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Three new species of the barracudina genus *Lestidium* (Aulopiformes: Paralepididae) from the Indo-West Pacific

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Abstract

Three new species of the genus *Lestidium* with complete lateral line are described from the Indo-west Pacific Ocean. *Lestidium longilucifer* **sp. nov.**, from Western Australia and Taiwan, belongs to the *Lestidium atlanticum* species complex and can be separated from other congeners by having 41–43 prehaemal vertebrae, 85–88 total vertebrae and 126–146 total lateral-line scales; and body proportions. *Lestidium australis* **sp. nov.** from eastern Australia and *Lestidium rofeni* **sp. nov.** from Taiwan and the Philippines together with *Lestidium prolixum* form the *L. prolixum* species complex. These three species can be separated from each other by a combination of different fin positions, vertebral formula, number of lateral-line scales and pigmentation.

Key words: Pisces, taxonomy, ichthyology, Aulopiformes, Australia, Taiwan

Introduction

The barracudina family Paralepididae comprises 11 genera (excluding *Sudis* which is now accepted as an independent family), with about 61 species (Ho, pers. data), although some genetic studies separate it into two or more families (e.g. Ghedotti *et al.*, 2015). They are found world-wide, mainly inhabiting deep pelagic waters of the outer continental shelf and slopes, and are important food for whales and swift predators (Rofen, 1966).

The family is commonly divided into two tribes: the scaly group Tribe Paralepidini, and the 'naked' group Tribe Lestidiini. The Paralepidini comprise four genera and 11 species, characterized by a relatively low number of vertebrae, and a body that is usually rather massive and fully scaled (Ho & Duhamel, 2019). The Lestidiini comprises 7 genera and at least 55 species (Fukuii & Ozawa, 2004; Ho & Golani, 2019; Ho *et al.*, 2019a, b), usually with a transparent or near-transparent slender body lacking scales (except for the lateral line), and a relatively high number of vertebrae.

Three species described herein belong the tribe Lestidiini (or family Lestidiidae, *sens*u Ghedotti *et al*., 2015) and possess a complete lateral line, i.e. the line extends to the caudal-fin base. In Australian/Indo-Pacific waters, the first species has long been identified as *Lestidium atlanticum* Borodin, 1928. Ege (1953) considered *L. atlanticum* to have a worldwide distribution, and it has been widely reported from the Atlantic and western Pacific oceans (Froese & Pauly, 2019). Detailed examination of specimens from different geographic regions, however, revealed several significant differences, and we here recognize a population with high vertebral counts, collected from southern Taiwan and northwestern Australia, as a new species.

The other two new species are similar *to Lestidium prolixum* Harry, 1953, all have an abdomen luminescent duct originating below the opercle; blackish gill chamber and a complete lateral line. These three species form a species complex and differ from each other in having different vertebral formulae, lateral-line scale counts, and pigmentation.

This work describes the three new species mentioned above and compares them with closely similar congeners.

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Methods and materials

Standard length (SL) and head length (HL) are used throughout. Terminology and methods for taking measurements and counts follow Hubbs & Lagler (1958), with additional methodology provided by Ho & Golani (2019) and Ho *et al.* (2019a).

Abbreviations. V–A = horizontal distance between origins of pelvic (ventral) and anal fins; V–D = horizontal distance between origins of pelvic and dorsal fins; D–A = horizontal distance between origins of dorsal and anal fins. DFO = dorsal-fin origin; VFO = pelvic-fin origin; AFO = anal-fin origin.

Specimens are deposited at the following institutions: National Museum of Marine Biology & Aquarium, Pingtung, Taiwan (NMMB-P); National Museum of Nature and Science, Tokyo, Japan (NSMT-P); Museum Victoria, Melbourne, Australia (NMV); Australian National Fish Collection, Hobart, Australia (CSIRO); Australian Museum Fish Collection, Sydney, Australia (AMS); Ichthyology Collection, Museum and Art Gallery of the Northern Territory, Northern Territory, Australia (NTM).

Data for comparison were provided in Ho & Golani (2019) and Ho *et al.* (2019a).

Results

Family Paralepididae

Genus *Lestidium* Gilbert, 1905

Lestidium Gilbert, 1905:607 (Type species: *Lestidium nudum* Gilbert, 1905)

Diagnosis. Body moderately long, not especially slender; luminescent duct in abdominal cavity unbranched, extending forward to below opercle or before anterior margin of eye; nostrils well before a vertical through posterior end of maxilla; lateral line complete or incomplete; no light organ at anterior margin of orbit; a small luminescent duct along lower margin of orbit or absent; ventral adipose fin well-developed along margin between anus and AFO; DFO at above same vertical at or behind VFO, if behind, always before midpoint of V–A; and anal-fin rays 26–34.

Remarks. *Lestidium* comprises a small group of species with five species previously recognized in the genus: *L. atlanticum*, *L. bigelowi* Graae, 1967, *L. nudum*, *L. orientale* Ho *et al.*, 2019, and *L. prolixum* Harry, 1953.

Of these species, *L. atlanticum* can be distinguished by having the luminescent duct extending beyond the pectoral girdle to before anterior margin of eye. It is also the only species that is reported to have a worldwide distribution. In this study, we recognize the population from southern Taiwan and northwestern Australia as a distinct species.

Another nominal species in the genus is *Lestidium blanci* Kartha, 1971 which was originally described from the Arabian Sea. Examination of a specimen (NTM S.13146-021) collected from northern Australia shows that it lacks the diagnostic luminescent duct in the abdominal cavity or a light organ around eye and is clearly a member of *Lestidiops,* a genus also in need of revision. All members of *Lestidium* have the DFO clearly before the midpoint of V–A, whereas *Lestidiops blanci* has its DFO well behind the midpoint of V–A, which is unique among paralepidid*s*. Moreover, the lateral line of *L. blanci* ends slightly behind the middle of the anal-fin base, also clearly different from the three new species described herein.

Lestidium longilucifer sp. nov.

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Long light-organ barracudina
Figs. 1A–C, 2A–E; Tables 1–3

Lestidium atlanticum (not of Borodin): Paxton *et al.*, 1989:247. Hutchins, 2001:21. Paxton *et al.*, 2006:492. Larson *et al.*, 2013:48.

Holotype. AMS I.22821-063, 260 mm SL, 18°16’S, 118°12’E, 190 km northwest of Port Hedland, North West Shelf, Western Australia, Australia, demersal trawl, 298–320 m, RV *Soela*, 10–11 Apr. 1982, coll. J. Paxton & M. McGrouther.

Paratypes. Twenty-one specimens, 183–292 mm SL. AMS I.22809-045 (2 specimens, 214–242 mm SL), 18°40’S, 116°42’E, North West Shelf, 250 km NW of Port Headland, Western Australia, 600 m, 4 Apr. 1982. AMS I.22817-022

(2, 279–292), 18°06'S, 117°45'E, North West Shelf, Western Australia, 500 m, FRV *Soela*, demersal trawl, 8 Apr. 1982. AMS I.22821-023 (6, 231–259), collected with holotype. AMS 31175-002 (1, 219), 26°57'S, 112°22'E, off Shark Bay, Western Australia, demersal trawl 666–688 m, RV *Southern Surveyor*, 31 Jan. 1991, coll. J. Paxton. CSIRO H2094-01 (1, 258), 16°59'S, 120°15'E, NE of Mermaid Reef, Rowley Shoals, Western Australia, prawn/demersal trawl, 395 m, 14 Apr. 1989. CSIRO H3040-05 (1, 225), 26°59'S, 112°38'E, SW of Shark Bay, Western Australia, demersal trawl, 435 m, 28 Dec. 1989. CSIRO H3154-36 (1, 231), CSIRO H3154-37 (3, 246–265),18°07'S, 118°08'E, SW of Imperieuse Reef, Western Australia, demersal trawl, 400 m, 8 Mar. 1992. NMMB-P25561 (1, 183), 20 Jan. 2017; NMMB-P26017 (1, 205), 15 Apr. 2017. NMMB-P27928 (1, 194), 16 Jul. 2017; all from off Dong-gang, Pingtung, Southwestern Taiwan. NTM 12607-007 (1, 243), 17°51'S, 118°30'E, off Rowley Shoals, Northwest Shelf, 410 m, FV *Comac Endeavour*, 6 Nov. 1985.

Non-type. AMS I.42182-009 (1, 50) 11°01'S, 149°59'E, Coral Sea, S of Alotau, Papua New Guinea, MIDOC plankton trawl, 12 m, RV *Southern Surveyor*, 16 May 1997. AMS I.42209-017 (2, 52–85), AMS I.42209-056 (2, 62–90), 11°19'S, 149°40'E, Coral Sea, SW of Alotau, Papua New Guinea, MIDOC plankton trawl, 12 m, RV *Southern Surveyor*, 16 May 1997. AMS I.42310-001 (1, 80), 10°21'S, 147°35'E, Coral Sea, S of Port Moresby, Papua New Guinea, MIDOC plankton trawl, 12 m, RV *Southern Surveyor*, 21 May 1997. AMS I.42344-010 (1, 48), 9°23'S, 145°23'E, Coral Sea, W of Port Moresby, Papua New Guinea, MIDOC plankton trawl, 12 m, RV *Southern Surveyor*, 23 May 1997. AMS I.22808-006 (3, 237–250), 17°59'S, 118°17'E, North West Shelf, Western Australia, 410 m, RV *Soela*, 3 Apr. 1982, coll. J. Paxton and M. McGrouther. AMS I.22825-002 (3, 252–260), 18°59'S, 117°10'E, North West Shelf, Western Australia, 315 m, RV *Soela*, 13 Apr. 1982, coll. J. Paxton and M. McGrouther . AMS I.23424-012 (2, 255–268, slightly damaged), 18°43'S, 117°12'E, North West Shelf, Western Australia, 370 m, RV *Soela*, 1 Aug. 1982. CSIRO H5638-01 (2, 247; 1 broken), Northwest Shelf, Western Australia, RV *Soela*, 1 Aug. 1982. NSMT-P122098 (2, 232–235), West coast of Australia, Eastern Indian Ocean, no date. NSMT-P122128 (1, 235), 24°1.2'S, 112°30.6'E, West coast of Australia, 420 m, 6 Nov. 1975. NSMT-P122129 (1, 254), West coast of Australia, Eastern Indian Ocean, no date.

