

# A Review of *Malthopsis jordani* Gilbert, 1905, with Description of a New Batfish from the Indo-Pacific Ocean (Lophiiformes: Ogcocephalidae)

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**Abstract** *Malthopsis jordani* Gilbert, 1905 was described from the Hawaiian Islands and subsequently recorded from the western Pacific. A review of the species is provided. Examination of all known specimens of this species revealed that *M. jordani* is endemic to the Hawaiian Islands and specimens outside the range represent a new species. *Malthopsis gigas* sp. nov., previously misidentified as *M. jordani*, is described from 111 specimens widely distributed in the Indo-Pacific Ocean. The new species differs from its congeners in having a relatively strong and long rostrum ( $\bar{x}$ =8.6% SL); body heavily covered with strong conical bucklers, with numerous small flat bucklers densely covering the space between principal bucklers on the dorsal surface; and the reclined anal fin that extends beyond the caudal fin base. The new species is also the largest member of the genus, reaching size up to 136.4 mm SL.

**Key words:** Taxonomy, New species, Batfish, Anglerfish, *Malthopsis*.

The ogcocephalid genus *Malthopsis* Alcock, 1891 comprises 7 valid species, all but the western Atlantic *Malthopsis gnoma* Bradbury, 1998 occur in the Indo-West Pacific Ocean. *Malthopsis lutea* Alcock, 1891 was originally described from Andaman Sea; *Malthopsis jordani* Gilbert, 1905 and *Malthopsis mitrigeria* Gilbert and Cramer, 1897 from Hawaii; and *Malthopsis annulifera* Tanaka, 1908 and *Malthopsis tiarella* Jordan, 1902 from Japan. Ochiai and Mitani (1956) recognized all these five species in Japanese waters and most of them are widely spread in the Indo-West Pacific region (Bradbury, 2003). Ho and Shao (2008) described *M. retifera* from the northwestern Indian Ocean more recently.

*Malthopsis jordani* was described from 12 specimens collected off the southern coast of Oahu, the Hawaii Islands. Subsequently, specimens identified as this species were reported from Japan (Matsubara, 1955; Ochiai and Mitani, 1956) and Taiwan (Lee, 1988). Examination of

all known materials of *M. jordani* revealed that it is a Hawaiian endemic species and the specimens referred to *M. jordani* from outside the Hawaiian Islands represent a new species.

The new species differs from *M. jordani* by a combination of characters. Moreover, all examined specimens of *M. jordani* from Hawaii are less than 60 mm SL (except for the holotype, 65.6 mm), whereas specimens collected from outside Hawaii can be twice that length (up to 136.4 mm). In total, 111 specimens collected from widely dispersed areas in the Indo-Pacific region were examined and proved to be the new species.

This paper, based on all known specimens, provided a redescription of *M. jordani* and a description of the new species previously misidentified as *M. jordani*.

### Methods and Materials

The body length used throughout is the standard length (SL). Terminology for describing the angling apparatus follows Bradbury (1967). Methods and definitions of the characters used in this study followed Ho *et al.* (2009). Proportional measurements are rounded to the nearest 0.1 mm. Morphometric values are expressed as percentages of standard length. Meristic values are counted on both sides when paired. Institutional abbreviations are as listed in Fricke and Eschmeyer (2009). Materials examined are listed as: institute code, collection number and, in parentheses, number of specimen (when more than 1) and standard length in mm.

### *Malthopsis jordani* Gilbert, 1905

(Figs. 1, 2A, 3A, 4A)

*Malthopsis jordani* Gilbert, 1905: 695 (off southern coast of Molokai, Hawaii Is.). Barudbry, 1967: 416 (list, Hawaii Is.); Chave and Mundy, 1994: 383 (list, Hawaii Is., fig. 21 labeled as this species was *M. mitrigeria*); Mundy, 2005: 267 (list, western Pacific).

*Materials examined.* **Holotype:** USNM 51625 (65.6), R/V Albatross, Diamond head, south coast of Oahu, Hawaii Is., 485–512 m. **Paratypes:** SU 8647 (5, 33.9–54.9, 1 C & S), R/V Albatross, sta. 4101, Pailolo Channel, between

Maui and Molokai Is., 223–262 m, 23 July 1902; USNM 51680 (10, 22.5–54.8), R/V Albatross, sta. 3810, south coast of Oahu, Hawaii Is., 386 m, 27 Mar. 1902. **Non-types:** All collected by R/V Townsend Cromwell from Pailolo Channel between Maui and Molokai Is. by using bottom or shrimp trawls: BPBM 23688 (45.5), cr.33, sta.18, 21°3'N, 156°44'W, 245 m, 1 Nov. 1967; BPBM 24156 (3, 47.7–50.3), cr.40, sta.42, 21°1'N, 156°44'W, 220–220 m, 16 Nov. 1968; BPBM 24168 (2, 48.3–54.7), cr.40, sta. 45, 1°1'N, 156°44'W, 214 m, 216 Nov. 1968; BPBM 24174 (2, 49.8–53), cr.40, sta. 47, 21°1'N, 156°45'W, 210 m, 16 Nov. 1968; BPBM 24184 (3, 41.8–55.7), cr.40, sta. 50, 21°1'N, 156°44'W, 210–227 m, 17 Nov. 1968; BPBM 24186 (8, 37.3–46.4), cr.40, sta. 50, 21°1'N, 156°44'W, 221 m, 17 Nov. 1968; BPBM 24199 (3, 39.2–52.3), cr.40, sta. 53, 21°1'N, 156°44'W, 219–229 m, 17 Nov. 1968; BPBM 24592 (1, 41.4); CAS 39630 (5, 44.2–51.3), 21 July 1977; CAS 78211 (43.1), cr.33, sta.15, 21°1'30"N, 156°45'54"W, 241–254 m, 31 Oct. 1967; CAS 78212 (7, 41.2–48.6), cr.35, sta.4, 21°1'42"N, 156°43'6"W, 185–232 m, 28 Mar. 1968; CAS 78218 (4, 43.1–51.2), cr.40, sta.43, 21°1'12"N, 156°43'36"W, 214 m, 16 Nov. 1968; CAS 78219 (6, 40.5–64.9), cr.40, sta.54, 21°1'36"N, 156°43'0"W, 223 m, 18 Nov. 1968; CAS 78222 (3, 53.1–57.6), cr.36, sta.10, 21°1'6"N, 156°43'36"W, 214–221 m, 28 Apr. 1968. BPBM 9999 (2, 47.8–49.3) and USNM 231978 (48.0), Hawaii Is., no other data.

