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FULL PAPER

Nemoossis, a new genus for the eastern Atlantic long-fin bonefish *Pterothrissus belloci* Cadenat 1937 and a redescription of *P. gissu* Hilgendorf 1877 from the northwestern Pacific

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Abstract The new generic name *Nemoossis* is proposed for the albulid species *Pterothrissus belloci* Cadenat 1937, a species endemic to the eastern Atlantic Ocean. *Nemoossis* differs from other genera in the family Albulidae as follows: longer dorsal-fin base, absence of supraneural bones, dorsal-fin rays [51–57 (mode 52)], vertebrae [total number 88–92 (91)], pored lateral-line scales [79–89 (84)], pre-dorsal-fin scale rows [3–8 (8)], head length [24–32 % (mean 30 %) of SL], pectoral-fin length [16–21 % (19 %) of SL], pre-dorsal-fin length [27–34 % (30 %) of SL], dorsal-fin base length [53–64 % (60 %) of SL], postorbital length [13–16 % (14 %) of SL], and upper caudal-fin length [18–31 % (24 %) of SL]. MNHN 1938-0002, 192 mm SL, is designated as a lectotype for *P. belloci*, and *Bathythrissa dorsalis* Günther 1877 is shown to be a junior synonym of *P. gissu.*

Keywords Albulidae · Redescription · *Pterothrissus* · New genus · *Nemoossis*

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Introduction

The bonefish family Albulidae is currently considered to comprise two genera (Nelson 2006), *Albula* Scopoli 1777 and *Pterothrissus* Hilgendorf 1877, although the latter has been considered the sole member of the family Pterothrissidae (e.g., Smith 1986; Aizawa 1993). Easily distinguished from the circumglobal genus *Albula* by its greater dorsal-fin base length, *Pterothrissus* has long been considered to include two species, *Pterothrissus gissu* Hilgendorf 1877, from the northwestern Pacific, and *P. belloci* Cadenat 1937, from the eastern Atlantic (Uyeno 1984; Smith 1986).

The genus *Pterothrissus* (type species: *P. gissu*) was described on the basis of a single specimen (ZMB 9890) collected from Yedo (=Tokyo), Japan by Hilgendorf (1877; published 31 Aug.). In the same year, Günther (1877; published 1 Nov.) described *Bathythrissa dorsalis* from "off Inosima" (=Enoshima), Kanagawa Pref., Japan, also from a single specimen (BMNH 1879.5.14.532). Examination of these specimens confirmed their conspecificity (see below). Elsewhere, Cadenat (1937) described *P. belloci* from Senegal on the basis of three syntype specimens (MHNLR P. 386, MNHN 1938-0002 and MSNG 36335). However, significant differences in morphological characters from the Japanese species suggested that the former

represented a new albulid genus, which is described herein. The type species of *Pterothrissus* and the new genus are redescribed.

Materials and methods

Counts and measurements followed Hubbs and Lagler (1958), with the following additions and modifications: body width, least distance between pectoral-fin bases; bony interorbital width, bony width across frontals above center of eye; interorbital width with membrane, broadest distance between eyes (including membrane and adipose tissue); pre-anus length, distance from snout tip to anteriormost point of anus; upper and lower caudal-fin lengths, distance from middle of posterior margin of hypural plate to posterior tip of longest caudal-fin ray of upper and lower lobes, respectively; jaw width, distance between posteriormost points of each jaw; and maxillary depth, distance between upper and lowermost points on posterior margin of maxilla. Terminology and formula of supraneural bones follow Mabee (1988) and Ahlstrom et al. (1976), respectively. Standard length is expressed as SL. In each species description, holotype or lectotype data are given in parentheses; characters given in the diagnosis are not repeated. Institutional codes follow Fricke and Eschmeyer (2016).

Nemoossis gen. nov.

Type species. *Pterothrissus belloci* Cadenat 1937: 443, figs. 8–9 (type locality: Senegal).

Diagnosis. A genus of the family Albulidae with the following combination of characters: supraneural bones absent (Fig. 1a); dorsal-fin rays 51–57 (mode 52; Table 3); total vertebrae 88–92 (91; Table 1); pored lateral-line scales 79–89 (84; Table 1); pre-dorsal scale rows 3–8 (8; Table 3); head length 24–32 % (mean 30 %) of SL (Fig. 4a); pectoral-fin length 16–21 % (19 %) of SL (Fig. 4b); pre-dorsal-fin length 27–34 % (30 %) of SL (Fig. 5a); dorsal-fin base length 53–64 % (60 %) of SL (Fig. 5b); postorbital length 13–16 % (14 %) of SL; upper caudal-fin length 18–31 % (24 %) of SL.

Etymology. The generic name "*Nemoossis*" is a combination of the Latin words "Nemo", meaning absence, and "ossis", meaning bones, in reference to the absence of supraneural bones.

