1.2
– 3rd ray	17.7–21.0	19.2±1.4	17.0–20.2	18.5±1.2	28.4	24.9–32.8*	28.3±2.4	19.9–23.6	21.8±1.3
– 4th ray	17.4–25.7	21.0±2.9	16.4–20.5	18.7±1.5	32	28.2–36.3*	31.3±2.0	20.4–24.2	22.7±1.2
– 5th ray	18.2–23.9	20.3±2.2	15.3–20.4	17.7±1.8	30.2	24.0–36.5*	29.7±3.4	18.7–22.8	20.7±1.2
– 10th ray	16.3–19.1	17.7±1.4	14.4–16.0	15.0±0.7	17.9	15.4–21.2*	18.3±1.5	14.5–17.2	15.4±0.9
– penultimate ray	17.6–19.5	18.4±0.9	12.5–16.5	14.5±1.5	20.3	19.2–23.4*	20.8±1.1	12.6–15.9	14.3±1.1
Anal-fin base length	9.5–11.6	10.8±0.8	8.6–10.8	9.6±0.8	11.5	10.2–13.2	11.2±0.7	9.5–11.1	10.3±0.5
Anal-fin length	18.1–20.5	19.7±1.0	15.7–18.1	16.4±0.9	23.1	19.0–24.3	22.6±1.4	16.6–18.5	17.6±0.5
Anal-fin ray length– 1st ray	6.0–8.7	7.0±1.0	4.3–7.2	5.5±1.1	8.7	4.8–9.9*	8.1±1.2	4.4–7.9*	6.9±1.0
– 2nd ray	9.1–10.2	9.4±0.4	7.6–8.8	8.3±0.4	10.1	8.7–11.0*	10.4±0.6	7.8–9.9*	9.1±0.6
– penultimate ray	9.5–10.6	10.0±0.4	7.1–8.9	8.0±0.7	13.3	12.2–15.5	13.7±0.7	7.8–9.3*	8.7±0.6
Pectoral-fin length	20.9–22.6	22.0±0.6	21.3–23.7	21.9±0.9	21.1	20.2–23.1	21.2±0.8	19.6–22.9	21.0±1.2
Pelvic-fin length	25.9–30.3	27.7±1.6	21.7–26.1	24.6±1.7	24.2	22.6–27.7	25.5±1.3	24.4–27.9	25.9±1.3
Length of 5th pelvic-fin ray	17.7–22.6	20.4±1.7	16.6–19.2	17.9±0.9	19.4	17.1–22.0*	19.1±1.1	16.8–19.1*	18.3±0.8
Upper caudal lobe length	21.9–25.8	23.9±1.7	21.9–25.2	23.1±1.3	26.7	29.0 [#]	29.0 [#]	21.9–27.3*	23.7±2.4
% HL									
Snout length	24.1–26.9	25.5±1.0	22.6–25.8	24.3±1.3	28.2	25.5–30.3	27.9±1.1	23.1–29.8	26.7±2.0
Orbital diameter	28.8–33.0	30.9±1.7	29.3–35.5	31.9±2.2	27.5	23.6–29.4	26.8±1.5	26.5–34.4	30.3±2.5
Interorbital width	16.8–18.4	17.5±0.6	16.7–19.5	18.1±1.1	15.9	13.9–17.2	15.4±1.0	12.6–15.7	13.7±1.0

* denotes damaged specimens excluded from range; — data not taken.

data taken on single specimen only.

ty, 120 m, 22 January 2006, K. Tilley, rod and line; NMNZ P.047782, 197 mm SL, female, 35°25'S, 175°11'E, east of Poor Knights Islands, 153 m, FV *Atlantis*, demersal trawl; NMNZ P.047783, 188 mm SL, female, 35°25'S, 175°11'E, eastern side of Poor Knights Islands, 153 m, FV *Atlantis*, demersal trawl; NMNZ P.050424, 171 mm SL, female, 30°30.83'S, 178°36.92'W, NW of Cheeseman Island, Kermadec Islands, 227–240 m, 24 May 2011, K2011-87, Kermadec Expedition, C. Struthers, rod and line; NMNZ P.051887, 241 mm SL, male, 36°48.26'S, 176°00.56'E,

off Karewa Island, Bay of Plenty, 90 m, July 2010, A. Oliver, rod and line; NMNZ P.051888, 218 mm SL, male, 36°48.26'S, 176°00.56'E, off Karewa Island, Bay of Plenty, 90 m, July 2010, A. Oliver, rod and line; NMNZ P.052762, 234 mm SL, female, 37°17.17'S, 176°18.07'E, off Mayor Island, 120 m, October 2011, J. Gray, rod and line; NMNZ P.054046, 204 mm SL, male, 35°28'S, 174°42'E, western side of Poor Knights Islands, 80 m, June 2012, E. Daysh, rod and line. **TASMAN SEA:** CSIRO H6060-04, 216 mm SL, male, 32°36.92'S, 167°35.22'E, Wanganella Bank, Norfolk Ridge,

116–122 m, 29 May 2003, NORFANZ TAN 0308/105, RV *Tangaroa*, demersal trawl; CSIRO H6068-04, 205 mm SL, male, 32°37.20'S, 167°35.63'E, Wanganella Bank, Norfolk Ridge, 120–127 m, 30 May 2003, NORFANZ TAN 0308/117, RV *Tangaroa*, demersal trawl; CSIRO H6068-05, 221 mm SL, male, 32°37.20'S, 167°35.63'E, Wanganella Bank, Norfolk Ridge, 120–127 m, 30 May 2003, NORFANZ TAN 0308/117, RV *Tangaroa*, demersal trawl; CSIRO H6068-06, 219 mm SL, male, 32°37.20'S, 167°35.63'E, Wanganella Bank, Norfolk Ridge, 120–127 m, 30 May 2003, NORFANZ TAN 0308/117, RV *Tangaroa*, demersal trawl; NMV A 25160-001, 176 mm SL, female, 32°37.20'S, 167°35.63'E, Wanganella Bank, West Norfolk Ridge, 120–127 m, 30 May 2003, NORFANZ TAN 0308/117, RV *Tangaroa*, M. Gomon, NORFANZ team, demersal trawl. **AUSTRALIA:** AMS I.43948-001, 206 mm SL, female, 28°33'S, 153°50'E, east of Brunswick Heads, New South Wales, 211 m, 13 April 2006, I. Cameron, hook and line; QM I.25673, 2, 193–201 mm SL, females, east of Innisfail, Queensland, 17°21'S, 150°09'E, 380 m, April 1988, Raptis, trawl.

Other material. NEW ZEALAND: NMNZ P.007533, 61 mm SL, sex unknown, 29°13'S, 178°10'W, East Anchorage, Raoul Island, depth unknown, RV *Acheron*; NMNZ P.052258, 227 mm SL, male, 36°28'S, 175°30.7'E, Great Barrier Island, 180 m, November 2010, J. Sheehan; NMNZ P.052290, 236 mm SL, sex unknown, 34°16.05'S, 173°1.58'E, off North Cape, 177 m, 25 March 2011, TAN 1105/009, RV *Tangaroa*, beam trawl; NMNZ P.052489, 245 mm SL, male, 35°34.67'S, 174°38.95'E, west of Sugarloaf Rock, Poor Knights Islands, 103 m, 6 September 2011, C.D. Roberts and P. Saul, rod and line; NMNZ P.052490, 214 mm SL, female, 35°34.67'S, 174°38.95'E, west of Sugarloaf Rock, Poor Knights Islands, 177 m, 6 September 2011, C.D. Roberts and P. Saul, rod and line; NMNZ P.053101, 204 mm SL, female, 35°22.7'S, 174°48.5'E, "Kumera Patch" off the Poor Knights Islands, 130 m, 2012, E. Daysh, rod and line, 2012. **AUSTRALIA:** AMS I.42982-001, 162 mm SL, male, 3 miles SW of Lord Howe Island, Australia, 31°37'S, 159°03'E, 160 m, April 2002, S. Wilson; QM I.25507, 230 mm SL, male, North Gifford Tablemount, Queensland, 26°47.4'S, 159°25.2'E to 26°45.8'S, 159°21.4'E, 318–320 m, 28 September 1988, K. King, FV *Eikyu-maru*, trawl; QM I.35639, 206 mm SL, female, Fraser Seamount, Queensland, 24°26'S, 155°17'E, 372 m, 11 February 2004, trawl, Australian Fisheries Management Authority.