Diagnosis. *Lestidium longilucifer* sp. nov. is one of three species recognized in the *Lestidium atlanticum* species complex with a luminescent duct extending beyond the anterior margin of the eye. It can be distinguished from its two congeners *L. atlanticum* and *L. orientale* in having prehaema vertebrae 41–43; predorsal vertebrae 38–40; prepelvic vertebrae 37–39; preanal vertebrae 56–59; total vertebrae 85–88; total lateral-line scales 126–146; and relatively short jaws.

Description. Dorsal-fin rays 10; pectoral-fin rays 13 (14 in 2 paratypes); pelvic-fin rays 9; anal-fin rays 30 (28–30 in paratypes, except for 1 with 26). Lateral-line scales: prepelvic 38 (37–39); predorsal 39 (38–39); preanal 55 (55–57); and total 132 (126–146). Vertebrae: prehaemal 41 (41–43); caudal 47 (43–47); prepelvic 38 (37–55 (55–57); and total 132 (126–146). Vertebrae: prehaemal 41 (41–43); caudal 47 (43–47); prepelvic 38 (37–39); predorsal 39 (38–40); preanal 58 (56–59); and total 88 (85–88).

FIGURE 1. *Lestidium longilucifer* **sp. nov.** A. Holotype, AMS I.22821-063, 260 mm SL, preserved. B. Paratype, AMS I.31175-002, 219 mm SL, fresh, arrow points the VFO. C. Paratype, NMMB-P26017, 205 mm SL, fresh.

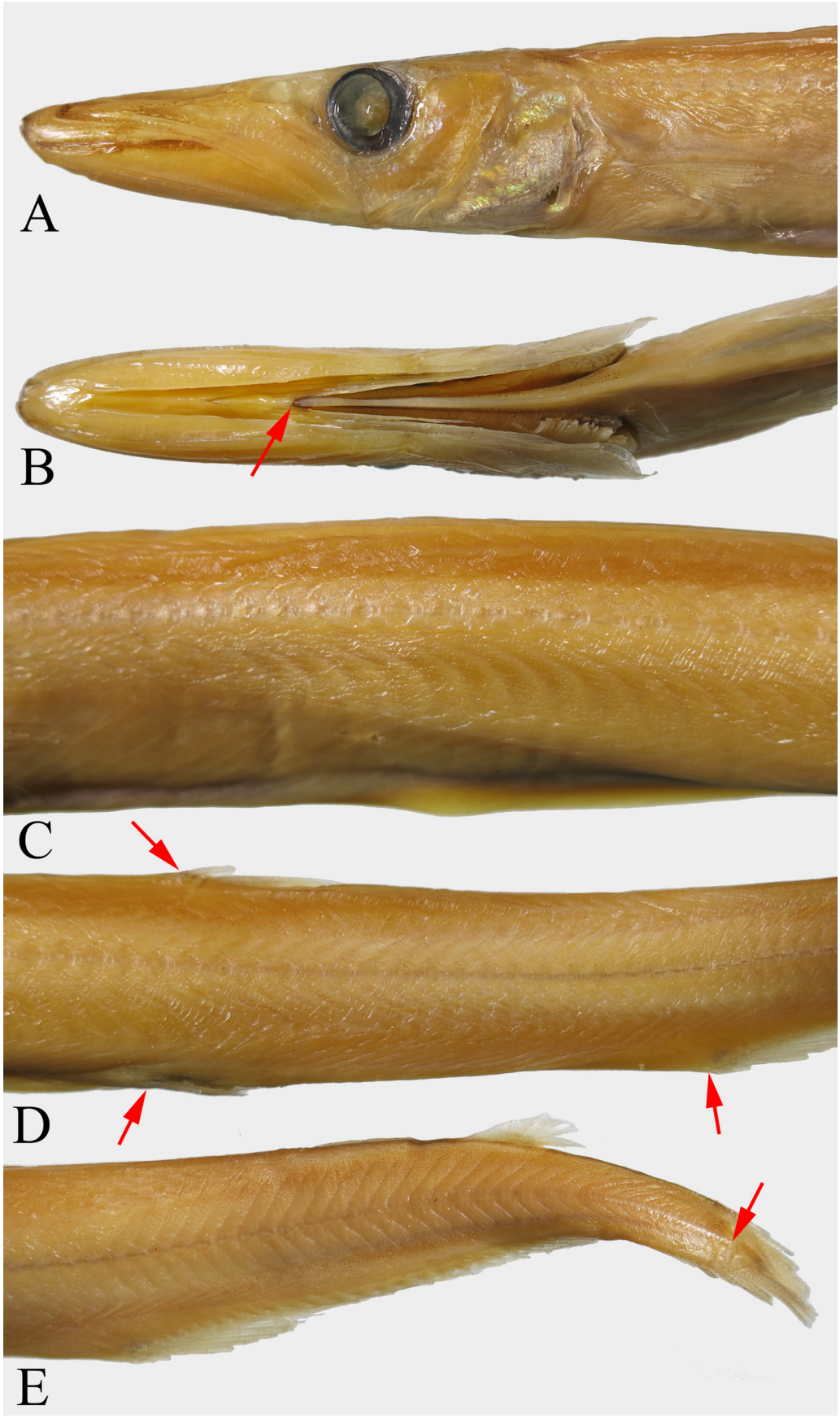

FIGURE 2. *Lestidium longilucifer* **sp. nov.**, from the holotype. A. Lateral view of head. B. Ventral view of head, arrow points the anterior end of luminescent duct. C. Middle region of trunk. D. posterior trunk region, arrows indicate DFO (dorsal), VFO (ventral left) and AFO (ventral right). E. Caudal region, arrow indicates posterior end of lateral line.

Body moderately elongate, robust, and relatively thick; belly nearly straight in profile; greatest depth at approximately anterior third of body; depth at pectoral fin 15 (13–15) times in SL. Caudal-peduncle length about 1.5 times eye diameter. Dorsal adipose fin small. A moderately constricted abdominal ridge between head and pelvic fins. Ventral adipose fins weakly developed along abdominal ridge and margin between anus and AFO. Anus above about tip of adpressed pelvic fin, about same vertical through posterior end of dorsal-fin base.

DFO well behind midpoint of SL (Figs. 1A–C), slightly behind VFO in most individuals (Fig. 2D) or nearly at same vertical in some, predorsal length 1.6 (1.5–1.6). Pectoral fin level with vertical of posterior margin of gill cover, its upper base about level with lower margin of eye. A small pocket behind pectoral-fin base. VFO slightly behind midpoint of SL, prepelvic length 1.6 (1.6–1.7) in SL, with a small axial scale behind pelvic fin base. Anal fin originating at posterior fourth of body, preanal length 1.3 (1.2–1.3). Anal-fin base 6.5 (6.4–7.9) in SL. Adipose fin above rear portion of anal-fin base.

Head moderately long, slightly wider at opercle than body, its length 4.6 (4.5–5.1) in SL. Snout long and blunt, its length 1.9 (1.9–2.1) in HL. Postorbital length slightly less than one-third of HL. Mouth terminal, its gape extending to under anterior half of eye posteriorly; lower jaw upturned distally, with a small fleshy tissue on its tip. Eye diameter 6.4 (5.6–7.5) in HL. No light organ in front of eye (Fig. 2A) and no luminescent duct at lower margin of orbit.

Interorbital space narrow, its width 10.7 (9.7–11.5) in HL; some straight ridges on top of head and snout. Upper jaw length 2.2 (2.1–2.3 in HL), posterior end of maxilla terminating at about half of eye diameter before a vertical through anterior margin of orbit. Two nostrils close together, both well in front of posterior end of maxilla, about one eye diameter before the eye. Sensory canals on snout, check, operculum, and jaws; numerous sensory pores on dorsal surface of snout and lower surface of lower jaw.

TABLE 1. Morphometric data for three new species of *Lestidium*. HT=Holotype.