Nemoossis belloci (Cadenat 1937)

(Figs. 1a, 2, 4–6; Tables 1, 3)

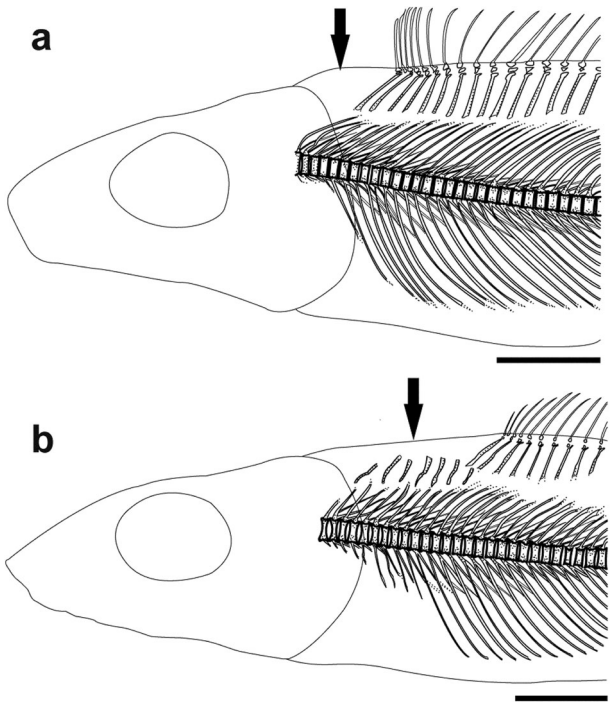

Fig. 1 Configuration of supraneural bones. **a** *Nemoossis belloci*, SAIAB 65836, 175 mm SL, Angola; **b** *Pterothrissus gissu*, HUMZ 71355, 193 mm SL, off Onahama, Iwaki, Fukushima Pref., Japan. *Bars* 10 mm

Pterothrissus belloci Cadenat 1937: 443, figs. 8–9 (type locality: Senegal); Smith 1986: 157 (West Africa); Whitehead 1990: 125 (eastern tropical Atlantic); Bianchi et al. 1993: 136 (Namibia); Heemstra and Heemstra 2004: 99 (southern Africa); Wirtz et al. 2013: 117 (Cape Verde Islands).

Lectotype. MNHN 1938-0002, 192 mm SL, Senegal.

Paralectotypes. MHNLR P. 386, 224 mm SL, Senegal; MSNG 36335, 158 mm SL, Senegal.

Other material (*n* = 49, 129–278 mm SL). MHNLR 6501014, 4 specimens, 236–266 mm SL, eastern central Atlantic (ECA); MUFS 22667–22670, 4 specimens, 149–190 mm SL, off Republic of Equatorial Guinea; SAIAB 65836, 175 mm SL, Angola; SAIAB 65607, 4 specimens, 224–243 mm SL, Angola; SAIAB 48544, 208 mm SL, Namibia; SAIAB 10603, 6 specimens, 225–249 mm SL, ECA; SAIAB 3677, 2 specimens, 129–146 mm SL, no data; SAM 28239, 2 specimens, 239–256 mm SL, ECA; SAM 28836, 20 specimens, 211–257 mm SL, no data; ZMB 22010, 5 specimens, 183–229 mm SL, ECA.

Diagnosis. See generic diagnosis.

Description. Counts and proportional measurements of the lectotype, two paralectotypes and non-type specimens are given in Table 1. Data for the lectotype are given in parentheses if different.

Table 1 Counts and measurements of the lectotype, 2 paralectotypes and non-type specimens of *Nemoossis belloci*