Diagnosis. Dorsal fin rays 16, rarely 15 or 17; anal fin rays 10, rarely 9 or 11; pectoral fin rays 11, rarely 10; vertebrae 42 or 43; total gill rakers 15–20; lateral line scales 41–43; pyloric caeca 11. Dorsal fin large and sail-like anteriorly in males, membranes deeply incised but none of the rays filamentous, third to fifth rays longest, reaching 36.5% SL, decreasing in length to middle of fin with posterior rays progressively longer, reaching 23.4% SL, posterior lobe reaching to or past adipose fin origin; anterior end of fin lower in females, membranes deeply incised with rays decreasing in length to middle of fin, lengths of subsequent rays subequal; posterior lobe reaching little more than half way to hypural crease. Anal fin relatively deep in males, posterior lobe ap-

proaching hypural crease in large individuals; fin smaller in females, posterior lobe reaching little more than half way to hypural crease. Males with subdistal red to orange band or row of spots anteriorly in raised portion of dorsal fin, row of fainter orange spots behind and below, broad distal margin mostly white, basal half of fin with two rows of large orange-edged yellow spots; anal fin white with broad yellow stripe on basal half of fin; caudal fin white with broad horizontal stripe from fleshy base on each lobe, lower lobe crossed with about two broad yellow bands, upper lobe crossed with three or four narrower orange bands, last just below white lobe tip; pelvic fins whitish with faint yellow to orange bands or rows of spots, especially at base; head and body tan to pink above, white below with three brown double bands on dorsal half of side and row of uneven sized dark pink to mauve blotches just below lateral midline. Females with several horizontal rows of large reddish or reddish-orange spots in dorsal fin, distal margin white, broadest anteriorly, unpaired fins without yellow markings; caudal, pelvic and sometimes anal crossed with usually faint orange bands, darkest near tip of upper caudal lobe; head and body similar to that of males; usually distinct dark brown horizontally aligned double blotch at ventral end of anteriormost band on side. A moderately large species for the genus, largest specimen examined 268 mm SL.

Description. Dorsal fin rays 16 (15–17); anal fin rays 10 (10 or 11); caudal fin rays 9+19+9; pectoral fin rays 11 (10 or 11); pelvic fin rays 9; vertebrae 27+15=42 (26–28+14–16=42 or 43); lateral line scales 41 (41–43+1); scales above lateral line 4.5; scales below lateral line 4.5; predorsal scales 12 (12–16, rarely 18); gill rakers 5+15=20 (3–5+11–16=15–20); pyloric caeca 11 (based on NMNZ P.052489) (see Tables 2 and 3 for additional meristic and morphometric values).

Body elongate, moderately thick, of similar breadth from eyes to posterior end of dorsal fin; dorsal profile of head and nape mostly straight, inclined to dorsal fin origin, sloping more gradually to base of tail with straight dorsal profile; ventral profile of head and body mostly straight; caudal peduncle moderately narrow; body deepest at anterior part of dorsal fin, depth at dorsal fin origin 20.0 (19.1–23.3) % SL, depth at origin of adipose fin 10.6 (9.3–11.9) % SL; anus slightly closer to anal-fin origin than pelvic-fin origin. Head of moderate size, bluntly pointed; snout short, much shorter than eye diameter, broadly rounded from above; eye large, diameter 8.1 (7.3–10.8) % SL and 25.7 (23.6–34.4) % HL, top of eye at or extending slightly above dorsal profile of head; bony interorbital distinctly concave, narrow, interorbital width 4.7 (4.0–5.3) % SL and 15.9 (12.6–17.2) % HL; postorbital nearly half head length. Anterior nostril small, about midway between tip of snout and orbit, posterior nostril much larger, about three or four times diameter of anterior nostril, long narrow, lanceolate skin flap based on septum separating nostrils (Fig. 2A). Edge of preopercle smooth, posterior margin straight, angle blunt; opercular margin nearly straight; without well-developed membranous lobe; branchiostegal membranes overlapping ventrally, free from isthmus. Mouth of moderate size, terminal, lower

jaw projecting slightly in advance of upper, profile of upper jaw with distinct notch at symphysis when viewed from above; posterior end of maxilla broad, posterior margin nearly straight, extending just past vertical through centre of eye, dorsal margin positioned adjacent to underside of eye with mouth closed; upper lip narrow, not covering tooth band in upper jaw with mouth closed. Teeth in jaws small, caniniform, in about two rows laterally and three to four ill-defined rows anteriorly in upper jaw, those mesially longest, small teeth extending onto side of jaw near front, distinct hiatus of teeth at symphysis; band of three to four rows of teeth laterally in lower jaw, additional row or two of much smaller teeth basally on outer edge at front; narrow hiatus in dentition at symphysis, teeth largest mesially. About two rows of small canines on palatines and traversing vomer, those medially slightly smaller. Gill rakers of moderate length.

Scales of moderate size, finely spiniform along margins, not extending onto fins. Predorsal scales extending forward to vertical through posterior extent of eye, covering opercle and preopercle forward to posterior end of maxilla; axial scale present at origin of pectoral and pelvic fins. Lateral line midlaterally on side, originating at horizontal through upper margin of eye; lateral line scales corresponding with oblique scale rows above and below lateral line; single pore on each lateral line scale.

Dorsal fin originating just in advance of vertical through pelvic fin origin, distance from snout tip to dorsal fin origin 34.3 (33.6–37.1) % SL; dorsal fin base of moderate length; fin large and sail-like anteriorly in males, membranes deeply incised but none of the rays filamentous, third to fifth rays longest, longest 32.0 (24.0–36.5 in males) % SL, decreasing in length to middle of fin with posterior rays progressively longer, penultimate ray reaching 20.3 (19.2–23.4 in males) % SL, posterior lobe reaching to or past adipose fin origin; anterior end of fin lower in females, membranes deeply incised, third or fourth ray longest (19.9–24.2% SL), subsequent rays decreasing in length to middle of fin (tenth ray 14.5–17.2% SL), lengths of subsequent rays subequal, penultimate ray 12.6–15.9% SL; posterior lobe reaching little more than half way to adipose fin; first dorsal-fin ray unbranched, others branched. Adipose fin rather small but prominent, positioned above posterior end of anal-fin base. Anal fin originating slightly in advance of vertical through midpoint between dorsal fin insertion and hypural crease, with short base; relatively deep in males, posteriormost rays much longer than anterior rays and posterior lobe approaching hypural crease in large individuals; fin smaller in females, lengths of posterior rays subequal; posterior lobe reaching little more than half way to hypural crease; first one or two rays unbranched, others branched. Caudal fin deeply forked, shortest rays at middle of fin slightly more than a third length of longest rays extending to corners, lobes nearly pointed, upper lobe slightly longer than lower; rays near ventral margin of fin more densely segmented than those near dorsal margin of fin; unbranched ray at ventral margin not with opaque fleshy covering. Pectoral fin of moderate size, length 21.1 (20.2–23.1 in males, 19.6–22.9

in females) % SL, tip reaching just past middle of dorsal fin base; origin of fin just in advance of vertical through dorsal fin origin; first two rays simple, others branched, third longest, subsequent rays progressively shorter. Pelvic fins moderately large, posterior tip of depressed fin reaching past anus, more so in males than females; first four rays not especially thickened and cylindrical, densely segmented, first ray unbranched, second to fourth each with pair of simple thickened branches, subsequent rays progressively shorter, flattened with typical multibranching, except for inner-most unbranched ray. A species of moderate size, largest specimen examined 268 mm SL.

Colour of preserved specimens. Body dusky above, almost uniformly pale below level of pectoral fin base, a number of darker blotches above lateral midline, most prominent a rectangular blotch below anterior fifth of dorsal fin base at level of upper third of eye, several others at same level, somewhat paired, below nape, below rear end of dorsal fin base, and below adipose fin; second row of horizontally aligned blotches closer to dorsal profile of side, just above and behind each blotch of first row, blotches appearing somewhat like obliquely slanted 'H' shaped marks in some; opercle mostly dark dusky; fins pale; anal fins of freshly preserved males with dusky band distally; adipose fin dusky.

Colour when fresh. Upper half of head and body orangish pink, darkest dorsally with three broad bands, each comprising series of orange to dark brown marks demarcating anterior and posterior edges, bands centred below anterior part of dorsal fin, posterior end of dorsal fin and adipose fin, anterior band with edges converging ventrally, lowermost dark marks forming rather prominent rectangular blotch, edges of second and third bands more parallel and angled slightly anteroventrally; orange and brown blotches and marks scattered elsewhere on upper half of body; lower half of body white, more orange ventrally between bases of pelvic and caudal fins; prominent rosy blotches midlaterally, largest below second and third bands; cheek and lower half of operculum rosy. Dorsal fin white with prominent red, orange and yellow spots in males, females with red to orange spots; pattern variable in both sexes but males usually with red spots dorsoanteriorly, joining into larger irregular red blotches in some, with broad mostly white distal margin anteriorly in some; spots in three or four irregular rows posteriorly transitioning from orange to yellow; females with about two or three rows of spots of similar colour, those anterodorsally converging in some, distal row also converging to some degree in some appearing as stripe, distal margin mostly white, often broader anteriorly. Adipose fin white, upper edge somewhat reddish; some males with yellowish hue. Anal fin white, males with broad yellow stripe on basal half of fin and often one or more yellow spots posteriorly in distal half; fin of females sometimes pinkish posteriorly. Caudal fin white with several pink to orange bands crossing each lobe, distal band on upper lobe often more distinct and broader, lobe tip often prominently white; males with pair of broad yellow stripes each directed horizontally across base of each lobe. Pectoral fin pale pink. Pelvic fin white with

pale pink concentric bands, bands more orange in some males (Fig. 3).