**Diagnosis.** A species of *Malthopsis* with fine reticulate color pattern on dorsal surface (uniformly brown or creamy white in some preserved specimens); large eye (12.5–14.9% SL); narrow



Fig. 1. *Malthopsis jordani*, holotype, USNM 51625, 65.6 mm.

interorbital space (4.4–6.1% SL) forming a groove; a short and blunt rostral protuberance directed upward; principal bucklers blunt and relatively few in number, naked between principal bucklers; no buckler dorsal to orbit; ventral surface with few small bucklers forming a large naked area; subopercular buckler with 1 spine directed forward; and a relatively small adult body size (<70 mm SL).

**Description.** Morphometric and meristic values are provided in Tables 1–3.

Body depressed, disk markedly triangular in dorsal view, cranium elevated above surface of other parts of disk; caudal peduncle cylindrical, tapering posteriorly; rostrum small and blunt, conical, directed upward vertically (Fig. 2A), its length about half of eye diameter or less; eye relatively large (12.5–14.9% SL,  $\bar{x}$ =13.5% SL), directed dorsolaterally; no pupillary operculum; interorbital space relatively narrow (4.4–6.1% SL,  $\bar{x}$ =5.0% SL), forming a deep groove between frontals; illicial cavity a small triangular cave, its width equals to its height; esca a single medial bulb bearing two small cirri on dorsal margin; mouth small, terminal; small villiform teeth on jaws forming narrow bands, those on cerato-

branchial V forming two large, closely spaced and elongated patches, and quadrangular tooth patches on vomer and palatines.

Scales on body surface in the form of bucklers, relatively blunt (Fig. 3A) and few in number, mostly associated with lateral line, skeleton and body edge; a few small bucklers may be present between principal bucklers on dorsal surface, center of disk usually with large naked area; 4 bucklers on each side of frontal ridge, the first one situated at anterolateral corner of orbit and relatively small, the second one strongly reduced, third and fourth bucklers relatively large in size; none or a few small bucklers on skin dorsal to eye; 4 bucklers on dorsal surface of skull forming 2 rows, the anterior 2 smaller than posterior 2 bucklers, followed by a median row at postcephalic region; a pair of bucklers at origin of dorsal fin; ventral surface naked excluding a few rounded and flat bucklers without apical spines on belly; buckler of subopercle relatively blunt, with a spine directed forward, some tiny spinelets may be present on lateral side in small individuals, and a posterior spine directed backward (Fig. 4A); caudal peduncle covered with large bucklers, the interspaces densely covered by smaller

Table 1. Morphometric data of 3 similar species in *Malthopsis*. The holotype (H) is separated in *M. gigas* n. sp. and *M. jordani*.

SL (mm) % SL	<i>M. annulifera</i> n=52		H	<i>M. gigas</i> n. sp. n=64		H	<i>M. jordani</i> n=31	
	35.9–88.9 Mean (Range)	SD		52.3–118.4 Mean (Range)	SD		36.5–55.7 Mean (Range)	SD
Skull length	27.0 (24.5–31.3)	1.5	28.4	28.4 (23.2–31.3)	1.5	28.8	29.2 (27.0–34.0)	1.5
Head width	23.4 (20.3–27.4)	1.6	23.0	24.1 (20.0–29.7)	2.0	20.6	22.4 (20.1–24.6)	1.2
Head depth	23.6 (20.4–29.5)	1.9	23.8	23.6 (19.5–27.5)	1.7	17.9	19.8 (17.0–22.5)	1.3
Orbital diameter	11.2 (10.1–13.2)	0.7	13.2	12.2 (10.1–13.8)	1.0	12.7	13.5 (12.5–14.9)	0.7
Interorbital width	7.7 (6.6–9.2)	0.6	7.5	8.2 (6.5–9.7)	0.7	4.7	5.0 (4.4–6.1)	0.4
Rostal length	5.8 (2.8–9.5)	1.6	6.6	8.6 (5.2–11.5)	1.5	5.4	7.0 (3.6–9.4)	1.2
Illicial cavity width	5.2 (3.5–6.7)	0.6	5.6	5.2 (4.0–6.4)	0.6	4.6	5.0 (3.6–6.3)	0.6
Mouth width	14.2 (12.6–16.5)	0.9	13.4	14.8 (13.4–17.4)	1.0	11.7	13.2 (11.3–15.5)	1.0
Predosal length	65.4 (62.0–68.8)	1.5	65.3	66.4 (63.8–75.0)	2.4	64.5	66.7 (63.4–70.3)	1.6
Postanus length	52.4 (48.5–60.5)	2.0	57.9	57.9 (52.2–62.7)	2.0	53.8	55.5 (52.2–58.9)	1.5
Preanal length	79.2 (77.0–82.1)	1.3	81.7	81.0 (76.5–85.3)	1.9	80.0	81.8 (78.8–86.4)	1.7
Disk margin length	48.2 (38.1–55.2)	2.9	45.7	46.2 (40.0–51.8)	2.3	40.2	44.8 (37.4–53.1)	2.9
Pectoral fin length	21.2 (17.3–24.5)	1.5	21.5	22.5 (16.2–27.7)	2.0	19.3	23.9 (19.3–28.2)	1.8
Anal fin length	16.7 (13.3–16.7)	1.3	20.0	20.3 (17.4–24.2)	1.8	16.4	19.8 (16.4–23.1)	1.5
Dorsal fin length	17.2 (13.9–19.6)	1.1	25.9	22.1 (17.6–29.5)	3.4	19.0	21.4 (18.0–24.6)	1.8
Caudal fin length	25.5 (22.4–29.3)	1.7	25.4	25.8 (21.6–29.8)	2.0	25.3	28.8 (27.4–32.7)	1.6