	Nemoossis belloci			
	Lectotype MNHN 1938-0002 $n = 1$	Paralectotype MHNLR P. 386 $n = 1$	Paralectotype MSNG 36335 $n = 1$	Non-type specimens $n = 49$
Standard length (mm)	192	224	158	129–278
Counts				
Dorsal-fin rays	56	53	52	51–57 (52)
Anal-fin rays	13	11	11	11–13 (11)
Pectoral fins	14	14	15	13–17 (14)
Pelvic-fin rays	9	9	9	8–11 (10)
Pored lateral-line scales	84	87	85	79–89 (84)
Scale rows above/below lateral line	6/6	8/6	7/6	5–8 (7)/5–7 (6)
Pre-dorsal-fin scale rows	3	4	4	3–8 (8)
Branchiostegal rays	7	7	7	6–8 (7)
Gill rakers	5 + 14 = 19	4 + 15 = 19	5 + 14 = 19	3–8 (5) + 12–15 (13) = 16–21 (19)
Total vertebrae	92	–	–	88–92 (91)
Measurements (means)				
Head length	30	29	31	24–32 (30)
Body depth	18	19	19	14–23 (19)
Body width	12	14	12	9–14 (12)
Snout length	10	10	10	6–10 (9)
Upper-jaw length	10	11	11	6–11 (10)
Mandible length	8	7	8	5–9 (7)
Mouth width	8	7	7	6–8 (7)
Maxillary depth	3	–	3	2–3 (3)
Bony interorbital width	8	7	8	7–9 (8)
Fleshy interorbital width	8	9	9	7–10 (9)
Orbit diameter	8	7	8	7–9 (7)
Suborbital width	4	2	3	2–4 (3)
Postorbital length	13	14	14	13–16 (14)
Longest dorsal-fin ray	14	–	13	9–17 (13)
Last dorsal-fin ray	6	6	–	5–8 (6)
Longest anal-fin ray	12	12	–	9–13 (11)
Last anal-fin ray	6	5	7	4–10 (6)
Longest pectoral-fin ray	20	19	21	16–21 (19)
Longest pelvic-fin ray	14	13	16	12–16 (14)
Pre-dorsal-fin length	33	30	31	27–34 (30)
Pre-anal-fin length	80	82	80	76–97 (80)
Pre-anus length	72	75	74	70–87 (74)
Pre-pelvic-fin length	54	56	56	50–63 (54)
Dorsal-fin base	62	59	58	53–64 (60)
Anal-fin base	9	8	9	7–11 (9)
Caudal-peduncle length	12	13	12	10–15 (12)
Caudal-peduncle depth	7	8	7	4–9 (7)
Upper caudal lobe	26	20	–	18–31 (24)
Lower caudal lobe	23	21	27	17–27 (23)

Data expressed as percentages of standard length, plus modes and means in parentheses

Fig. 2 *Nemoossis belloci.* **a** lectotype, MNHN 1938-0002, 192 mm SL, Senegal; **b** paralectotype, MHNLR P. 386, 224 mm SL, Senegal; **c** paralectotype, MSNG 36335, 158 mm SL, Senegal

Body elongate, subcylindrical; head large, its length nearly equal to pre-dorsal-fin length; snout conical, projecting slightly beyond lower jaw, its length nearly equal to upper-jaw length; mouth small, inferior; posterior margin of maxilla not reaching vertical through anterior margin of eye; eye moderate size, oblong, its diameter slightly less than bony interorbital width; small gular plate absent between lower jaws; suborbital bones well developed; teeth minute, conical and villiform on premaxillary and dentary, respectively; vomer and palatines toothless; gill rakers rudimentary; modified median row of enlarged scales in front of dorsal fin; all fins without spines; dorsal-fin base very long, about twice head length; longest dorsal-fin ray somewhat shorter than longest pectoral-fin ray (tip broken); anal fin located under posterior part of dorsal fin; longest anal-fin ray slightly shorter than caudal-peduncle length; pectoral fins low on side of body, near ventral outline; pelvic fins abdominal, located under central part of dorsal fin, length nearly equal to postorbital length; caudal fin deeply forked, upper lobe longer than lower; body covered with cycloid scales; head naked, cavernous; lateral line beginning at upper margin of opercle, running straight to caudal peduncle; intermuscular bone present.

Color of fresh specimens. Based on color transparencies of a freshly thawed specimen (MUFS 43595): Body bright silvery-white dorsally and ventrally; dark longitudinal lines between dorsal scale rows; head blackish; first dorsal-fin ray black; upper margin of dorsal-fin rays slightly black-edged, lower part yellowish-white; first pectoral-fin ray black, remaining rays dull yellow; pelvic-fin base grayish, other fin bases white; anal fin white; posterior margin of caudal-fin lobes black, lobes otherwise gray.

Color of preserved specimens. Based on the lectotype (MNHN 1938-0002, 192 mm SL) and non-type specimens: body black dorsally, brown ventrally; head blackish; first pectoral-fin ray blackish; other fins yellow; posterior margin of caudal-fin lobes blackish.

Distribution. *Nemoossis belloci* is a deep water (50–500 m depth, Whitehead 1990) eastern Atlantic species, ranging from Senegal to the west coast of South Africa (Fig. 6).

Remarks. *Nemoossis belloci* differs significantly from *Pterothrissus gissu* in lacking supraneural bones (Fig. 1), and in having different counts of dorsal-fin rays [51–57 (mode 52) vs. 54–65 (58) in *P. gissu*], total vertebrae [88–92 (91) vs. 105–107 (107)], pored lateral-line scales [79–89 (84) vs. 99–109 (104)], and pre-dorsal-fin scale rows [3–8 (8) vs. 13–20 (16)] (Tables 1, 3), and longer head [24–32 % (mean 30 %) of SL vs. 23–31 % (27 %)], pectoral fin [16–21 % (19 %) vs. 10–18 % (15 %)], pre-dorsal fin [27–34 % (30 %) vs. 31–39 % (35 %)] and dorsal-fin base [53–64 % (60 %) vs. 47–56 % (52 %)] (Figs. 4, 5).