Etymology. The specific name *pyrhiston* is a combination of the Greek words *pyr* for 'fire' and *histon* for 'sail', to recognise the colourful red and yellow patterned dorsal fin characteristic of this species. As mentioned above, Thompson provided a name for this species but we have chosen to alter his '*pyrrhopinna*' based on Greek and Latin derivatives to the all Greek combination with essentially the same meaning.

Distribution. Recorded from northeastern New Zealand, south to the Bay of Plenty, and the Kermadec Ridge, the Norfolk Ridge and Lord Howe Rise in the Tasman Sea and off eastern Australia between Innisfail, Queensland and Brunswick Heads, New South Wales (Fig. 4), at depths of 80–380 m. Like other species in the family, the vast majority of specimens in collections have been taken with hook and line, implying a preference for hard to cobble substrate habitat.

Remarks. Shimizu (in Amaoka *et al.* 1990), based on specimens collected by the R/V *Shinkai-maru* between 1975 and 1986, recognised that Paulin (1984) had misidentified this species as *Aulopus japonicus*. Shimizu was able to separate the two by the shape of the dorsal fin, which has a distinctly concave distal margin in males of this new species, in contrast to the mostly straight outer margin in males of *H. japonica*. Although the dorsal fin has a similar shape in females of both species, they differ in the relative height of the fin, as reflected in the lengths of the third and fourth dorsal fin rays that are distinctly shorter in *H. japonica* (17.0–20.2 and 16.4–20.5 vs 19.9–23.6 and 20.4–24.3% SL, respectively). The same is true for males, but the relative differences of fin ray lengths are much greater (17.7–21.0 and 17.4–25.7 vs 24.9–32.8 and 28.2–36.3% SL).

Genus *Leptaulopus* gen. nov

Aulopus nec Cloquet, 1816; Sulak 1977: 53; Yamakawa in Masuda *et al.* 1984: 60; Okamura and Amaoka 1997: 109; Paxton and Niem 1999: 1919; Nakabo in Nakabo 2000: 349; Prokofiev 2008: 141.

Hime nec Starks, 1924; Parin and Kotlyar 1989: 407; Thompson 1998: 50; Hoese, Bray and Gates in Hoese *et al.* 2006: 464.

Type species. *Aulopus damasi* Tanaka, 1915, by designation.

Diagnosis. Dorsal fin with 13–16 rays; pectoral fin with 12 rays; total vertebrae 36 or 44; lateral line scales 33–37 or 44. Head moderately large, length 33.1–38.7% SL; snout slightly to distinctly elongate, 10.6–12.6% SL and 30.3–36.5% HL; eye of moderate size 6.4–10.6% SL and 19.1–29.7% HL; bony interorbital narrow 2.4–4.0% SL; predorsal elongate 40.3–46.7% SL; anal fin to anus 9.6–14.3% SL. Nasal flap arising from septum between anterior and posterior nasal openings extremely fimbriate (Fig. 2B, C). Teeth in jaws very small, caniniform to cardiform, more or less of uniform size, those of upper jaw in band of about four to

eight ill-defined rows, five to eight rows in lower jaw. Dorsal fin originating just behind vertical through pelvic fin origin, base moderately short 21.9–26.2% SL, moderately low without apparent sexual dimorphism in form, third ray longest, 13.6–17.6% SL, subsequent rays progressively shorter, posterior lobe of both sexes reaching little more than half way to hypural crease; no apparent sexual dimorphism in form of anal fin, with posterior lobe reaching less than half way to hypural crease; caudal fin with shallow fork, shortest rays at middle of fin about half length of longest rays to corners; ray on ventral edge of caudal fin with fleshy covering in large individuals; pectoral fin origin in advance of vertical through dorsal fin origin by distance equal to or greater than eye diameter; first four rays of pelvic fin thickened and cylindrical with fleshy dermal covering at least distally. Little if any sexual dichromatism.

Description. Dorsal fin rays 13–16; anal fin rays 8–11; caudal fin rays 10+19+8–9=37–38; pectoral fin rays 12; pelvic fin rays 9; vertebrae 20–27+15–18 = 36 or 44; lateral line scales 33–37 or 44+1; scales above lateral line 3.5; scales below lateral line 3.5 or 4.5; predorsal scales 13–20; gill rakers 2 or 3+9–12=11–15 (see Tables 2 and 4 for additional meristic and morphometric values).

Body elongate, moderately thick, of similar breadth from eyes to posterior end of dorsal fin; dorsal profile of snout straight, nape with slight convex curve, inclined to dorsal fin origin, sloping more gradually to base of tail with straight dorsal profile; ventral profile of head and body mostly straight; caudal peduncle of moderate depth; body deepest at anterior part of dorsal fin, depth at dorsal fin origin 16.8–19.9% SL; depth at origin of adipose fin 8.3–13.1% SL; anus slightly to distinctly closer to anal-fin origin than pelvic-fin origin. Head moderately large, pointed; snout slightly to distinctly elongate, slightly to much longer than eye diameter, slightly to distinctly dorsoventrally flattened, broadly to narrowly rounded from above; eye of moderate size, diameter 6.4–10.6% SL and 19.1–29.7% HL, top of eye protruding above dorsal profile of head; bony interorbital distinctly concave, narrow, interorbital width 2.4–4.0% SL and 7.0–11.1% HL; postorbital length approaching half head length. Anterior nostril small, posterior nostril much larger, anteroposteriorly elongate, about three or four times diameter of anterior nostril, both about midway between tip of snout and orbit; fimbriate tabular skin flap based on septum separating nostrils (Fig. 2B, C). Edge of preopercle smooth, posterior margin straight, angle about 90°, blunt; opercular margin broadly curved; without well-developed membranous lobe; branchiostegal membranes overlapping ventrally, free from isthmus. Mouth of moderate size, terminal, lower jaw not projecting in advance of upper, profile of upper jaw hidden when viewed from above; posterior end of maxilla moderately broad, posterior margin nearly straight, extending just past vertical through centre of eye, dorsal margin separated by skin covered gap from underside of eye with mouth closed; upper lip broad, covering upper jaw laterally with mouth closed. Teeth in jaws very small, caniniform to cardiform, those of upper jaw in band of about four or five poorly-defined rows laterally and four to seven ill-defined