	L. longilucifer **sp. nov.**			*L. nigrorostrum* **sp. nov.**			*L. rofeni* **sp. nov.**		
	HT	Types		HT	Types		HT	Types	
SL (mm)	260	214–248 (n=15)		316	175–337 (n=23)		245	143–245 (n=23)	
% SL		Mean (Range)	SD		Mean (Range)	SD		Mean (Range)	SD
Head length	21.6	21.1 (19.5–22.4)	0.7	21.0	21.0 (20.4–21.9)	0.4	21.0	20.2 (19.0–21.2)	0.7
Body depth	6.6	7.0 (6.2–7.9)	0.5	7.1	7.0 (5.8–7.7)	0.5	6.7	6.3 (5.8–6.7)	0.3
Pectoral-fin length	5.6	6.0 (4.6–7.3)	0.9	8.8	8.1 (6.4–9.0)	0.7	9.4	7.7 (6.6–9.4)	1.0
Predorsal length	63.1	62.7 (60.9–64.8)	1.0	63.3	62.3 (61.1–63.8)	0.9	62.9	62.3 (61.0–62.9)	0.6
Prepelvic length	62.3	61.5 (59.7–63.4)	0.9	56.0	55.3 (53.8–56.8)	0.8	55.9	55.0 (53.5–56.0)	0.9
Preanal length	78.1	80.0 (77.5–81.9)	1.1	78.2	77.5 (76.4–78.9)	0.7	77.1	77.5 (76.6–79.0)	0.7
V–A	15.8	18.5 (15.8–20.0)	1.0	7.3	22.1 (20.1–23.6)	0.9	21.2	22.5 (21.2–23.8)	0.9
V–D	0.8	1.0 (0.4–2.1)	0.4	22.2	7.0 (5.6–8.5)	0.7	6.9	7.3 (6.7–8.7)	0.5
Eye diameter	3.4	3.4 (2.9–3.8)	0.2	3.1	3.6 (3.1–4.2)	0.3	3.3	3.4 (3.0–3.8)	0.3
Interorbital width	2.0	2.0 (1.8–2.1)	0.1	2.2	2.2 (1.8–2.3)	0.1	2.2	2.2 (2.1–2.3)	0.1
Snout length	11.1	10.8 (10.1–11.2)	0.3	10.7	10.8 (10.2–11.3)	0.3	11.0	10.2 (9.6–11)	0.3
Head depth	5.8	5.9 (5.4–6.1)	0.2	5.8	5.7 (5.4–5.9)	0.1	6.0	6.0 (5.8–6.1)	0.1
Upper-jaw length	9.8	9.7 (9.2–10.5)	0.3	9.9	10.0 (9.4–10.7)	0.4	9.9	9.7 (8.8–10.3)	0.4
Lower-jaw length	13.6	13.2 (12.5–14.1)	0.4	13.0	12.2 (11–13.5)	0.8	13.1	12.9 (12.2–13.4)	0.4
Anal-fin-base length	15.3	14.6 (12.7–15.8)	1.0	17.7	17.3 (16.3–17.9)	0.5	18.6	17.7 (16.9–18.7)	0.5
V–A/V–D	4.9	5.5 (2.3–10.6)	2.1	32.9	31.9 (28.6–38.6)	2.7	32.7	32.5 (30.2–36.7)	1.7
% HL									
Eye diameter	15.7	16.1 (13.4–18.3)	1.2	14.7	16.0 (14.7–16.9)	0.7	16.0	16.7 (14.8–18.2)	1.2
Interorbital width	9.3	9.4 (8.7–10.3)	0.4	10.5	10.3 (8.5–11.1)	0.6	10.3	10.7 (10.3–11.2)	0.3
Snout length	51.4	51.2 (48.6–53.1)	1.2	50.6	51.5 (50.1–53.7)	1.3	52.3	50.3 (47.9–52.3)	1.2
Head depth	26.6	27.8 (25.8–29.8)	1.1	27.5	27.3 (26.4–28.3)	0.5	28.6	28.2 (27.8–28.6)	0.6
Upper-jaw length	45.3	46.0 (44.2–50.2)	1.5	47.1	48.1 (46.6–50.6)	1	47.4	47.6 (46.2–49.3)	1.0
Lower-jaw length	63.0	62.7 (58.9–66.0)	1.8	61.8	62.3 (60.3–63.6)	1.2	62.5	63.5 (60.7–65.4)	1.5

TABLE 2. Meristic data for three new species of *Lestidium*. Selected types and non-types are included.

	L. longilucifer **sp. nov.**		*L. nigrorostrum* **sp. nov.**		*L. rofeni* **sp. nov.**	
	HT	n=24	HT	n=24	HT	n=26
Fin elements						
Dorsal-fin rays	10	10	10	10	10	10
Pectoral-fin rays	13	13–14	13	12–14	13	12–14
Pelvic-fin rays	9	9	9	9	9	9
Anal-fin rays	30	28–30	34	31–34	33	30–33
Lateral-line scales						
Prepelvic	38	37–39	34	33–36	35	34–36
Predorsal	39	38–39	40	39–42	41	40–43
Preanal	55	55–57	54	53–57	55	54–57
Total	132	126–146	150	142–157	125	123–139
Vertebrae						
Prehaemal	41	41–43	36	35–38	36	36–38
Caudal	47	43–47	52	51–53	52	50–53
Prepelvic (P2)	38	37–39	34	33–36	35	34–36
Predorsal (PD)	39	38–40	40	38–41	41	40–41
Preanal (PA)	58	56–59	54	53–56	54	54–56
Total	88	85–88	88	86–90	88	87–90
PA-P2	20	18–20	20	19–20	19	19–21
PD-P2	1	0–2	6	4–6	6	5–7
Gill rakers						
Eipbranchial	15	14–15	12	10–14	12	9–15
Ceratobrnachial	19	13–19	19	17–22	19	15–21
Hypobranchial	16	16–20	16	12–17	16	11–17
Total	50	48–53	47	40–50	47	39–49

TABLE 3. Selected meristic data for of three species in *Lestidium atlanticum* species complex.

	***L. longilucifer* sp. nov.**		***L. atlanticum***		***L. orientale***
Locality	NW Australia		Atlantic Ocean		Taiwan
	n=24	n=7		n=3	n=52
Dorsal-fin rays	10	10	-	9–10	10
Pectoral-fin rays	13–14	13	-	12–13	12–14
Anal-fin rays	28–30	28–30	29–31 (n=41)	29–30	26–30
Lateral-line scales	126–146	115–125	-	121	109–126
Prehaemal vertebrae	41–43	36–38	36–39 (n=22)	38	34–37
Caudal vertebrae	43–47	44–45	-	45	41–44
Prepelvic vertebrae	37–39	34–36	-	-	34–37
Predorsal vertebrae	38–40	33–35	-	-	33–36
Preanal vertebrae	56–59	52–53	-	-	51–54
Total vertebrae	85–88	81–82	80–83 (n=44)	80+–83	79–83
Data sources	This study	Ho *et al.* (2019a)	Ege (1953)	Rofen (1966)	Ho *et al.* (2019a)

Opercle thin, with posterior margin bluntly pointed, its lower margin notched around the base of pectoral fin. Gill membranes joined anterior to a vertical from middle of eye, free from isthmus. Four gill arches, all with filaments; the fourth arch fully connected to the gill wall by membrane. Pseudobranchs present, inside a deep pocket above first gill arch.

Two or 3 small fangs at tip of upper jaw, followed by single row of small retrorse teeth along upper jaw, teeth becoming gradually smaller on posterior portion. Three depressible or fixed fangs at front of lower jaw, followed by two rows of fangs on the lower jaw forming 5–9 tooth pairs, those in inner row long, with a knife-like tip, and depressible; those in outer row much shorter, curved back and fixed. Vomerine teeth absent. Two rows of fangs on each palatine, anterior 3–4 teeth forming widely-spaced tooth pairs, those in the inner row depressible and long, and in outer row small and fixed; posterior portion with single row of small fixed teeth. One row of small, straight teeth on each side of tongue.

Gill rakers well-developed on epibranchial, ceratobanchial and hypobanchial of first gill arch; the rakers shield shaped, each with 4–7 small teeth and a narrow base. Rakers on epibranchial of first arch 15 (14–15), ceratobranchial with 19 (16–19), hypobranchial with 18 (17–20), and in total 50 (48–53). Teeth on pharyngeal arch slender, forming an oval patch with about 5 rows at middle/centre. Single row of small teeth on fifth ceratobranchial.

Body devoid of scales, except for a single row of lateral-line scales 132 (126-146) originating at upper corner of pectoral girdle and extending to caudal-fin base (Fig. 2E). Anterior 66 (62–66) scales of lateral line extending to about midway along the anal-fin base clearly larger in size than the remaining and almost square in shape with slightly concave upper and lower margins; these scales gradually become smaller and narrower posteriorly. Posterior 66 (63–83) scales of lateral line distinctly smaller. The large scales have a row of 3 (rarely 4) pores on each margin, the first pore larger than the rest; one pore on upper and lower end of these distinctly smaller scales.

A well-developed, unbranched, elongate luminescent duct along mid-line of ventral margin, extending forward from anus to well beyond eye (including those specimens smaller than 50 mm SL).

Coloration. Color when fresh (Figs. 1B–C), body slightly translucent, dorsal fourth greyish; dorsal surface of head and lower lips blackish; posterior portion above anal-fin base and behind silvery white; through the skin, upper abdominal cavity black with all peritoneal sections fused, the rest slivery white; all fins clear, except for the caudal fin slightly blackish. Preserved specimens (Figs. 1A, 2) light brown dorsally, with melanophores extending downwards from mid-line about two-thirds the distance to the lateral-line; ventrally the body is uniformly pale. Dense melanophores cover top of head, snout, lips, under surface of lower jaw; the pectoral, dorsal, pelvic and anal fins are covered with scattered melanophores. Adipose and caudal fins densely covered with melanophores; gill chamber with large blackish patches; peritoneal membrane black, all peritoneal sections fused in adults.

Size. The largest specimen examined was 292 mm SL.

Etymology. The specific name *longilucifer* is derived from the combination of Latin *longus* and *lucifer*, referring to the long luminescent duct that extends well forward of the eye.

Distribution. The species is currently known only from the type series collected from northwestern Australia and southern Taiwan.

Remarks. *Lestidium longilucifer* and its congeners *L. orientale* and *L. atlanticum* form a group possessing a luminescent duct extending forward to in front of the eyes, and VFO at about same vertical through DFO; in contrast the luminescent duct extending between the anus to just below the opercle and the DFO is well behind VFO in the rest of congeners. All these species differ from *L. bigelowi* in lacking light organs on the lateral and ventral surfaces of the body.

Lestidium longilucifer can be separated from *L. atlanticum* and *L. orientale* by having predorsal vertebrae 38–40 (vs. 33–35 in *L. atlanticum* and 33–36 in *L. orientale*, respectively); prepelvic vertebrae 37–39 (vs. 34–36 and 34–37 [mainly 35–36]); prehaemal vertebrae 41–43 (vs. 36–38 and 37–40); preanal vertebrae 56–59 (vs. 52–53 and 51–54); total vertebrae 85–88 (vs. 81–82 and 79–83); total lateral-line scales 126–146 (vs. 115–123 and 109–126); predorsal length 60.9–64.8% SL (vs. 58.7–60.4% SL and 57.7–59.9% SL); jaws slightly shorter with upper jaw 9.2–10.5% SL (vs. 9.9–11.3% SL in *L. atlanticum*; overlapped with *L. orientale*) and lower jaw 12.5–14.1% SL (vs. 13.5–14.8% SL in *L. atlanticum*; overlapped with *L. orientale*). Moreover, the maximum adult size is clearly greater (up to 292 mm SL) in *L. longilucifer*, whereas the largest known specimen of *L. atlanticum* is 177 mm SL (USNM 11727; Rofen, 1966) and 177 mm SL (NMMB-P25557) for that of *L. orientale*.