Fig. 3 *Pterothrissus gissu.* **a** holotype, ZMB 9890, 319 mm SL, Tokyo, Japan; **b** holotype of *Bathythrissa dorsalis*, BMNH 1879.5.14.532, 365 mm SL, Enoshima, Kanagawa Pref., Japan

A new genus "*Nemoossis*" is proposed for *Pterothrissus belloci* Cadenat 1937 because distinct differences of the skeletal system (no supraneural, more vertebrae, and fewer dorsal-fin rays) and many counts and proportional measurements (less lateral-line scales, fewer pre-dorsal-fin scale rows, and longer head length) are clearly recognized.

Nemoossis belloci was originally described (as *Pterothrissus belloci*) by Cadenat (1937) on the basis of three syntype specimens (MNHN 1938-0002, MHNLR P. 386, and MSNG 36335, Fig. 2a–c) from Senegal. We examined three syntype specimens and confirmed having counts and proportional measurement of the genus and species of *N. belloci* (Tables 1, 3 and Figs. 4, 5). One (MNHN 1938-0002, 192 mm SL) of the three syntype specimens is designated as the lectotype of *P. belloci* under Article 74.7.3 (ICZN 2003) because of avoiding future taxonomic confusion, while others automatically become the paralectotypes.

Pterothrissus Hilgendorf 1877

Type species. *Pterothrissus gissu* Hilgendorf 1877: 127 (type locality: Tokyo, Japan).

Diagnosis. A genus of the family Albulidae with the following combination of characters: 6–7 supraneural bones (Fig. 1b); dorsal-fin rays 54–65 (mode 58; Table 3); total vertebrae 105–107 (107; Table 1); pored lateral-line scales 99–109 (105; Table 1); pre-dorsal scale rows 13–20 (16; Table 3); head length 23–31 % (mean 27 %) of SL (Fig. 4a); pectoral-fin length 10–18 % (15 %) of SL (Fig. 4b); pre-dorsal-fin length 31–39 % (35 %) of SL (Fig. 5a); dorsal-fin base length 47–56 % (52 %) of SL (Fig. 5b); postorbital length 9–12 % (10 %) of SL; upper caudal-fin length 16–32 % (21 %) of SL.

Pterothrissus gissu Hilgendorf 1877

(Figs. 1b, 3–6, Tables 2, 3)

Pterothrissus gissu Hilgendorf 1877 (31 Aug.): 127 (type locality: Tokyo, Japan); Tameka 1982: 57, 316 (Kyushu-Palau Ridge, Japan); Shirai 1983: 65, 173 (north-eastern Sea of Japan); Machida 1984: 79, 314 (Okinawa Trough, Japan); Uyeno 1984: 21, pl. 23-H (Japan); Aizawa 2000: 189 (Japan); Sheiko and Fedorov 2000: 16 (Kamchatka, Russia); Shinohara et al. 2001: 291 (Pacific coast of northern Honshu, Japan); Aizawa 2002: 189 (Japan); Tsukamoto 2002: 267 (Japan); Shinohara et al. 2005: 399 (Ryukyu Islands); Shinohara et al. 2011: 39 (Sea of Japan); Aizawa and Doiuchi 2013: 190 (Japan).

Bathythrissa dorsalis Günther 1877 (1 Nov.): 443 [type locality: Enoshima, (originally given as "off Inosima"), Kanagawa Pref., Japan]: Günther 1887: 222, pl. 56-A.

Holotype. ZMB 9890, 319 mm SL, Tokyo, Japan (originally given as "Yedo").

Other material (*n* = 79, 61–406 mm SL, all from Japan, except where stated). ASIZP 60837, 325 mm SL, Dahsi fish market, Dahsi, Ylian, Taiwan; ASIZP 63258, 282 mm SL, Dahsi fish market, Dahsi, Ylian, Taiwan; BMNH 1879.5.14.532, 365 mm SL, off Inosima (=Enoshima, *ca.* 35°30'N, 139°50'E), Kanagawa Pref.; BSKU 4650, 307 mm SL, Suzaki, Kochi Pref.; BSKU 8986, 285 mm SL, Kochi Pref.; BSKU 18865–18880, 16 specimens, 63–113 mm SL, Sendai Bay, Miyagi Pref.; BSKU 33263, 386 mm SL, Okinawa Trough, East China Sea, *ca.* 29°N, 42°E; BSKU 53727–53728, 2 specimens, 319–331 mm SL, Kochi Pref.; FRLM 2343, 388 mm SL, Sea of Kumano, Wagu, Shima, Mie Pref.; FRLM 3463–3464, 3861, 3 specimens, 377–385 mm SL, Sea of Kumano, Shima, Mie Pref.; HUMZ 59213, 71231, 71355, 71421, 72132, 5 specimens, 151–248 mm SL, Onahama fish market, Iwaki, Fukushima Pref.; HUMZ 89817,