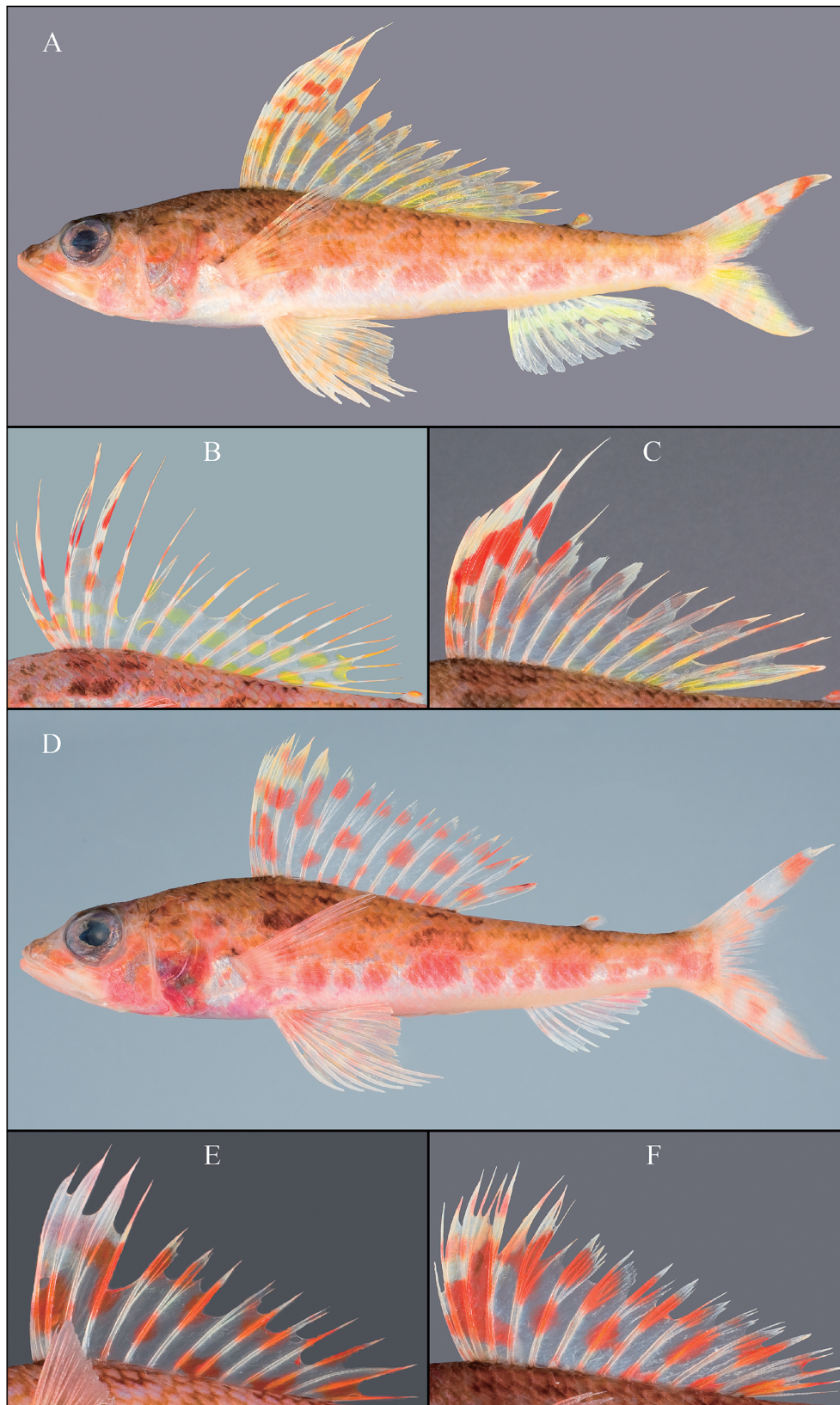


Fig. 3. *Hime pyrhistion* sp. nov.: A) NMNZ P.054047, holotype, 236 mm SL, male, Poor Knights Islands, New Zealand; B) dorsal fin of CSIRO H 6060-04, 216 mm SL, male, paratype, Norfolk Ridge, Tasman Sea (NORFANZ founding parties, photo by K. Parkinson); C) dorsal fin of NMNZ P.052258, non-type, 227 mm SL, male, Great Barrier Island, New Zealand; D) NMNZ P.047782, paratype, 197 mm SL, female, Poor Knights Islands, New Zealand; E) dorsal fin of NMNZ P.050424, paratype, 171 mm SL, female, Kermadec Islands, New Zealand; F) dorsal fin of NMNZ P.052762, paratype, 234 mm SL, female, Mayor Island, New Zealand.

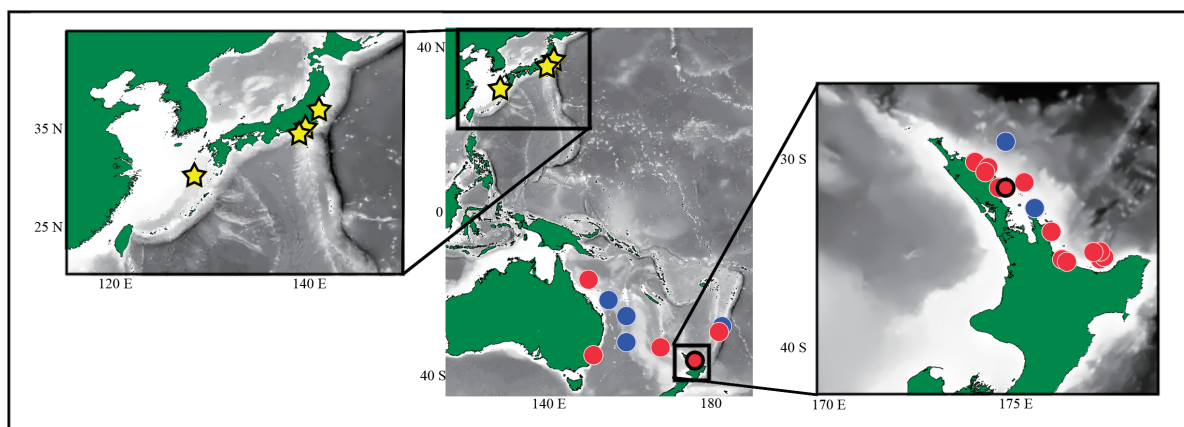


Fig. 4. Collection localities for specimens examined of *Hime* spp. *Hime pyrhistion* sp. nov. (circles): holotype black with red centre, paratypes red and other material blue; *Hime japonica* (yellow stars).

rows anteriorly, more or less of uniform size, smaller teeth on side of jaw near front, distinct hiatus of teeth at symphysis; band of five to eight ill-defined rows of teeth laterally in lower jaw, band narrower in about four or five rows at front, inner row of noticeably larger teeth mesially in some; triangular naked hiatus in dentition at symphysis. Band of two or five rows of small canines on palatines, mesial row longest, and bilateral pair of dentate patches of teeth on vomer, interconnected by row of smaller teeth medially in large individuals. Gill rakers moderately long and slender.

Scales of moderate size, finely spiniform along margins, not extending onto fins, except caudal fin with small scales dorsally and ventrally at base; scales on breast and anteriorly on belly cycloid to weakly spiniform. Predorsal scales extending forward to vertical through posterior extent of eye, covering opercle and preopercle forward to posterior end of maxilla; axial scale present at origin of pectoral and pelvic fins. Lateral line midlaterally on side, originating at horizontal through upper margin of eye; lateral line scales corresponding with oblique scale rows above and below lateral line; single pore on each lateral line scale.

Dorsal fin originating just behind vertical through pelvic fin origin, distance from snout tip to dorsal fin origin 40.3–46.7% SL; dorsal fin base moderately short, length 1.12–1.38 times distance from dorsal fin insertion to origin of adipose fin; fin moderately low without apparent sexual dimorphism in form; third ray longest, rays progressively decreasing in length posteriorly; posterior lobe reaching little more than half way to hypural crease; distance from dorsal-fin origin to tip of posterior lobe 30.7–36.2% SL; first two dorsal-fin rays unbranched, others branched. Adipose fin rather small but prominent, positioned above posterior end of anal-fin base. Anal fin originating slightly behind or slightly in advance of vertical through midpoint between dorsal fin insertion and adipose fin, with short base, length 8.2–10.2% SL; of moderate depth, rays progressively decreasing in length posteriorly without apparent sexual dimorphism in form; posterior lobe reaching much less than half way to hypural crease; first two or three rays unbranched, others branched. Caudal fin with shallow fork, shortest rays at middle of fin about half length of longest rays extending to corners, lobes bluntly pointed,

lobes of similar length; rays near ventral margin of fin more densely segmented than those near dorsal margin of fin; unbranched ray at ventral margin with opaque fleshy covering ventrally in large individuals. Pectoral fin of moderate size, tip reaching vertical through middle of dorsal fin base; origin of fin well in advance of vertical through dorsal fin origin by distance equal to or greater than eye diameter; first two rays simple, others branched, third longest, subsequent rays progressively shorter. Pelvic fins moderately large, posterior tip of depressed fin reaching just past anus; first four rays distinctly thickened and cylindrical with fleshy dermal covering at least distally, densely segmented, first ray unbranched, second to fourth each with a pair of simple thickened branches, subsequent rays progressively shorter, flattened with typical multi-branching, except for inner-most unbranched ray.

Species attain moderate size.

Etymology. The generic name *Leptaulopus* is a combination of the Greek *leptos* for 'slender' and *aulopus*, a name long applied to the broader group of fishes to which the genus belongs, in reference to the slender form of species it comprises.

Discussion. Shimizu and Yamakawa (1989) distinguished this genus from *Aulopus*, *Hime* and *Latropiscis* on the basis of the length of the snout relative to the eye diameter, length of the dorsal fin base relative to the distance from the dorsal fin insertion to the adipose fin origin and position of the dorsal fin origin relative to the pelvic fin origin. They also noted distinct differences in meristic values between the two species they referred to it, *Aulopus damasi* and the new species described below. While species of the genus *Hime* are extremely conservative meristically, the two species of *Leptaulopus* differ greatly in the numbers of dorsal fin rays, lateral line scales, and vertebrae, despite their overall similarity in appearance. These differences, as well as several others evident in relative morphometric dimensions discussed in species treatments, are consistent with genetic distances observed above but are not regarded as more than intrageneric variation. Species of *Aulopus* also exhibit considerable variation in values for meristic characters, as reported by Thompson (1998) for the eastern Pacific *A. baja-*

Table 4. Selected proportional measurements for neotype and other specimens of *Leptaulopus damasi* and types of *L. erythrozonatus* sp. nov.