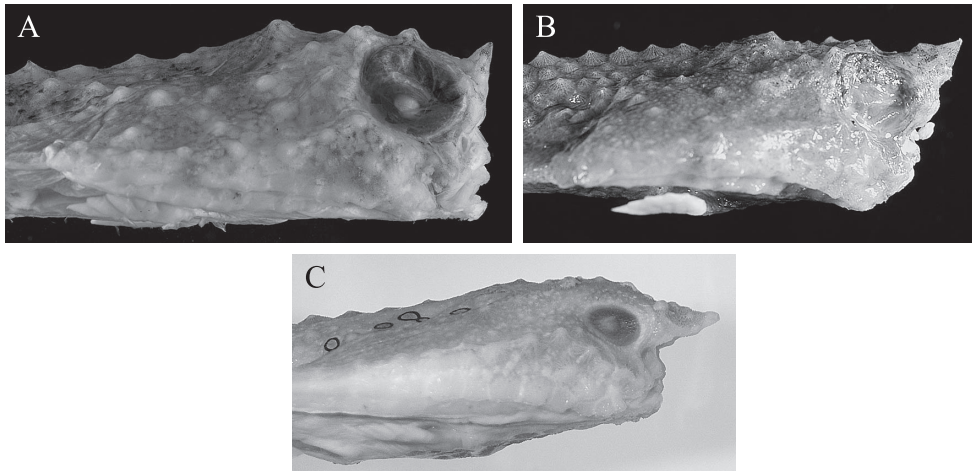


Fig. 2. Lateral profile of body disk shows the rostrum, eye size and squamation in 3 *Malthopsis* species. A: *M. jordani* (holotype); B: *M. gigas* n. sp. (holotype); C: *M. annulifera* (NSMT P45994, 63.5 mm).

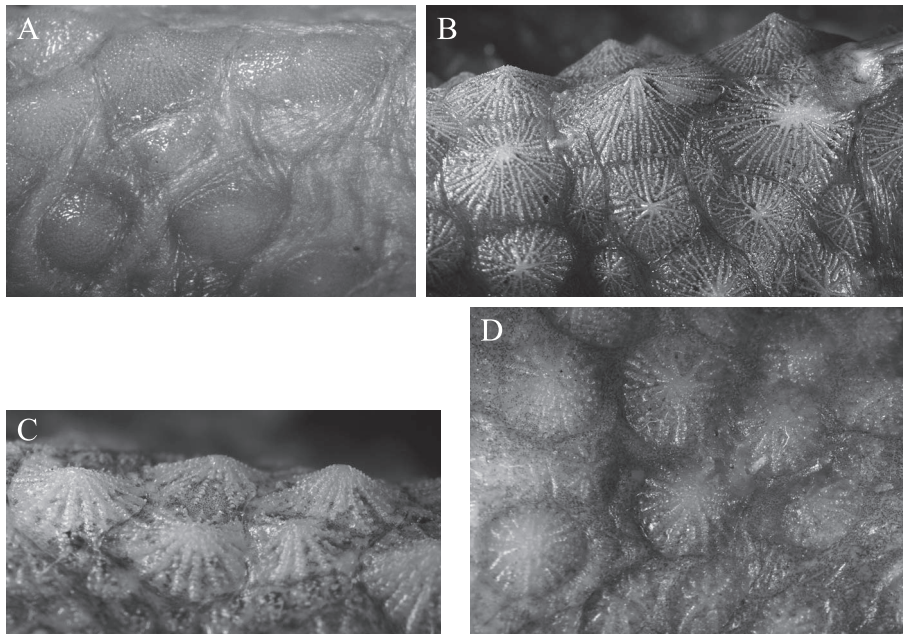


Fig. 3. Bucklers on body surface of 3 *Malthopsis* species. A: *M. jordani*, ASIZP 70335, 56.0 mm; B: *M. gigas* n. sp., from the holotype; C: *M. annulifera*, ASIZP 63084, 48.0 mm; D: *M. gigas* n. sp., ventral surface near pelvic fin base, from the holotype. A–C: taken from dorsal surface anterior to dorsal fin.

bucklers, those on dorsal surface forming 2 irregular rows, those on lateral side forming 2 rows of about equal size associated with lateral line, the lower row dense in arrangement, those on ventral surface of caudal peduncle forming two rows be-

tween anus and anal fin, 4–5 relatively flattened bucklers on each row; posterior portion of anus surrounded by 4–5 bucklers of larger size than neighboring bucklers.