Ege (1957) recognized *Lestidium atlanticum* as a widespread species in tropical and subtropical regions (between 40°N and 30°S) of the Atlantic, Indian and Pacific oceans. However, he reported adults only from the western Atlantic Ocean, and only young stages from elsewhere, including just one specimen from each of western and eastern Australia.

The meristic data provided by Ege (1957) were divided into several geographic regions and encompassed broad ranges, i.e. 75–87 total vertebrae and 35–41 prehaemal vertebrae. However, his data for Atlantic specimens are 80–83 total vertebrae (n=44) and 36–38 prehaemal vertebrae (n=22), which agree well with our examination.

Ege's data for specimens taken from the Indo-west Pacific can be further divided into a high vertebral population (83–87 total vertebrae), moderately high vertebral population (79–83 total vertebrae) and low vertebral population (75–80

total vertebrae). As few adult specimens were available to this study from the Indo-west Pacific other than from Taiwan and Australia (HCH, pers. data), we are not able to make judgement on all these populations. However, Ege's specimens taken from the western Indian Ocean and Indonesia show similar vertebral counts to *L. longilucifer*.

Moreover, the northwestern Pacific Ocean population (e.g. from Taiwan, Japan and the Philippines) is now recognised as a distinct species (Ho *et al.*, 2019a), representing Ege's moderately high vertebral number population. Specimens of the low vertebral number population are needed for further study.

Rofen (1966) cited Ege's (1957) data to define *Lestodium atlanticum* and provided data for three additional specimens collected from the Atlantic Ocean. These specimens have 121 lateral-line scales; 9–10 dorsal-fin rays; 29–30 anal-fin rays; 12–13 pectoral-fin rays; 38 prehaemal vertebrae and 80–83 total vertebrae, consistent with our separation of *L. longilucifer* from the Atlantic population of *L. atlanticum*.

The smallest specimen of *L. longilucifer* examined was 48 mm SL (AMS I.42344-010) but even at this small size, it exhibited a well-developed luminescent duct inside the abdominal cavity that extended forward to beyond the eye. Another example is the holotype of *Paralepis thermophilus* (=*Lestidium atlanticum*), a 43.5 mm SL juvenile, also show clearly a luminescent duct extending forward before the eye.

Lestidium nigrirostrum sp. nov.
urn:lsid:zoobank.org:act:5C95A762-A737-46ED-984B-169E5F5400E1
Australian Robust Barracudina
Figs. 3A–E, 4A, 5A; Tables 1–2

Holotype. CSIRO H1159-16, 316 mm SL, 17°30.1'S, 150°41.2'E, Marian Plateau, ENE of Townsville, Queensland, northeastern Australia, Southwestern Pacific Ocean, demersal trawl, 752–751 m, 24 Nov. 1985.

Paratypes. Twenty-two specimens, 195–338 mm SL. AMS I.19202-004 (6 specimens, 242–264 mm SL), 33°11'S, 152°20'E, 50 km SE of Newcastle, New South Wales, Australia, demersal trawl 600 m, FRV Kapala, 11 May 1976, coll. K. Graham. AMS I.25825-001 (1, 324), 18°00'S, 147°06'E, 120 km N of Townsville, Queensland, Australia, demersal trawl 300 m, RV Soela, 16 Jan. 1986, coll. M. McGrouther and S. Reader. AMS I.25836-003 (1, 308), 17°59'S, 147°07'E, 125 km N of Townsville, Queensland, Australia, demersal trawl 305 m, RV Soela, 20 Jan. 1986, coll. M. McGrouther and S. Reader. AMS I.26393-002 (5, 218–245), 33°44'S, 151°52'E, 70 km ENE of Sydney, New South Wales, Australia, demersal trawl 525 m, FRV Kapala, 4 Nov. 1985, coll. K. Graham. AMS I.27594-009 (1, 216), 36°38'S, 156°11'E, near Gascoyne Seamount, Tasman Sea, midwater trawl 520 m, 15 March 1988, coll. N. Klaer. AMS I.40005-001 (1, 338), 36°12'S, 150°24'E, 15 km E of Montague I. New South Wales, Australia, demersal trawl 520 m, FV Shelley H, 1 March 2000, coll. K. Graham. NMV A.7122 (1, 195), 33°43'S, 151°52'E, Broken Bay, New South Wales, Australia, 420 m, 24 Jan. 1982. NMV A.7661 (1, 203), 34°27'S, 151°18'E, off Wollongong, Tasman Sea, New South Wales, Australia, 280 m, 22 Jan. 1982. CSIRO H616-27 (1, 314), CSIRO H616-28 (1, 317), CSIRO H616-29 (1, 313), CSIRO H616-30 (1, 317), CSIRO H616-31 (1, 325), 19°0.7'S, 150°41.2'E, northeast of Whitsunday group, Marian Plateau, demersal trawl, 752–751 m, 24 Nov. 1985.

Non-types. AMS I.15967-004 (1, 205), FRV Kapala,33°42'S, 151°52'E, 60 km ENE of Sydney, New South Wales, demersal trawl, 280 m, 6 Apr. 1971. AMS I.15977-003 (1, 258), FRV Kapala, 29°54'S, 153°40'E, 40 km E of Wooli, New South Wales, demersal trawl 380 m, 12 May 1971. AMS I.17879-007 (1, 191), FRV Kapala,33°50'S, 151°36'E, 30 km E of Sydney, New South Wales, midwater trawl 0-110 m, 2 Jul. 1973, coll. K. Graham. AMS I.19206-002 (1, 233), FRV Kapala,33°29'S, 152°03'E, 60 km E of Terrigal, New South Wales, Australia, demersal trawl 495 m, 27 May 1976, coll. K. Graham. AMS I.20518-017 (1, 250), FRV Kapala, 28°00'S, 153°59'E, 55 km E of Gold Coast, Queensland, Australia, demersal trawl 550 m, 2 Jun. 1978, coll. K. Graham. AMS I.22642-002 (1, 167), FRV Kapala, 32°08'S, 153°04'E, 55 km E of Tuncurry, New South Wales, demersal trawl 495 m, 27 July 1981, coll. K. Graham. AMS I.23488-002 (1, 287), FRV Kapala, 33°40'S, 150°56'E, 55 km ESE of Broken Bay, New South Wales, demersal trawl 510 m, 13 Oct. 1982, coll. K. Graham. AMS I.25288-015. (1, 95), FRV Kapala, 35°14'S, 151°54'E, 30 km SE of Jervis Bay, New South Wales, midwater trawl 0-110 m (bottom depth 220m), 1 May 1980, coll. K. Graham. AMS I.25814-002 (1, 126), RV Soela, 17°55'S, 147°06'E, 90 km E of Mission Beach, Queensland, demersal trawl 260 m, 13 Jan. 1986, coll. M. McGrouther and S. Reader. AMS I.25816-005 (1, 305), RV Soela, 17°57'S, 147°02'E, 100 km E of Mission Beach, Queensland, demersal trawl 300 m, 13 Jan. 1986, coll. M. McGrouther and S. Reader. AMS I.26029-003 (1, 162), FRV Kapala, 33°44'S, 151°52'E, 65 km off Broken Bay, New South Wales, demersal trawl 525 m, 4 Nov. 1985, coll. K. Graham. AMS I.29738-005 (1, 285), FRV Kapala, 31°54'S, 153°12'E, 45 km ESE of Crowdy Head, New South Wales, demersal trawl 500-900 m, 13 Oct. 1982, coll. K. Graham. AMS I.33318-001 (18, 159–185), AMS I.33318-002 (16), FV Imlay, 37°04'S, 150°18'E, 40 km off Eden, New South Wales, demersal trawl