	<i>L. damasi</i>			<i>L. erythrozonatus</i> sp. nov.			
	Neotype NSMT P 115220	Japan/Taiwan <i>n</i> =18	Australia CSIRO H 651–10	Holotype NMNZ P.042518	Paratypes <i>n</i> =3		
Standard Length (mm)	297	145–311	170	271	186–274		
% SL		range	mean±s.d		range	mean±s.d	
Body depth–dorsal-fin origin	19.7	17.0–19.9	18.8±0.9	19.3	16.8	18.0–19.3	18.5±0.7
– anal-fin origin	11.3	8.3–13.1	10.8±1.3	10.9	10.8	11.0–11.6	11.3±0.3
Caudal peduncle length	17.1	15.5–19.1	17.3±0.9	17.4	17.5	16.5–18.0	17.1±0.8
Caudal peduncle depth (least)	8.9	7.8–9.8	8.6±0.6	8.7	8.7	8.4–9.1	8.8±0.4
Head length	34.0	33.8–38.7	35.4±1.2	35.5	33.1	33.1–34.0	33.6±0.5
Orbital diameter	8.1	7.7–10.6	9.2±0.8	9.5	6.4	6.5–7.2	6.9±0.4
Interorbital width	3.1	2.4–4.0	3.1±0.4	2.8	3.2	3.0–3.5	3.1±0.3
Postorbital length	16.0	14.6–18.0	15.8±0.8	15.7	14.7	15.2–15.6	15.4±0.2
Snout length	11.2	10.6–12.6	11.4±0.4	11.7	12.1	11.5–12.4	12.0±0.5
Upper-jaw length	17.1	17.1–18.7	17.8±0.5	17.5	16.4	16.5–17.1	16.7±0.3
Predorsal-fin length	43.4	40.3–46.7	43.8±1.4	43.5	42.6	42.5–43.7	43.1±0.6
Prepectoral-fin length	33.8	33.8–37.1	35.5±0.8	35.8	34.8	32.6–34.8	33.8±1.2
Prepelvic-fin length	39.4	37.4–40.9	39.2±1.2	40.5	38.8	36.6–39.1	38.0±1.3
Preanus length	63.9	60.7–69.1	64.5±2.1	64.1	61.3	60.0–62.5	61.2±1.3
Preanal-fin length	74.9	73.6–77.8	75.9±1.4	76.4	74.1	72.8–75.0	74.1±1.2
Anus to anal-fin length	10.9	9.6–14.0	11.8±1.3	12.7	12.6	12.5–14.3	13.2±1.0
Pelvic fin origin to anus	25.3	22.4–29.9	26.3±2.1	23.8	24.7	22.5–24.8	23.4±1.2
Dorsal-fin insertion to adipose origin	18.3	15.7–19.7	18.0±1.3	19.6	18.3	16.5–21.2	18.8±2.4
Dorsal-fin base length	23.8	22.0–25.3	23.3±0.9	22.2	22.8	21.9–26.2	23.6±2.3
Dorsal-fin length	32.9	32.5–35.4	33.8±0.9	33.2	30.7	31.8–36.2	33.8±2.2
Dorsal-fin ray length– 1st ray	6.9	1.5–9.9	7.0±1.9	6.3	6.9	4.8–8.3	7.0±1.9
– 2nd ray	12.8	12.2–15.0	13.5±0.7	13	15.7	11.2–17.1	14.8±3.1
– 3rd ray	13.6	13.6–15.7	14.3±0.6	14.4	15.6	15.3–17.6	16.4±1.1
– 4th ray	13.1	12.7–15.7	13.9±0.9	14.6	15.4	15.0–16.7	15.7±0.9
– 5th ray	12.6	11.5–15.3	13.3±0.9	13.7	14.1	14.2–16.7	15.2±1.3
– 10th ray	12.7	12.7–14.6	13.4±0.5	13.4	13.1	13.1–14.4	13.7±0.6
– penultimate ray	11.5	9.9–13.9	12.3±0.9	12.3	10.9	11.7–12.2	14.8±0.3
Anal-fin base length	9.1	8.2–10.2	9.0±0.5	8.3	9.7	9.2–9.8	9.4±0.3
Anal-fin length	15.1	13.5–16.8	15.1±0.9	13.4	16.5	14.7–16.7	15.9±1.1
Anal-fin ray length– 1st ray	6.2	5.2–9.7	7.4±1.3	6.4	2.5	4.3–7.3	5.8±1.5
– 2nd ray	8.5	8.3–11.5	9.5±0.9	8.5	6.1	9.0–10.7	10.±0.9
– penultimate ray	7.9	6.8–9.4	7.6±0.6	7.4	8.4	6.6–8.1	4.6±0.9
Pectoral-fin length	16.5	16.5–18.1	17.3±0.6	17.3	15.8	16.4–17.9	17.0±0.8
Pelvic-fin length	24.8	23.5–28.2	26.2±1.3	25.4	25.4	25.1–25.4	25.2±0.2
Length of 5th pelvic-fin ray	18.4	18.2–25.2	20.3±2.0	18.5	18.1	18.0–20.0	19.0±1.0
Upper caudal lobe length		23.4–24.2	23.8±0.6	21.3	21.3	20.9–23.3	22.4±1.3
% HL							
Snout length	34.3	30.3–34.3	32.2±1.0	33.0	36.5	34.6–36.4	35.6±0.9
Orbital diameter	22.6	22.6–29.7	25.9±1.9	26.7	19.2	19.1–21.7	20.7±1.4
Interorbital width	9.8	7.0–11.1	8.7±1.0	7.8	9.7	8.9–10.3	9.4±0.8

cali with 14–17 dorsal fin rays, 48–54 lateral line scales and 47–53 vertebrae.

Species of *Leptaulopus* have a slender body when compared with species of *Hime* and *Latropiscis* (16.8–19.9 vs 16.6–24.3 and 18.7–21.4 respectively, based in part on values reported by Parin and Kotlyar 1989 and Matsunuma *et al.* 2008) and narrower interorbital (2.4–4.0 vs 3.2–6.1% SL and 7.0–11.1 vs 10.3–19.5% HL, respectively). They have typically 12 pectoral fin rays, while species of *Hime* and *Latro-*

piscis have typically 11 and *Aulopus* mostly 13. As in species of *Aulopus*, the origin of the dorsal fin in *Lepataulopus* is posterior to a vertical through the pelvic fin origin rather in advance of it, but the predorsal distance is markedly greater than species in any of the other three genera (40.3–46.7 vs 32.6–40.1% SL). Species of *Leptaulopus*, like those of *Hime* and *Latropiscis*, have the anus positioned well in front of the anal fin origin, considerably more so than described above for *Aulopus*. Teeth on the jaws of *Leptaulopus* are finer, more

cardiform than caniniform and far more numerous than in species of the other genera. *Leptaulopus* species also have extremely fimbriate nasal flaps arising from the septum between the anterior and posterior nasal openings, in contrast to the lanceolate flaps of *Hime* spp. (Fig. 2A–C), as well as *Aulopus* spp. and the rectangular flaps with uneven to lobate distal margin in *Latropiscis*. Species of *Aulopus* and *Leptaulopus* appear to lack the expansion of the dorsal fin characteristic of males of *Hime* and *Latropiscis*, even if males in *Aulopus* may have prolonged anterior fin rays.

***Leptaulopus damasi* (Tanaka, 1915)**

[Japanese name: Esodamashi]

(Figs 1, 2B, 5A, B, 6; Tables 2, 4)

Aulopus damasi Tanaka, 1915: 340, pl. 92, fig. 295, Tokyo market, “off Izu, Sagami Sea, Japan”; Yamakawa in Masuda *et al.* 1984: 60; Yamakawa in Okamura and Kitajima 1984: 161, 342; Yu 1988: 25; Nakabo 1993: 300; Okamura and Amaoka 1997: 109; Nakabo in Nakabo 2000: 349; Paxton in Randall and Lim 2000: 591; Shinohara *et al.* 2001: 299; Nakabo in Nakabo 2002: 349; Shinohara *et al.* 2005: 407; Senou *et al.* 2006: 415; Yamada *et al.* 2007: 244; Prokofiev 2008: 134; Matsunuma *et al.* 2008: 71; Hata *et al.* 2012: 9; Nakabo and Kai in Nakabo 2013: 421.

Hime damasi: Masuda *et al.* 1975: 175, pl. 20-B; Parin and Kotlyar 1989: 407; Thompson 1998: 50; Hoese, Bray and Gates in Hoese *et al.* 2006: 464.

Neotype. NSMT-P 115220 (formerly KAUM-I. 55574) Kagoshima Prefecture, off Kusagaki Islands, 31°11.00'N, 129°29.28'E, 202 m, line fishing, collected by Toru Miyashita, 18 July 2013.