Table 2 Counts and measurements of the holotype and non-type specimens of *Pterothrissus gissu* and holotype of *Bathythrissa dorsalis*

	Pterothrissus gissu		
	Holotype of *Pterothrissus gissu* ZMB 9890 $n = 1$	Holotype of *Bathythrissa dorsalis* BMNH 1879.5.14.532 $n = 1$	Non-type specimens $n = 78$
Standard length (mm)	319	365	61–406
Counts			
Dorsal-fin rays	62	56	54–65 (58)
Anal-fin rays	11	11	10–13 (11)
Pectoral fins	15	17	13–18 (16)
Pelvic-fin rays	10	10	9–11 (10)
Pored lateral-line scales	102	99	99–109 (104)
Scale rows above/below lateral line	8/8	9/7	5–9 (8)/5–8 (7)
Pre-dorsal-fin scale rows	16	14	13–20 (16)
Branchiostegal rays	6	7	6–7 (6)
Gill rakers	5 + 11 = 16	3 + 9 = 12	3–6 (5) + 9–13 (11) = 14–18 (15)
Total vertebrae	–	–	105–107 (107)
Measurements (means)			
Head length	24	27	23–31 (27)
Body depth	15	21	11–20 (15)
Body width at pectoral-fin base	10	13	6–13 (10)
Snout length	8	9	8–10 (9)
Upper-jaw length	7	7	7–10 (8)
Mandible length	5	–	4–7 (6)
Mouth width	6	5	5–8 (6)
Maxillary depth	2	3	2–4 (2)
Bony interorbital width	5	4	4–6 (5)
Interorbital width with membrane	–	6	5–10 (7)
Orbit diameter	7	8	6–11 (8)
Suborbital width	3	4	2–4 (2)
Postorbital length	9	11	9–12 (10)
Longest dorsal-fin ray	–	–	8–14 (12)
Last dorsal-fin ray	–	–	3–9 (5)
Longest anal-fin ray	–	–	6–13 (9)
Last anal-fin ray	–	–	3–7 (5)
Longest pectoral-fin ray	–	14	10–18 (15)
Longest pelvic-fin ray	–	10	6–13 (11)
Pre-dorsal-fin length	33	36	31–39 (35)
Pre-anal-fin length	81	83	77–83 (81)
Pre-anus length	77	81	75–81 (78)
Pre-pelvic-fin length	54	54	48–57 (53)
Dorsal-fin base	54	57	47–56 (52)
Anal-fin base	8	11	7–11 (9)
Caudal-peduncle length	11	8	8–14 (12)
Caudal-peduncle depth	6	6	4–7 (5)
Upper caudal lobe length	–	–	16–32 (21)
Lower caudal lobe length	–	19	15–36 (23)

Data expressed as percentages of standard length, plus modes and means in parentheses

Table 3 Counts of dorsal-fin rays and pre-dorsal-fin scale rows in *Nemoossis belloci* and *Pterothrissus gissu*

		Dorsal-fin rays											
		51	52	53	54	55	56	57	58	59	60	61	62
Nemoossis belloci	$n = 46$	3	13	8	7	4	6[b]	5					
Pterothrissus gissu	$n = 63$				1	9	7[c]	4	15	8	7	7	4[a]

		Pre-dorsal-fin scale rows													
		3	4	5	6	7	8	.....	13	14	15	16	17	18	19	20
Nemoossis belloci	$n = 30$	2[b]	5	4	5	3	11									
Pterothrissus gissu	$n = 42$							.....	2	7[c]	8	11[a]	7	2	3	2