All fins naked, with small bucklers only on

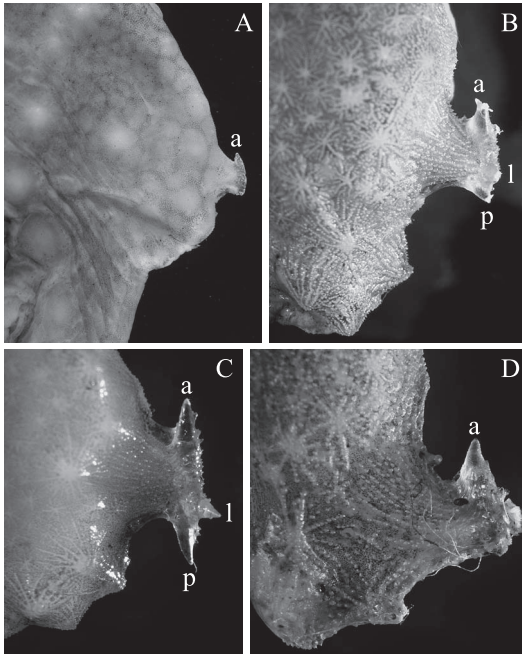


Fig. 4. Close view of subopercular tubercle shows the squamation and spinelets in three *Malthopsis* species. A: *M. jordani*, from the holotype; B: *M. gigas* n. sp., from the holotype, lateral spine directed upward; C: *M. gigas* n. sp., NMNZ P29021, 101 mm SL; D: *M. annulifera*, ASZIP 64083, 48.0 mm. a: anterior spine; l: lateral spine; p: posterior spine. Not to scale.

base of caudal fin rays; interradial of pectoral fins thin, transparent; dermal cirri present on disk margin, lateral sides of tail and in association with lateral line scales.

**Coloration.** Background color of preserved specimen uniformly creamy-white to brown. The holotype and most specimens have a fine reticulate brown pattern and a darker lineate pattern may also be present on dorsal surface; ventral surface light brownish-yellow or creamy-white; all fins similar to background color.

**Distribution.** All examined specimens were collected from the Pailolo Channel between Molokai and Maui (Fig. 6) at depths of 185–512 m. It is considered to be endemic in this area.

**Remarks.** One paratype of *M. jordani*, USNM 231819, is reidentified as *M. mitrigeria* co-occur-

ring with *M. jordani* in Hawaii. However, *M. mitrigeria* is widespread in the Indo-West Pacific region. *Malthopsis jordani* can be distinguished from *M. mitrigeria* by the narrow interorbital space (vs. wide, 8.7–11.8% SL), relatively small bucklers on ventral surface (vs. large and strong), a single spine on opercular buckler directly forward (vs. 2) and anal fin reaches the caudal fin base when laid down (vs. not reaches).

Although Chave and Mundy (1994), followed by Mundy (2005), recorded this species from the Hawaiian Islands, the figure in Chave and Mundy (1994: 372, fig. 21) is actually a *M. mitrigeria*.

#### *Malthopsis gigas* sp. nov.

[New English name: Giant triangular batfish]

[Japanese name: Kowanuke-furyuuo]

(Figs. 2B, 3B, D, 4B, C, 5)

*Malthopsis jordani* (not of Gilbert, 1905): Matsubara, 1955: 1347 (Japan); Ochiai and Mitani, 1956: 276 (descr., Japan); Okamura in Masuda *et al.*, 1984: 104 (descr., Japan); Yamakawa in Okamura and Kitajima, 1984: 285, 382 (descr., Japan); Lee, 1988: 21 (descr., Taiwan); Lee in Shen *et al.*, 1993: 184 (descr., Taiwan); Yamada in Okamura and Amaoka, 1997: 145 (descr., Japan); Bradbury, 2000: 598 (list, South China Sea); Shinohara *et al.*, 2001: 310 (list, Tosa Bay, Japan); Yamada in Nakabo, 2002: 461 (key, Japan); Shinohara *et al.*, 2005: 420 (list, Ryukyu Is., Japan).

*Malthopsis* cf. *jordani*: Ho and Shao, 2008: 309 (descr., Taiwan).

**Holotype:** ASIZP 63084 (94.6), ca. 24°48'N, 122°25.2'E, Tashi fish market, Yilan, NE Taiwan, 2 Apr. 2004, 210–340 m, coll. H.-C. Ho.

**Paratypes** (110, 23.0–136.4): **Japan:** BSKU 48157 (106.8), off Kochi City, Tosa Bay, 300 m, 19 Mar. 1989; BSKU 48189 (107.7), off Kochi City, Tosa Bay, 400 m, 19 Mar. 1989; BSKU 48190 (86.8), off Kochi City, Tosa Bay, 300 m, 19 Mar. 1989; BSKU 59220 (58.5), Mimase Fish Market, Kochi, 18 Mar. 2002; BSKU 64487 (81.8), R/V Kotaka-Marun, 33°13.7'N, 133°37.1'E, off Kochi City, Tosa Bay, 250–241 m, 21 May 2003, coll. H. Honda and H. Sakaji; BSKU 68235 (118.4), Mimase Fish Market, Kochi, 26 October 2003; BSKU 94587 (136.4), Mimase Fish Market, Kochi, coll. N. Nakayama; FAKU P1629 (98.3), off Owase, Mie, 6–9 Dec. 1935; FAKU P4152 (88.1) and FAKU P4154 (109.9), Kumanonada, Mie (or Wayayama), Jan. 1937; FAKU 19062 (76.3); off Owase, Mie, 11–17 Nov. 1952; FAKU 20513 (106.5) and FAKU