Other material examined. 19 specimens, 145–311 mm SL. **JAPAN:** BSKU 22427, 199 mm SL, off Kochi, *Kaikomaru*, bottom trawl, 13 July 1971; BSKU 050964, 148 mm SL, Okinawa Prefecture, Nago fish market, bottom trawl around Tonaki-jima Island (west of Okinawa-jima Island), collected by I. Ohta, 13 November 2012; BSKU 050965, 168 mm SL, same data as BSKU 050964; BSKU 050966, 146 mm SL, same data as BSKU 050964; BSKU 050967, 156 mm SL, same data as BSKU 050964; BSKU 050968, 162 mm SL, same data as BSKU 050964; BSKU 106639, 213 mm SL, Kochi Prefecture, Kochi City, Mimase fish market, bottom trawl by *Kosei-mau*, collected by K. Hirota, 15 March 2012; KAUM-I. 43848, 311 mm SL, Kagoshima Prefecture, off Bonotsu, Minami-satsuma, 31°11.25'N, 130°06.86'E, 250 m, line fishing, collected by Toru Miyashita, 20 November 2011. **TAIWAN:** ASIZ 63217, 231 mm SL, northeastern Taiwan, Yilang, Da-Shi fishing port, 24.94°N, 121.9°E, bottom trawl, collected by H.-C. Ho, 7 May 2004; ASIZ 65839, 258 mm SL, northeastern Taiwan, Da-Shi fishing port, Yilang, 24.94°N, 121.9°E, bottom trawl, collected by P.-F. Lee, 24 April 2005 (X-ray at <http://fishdb.sinica.edu.tw/chi/specimendetail.php?id=ASIZP0065839>); ASIZ 65841, 263 mm SL, same data as ASIZ 65839; ASIZ 65842, 228 mm SL, same data as ASIZ 65839; ASIZ 65861, 250 mm SL, same data as ASIZ 65839; BSKU 050404, 198 mm SL,

northeastern Taiwan, Da-Shi fishing port, Yilang, 24.94°N, 121.9°E, bottom trawl, collected by R. Asaoka, 4 April 2012; NMMB P11215, 2, 249–275 mm SL, northeastern Taiwan, Da-Shi fishing port, Yilang, 24.94°N, 121.9°E, bottom trawl, collected by H.-C. Ho, 5 September 2009; NMMB P11217, 145 mm SL, northeastern Taiwan, Yilang, Nan-fang'ao fishing port, 24.94°N, 121.9°E, bottom trawl, collected by H.-C. Ho, 5 July 2010; NMMB P18071, 263 mm SL, northeastern Taiwan, Yilang, Nan-fang'ao fishing port, 24.94°N, 121.9°E, bottom trawl, collected by H.-C. Ho, 12 November 2012. **AUSTRALIA:** CSIRO H651-10, 170 mm SL, Queensland, Marion Reef, Marian Plateau, 19°43.7'S, 152°06.4'E–19°46.3'S, 152°04.5'E, 370–368 m, FRV *Soela*, 23 November 1985.

Diagnosis. Dorsal fin rays 14 (rarely 13); anal fin rays 9 (rarely 8); vertebrae 20 or 21+15 or 16=36 (usually 21+15=36); lateral line scales 33–37+1 (usually 35+1); scales below lateral line 3.5; predorsal scales 13–17; gill rakers 2 or 3+9–12=11–15. Snout moderately elongate, length 10.6–12.6% SL, 30.3–34.3% HL, longer than eye diameter, slightly dorsoventrally flattened, narrowly rounded from above; bony interorbital narrow, width 2.4–4.0% SL and 7.0–11.1% HL; distance from snout tip to dorsal fin origin 40.3–46.7% SL and 115–130% HL; anal fin base 8.2–10.2% SL and 22.6–29.0% HL (see Tables 2 and 4 for additional meristic and morphometric values). Expanded posterior end of maxilla and posterior and ventral margins of preopercle dusky to dark brown. Dorsal fin translucent with about three narrow submarginal stripes paralleling outer edge of fin, obscure basally, intervening spaces on fin rays white. Caudal fin white with two to four broad red bands crossing each lobe, proximal band continuous across fin in some. Reaches a moderately large size, largest specimen known 311 mm SL.

Distribution. A western Pacific species reported in Japan from the original type locality in Sagami Bay south to Kochi, Kagoshima (Hata *et al.* 2012: 9), Okinawa and the East China Sea (Yamada *et al.* 2007: 244), northern Taiwan and the Marion Plateau off Queensland, Australian (Hoese *et al.* 2006: 464; Fig. 6). It appears to be confined to the upper continental slope at depths of about 250–508 m. Like other members of the family it is likely to inhabit hard bottom environments where trawling is rarely undertaken, which would explain its paucity in collections.

Remarks. Eschmeyer (2012) reported that the sole type specimen of *A. damasi* (ZUMT 3771) is lost. Kazuo Sakamoto, the current curator of Tanaka's collection, confirmed that Yoshiaki Tominaga and his co-workers had checked Tanaka's type specimens and concluded it had been mislaid or lost. As the type specimen of *A. damasi* is no longer extant the erection of a neotype for *A. damasi* is considered necessary to affix the name and to distinguish it from the very similar *Leptaulopus erythrozonatus* sp. nov. A specimen (NSMT-P.115220, 297 mm SL; Fig. 5A) collected off Kagoshima, Japan is proposed as the neotype for the species. Accordingly, Kagoshima becomes the type locality of *A. damasi* under Article 76.3 of The International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature 1999).

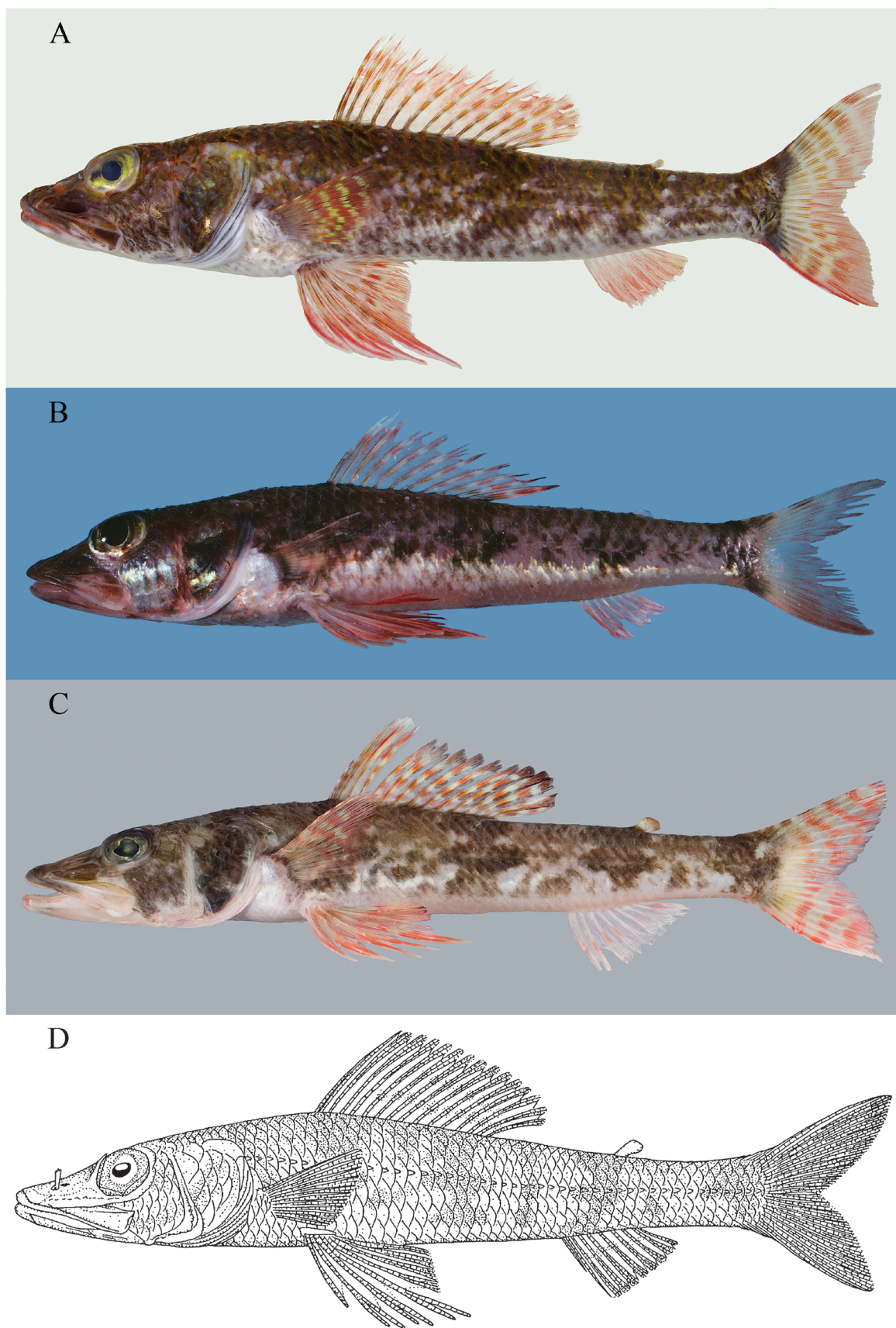


Fig. 5. Species of *Leptaulopus* gen. nov.: A) *L. damasi*, NSMT-P115220, neotype, 297 mm SL, Kagoshima Prefecture, Japan (photo by H. Motomura); B) *L. damasi*, CSIRO H 651-10, 170 mm SL, Marion Reef, Queensland, Australia (photo courtesy of CSIRO); C) *L. erythrozonatus* sp. nov., NMNZ P.042518, holotype, 271 mm SL, Bay of Plenty, New Zealand; and, D) new genus and species (after Shimizu and Yamakawa 1989), Norfolk Ridge, New Zealand.