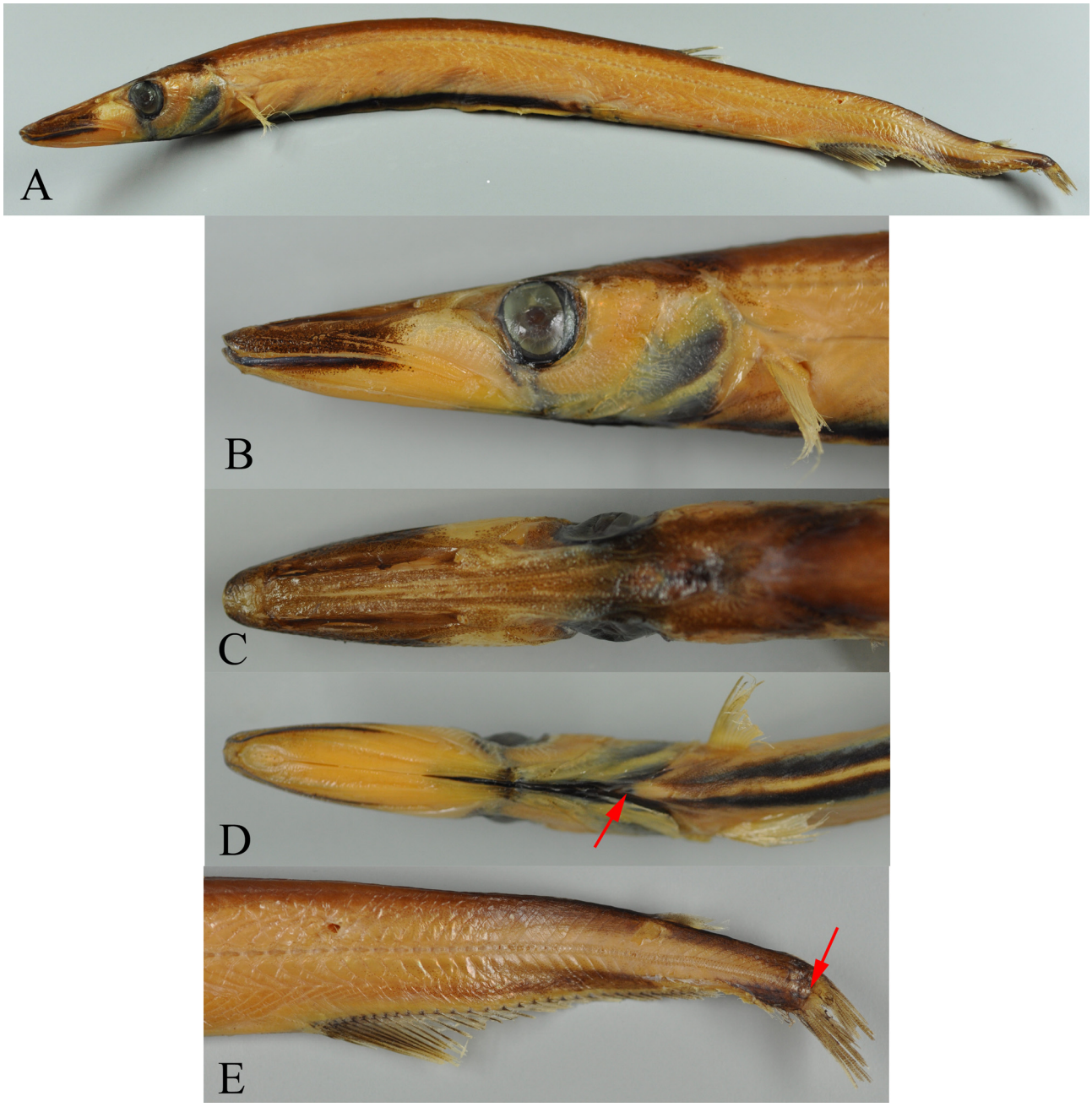

FIGURE 3. *Lestidium nigrorostrum* **sp. nov.**, holotype, CSIRO H1159-16, 316 mm SL. A. Lateral view. B. Lateral view of head. C. Dorsal view of head. D. Ventral view of head, arrow indicates the anterior end of luminescent duct. E. Lateral view of tail region, arrow indicates the posterior end of lateral line.

400 m, 1992, coll. R. Drenkhahn. AMS I.38508-001 (1, 210), 37°40'S, 150°15'E, 35 km SE of Gabi I., Victoria, demersal trawl 440 m, FRV Kapala, 29 April 1997, coll. K. Graham. CSIRO A4289 (1, 171), 37°27'S, 150°15'E, east of Cape Howe, midwater trawl, 138–150 m, 6 Feb. 1977. CSIRO B1246 (2, 158–217), 36°03'S, 150°21'E, northeast of Narooma, midwater trawl, 79–90 m, 31 Mar. 1976. CSIRO CA860 (1, 230), 37°39'S, 150°15'E, southeast of Gabo Island, Midwater trawl, 20–40 m, 18 Apr. 1977.

Tentatively identified. CSIRO H 2128-002 (1, 242), 17°50'S, 150°41.2'E, southwest of Rowley Shoals, Western Australia, 420 m, bottom trawl, 12 Feb. 1989.

Diagnosis. A species in the *Lestidium prolixum* species complex with a complete lateral-line, and a simple luminescent duct originating below opercle; it can be further distinguished from two other congeners in the species complex in having 31–34 anal-fin rays; prehaemal vertebrae 35–38 and total vertebrae 87–90; lateral-line ended at caudal fin base, with 142–157 scales; DFO clearly behind tip of adpressed pelvic fin, V–D 5.6–8.5%SL and 28.6–38.6%V–A; 5–7 lateral-line scales and 4–7 vertebrae between VFO and DFO; dorsum dark brownish, mela-

nophores extending downward to the lateral-line along its entire upper margin; anterior portions of snout and lower jaw blackish; abdomen with a very broad black sub-margin.

Description. Dorsal-fin rays 10; pectoral-fin rays 13 (12–14); pelvic-fin rays 9; anal-fin rays 34 (31–34). Lateral-line scales: prepelvic 34 (33–36); predorsal 40 (39–42); preanal 54 (53–57); and total 150 (142–157). Vertebrae: prehaemal 36 (35–38); caudal 52 (50–53); prepelvic 35 (34–36); predorsal 41 (40–41); preanal 54 (54–56); and total 88 (87–90).

Body relatively elongate, robust and less compressed; belly slightly convex in profile; greatest depth of body at approximately anterior third of body, body depth at pectoral-fin base 14 (13–17) times in SL. Caudal peduncle short, about 1.3–1.5 times eye diameter. Dorsal adipose fin small. A moderately constricted abdominal ridge between head and pelvic fins. Ventral adipose fin slightly developed on abdominal ridge and moderately developed along margin between anus and AFO. Anus at about tip of adpressed pelvic fin, slightly in front of DFO.

DFO clearly behind VFO and midpoint of SL (Figs. 4A), well before midpoint of V–A; predorsal length 1.6 (1.6) in SL. Pectoral-fin base at same vertical as posterior margin of gill cover, its upper base about same horizontal of lower margin of eye. A small pocket behind pectoral-fin base. VFO well behind midpoint of SL, prepelvic length 1.8 (1.8–1.9) in SL, with a small axial scale behind pelvic fin base. Anal fin originating at posterior fourth of body, preanal length 1.3 (1.3) in SL. Anal-fin base 5.6 (5.6–6.1) in SL. Adipose fin above rear portion of anal-fin base. Head moderately long and stout, slightly wider at opercle than body, its length 4.8 (4.6–4.9) in SL. Snout moderately long and blunt, its length 2.0 (1.9–2.0) in HL. Postorbital length slightly less than third of HL. Mouth terminal, moderately large, its gape extending to level of anterior margin of eye or slightly beyond; tip of lower jaw upturned distally, with a small fleshy process on its tip. Eye moderately large, its diameter 6.8 (5.9–6.8) in HL. No light organ in front of eye; a luminescent duct at lower margin of orbit.

Interorbital space narrow, its width 9.6 (9.0–11.7) in HL; some straight ridges on top of head and snout. Upper jaw length 2.1 (2.0–2.1) in HL, posterior end of maxilla extending to about one-third eye diameter before a vertical from orbit. Two nostrils close together, about one-third eye diameter before posterior end of maxilla. Sensory canals on snout, check, operculum, and jaws; numerous sensory pores on dorsal surface of snout and lower surface of lower jaw.

Opercle thin, with posterior margin bluntly pointed, its lower margin notched around base of pectoral fin. Gill membranes joined far forward, before a vertical from eye, free from isthmus.

Five gill arches, filament present on the first to fourth arches and absent on fifth; fourth arch mostly connected to the gill wall by membrane; pseudobranchs present, inside a deep pocket.

Two to 4 small fangs at tip of upper jaw, followed by numerous small retrorse teeth in a single row along the upper jaw, these gradually becoming smaller posteriorly. Three fixed or depressible fangs at/on front of lower jaw, followed by two rows of fangs forming 6–8 tooth pairs, those in inner row long with knife-like tips and depressible; those in inner row much shorter, recurved and fixed. Vomerine teeth absent. Two rows of fangs on each palatine, the anterior 5–6 teeth forming widely-spaced tooth pairs; those in the outer row long and depressible; teeth in the inner row small and fixed; posterior portion with single row of small fixed teeth. One row of small straight, teeth on each side of tongue.

Gill rakers present on epibranchial, ceratobanchial and hypobanchial of first gill arch; the rakers shield shaped, each with 2–4 small teeth and a narrow base. Rakers on epibranchial of first arch 12 (10–14), ceratobranchial with 19 (17–22), hypobranchial with 16 (12–17), total rakers 47 (40–50). Teeth on pharyngeal arch slender, forming an oval patch with about 5 rows at middle/centre. Single row of small teeth on fifth ceratobranchial.

Body devoid of scales, except for a single row along the lateral-line originating above pectoral girdle and extending to caudal-fin base. Anterior 65 (63–66) scales on lateral line are clearly larger in size, with lengths about equal to height and gradually becoming smaller and narrower posteriorly; followed by 85 (79–97) distinctly smaller scales from above posterior half of anal-fin base to caudal fin. Larger scales with a cluster of 4–6 (usually 5) large pores on each margin, the first one larger than the rest and a median pore on center of broader of these larger scales; a pore on upper and lower end of the distinctly smaller scales.

A well-developed, unbranched, elongate luminescent duct along the mid-line of the ventral margin, extending anteriorly from the anus to below opercle (Fig. 3D).

Coloration. Preserved specimens (Figs. 3, 4A, 5A) dark brownish on dorsum, pale ventrally; melanophores on dorsum extending downward to entire lateral line, gradually becoming scattered along the posterior third of lateral line; dense melanophores on top of head, snout, lips, orbit (Figs. 3B, C); lower surface/underside of lower jaw covered with scattered melanophores (Fig. 3D); abdomen with pale margin and a broad black sub-margin (Figs. 3A, 5A); pectoral and pelvic fins covered with scattered melanophores; dorsal, adipose, anal and caudal fins densely covered with choromatophores; gill chamber mostly black with broad pale margin on gill cover; branchiostegal membrane and isthmus uniformly black; peritoneal membrane black, all sections fused in adults. Fresh color unknown.

Size. The largest specimen examined was 338 mm TL.

Etymology. The specific name is derived from Latin *niger* and *rostrum,* in referring to the black snout.