[a] Holotype of *Pterothrissus gissu*

[b] lectotype of *Nemoossis belloci*

[c] holotype of *Bathythrissa dorsalis*

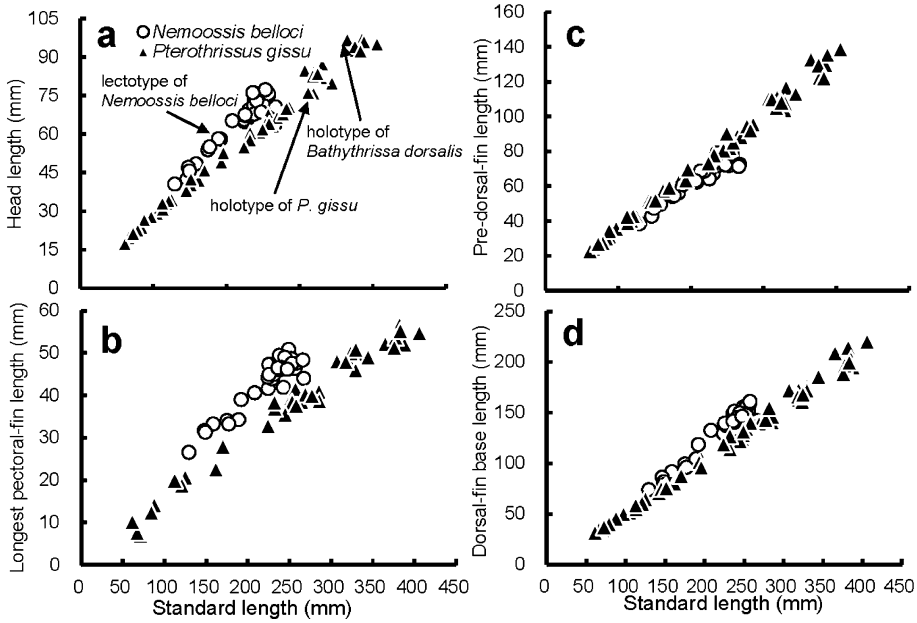

Fig. 4 Relationships of **a** head length, **b** longest pectoral-fin length, **c** pre-dorsal fin length, and **d** dorsal-fin base length to standard length in *Nemoossis belloci* (open circles) and *Pterothrissus gissu* (solid triangles)

142 mm SL, off Muroran, Hokkaido; HUMZ 96624, 145 mm SL, southern part of Funka Bay, Hokkaido; OMNH 5865, 406 mm SL, Hyogo Pref.; OMNH 8158, 344 mm SL, Hyogo Pref.; OMNH 10083, 10415–10418, 10608–10609, 7 specimens, 286–383 mm SL, Suruga Bay, Shizuoka Pref.; NSMT-P 7506–7515, 10 specimens, 125–269 mm SL, Suruga Bay, Shizuoka Pref.; NSMT-P 12522, 2 specimens, 113–118 mm SL, off Fujigawa, Shizuoka Pref.; NSMT-P 12526, 151 mm SL, off Fujigawa, Shizuoka Pref.; NSMT-P 21812, 3 specimens, 88–121 mm SL, off Ida, Suruga Bay, Shizuoka Pref.; NSMT-P 46856, 277 mm SL, off Toda, Suruga Bay, Shizuoka Pref.; NSMT-P 48729, 5 specimens, 67–73 mm SL, Fukushima Pref.; NSMT-P 48909, 2 specimens, 70–71 mm SL, northeastern Pacific coast (37°N, 141°E); NSMT-P 49200, 2 specimens, 61–66 mm SL, Ibaraki Pref. (36°N, 140°E); NSMT-P 50031, 224 mm SL, off Choshi, Chiba Pref.; NSMT-P 53648, 2 specimens, 76–84 mm SL, off Miyagi Pref.; NSMT-P 65745, 65748–65749, 3 specimens, 73–88 mm SL, northeastern Pacific coast (37°N, 141°E), Japan; MUFS 498, 1174, 2 specimens, 199–254 mm SL, Owase market, Mie Pref.; MUFS 1601, 312 mm SL, off Atashika, Mie Pref.

Diagnosis. See generic diagnosis.

Description. Counts and proportional measurements of the holotype and non-type specimens of *Pterothrissus gissu* and holotype of *Bathythrissa dorsalis* are given in Table 2. Data for the holotype of *P. gissu* are given in parentheses if different.

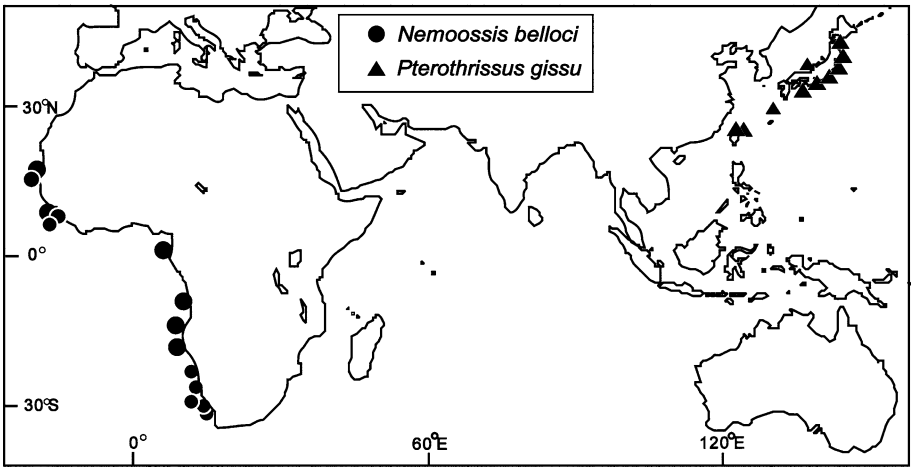

Fig. 5 Distributional record of *Nemoossis belloci* (solid circles) and *Pterothrissus gissu* (solid triangles), based on specimens examined in this study