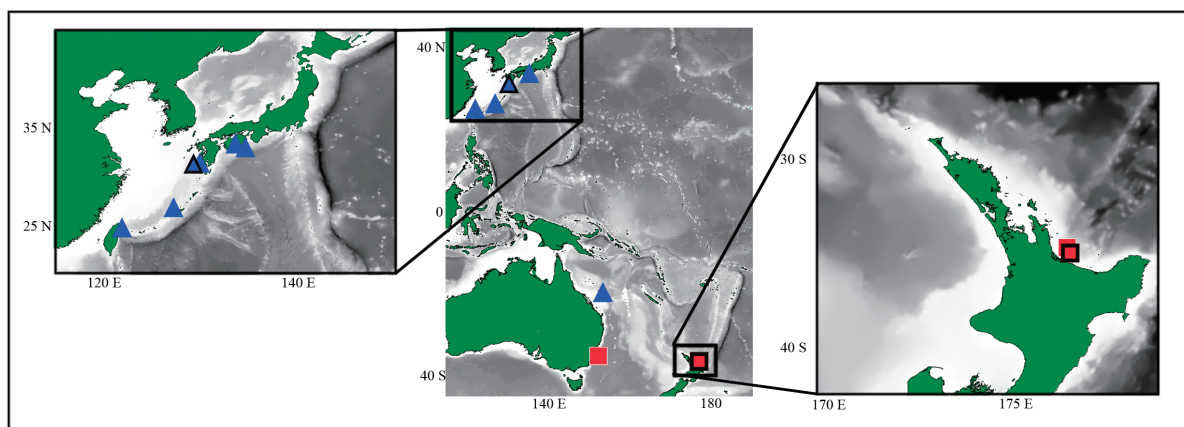


Fig. 6. Collection localities for specimens examined of *Letaulopus* spp. *Leptaulopus damasi* (triangles): neotype black with blue centre and other material blue. *Lepaulopus erythrozonatus* sp. nov. (squares): holotype black with red centre and paratype red.

As indicated by the brief summary of citations above, this species has not been treated often in the literature and most references to it have been as single entry listings in faunal lists. The first report of *L. damasi* (as *Hime damasi*; Hoese Bray and Gates in Hoese *et al.* 2006: 464) in the Southern Hemisphere was based on a single specimen (CSIRO H651-10, 170 mm SL, Fig. 5B), the morphology of which (Tables 2, 4) mostly agrees with Japanese specimens examined. Although the vertebral numbers for Japanese specimens have not appeared in published accounts, the Australian specimen of this species appears to have the same number of vertebral elements as material examined from Taiwan and Japan.

Leptaulopus erythrozonatus sp. nov.

[New English Name: Duckbill Flagfin]

(Figs 1, 2C, 5C, D, 6; Table 2, 4)

Aulopodidae n. gen et n. sp.: Roberts *et al.* 2009: 530.

Holotype. NMNZ P.042518, 271 mm SL, 37°24.29'S, 176°24.83'E, Penguin Rise, Bay of Plenty, 130–140 m, 30 September 2006, R. Keyzer, rod and line.

Paratypes. 3 specimens, 186–274 mm SL. **NEW ZEALAND:** NMNZ P.037704, 256 mm SL, 37°17.00'S, 176°25.00'E, 7 miles east of Mayor Island, 280 m, 22 April 2001, D. Brambley, rod and line; NMNZ P.047334, 274 mm SL, 37°24.24'S, 176°24.69'E, Penguin Rises, Bay of Plenty, 135 m, 25 December 2009, R. Keyzer, rod and line. **AUSTRALIA:** AMS I.40318-001, 186 mm SL, off Batemans Bay, New South Wales, 35°44.0'S, 150°13.0'E, 174–177 m, 1996, K. Graham on FV *Salvatore V*, demersal trawl.

Diagnosis. Dorsal fin rays 15 or 16; anal fin rays 10 or 11; vertebrae 26 or 27+17 or 18=44; lateral line scales 44+1; scales below lateral line 4.5; predorsal scales 20; gill rakers 3+12. Snout elongate, length 11.5–12.4% SL and 34.6–36.5% HL, much longer than eye diameter, dorsoventrally flattened, narrowly rounded from above; bony interorbital narrow, width 3.0–3.5% SL and 8.9–10.3% HL; distance from snout tip to dorsal fin origin 42.5–43.7% SL and 128–129% HL; anal fin base 9.2–9.8% SL and 27.0–29.1% HL.

Expanded posterior end of maxilla and posterior and ventral margins of preopercle stark white. Dorsal fin translucent with four to six narrow submarginal stripes from base to outer edge of fin, those posteriorly angled obliquely, intervening spaces on fin rays white. Caudal fin white with four or five red bands crossing each lobe, proximal bands continuous across fin in some.

Description. Dorsal fin rays 16 (15 or 16); anal fin rays 11 (10 or 11); caudal fin rays 10+19+8; pectoral fin rays 12; pelvic fin rays 9; vertebrae 26+18=44 (27+17=44); lateral line scales 44+1; scales above lateral line 3.5; scales below lateral line 4.5; predorsal scales 20 (19–20); gill rakers 3+12 (2–3+12=14–15) (see Table 4 for morphometric values).

Body elongate, moderately thick, of similar breadth from eyes to posterior end of dorsal fin; dorsal profile of snout straight, nape with slight convex curve, inclined to dorsal fin origin, sloping more gradually to base of tail with straight dorsal profile; ventral profile of head and body mostly straight; caudal peduncle of moderate depth; body deepest at anterior part of dorsal fin, depth at dorsal fin origin 16.8 (18.0–19.3) % SL; depth at origin of adipose fin 10.8 (11.0–11.6) % SL; anus closer to anal-fin origin than pelvic-fin origin, length from anus to anal-fin origin 12.6 (12.5–14.3) % SL. Head moderately large, pointed; snout elongate, length 12.1 (11.5–12.4) % SL and 36.5 (34.6–36.4) % HL, much longer than eye diameter, dorsoventrally flattened, narrowly rounded from above; eye of moderate size, diameter 6.4 (6.5–7.2) % SL and 19.2 (19.1–21.7) % HL, top of eye jutting above dorsal profile of head; bony interorbital distinctly concave, narrow, interorbital width 3.2 (3.0–3.5) % SL and 9.7 (8.9–10.3) % HL; postorbital nearly half head length. Anterior nostril small, posterior nostril much larger, anteroposteriorly elongate, about three or four times diameter of anterior nostril, both about midway between tip of snout and orbit; fimbriate tabular skin flap based on septum separating nostrils (Fig. 2C). Edge of preopercle smooth, posterior margin straight, angle about 90°, blunt; opercular margin broadly curved; without well-developed membranous lobe; branchiostegal membranes overlapping ventrally, free from isthmus. Mouth of moderate size, terminal, lower jaw not projecting in advance of upper, profile of upper jaw

hidden when viewed from above; posterior end of maxilla moderately broad, posterior margin nearly straight, extending just past vertical through centre of eye, dorsal margin separated by skin covered gap from underside of eye with mouth closed; upper lip broad, covering upper jaw laterally with mouth closed. Teeth in jaws very small, caniniform to cardiform, those of upper jaw in band of about four or five ill-defined rows laterally and six or seven ill-defined rows anteriorly, more or less of uniform size, smaller teeth on side of jaw near front, distinct hiatus of teeth at symphysis; band of seven or eight ill-defined rows of teeth laterally in lower jaw, band narrower in about four or five rows at front, inner row of noticeably larger teeth mesially; triangular naked hiatus in dentition at symphysis. Band of several rows of small canines on palatines and bilateral pair of dentate patch of teeth on vomer, interconnected by row of smaller teeth medially in large individuals. Gill rakers moderately long and slender.

Scales of moderate size, finely spiniform along margins, not extending onto fins, except caudal fin with small scales dorsally and ventrally at base; scales on breast cycloid to weakly spiniform. Predorsal scales extending forward to vertical through posterior extent of eye, covering opercle and preopercle forward to posterior end of maxilla; axial scale present at origin of pectoral and pelvic fins. Lateral line midlaterally on side, originating at horizontal through upper margin of eye; lateral line scales corresponding with oblique scale rows above and below lateral line; single pore on each lateral line scale.