Distribution. The species is currently known from waters off eastern Australia, ranging from the Coral Sea off central Queensland to Bass Strait and into the Tasman Sea.

Remarks. The species is one of three species recognized in the *Lestidium prolixum* complex having a large body size, a complete lateral line extending to caudal fin base, a luminescent duct on the lower margin of orbit, DFO behind VFO, but well before midpoint of V–A; and more than 126 lateral-line scales.

It differs from *L. prolixum* in having the DFO slightly, but clearly behind the tip of adpressed pelvic fin and anus (vs. overlapped with the adpressed pelvic fin and above anus in *L. prolixum*, Fig. 4B). Related to this character are V–D 28.6–38.6% (vs. 18.4–25.5%) of V–A; lateral-line scales between VFO and DFO 5–7 (vs. 3–4, rarely 5). Moreover, the melanophores on the dorsum extend downward to the lateral line in L. nigr*orostrum, but ex*tend only to the upper margin of the lateral line and form a wavy line in *L. prolixum* (Fig. 5A vs. 5B). *Lestidium nigrorostrum* also reaches a large adult body size (338 mm SL), whereas the largest specimen of *L. prolixum* examined was 276 mm SL (Ho *et al.*, 2019a).

Specimens from Western Australia, very similar to this new species, have a much lighter body coloration and shorter body, and possibly represent a different species. Pending more detailed investigation, we exclude these specimens from the type series here.

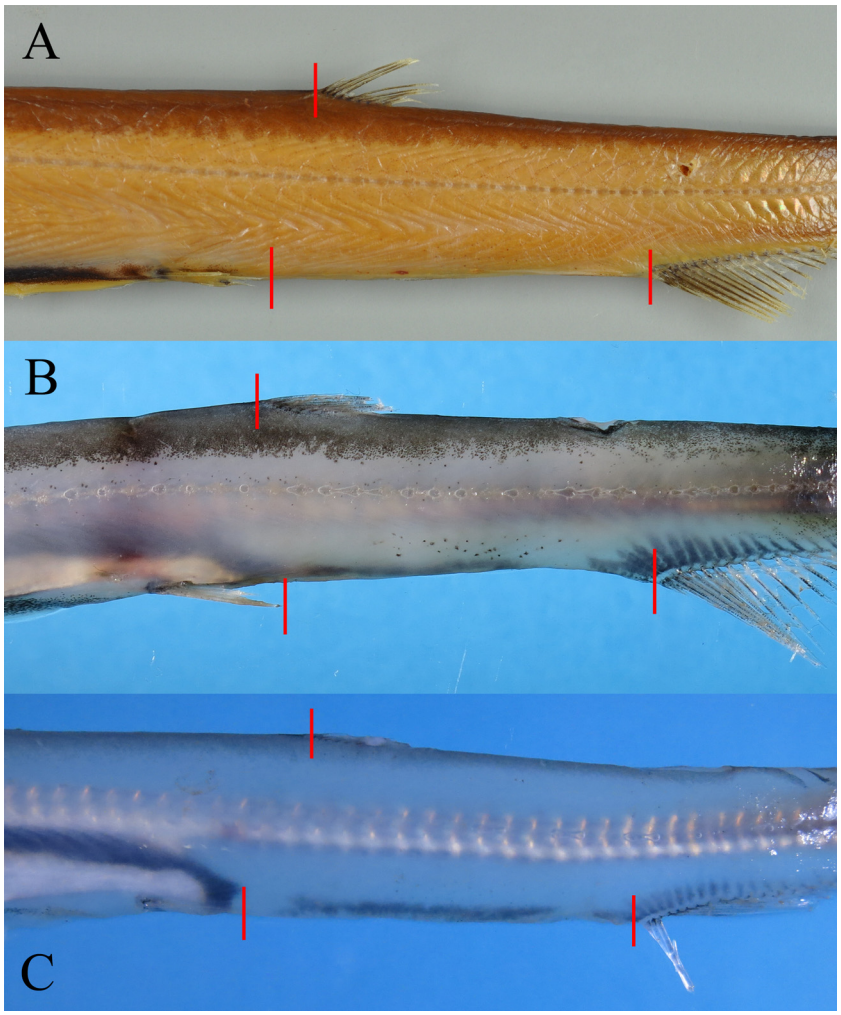

FIGURE 4. Posterior region of trunk showing the fin position. A. *L. nigrorostrum* **sp. nov.**, from the holotype. B. *L. prolixum*, NMMB-P25552, 276 mm SL. C. *L. rofeni* **sp. nov.**, one of paratypes, catalog number unknown. Bars indicate DFO (upper), tip of pelvic fin (ventral left) and AFO (right).

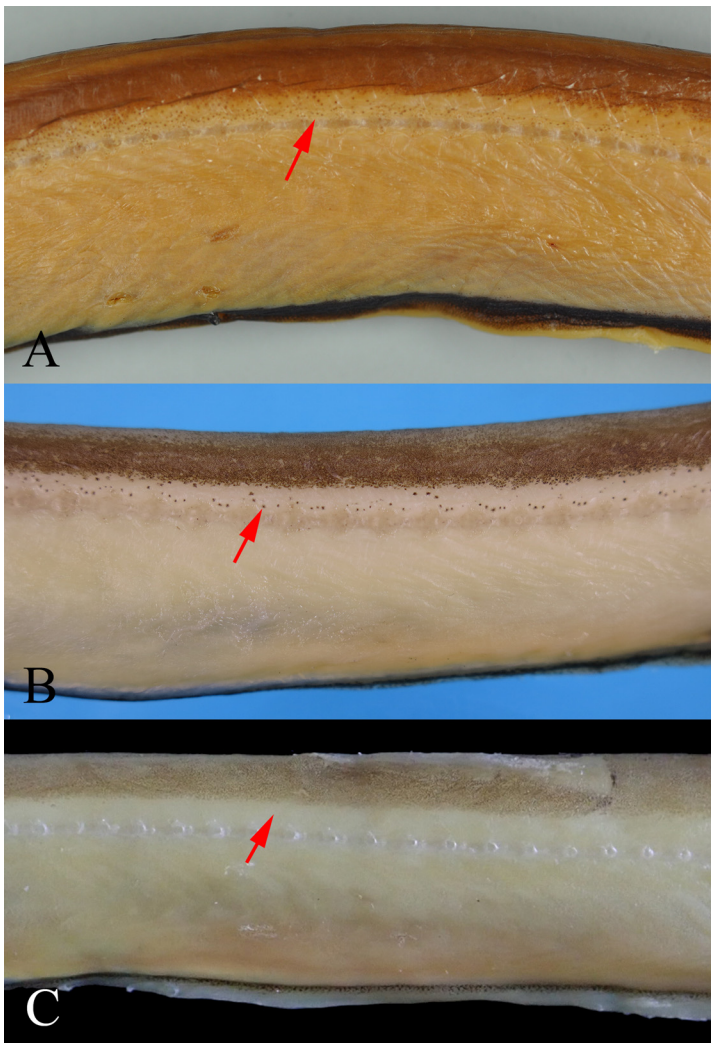

FIGURE 5. Anterior trunk region showing the pigmentation. A. *L. nigrorostrum* **sp. nov.**, from the holotype, arrow indicates the upper margin of lateral line.B. *L. prolixum*, NMMB-P25552, 276 mm SL, arrow indicates the dots along upper margin of lateral line. C. *L. rofeni* **sp. nov.** from the holotype, arrow indicates the unpigmented region above lateral line.

***Lestidium rofeni* sp. nov.**

urn:lsid:zoobank.org:act:E117C340-DA0C-42EE-8007-18451C8B5D7A

Rofen's Barracudina

Figs. 4C, 5C, 6A–D, 7A–D, 8A–C; Tables 1–2

Holotype. NMMB-P28479 (245 mm SL), off Dong-gang, Pingtung, southwestern Taiwan, northern South China Sea, 30 Jan. 2018, collected from fish landing port.

Paratypes. Twenty-five specimens, 135–264. AMS I.36454-009 (2, 217–242), FSV *Fishery Researcher 1*, 13°09'N 124°02'E, Albay Gulf, Philippines, demersal trawl, 375 m, 23 Sept. 1995, coll. J. Paxton. AMS I.36464-004 (3, 247–264), FSV *Fishery Researcher 1*, 14°42'N 123°23'E, 250 km E of Manila, Philippines, demersal trawl, 440 m, 27 Sept. 1995, coll. J. Paxton. NMMB-P24621 (1, 244), 5 Jul. 2016; NMMB-P25548 (1, 143), 20 Jan. 2017; NMMB-P25549 (1, 154), 20 Jan. 2017; NMMB-P25550 (1, 172), 20 Jan. 2017; NMMB-P25551 (1, 162), 10 Jan. 2017; NMMB-P27926 (1, 248), 16 Jul. 2017; NMMB-P27927 (1, 239), 16 Jul. 2017; NMMB-P27931 (7, 135–148), 6 Dec. 2017; NMMB-P28480 (1, 192), 30 Jan. 2018; NMMB-P30875 (5, 151–183), 30 Jan. 2018; collected from near type locality.

Non-types. NMMB-P16428 (1, 211), 28 Jan. 2012; NMMB-P23851 (1, 193), 17 Feb. 2017; NMMB-P23939 (3, 228–243), 20 Feb. 2016; NMMB-P23988 (1, 244), 5 Mar. 2016; NMMB-P24426 (1, 189), 17 Feb. 2016; NMMB-P24624 (5, 140–169), 27 Jun. 2016; NMMB-P24627 (4, 122–143), 27 Jun. 2016; NMMB-P24632 (1, 207), 12 Jan. 2011; NMMB-P24633 (1, 184), 25

May 2013; NMMB-P25546 (5, 126–149), 4 Feb. 2016; NMMB-P25547 (1, 181.5), 20 Jan. 2017; NMMB-P25603 (1, 146.5), 21 Sep. 2015; NMMB-P25761 (1, 235), 29 Mar. 2017; NMMB-P26453 (1, 243), 23 Jun. 2017; NMMB-P26586 (1, 199), 25 Apr. 2017; NMMB-P28838 (1, 167), 27 Jun. 2016; NMMB-P30028 (1, 250), Dong-gang, no date; NMMB-P30786 (5, 180–184); NMMB-P30792 (1, 151), out of NMMB-P25553, 31 Mar. 2016; NMMB-P30804 (16, 105-187); NMMB-P30805 (26, 90–195); NMMB-P30806 (2, 203-235), 27 Mar. 2018; all collected from near type locality.