Body elongate, subcylindrical; head moderate size, its length considerably less than pre-dorsal-fin length; snout conical, projecting slightly beyond lower jaw, its length equal to upper-jaw length; mouth small, inferior; posterior margin of maxilla not reaching vertical through anterior margin of eye; eye large, oblong, its diameter greater than bony interorbital width; small gular plate absent between lower jaws; suborbital bones well developed; teeth minute, conical and villiform on premaxillary and dentary, respectively; vomer and palatines toothless; gill rakers rudimentary; modified median row of enlarged scales in front of dorsal fin; all fins without spines; base of dorsal fin long, about twice head length; longest dorsal-fin ray shorter than longest pectoral-fin ray (tip broken); anal fin located under posterior part of dorsal fin; longest anal-fin ray slightly shorter than caudal-peduncle length (broken); pectoral fins low on side of body, near ventral outline; pelvic fins abdominal, located under central part of dorsal fin, length slightly greater than postorbital length; caudal fin forked, upper lobe slightly shorter than lower; body covered with cycloid scales; head naked, cavernous; lateral line beginning at upper margin of opercle, running straight to caudal peduncle; intermuscular bones present.

Color of fresh specimens. Based on color transparencies (OMNH 5865): Body dark grayish dorsally, silvery-white ventrally; dark longitudinal lines between dorsal scale rows; head dark grayish; anterior part of dorsal fin blackish; upper margin of dorsal-fin rays black edged, lower part hyaline white; pectoral fin gray; pectoral-fin base blackish, other fin bases white; anal fin white; posterior margin of caudal-fin lobes black.

Color of preserved specimens. Based on the holotype (ZMB 9890, 319 mm SL) and a non-type specimen (NSMT-P 46856): body dark brown dorsally and ventrally; head blackish; fins yellow; posterior margin of caudal-fin lobes blackish.

Distribution. *Pterothrissus gissu* is a moderately deep water (200–1000 m depth, Machida 1984) northwestern Pacific species (Fig. 6).

Remarks. Examination of the holotypes of *Pterothrissus gissu* Hilgendorf (1877; published in 31 Aug.) and *Bathythrissa dorsalis* Günther (1877; published in 1 Nov.) showed them to be conspecific, having the same diagnostic features (Tables 2, 3, and Figs. 4, 5). Accordingly, *B. dorsalis* is recognized as a junior synonym of *P. gissu.*

The original description (Günther 1877) of *B. dorsalis* was written as only "Off Inosima", although Fricke and Eschmeyer (2016) erroneously noted it as "Off Inoshima, Hiroshima Prefecture, Japan, Inland Sea, depth 345 fathoms?" However, Günther (1887) added a postscript as "Off Inosima; purchased from Japanese fishermen; depth, (?) 345 fathoms. One specimen, 15 inches long". Furthermore in the same reference, the same locality species of *Centrophorus squamulosus* was mentioned in addition to the station number (station 232). The latitude and longitude data of station 232 in the Expedition of HMS Challenger were 35°11'N and 139°28'E, respectively (Brady 1884). These data clearly point to Sagami Bay, Kanagawa Pref., Japan. Accordingly, we presumed that "Inosima" is equal to Enoshima.

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References

Ahlstrom EH, Butler JL, Sumida BY (1976) Pelagic stromateoid fishes (Pisces, Perciformes) of the eastern Pacific: kinds, distributions, and early life histories and observations on five of these from the Northwest Atlantic. Bull Mar Sci 26:285–402

Aizawa M (1993) Pterothrissidae. In: Nakabo T (ed) Fishes of Japan with pictorial keys to the species. Tokai University Press, Tokyo, pp 155, 1247–1248

Aizawa M (2000) Pterothrissidae. In: Nakabo T (ed) Fishes of Japan with pictorial keys to the species, second edition. Tokai University Press, Tokyo, pp 190, 1451

Aizawa M (2002) Pterothrissidae. In: Nakabo T (ed) Fishes of Japan with pictorial keys to the species, English edition. Tokai University Press, Tokyo, p 189

Aizawa M, Doiuchi R (2013) Pterothrissidae. In: Nakabo T (ed) Fishes of Japan with pictorial keys to the species, third edition. Tokai University Press, Hadano, pp 236, 1781

Bianchi G, Carpenter KE, Roux J-P, Molloy FJ, Boyer D, Boyer HJ (1993) FAO species identification field guide for fisheries purposes. The living marine resources of Namibia. FAO, Rome

Brady HB (1884) Report on the Foraminifera dredged by H. M. S. *Challenger,* during the years 1873–1876. In: Murray J (ed) Report on the scientific result of the voyage of H. M. S. *Challenger* during the years 1873–1876, Zoology, Volume 9. Neill and Company, Edinburgh, pp 1–814