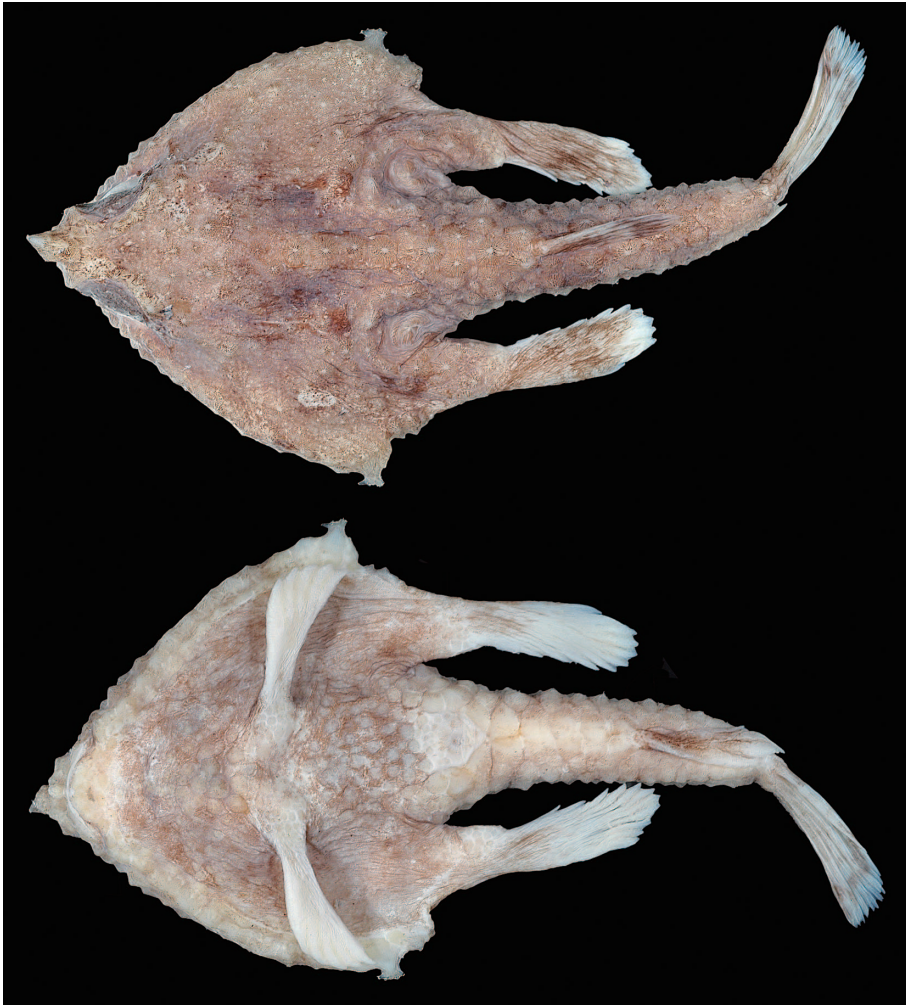


Fig. 5. *Malthopsis gigas*, holotype, ASIZP 63084, 94.6 mm SL. Upper: dorsal view; lower: ventral view.

20514 (95.9), off Miya, Aichi; FAKU 23827 (82.8) and FAKU 23829 (73.5), off Owase, Mie, 20 Oct. 1954; FAKU-KP 33, 26°44.9'N, 135°21.1'E; FAKU-KP 88, 26°06.1'N, 135°48.8'E; FUMT P1329 (52.3), Off Maku-razaki, Kagoshima, 19 Jun. 1975; FUMT P2881 (90.7), Japan, no other data; FUMT P3696 (57.1), Off Kunou, Suruga Bay, Shizuoka, 17 Nov. 1982; FUMT P4730 (87.5); Off Kunou, Shizuoka, 30 Nov. 1983; FUMT P 4875, no locality data, 24 Jan. 1984; NSMT P7204 (94.2), Suruga Bay, 16–20 Sep. 1968; NSMT-P 12485 (87.2), Suruga Bay, 1 Apr. 1969; NSMT-P 81362 (70.3), F/V Hinode-maru, 34°42.58'N, 138°40.36'E, off Hagachizaki, Suruga Bay, 288 m, 26 Oct. 1983; ZUMT 44910 (90.0), Shizuoka, coll. N. Onodera; ZUMT 54659 (85.8), off Mt. Kunoh, Suruga Bay, 9 May 1983. **East China Sea:** FAKU 76182 (99.3), 26 Oct. 1991. **Taiwan:** ASIZP 58056

(65.4), Naofangao fish market, Yilan, 21 May 1996; ASIZP 64578 (66.8), ASIZP 64594 (2, 80.7–84.7), Naofangao fish market, Yilan, 300–400 m, 7 July 2004, coll. H.-C. Ho; ASIZP 56025 (88.2), Tongkang fish market, Pingtung, 10 May 1968, coll. S.-C. Lee; ASIZP 62595 (83.5), Tashi fish market, Yilan, 2002, coll. H.-C. Ho; ASIZP 64577 (84.7), Naofangao fish market, Yilan, ca. 300–400 m, 13 July 2004, coll. H.-C. Ho; ASIZP 64584 (69.4), ASIZP 64595 (2, 71.8–76.7) and ASIZP 64596 (80.8), Naofangao fish market, Yilan, 300–400 m, 7 July 2004, coll. H.-C. Ho; ASIZP 65124 (70.5) and ASIZP 65891 (67.5), Tongkang, Pingtung, 10 Mar. 2005, ca. 400 m, coll. H.-C. Ho; FRIP 0671 (3, 79.6–91.0), 400–420 m, coll. D.-A. Lee, no other data; MNHN 2005-1786, (76.1), Tashi, Yilan, ca. 300–400 m, 14 Mar. 2005, coll. H.-C. Ho; NMNSF 0428 (106.9), Tongkang, Ping-

Table 2. Distribution of number of dorsal fin rays and pectoral fin rays (counted on both sides) in 3 *Malthopsis* species.

Species	Dorsal fin rays						Pectoral fin rays						
	N	3	4	5	6	7	10	11	12	13	14	15	mean
<i>M. annulifera</i>	52		6	41	5		2	4	54	44			12.35
<i>M. gigas</i> n. sp.	86			17	69			2	52	94	4		12.62
<i>M. jordani</i>	67			5	60	2			106	28			12.21

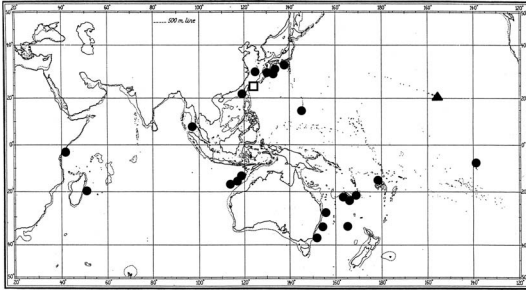


Fig. 6. Distribution map of *M. jordani* (triangular) and *M. gigas* n. sp. (dots). Open square indicates the holotype locality of *M. gigas* n. sp. One dot may represent more than one capture.