FIGURE 6. *Lestidium rofeni* **sp. nov.** A. Holotype, NMMB-P28479, 245 mm SL, fresh. B. preserved holotype. C. Paratype, NMMB-P27926, 248 mm SL, fresh. D. Paratype, NMMB-P27927, 239 mm SL, fresh.

Diagnosis. A species in the *Lestidium prolixum* species complex with a complete lateral line and a simple luminescent duct originating below opercle.; *L. rofeni* can be further distinguished from two other congeners in the species complex in having 30–33 anal-fin rays; prehaemal vertebrae 36–38 and total vertebrae 87–90; lateral-line ending at caudal fin base, with 123–139 scales; DFO clearly behind tip of adpressed pelvic fin; V–D 6.7–8.7% SL and 30.2–36.7% V–A; 5–7 lateral-line scales and 5–8 vertebrae between VFO and DFO; scattered melanophores away from upper margin of lateral line before VFO, entirely translucent on remaining section of lateral line; abdominal ridge with none or scattered melanophores.

Description. Dorsal-fin rays 10; pectoral-fin rays 13 (12–14); pelvic-fin rays 9; anal-fin rays 33 (30–33). Lateral-line scales: prepelvic 35 (34–36); predorsal 41 (40–43); preanal 55 (54–57); total 125 (123–139). Vertebrae: prehaemal 36 (36–38); caudal 52 (50–53); prepelvic 35 (34–36), predorsal 41 (40–41); preanal 54 (54–56); and total 88 (87–90).

Body relatively elongate, slender and compressed; belly straight to slightly convex in profile; greatest depth of body at approximately anterior third of body, depth at pectoral fin 15 (15–17) times in SL. Caudal peduncle longer than eye diameter, its length 1.3–1.4 time eye diameter. Dorsal adipose fin small. A moderately constricted abdominal ridge between head and pelvic fins. Ventral adipose fin well-developed along abdominal ridge and along the margin between anus and AFO. Anus at about tip of adpressed pelvic fin, below or slightly before DFO.

DFO slightly, but clearly, behind tip of adpressed pelvic fin (Figs. 4C) and mid-point of SL (Fig. 6), predorsal length 1.6 (1.6). Pectoral fin level with posterior margin of gill cover, the uppermost ray at about same level as lower margin of eye. VFO well behind midpoint of SL, prepelvic fin 1.8 (1.8–1.9) in SL. Anal fin originating at posterior

fourth of body, preanal fin length 1.3 (1.3) in SL. Anal-fin base 5.4 (5.4–5.9) in SL. Adipose fin above rear portion of anal-fin base.

Head relatively slender, slightly wider at opercle than body, its length 4.8 (4.6–5.3) in SL. Snout moderately long and pointed distally, its length 1.9 (1.9–2.1) in SL. Postorbital length about one-third of HL. Mouth terminal, moderately large, its gape extending to anterior margin of eye; lower jaw slightly upturned distally, with a small fleshy tissue at its tip. Eye moderately large, its diameter 6.3 (5.5–6.8) in HL. No light organ in front of eye; a luminescent duct at lower margin of orbit.

Interorbital space narrow, its width 9.7 (8.9–9.7) in HL, some straight ridges on top of head and snout. Upper jaw length 2.1 (2.0–2.1) in HL, posterior end of maxilla extending slightly less than half eye diameter before anterior margin of orbit. Two nostrils close together, well in front of posterior end of maxilla, about one eye diameter before eye. Sensory canals on snout, check, operculum, and jaws; numerous sensory pores on dorsal surface of snout and lower surface of lower jaw.

Opercle thin, with posterior margin bluntly pointed, its lower margin notched around base of pectoral fin. Gill membranes joined far forward, before a vertical from anterior margin of the eye, free from isthmus. Five gill arches, filaments presence on the first to fourth arches, absent on fifth. The fourth arch mostly connected to the gill wall by a membrane. Pseudobranchs present, inside a deep pocket above gill arches.

Two or 3 fangs on upper jaw, followed by bands of small and retrorse teeth along upper jaw, becoming gradually smaller posteriorly. Three fangs, either depressible or fixed, at front of lower jaw, followed by two rows of fangs on lower jaw, forming 6–8 tooth pairs; those in the inner row long and depressible with a knife-like tip, and those in the outer row much shorter, recurved and fixed. Vomerine teeth absent. Two rows of fangs on each palatine, anterior 3–4 teeth forming widely-spaced tooth pairs, those in the inner row long and depressible, and in outer row small and fixed; posterior portion of palatine with single row of small fixed teeth. One row of small straight, teeth on each side of tongue.

Gill rakers well-developed on epibranchial, ceratobanchial and hypobanchial of first gill arch; the rakers shield shaped, each with 2–4 small teeth and a narrow base. Rakers on epibranchial of first arch 12 (9–15), ceratobranchial with 19 (15–21), hypobranchial with 16 (11–17), total rakers 47 (39–49). Teeth on pharyngeal arch slender, forming an oval patch with about 5 rows at middle. Single row of small teeth on fifth ceratobranchial.

Body devoid of scales, except for a single row of lateral-line scales originating at above pectoral girdle and extending to the caudal-fin base. The anterior 67 (64–68) scales on the lateral line are clearly larger in size than the remainder, are slightly longer than high with slightly concave upper and lower margins, and gradually becoming smaller and narrower posteriorly. The posterior 58 (57–72) scales are distinctly smaller scales above posterior half of anal-fin base and behind. Row of 3–5 large pores on each margin of the larger scales, the first pore larger than the rest, and a pore on upper and lower end of these distinctly smaller scales.

A well-developed, unbranched, elongate luminescent duct, extending forward to well beyond the eye and backward along midventral line of ventral margin to anus**.**

Coloration. Color when fresh (Figs. 6A, C, D, 8A–C), body slightly translucent, dorsal fourth greyish but rather indistinct; dorsal surface of head and lower lips blackish; posterior portion above anal-fin base and behind silvery white; through the skin, upper abdominal cavity black with all peritoneal sections fused, the rest slivery white; all fins clear, except for the caudal fin slightly blackish. Narrow black sub-margin along abdominal ridge or not (Figs. 5C, 7B, 8B)

Preserved specimens (Figs. 6B, 7A–D) with upper fourth of body covered by fine melanophores, the lower margin of these melanophores not overlapped with lateral line (Fig. 5C). Anterior third of upper margin of lateral line with scattered melanophores, entirely translucent on posterior portion. Very few melanophores or unpigmented on lateral sides between pelvic and anal fins. Lower margin of orbital blackish; surface of cheek below eye covered by melanophores; anterior half of jaws blackish; dorsal surface of skull and nape black. Pectoral fin translucent; base of dorsal, pelvic and anal fin blackish interiorly; scattered melanophores on anal-fin rays and branchiostegal rays. Membranes of branchiostegal region translucent in younger individuals, gradually becoming scattered blackish patches, but never as much as in *L. prolixum* and *L. nigrorostrum.* Luminous duct creamy yellow; peritoneal membrane melanophores alone lateral side of luminous duct inside the abdominal cavity. Abdominal ridge pale or with narrow dark submargin (Figs. 5C, 7B).

Size. The largest specimen examined is a 264 mm SL non-type.

Etymology. The species is named after Robert R. Rofen (previously R. R. Harry), former research director of George Vanderbilt Foundation, Stanford University, who contributed a lot of knowledge on paralepidid fishes.