Cadenat J (1937) Recherches systématiques sur les poissons littoraux de la côte occidentale d'Afrique, récoltés par le navire Président Théodore-Tissier, au cours de sa 5e croisière (1936). Rev Trav Inst Peches Marit 10:425–562

Fricke R, Eschmeyer WN (2016) A guide to fish collections in the Catalog of Fishes database, online version. Updated 31 Mar. 2016. http://researcharchive.calacademy.org/research/ichthyology/catalog/collections.asp. Accessed 10 May 2013

Günther A (1877) Preliminary notes on new fishes collected in Japan during the expedition of H. M. S. 'Challenger.'. Ann Mag Nat Hist 20:433–446

Günther A (1887) Report on the deep-sea fishes collected by H. M. S. Challenger during the years 1873-76. Rep Sci Res Voy HMS Challenger 22:i–lxv + 1–268, pls 1–66

Heemstra PC, Heemstra E (2004) Coastal fishes of southern Africa. National Inquiry Service Centre (NISC) and South African Institute for Aquatic Biodiversity (SAIAB), Grahamstown

Hilgendorf FM (1877) *Pterothrissus*, eine neue Clupeidengattung. Acta Soc Leopoldina 13:127–128

Hubbs CL, Lagler KF (1958) Fishes of the Great Lakes region. Bull Cranbrook Inst Sci 26:1–213

ICZN (The International Commission on Zoological Nomenclature) (2003) Declaration 44. Amendment of Article 74.7.3. Bull Zool Nomencl 60:263

Mabee PM (1988) Supraneural and predorsal bones in fishes: development and homologies. Copeia 1988:827–838

Machida Y (1984) *Pterothrissus gissu* Hilgendorf. In: Okamura O, Kitajima T (eds) Fishes of the Okinawa Trough and the adjacent waters. Vol 1. Japan Fisheries Resource Conservation Association, Tokyo, pp 78–79

Nelson JS (2006) Fishes of the world, 4th edn. Wiley, New Jersey

Sheiko BA, Fedorov VV (2000) Part 1. In: Moiseev RS, Tokranov AM (eds) Catalog of the vertebrates of Kamchatka and adjacent waters. Kamchatskiy Petchatniy Dvor, Petropavlovsk-Kamchatsky, pp 7–69

Shinohara G, Endo H, Matsuura K, Machida Y, Honda H (2001) Annotated checklist of the deepwater fishes from Tosa Bay, Japan. Natl Sci Mus Monogr 20:283–434

Shinohara G, Sato T, Aonuma Y, Horikawa H, Matsuura K, Nakabo T, Sato K (2005) Annotated checklist of deep-sea fishes from the waters around the Ryukyu Islands, Japan. Deep-sea fauna and pollutants in the Nansei Islands. Natl Sci Mus Monogr 29:385–452

Shinohara G, Shirai AM, Nazarkin MV, Yabe M (2011) Preliminary list of the deep-sea fishes of the Sea of Japan. Bull Natl Mus Nat Sci 37:35–62

Shirai S (1983) Albulidae. In: Amaoka K, Nakaya K, Araya H, Yasui T (eds) Fishes from the north-eastern Sea of Japan and the Okhotsk Sea off Hokkaido. The intensive research of unexploited fishery resources on continental slopes. Japan Fisheries Resource Conservation Association, Tokyo, pp 65, 173

Smith MM (1986) Albulidae. In: Smith MM, Heemstra PC (eds) Smiths' sea fishes. Macmillan South Africa, Johannesburg, p 157

Tameka S (1982) *Pterothrissus gissu* Hilgendorf. In: Okamura O, Amaoka K, Mitani F (eds) Fishes of the Kyushu–Palau Ridge and Tosa Bay. Japan Fisheries Resource Conservation Association, Tokyo, pp 57, 316

Tsukamoto Y (2002) Leptocephalus larvae of *Pterothrissus gissu* collected from the Kuroshio–Oyashio transition region of the western North Pacific, with comments on its metamorphosis. Ichthyol Res 49:267–269

Uyeno T (1984) Albulidae. In: Masuda H, Amaoka K, Araga C, Uyeno T, Yoshino T (eds) The fishes of the Japanese Archipelago. Tokai University Press, Tokyo, p 21

Whitehead PJP (1990) Pterothrissidae. In: Quéro, JC, Hureau JC, Karrer C, Post A, Saldanha L (eds) Check-list of the fishes of the eastern tropical Atlantic. CLOFETA. Unesco, Paris, p 125

Wirtz P, Brito A, Falcón JM, Freitas R, Fricke R, Monteiro V, Reiner F, Tariche O (2013) The coastal fishes of the Cape Verde Islands, new records and an annotated check-list. Spixiana 36:113–142