tung, 28 Sep. 2000; NMNSF 0433 (83.4), Tongkang, Pingtung, 25 Mar. 1995; NMNSF 0434 (71.4), Tongkang, Pingtung, 24 Sep. 2001. **Northern Mariana Islands:** CAS 42754 (1, 100.3), 15°10'6"N; 145°39'54"E, 302 m, 30 Apr. 1972, coll. P. Struhsakern. **Vanuatu:** MNHN 1997-4056 (29.0), N. O. Alis, sta. DW0964, 20°19'S, 169°49'E, 360–408 m, 20 Sep. 1994; MNHN 1997-4096 (23.0), N. O. Alis, sta. cp0982, 19°21'S, 169°26'E, 408–410 m, 23 Sep. 1993. **New Caledonia:** MNHN 2000-0333 (3, 81.4–100.5), Vauban, sta. cp180, 18°56'S, 163°17'E, 450 m, 18 Sep. 1985; MNHN 2003-1545 (2, 45.0–57.0), N. O. Alis, sta. cp9, 24°52'13"S, 168°21'13"E, 518–540 m, 11 Aug. 1999; MNHN 2004-2239 (50.0), N. O. Alis, sta. cp1670, 23°39'S, 167°59'E, 382–386 m, 21 Jun. 2001; MNHN 2004-2497 (86.1), N. O. Alis, cp647, 21°48'S, 166°46'E, 450–530 m, 10 Mar. 1993; MNHN 2004-2774 (68.0), N. O. Alis, sta. cp2128, 23°15'48"S, 168°14'E, 413–650 m, 2 Nov. 2003; NMNZ 29021 (35.2), 24°44.7'S, 168°6.65'E, Kaiyo Maru Seamount, 490–510 m, 17 Oct. 1992. **Fiji:** MNHN 2002-3102 (2, 61.2–83.9), N. O. Alis, sta. cp1395, 16°45'S, 179°59'E, 423–500 m, 23 Feb. 1999; MNHN 2008-1214 (99.1), N. O. Alis, sta. cp1444, 17°11'S, 178°41'W, Fiji Is., 398–409 m, 3 Mar. 1999. **French Polynesia:** MNHN 2000-4522 (7, 58.7–83.3), N. O. Alis, sta. cp1269, 7°56'S, 140°43'W, 420–430 m, 4 Sep. 1997; MNHN 2000-5509 (3, 15.0–21.0), N. O. Alis, sta. cp 1238, 9°41'S, 139°03'W, 280–370 m, 31

Aug. 1997; MNHN 2002-2999 (83.1), Alis, sta. dw1280, 7°47'0"S, 140°20'W, 450–455 m, 7 Sep. 1997; MNHN 2003-0975 (4, 72.4–80.5), N. O. Alis, sta. cp1300, 8°49'S, 140°17'W, 416–430 m, 9 Sep. 1997; MNHN 2003-1247 (66.8), N. O. Alis, sta. cp1169, 8°58'S, 140°4'W, 24 Aug. 1994; MNHN 2008-1215 (2, 81.4–85.7), N. O. Alis, sta. cp1306, 8°55'3"S, 140°14'13"W, 283–448 m, 10 Sep. 1993. **New Zealand:** NMNZ 38377 (48.9), 34°07'S, 162°48'E, Lord Howe Rise, Nov. 2001. **Eastern Australia:** AMS I.15551-007 (23.1), 26°30'S, 153°30'E, off Brisbane, 366 m, 1968; AMS I.19083-001 (102.6) 31°39'S, 153°13'E, SE of Port Macquarie, 358–366 m, 11 Sep. 1975; AMS I.41126-001 (91.0), 36°36'S, 150°20'E, New South Wales, 330–366 m. **Western Australia:** AMS I.22825-005 (2, 84.4–110.1), NW shelf, 300 m, 13 Apr. 1982; AMS I.22821-024 (2, 64.8–67.5), NW shelf, 300 m, 10 Apr. 1982; CSIRO H.2090-1 (96.3), 16°54'S, 120°22'E, NE Mermaid Reef, Rowley; CSIRO H.2090-2 (99.2), 16°54'S, 120°22'E, NE Mermaid Reef, Rowley; CSIRO CA4491 (95.8), 14°37'S, 121°47'E, Scott Plateau; CSIRO H.2116-4 (77.9), 16°52'S, 120°23'E, NE Mermaid Reef, Rowley; NMV A.29733-004 (68.0), 12°36'12"S, 123°25'56"E, 8 Jul. 2007; NTM S.14368-015 (89.1), NW shelf; WAM P. 28075.012 (106.9), 17°37'S, 118°46'E, Rowley Shoals, 368–369 m, 18 Aug. 1993; WAM P. 28272.003 (94.4), 16°41'S, 120°33'E, Rowley Shoals, 400 m, 2 May 1984. **Andaman Sea:** CAS 39632 (75.7), R/V Anton Bruun, 10°39'0"N; 97°6'0"E, Myanmar, 293 m, 24 Mar. 1964. **Somalia:** CAS 39633 (65.7), R/V Anton Bruun, 2°50'0"S; 40°31'0"E, 290 m, shrimp trawl, 8 Nov. 1964. **Madagascar:** MNHN 1986-0078 (92.9), MNHN 1986-0109 (103.7), MNHN 1986-0110 (97.1), MNHN 1986-0114 (93.6), MNHN 1986-0115 (88.1), all collected by N. O. Vauban, 1971–1974, no other data.

**Diagnosis.** A species of the genus *Malthopsis* differing from its congeners in having a relatively long and strong rostrum (5.2–11.5% SL,  $\bar{x}$  = 8.6% SL); rostral spine directed forward and upward; body heavily covered with strong conical bucklers; numerous small and flat bucklers covering dorsal surface between principal bucklers; dorsal

Table 3. Distribution of standard length of 3 *Malthopsis* species. Only specimens larger than 30 mm SL are included.