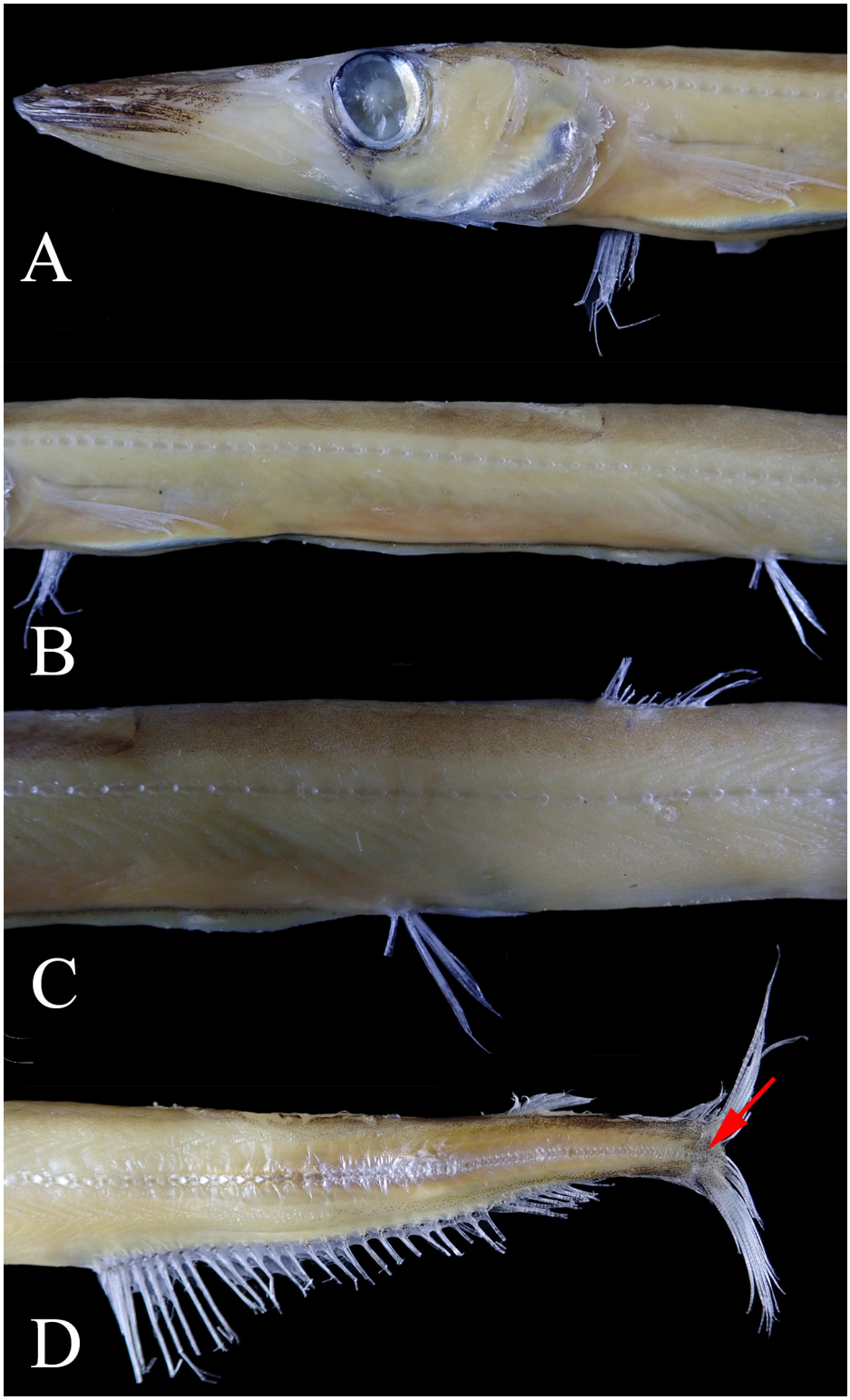

FIGURE 7. *Lestidium rofeni* s**p. nov.**, from the holotype. A. Lateral view of head. B. Anterior trunk region. C. Middle region of trunk.

Distribution. The species is currently known only from Taiwan and the Philippines, but is likely widespread in northwestern Pacific Ocean. Off southern Taiwan, smaller specimens were collected by mid-water trawl (<100 m depth) and larger specimens usually caught by demersal trawl (> 300 m), which may suggest the adults shift to deeper waters with growth/age.

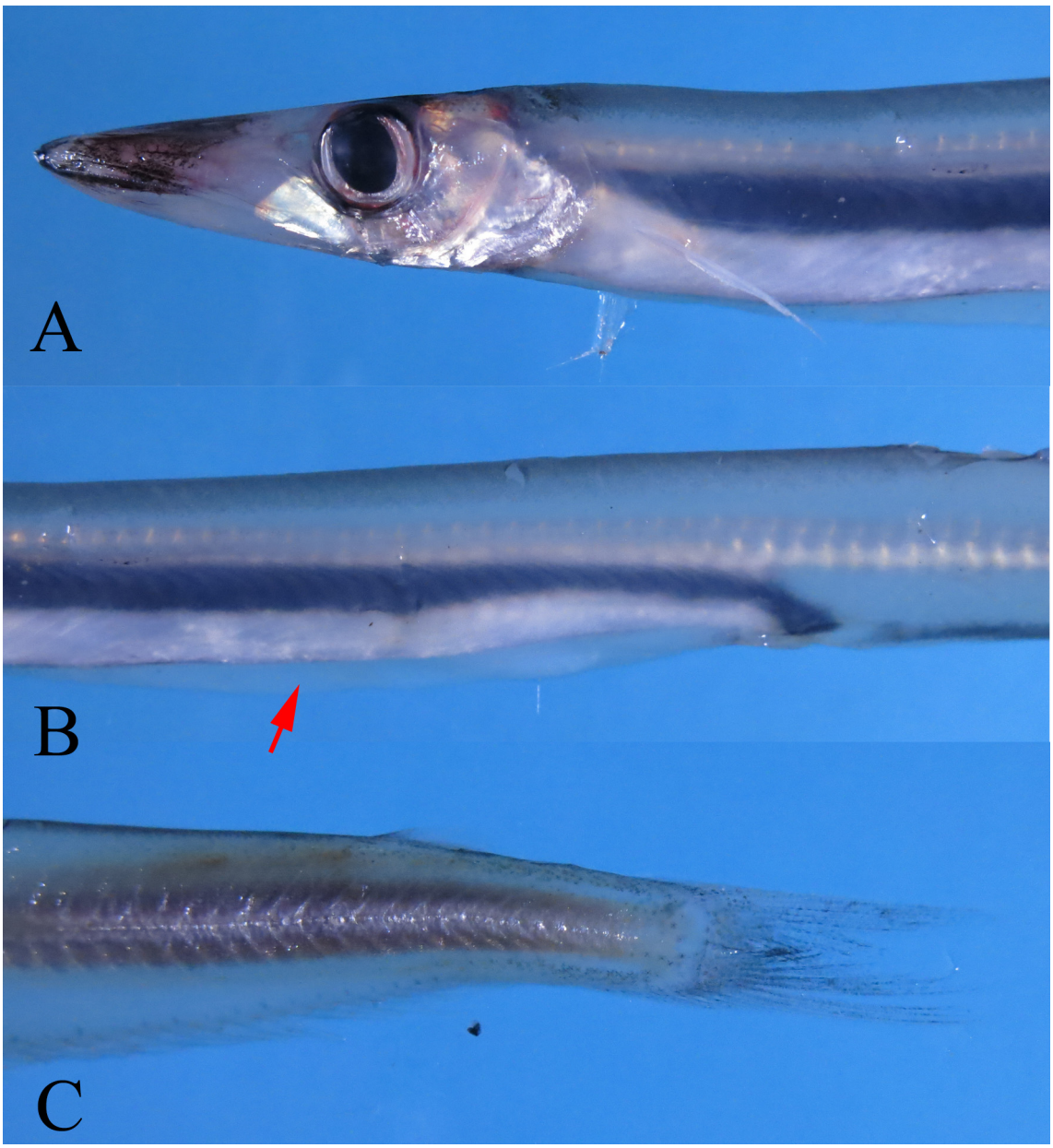

FIGURE 8. *Lestidium rofeni* **sp. nov.**, NMMB-P30805, 195 mm SL, fresh coloration, showing pigmentations in different body region. **A.** Lateral view of head. **B.** Anterior region of trunk, arrow points the clear abdominal ridge. **C.** Caudal region.

Remarks. *Lestidium rofeni*, *L. prolixum* and *L. nigrorostrum* share similar body proportions, meristics and general appearance, and form a species complex. *Lestidium rofeni* is sympatric with *L. prolixum* in southern Taiwanese waters but can be separated from *L. prolixum* in having 123–139 total lateral-line scales (vs. 147–158 in *L. prolixum*); 57–72 (vs. 82–91) small scales along posterior portion of lateral line. The DFO is clearly behind the tip of adpressed pelvic fin in *L. rofeni* (Figs. 4C, 7C), whereas it overlaps or is just slightly behind the tip of the adpressed pelvic fin in *L. prolixum* (Fig. 4B). Associated with this character are: V–D 30.2–36.7% SL in *L. rofeni* (vs. 18.4–25.5% SL); 5–7 lateral-line scales and 5–8 vertebrae between VFO and DFO in *L. rofeni* (vs. 3–5 [mainly 4] scales and vertebrae, respectively); and 3–5 more prehaemal than predorsal vertebrae in *L. rofeni* (vs. 1–3, mainly 1 or 2 vertebrae). Moreover, *L. rofeni* generally has light coloration, compared to similar size individuals of *L. prolixum* which are darker.

Lestidium rofeni differs from *L. nigrorostrum* in having 123–139 total lateral-line scales (vs. 142–157 in *L*

nigrorostrum) and body coloration is also different. The area along the lateral line of *Lestidium rofeni* is without pigmentation except for few scattered black dots above the lateral line, whereas in *L. nigrorostrum,* melanophores extend downward from the dorsum to the lateral line along its whole length. In *L. rofeni,* the abdominal ridge is pale or with a narrow blackish sub-margin (Figs. 5C, 7B, 8B; vs. abdomen with pale margin and a very broad black sub-margin, Figs. 3A, 5A); the gill chamber is mostly translucent or, at most, with scattered dark patches (vs. mostly blackish); and the membranes of the branchiostegal region are without colour in young/small individuals, gradually developing scattered blackish patches with increasing age/size, but never to the extent of *L. nigrorostrum.*

Lestidium rofeni was likely misidentified as *L. nudum* in the northwestern Pacific Ocean. Both species have nearly identical vertebral formulae and body proportions. However, *L. rofeni* is clearly different from *L. nudum* in having a complete lateral line extending to the caudal-fin base, whereas that in *L. nudum* is incomplete, extending only to above the anterior third of anal-fin base; and the total lateral-line scales are 84–87, with 64–68 large scales, followed by 15–21 smalles scales in *L. nudum*. All specimens of *L. nudum* examined by us have the branchiostegal membranes and rays entirely black, whereas in *L. rofeni* the color ranges from entirely translucent to irregular black patches on the membranes. Because the black patches on the branchiostegal region develop with age/size in *L. rofeni*, more small specimens of *L. nudum* need to be examined to fully understand the development of pigmentation in that species.

Comparative materials. *Lestidium atlanticum*: listed in Ho *et al.* (2019a). *Lestidium orientale*: listed in Ho *et al*. (2019a). *Lestidium prolixum*: listed in Ho *et al.* (2019a); CSIRO H 6295-11 (1, 262), Taiwan; NMMB-P30959 (33, 253–268) and NMMB-P30960 (24, 255–275), off Dong-gang, 13 Mar. 2019. *Lestidium nudum*: listed in Ho *et al.* (2019a).

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