Dorsal fin originating just behind vertical through pelvic fin origin, distance from snout tip to dorsal fin origin 42.6 (42.5–43.7) % SL; dorsal fin base moderately short, length 1.12–1.38 times distance from dorsal fin insertion to origin of adipose fin; third ray longest, rays progressively decreasing in length posteriorly; posterior lobe reaching little more than half way to hypural crease; first two dorsal-fin rays unbranched, others branched. Adipose fin rather small but prominent, positioned above posterior end of anal-fin base. Anal fin originating slightly in advance of vertical through midpoint between dorsal fin insertion and adipose fin, with short base, length 9.7 (9.2–9.8) % SL; of moderate depth, rays progressively decreasing in length posteriorly; posterior lobe reaching much less than half way to hypural crease; first two or three rays unbranched, others branched. Caudal fin with shallow fork, shortest rays at middle of fin about half length of longest rays extending to corners, lobes bluntly pointed, lobes of similar length; rays near ventral margin of fin more densely segmented than those near dorsal margin of fin; unbranched ray at ventral margin with opaque fleshy covering ventrally in large individuals. Pectoral fin of moderate size, length 15.8 (16.4–17.9) % SL, tip reaching vertical through middle of dorsal fin base; origin of fin well in advance of vertical through dorsal fin origin by distance equal to or greater than eye diameter; first two rays simple, others branched, third longest, subsequent rays progressively shorter. Pelvic fins moderately large, posterior tip of depressed fin reaching just past anus; first four rays distinctly thickened and cylindrical with fleshy dermal covering at

least distally, densely segmented, first ray unbranched, second to fourth each with a pair of simple thickened branches, subsequent rays progressively shorter, flattened with typical multibranching, except for inner-most unbranched ray.

A species of moderate size, largest specimen examined 274 mm SL.

Colour of preserved specimens. Head and body blotched with dark, dusky and pale patches above level of pelvic fin base, uniformly pale below and behind edge of operculum on and below pectoral fin base; darker patches form broad jagged bands below dorsal fin origin, rear or dorsal fin base, below and in advance of adipose fin origin and in front of caudal fin base; row of six or seven moderately small pale spots just above lateral line; basal edge of pectoral fin with irregular narrow dark band. Snout, top of head and head behind and below eye rather uniformly dusky, operculum darker with distinctly pale branchiostegal membranes, strip along posterior edge of preopercle and rear half of upper jaw. Fins pale; recently preserved individuals with faint dusky angled stripes in dorsal fin and bands across lobes of caudal fin; distal half of adipose fin dusky.

Colour when fresh. Head and body olive brown to brown, ventral surface and prepectoral area white; back and sides crossed by four darker, broad jagged bands, intervening spaces blotched with white; bands centred on anterior part of dorsal fin, posterior end of dorsal fin base, adipose fin origin and based of tail; fifth band crossing back of head and covering operculum behind preopercle, preopercular edge, branchiostegals, most of maxilla and lower jaw white. Dorsal fin white with about four narrow reddish orange to somewhat brownish stripes angled slightly posteroventrally; distal margin narrowly white anteriorly, dark brown to black posteriorly. Anal fin white with obscure orange midlateral stripe. Caudal fin white with four or five narrow reddish orange bands crossing each lobe, basal band on lobes continuous across base of fin. Pectoral fin milky with four or five narrow reddish orange concentric bands. Pelvic fin reddish orange with white tips to anterior four rays (Fig. 5C).

Etymology. The specific name *erythrozonatus* is a combination of the Greek *erythros* for 'red' and *zone* for 'belt' in reference to the distinctive red bands on the dorsal and caudal fins. Again, we thank Thompson for suggesting the name.

Distribution. Apparently confined to the Australasian region with a trans-Tasman distribution, so far recorded from New Zealand's Bay of Plenty on the northeastern coast of the North Island and off Batemans Bay in northern New South Wales (Fig. 6), at depths of 130–280 m. Shimizu and Yamakawa (1989) indicated the species also occurs on the Norfolk Ridge, but the specimen on which the authors based their information was not located until this contribution was in the final stages of publication. The specimen (NSMT-P 41872; G. Shinohara, pers. comm.) was unable to be examined to verify its identification.

Remarks. Both Shimizu and Yamakawa (1989) and Thompson and Stewart (2006) were aware of this species as evidenced by the figure prepared by the former, here reproduced as Fig. 5D, and the manuscript name made known to

us by B. Thompson prior to his death. They distinguished the two by the numbers of dorsal fin rays (13 or 14 in *L. damasi* vs 16 in the new species), lateral line scales (33–37 vs 46) and vertebrae (37 vs 45). As is evident in the description above, the type series expands the variation in the values reported only very slightly. The two species are also separable by the relative lengths of the snout and eye, *L. erythrozonatus* having a smaller eye and longer snout, eye 1.6–1.9 in the snout (vs 1.2).

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- 11, BW-A11844) Queensland, Australia; CSIRO H 7280-08 (FOAN1050-11, BW-A11843) Queensland, Australia; CSIRO H 7280-08 (FOAN1049-11, BW-A11842) Queensland, Australia.
- H. diactithrix:** CSIRO H 6426-11 (FOAN215-11, BW-A11008) Western Australia; CSIRO H 6426-11 (FOAN216-11, BW-A11009) Western Australia; CSIRO H 6426-11 (FOAN217-11, BW-A11010) Western Australia; NSMT P.66564 (NSMT-DNA 17248) Japan.
- H. formosanus:** NSMT P.66548 (NSMT-DNA 17232) Japan; NSMT P.79945 (NSMT-DNA 12546) Japan; NSMT P.100080 (NSMT-DNA 14992) Japan.
- H. japonica:** ASIZP0064903 (ASIZP0800075) Taiwan; CBM-ZF 10462 (GBGC1516-06) Japan.
- H. cf. japonica:** (FOAM601-10, BW-A10564) Indonesia; (FOAM602-10, BW-A10565) Indonesia; (FOAM603-10, BW-A10566) Indonesia; (FOAM604-10, BW-A10567) Indonesia; (FOAM605-10, BW-A10568) Indonesia; (FOAM606-10, BW-A10569) Indonesia; (FOAM650-10, BW-A10613) Indonesia; (FOAM651-10, BW-A10614) Indonesia.
- H. pyrhistion sp. nov.:** AMS I.43948-001 (AMS 192-08) New South Wales, Australia; NMNZ P.042234 (FNZ672-06) New Zealand; NMNZ P.047782 (NMNZ P.047782-TS2) New Zealand; NMNZ P.047783 (NMNZ P.047783-TS2) New Zealand; NMNZ P.050424 (NMNZ P.050424-TS1) Kermadec Island; NMNZ P.051887 (NMNZ P.051887-TS2) New Zealand; NMNZ P.051888 (NMNZ P.051888-TS2) New Zealand; NMNZ P.052258 (NMNZ P.052258-TS1) New Zealand; NMNZ P.052290 (NMNZ P.052290-TS1) New Zealand; NMNZ P.052489 (NMNZ P.052489-TS1) New Zealand; NMNZ P.052490 (NMNZ P.052490-TS1) New Zealand; NMNZ P.052762 (NMNZ P.052762-TS1) New Zealand; NMNZ P.053101 (NMNZ P.053101-TS1) New Zealand; NMNZ P.054046 (NMNZ P.054046-TS1) New Zealand; NMNZ P.054047* (NMNZ P.054047-TS1) New Zealand.
- Latropiscis purpurissatus:** AMS I.44764-001 (AMSF103-09, GU661095) New South Wales, Australia; NMV A22020 (FMVIC128-08) Western Australia; CSIRO H 6347-15 (FOAMP014-06, BW-B14) Western Australia.
- Leptaulopus damasi:** ASIZ P0065839 (ASIZP0800943) Taiwan; ASIZ P0065842 (ASIZP0800942) Taiwan; ASIZ P0065861 (ASIZP0800941) Taiwan; NSMT P. 115220* Japan; KAUM-I.43848 Japan.
- L. erythrozonatus sp. nov.:** NMNZ P.042518* (FNZ1042-07) New Zealand; NMNZ P.047334 (NMNZ P.047334-TS2) New Zealand.
- Paraulopus nigripinnis:** NMNZ P.042529 (FNZ1030-07) New Zealand; NMNZ P.044519 (FNZA709-08) New Zealand; NMNZ P.046748 (FNZC705-10) New Zealand.

Appendix

Appendix 1. Sequences and source information featuring in Figure 1.

The following list comprises registration numbers for vouchers, where available, with tissue numbers and BOLD, GenBank and personal sequence numbers as parenthetical expressions, and a collection locality for individuals featuring in the genetic analysis. Holotype and neotype are marked with an asterisk (*).

Aulopus filamentosus: (CSFOM013-10, CSFOM-018) Italy; (CSFOM078-10, CSFOM-103) Italy; (USNM T3816, GBGC6635-09, EU366546) Bermuda.

A. sp.: SIO 02–68 (GBGC6622-09, EU366559) Eastern Pacific.

Hime curtirostris: AMS I.44761-029 (AMS174-09) New South Wales, Australia; AMS I.44761-029c (AMS177-09) New South Wales, Australia; CSIRO H 7261-05 (FOAN1044-11, BW-A11837) Queensland, Australia; CSIRO H 7261-06 (FOAN1045-11, BW-A11838) Queensland, Australia; CSIRO H 7278-07 (FOAN1046-11, BW-A11839) Queensland, Australia; CSIRO H 7278-07 (FOAN1047-11, BW-A11840) Queensland, Australia; CSIRO H 7280-07 (FOAN1048-11, BW-A11841) Queensland, Australia; CSIRO H 7280-08 (FOAN1051-