Species	N	>30	>40	>50	>60	>70	>80	>90	>100	>110	>120	>130	mean
<i>M. annulifera</i>	92	4	11	21	18	22	15	1					65.17
<i>M. gigas</i> n. sp.	77			4	11	10	22	17	10	2	–	1	85.73
<i>M. jordani</i>	64	5	38	19	2								47.64

and anal fins relatively long (17.6–29.5% SL, 17.4–24.2% SL, respectively); black spots present on dorsal surface; and anal fin extends beyond caudal fin base when fully laid back. It also has the largest adult body size (up to 136.4 mm) among its congeners.

**Description.** Morphometric and meristic data are provided in Tables 1–3.

Body depressed, disk markedly triangular in dorsal view, cranium elevated above general surface of other part of disk; caudal peduncle cylindrical, tapering posteriorly; rostrum relatively strong, its base widest of genus, conical, directed forward and upward (Fig. 2B), distinctly overhanging illicial cavity and mouth; rostral length about equal to eye diameter; eye relatively large (10.1–13.8% SL,  $\bar{x}$ =12.2%), directed dorsolaterally; no pupillary operculum; interorbital space relatively wide (6.5–9.7% SL,  $\bar{x}$ =8.2), flattened, not forming a groove; illicial cavity a small triangular cave, wider than height; esca a single bulb, bearing 2 small cirri on dorsal margin; mouth small, terminal; small villiform teeth on jaws forming narrow bands, those on ceratobranchial V forming 2 large and elongated patches close together, and teeth on vomer and palatines in quadrangular patch.

Scales on body surface in the form of bucklers, relatively sharp and pointed (Figs. 2B, 3B), mostly associated with lateral line, skeleton and body edge; no tiny tubercle, dorsal surface completely covered with small bucklers between principal bucklers, except for eyes and fins. Four bucklers on each side of frontal ridge, the first one situated at anterolateral corner of orbit, directed upward, and with the rostrum forming a trident; the second one strongly reduced; third and fourth bucklers relatively large in size. Skin above eye

bears a series of small bucklers, naked elsewhere. Bucklers of dorsal surface of skull forming 2–3 irregular rows, joined to a median row at post-cephalic region; numerous rounded and flattened bucklers on ventral surface, usually 10–12 facets, with few apical spines at center of each buckler (Fig. 3D); ventral surface of gill cavity and thoracic regions with large naked area; buckler of subopercular divided into 2 or more spinelets, a larger one directed forward, 1 or 2 lateral ones directed upward and outward, some smaller spines may be present behind and below (Fig. 4B, C); caudal peduncle covered by large bucklers, those on dorsal surface forming 5 irregular rows, 1 median row behind dorsal fin, 2 rows on each side of dorsal fin, 2 rows on each lateral side associated with lateral line, bucklers of lower row larger than those of upper row; bucklers on ventral surface of caudal peduncle forming 2 regular rows between anus and anal fin, relatively flattened; anus surrounded by 4–6 bucklers, those are not larger than neighboring ones.

All fins naked, without bucklers, except for some small ones running out along the base of caudal fin rays; inter-radials of pectoral fins thin, transparent; dermal cirri flap-like, present on disk margin and lateral sides of tail associated with lateral line scales.

**Coloration.** Dorsal background uniformly gray to deep brown, with 0–5 black spots about half diameter of eye pupil; a dark band may present crossing the caudal peduncle; ventral surface uniformly pale to gray; all fins deeper in color, except for anal fin that may be pale and associated with the ventral coloration of individual.

**Distribution.** Known from the Indian and Pacific oceans off Madagascar, Somalia, the Andaman Sea, Japan, Taiwan, the Northern Mariana



Islands and Australia; and the central Pacific off Fiji, Vanuatu, New Caledonia, French Polynesia and New Zealand (Fig. 6).

**Etymology.** The specific name “*gigas*” is referred to the giant adult body size of the genus.

**Remarks.** Most specimens examined have a relatively long rostrum, except for few specimens collected from Madagascar, Western Australia, Fiji and French Polynesia which have a relatively small rostrum. Although no asymmetric growth has been found in other members of *Malthopsis*, Bradbury (1980) reported that some members of *Ogcocephalus*, such as *Ogcocephalus nasutus* (Cuvier, 1829) and *Ogcocephalus cubifrons* (Richardson, 1836), show highly variable in rostral length. The relatively small rostrum might attribute to intraspecific variation.

**Comparison.** In the western Pacific, *M. gigas* had long been misidentified as *M. jordani*. Specimens of *M. jordani* collected from outside Hawaii should be referred to the new species. *Malthopsis gigas* is similar to *M. retifera*, *M. annulifera* and *M. jordani* in having no small spine on interspaces of principal bucklers. *Malthopsis retifera* differs from its congeners in having 5 pairs of black spots on lateral body (also see Ho *et al.*, 2009 for detail comparison). *Malthopsis annulifera* (Fig. 8) differs from *M. jordani* and *M. gigas* in having a relatively short anal fin that does not reach the caudal-fin base when fully laid back, a rostrum directed forward horizontally, body uniformly yellowish brown with 4–12 ocelli present on the dorsal surface. *Malthopsis gigas* differs from *M. jordani* in having a relatively strong and long rostral spine (Fig. 4B vs. Fig. 4A; Fig. 7), bucklers on the body surface strong and sharp, bucklers densely covering the ventral surface, subopercular buckler bearing spines directed outward and backward, and a relatively long caudal fin.

The proportion of rostral length is higher in *M. gigas* than that of *M. annulifera* and *M. jordani* (Fig. 7). The interorbital space is relatively wide in both *M. annulifera* and *M. gigas*, and relatively narrow in *M. jordani* (Fig. 9). The proportion of anal fin length is relatively high in *M. gigas*,

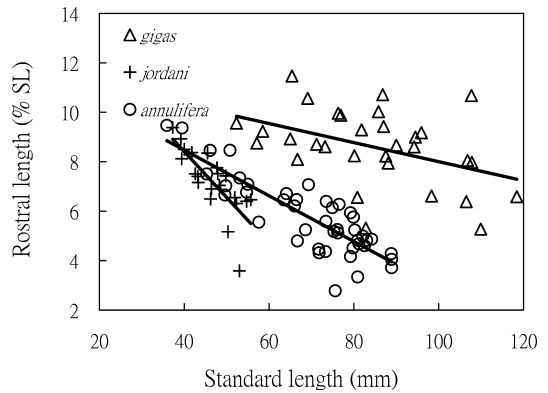


Fig. 7. Proportion of rostral length (%SL) versus standard length (mm) in 3 *Malthopsis* species.



Fig. 8. *Malthopsis annulifera*, holotype, ZUMT 1954, 67.8 mm SL.

medium in *M. jordani*, and small in *M. annulifera* (Fig. 10). The latter may explain the anal fin can extend beyond the caudal fin base in *M. gigas* and *M. jordani*, but never reach the caudal fin base in *M. annulifera*.

The adult body size among the congeners is also different (Table 3). The largest examined and the average body size of adult specimens is 136.4 mm and 85.7 mm, respectively, in *M. gigas*; those for *M. annulifera* are 96.2 mm and 65.2 mm; those for *M. jordani* are 65.6 mm and 47.6 mm; and those for *M. retifera* are 70.8 mm and 58.7 mm.

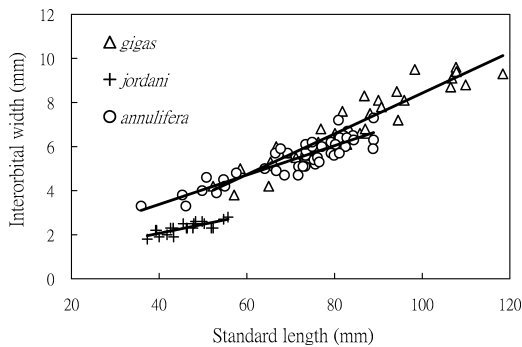


Fig. 9. Interorbital width (mm) versus standard length (mm) in 3 *Malthopsis* species.

**Comparative materials.** *Malthopsis annulifera*: Holotype: ZUMT 1954 (67.7), Japan. **Taiwan:** listed in Ho and Shao (2008) and Ho *et al.* (2009). **Japan:** BSKU 40947 (71.8), 54400 (39.5), 56345 (35.9), 56378 (49.8), 58240 (81.2), 58544 (76.5), 58545 (79.9), 59154 (68.6), 65340 (80.9), 66097 (46.1), 66822 (66.5), 66967 (64.1), 66968 (79.2), 68481 (79.2), 68482 (66.0), 69981 (88.9), 72189 (49.6), 74312 (76.1), 76112 (50.8), 77494 (75.3), 77932 (79.8), 79894 (88.9), 82879 (82.1), 88691 (82.5), 88992 (45.3), 89015 (75.6), 90124 (83.0), 90196 (69.3), 94682 (96.2). FAKU 19063 (84.2), 21072 (88.8), 21073 (80.9), 21414 (73.3), 23824 (80.2), 23825 (81.1), 23826 (72.8), 23827 (82.8), 23828 (74.9), 23829 (73.5), 27034 (53.1), 27035 (73.4), 27036 (77.1); FUMT 4875 (76.2); NSMT-P 30502 (74.9), 45993 (43.6), 45994 (63.5), 46605; ZUMT 18926 (73.4), 20144 (71.7). **East China Sea:** NSMT-P 63491 (2, 50.0–56.9), 64334 (2, 56.1–59.1), 64349 (54.7), 65645 (59.2), 69671 (56.0). **Philippines:** MNHN 1986-0143 (67.2), 1986-0144 (64.8), 1986-0162 (22.7), 1986-0174 (59.4); CAS 32886 (53.3); CAS 34161 (44.9); CAS 34882 (67.3); CAS 34901 (53.3); CAS 39626 (3, 29.0–44.9); CAS 34274 (72.0); CAS 39625 (39.0); CAS 33061 (44.6); CAS 33713 (64.1). *Malthopsis mitrigrea*: listed in Ho and Shao (2008) and Ho *et al.* (2009). *Malthopsis retifera*: listed in Ho *et al.* (2009).

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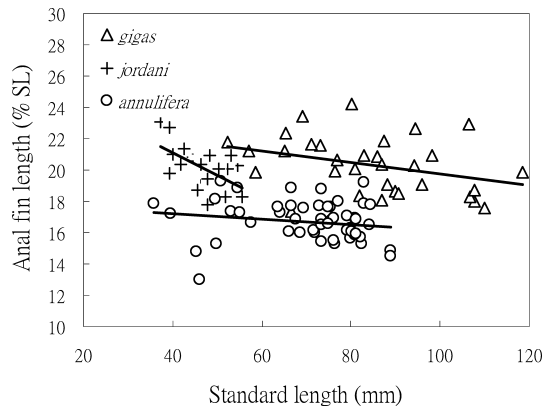


Fig. 10. Proportion of anal fin length (% SL) versus standard length (mm) in 3 *Malthopsis* species.

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### Literature Cited

- Alcock, A. 1891. Class Pisces. Natural history notes from H. M. Indian Marine Survey Steamer Investigator. Commander R. F. Hoskyn, R. N., commanding. —Series II., No. 1. On the results of deep-sea dredging during the season 1890–91. *Annals and Magazine of Natural History*, ser. 6, 8(43/44): 19–34.
- Bradbury, M. G. 1967. The genera of batfishes (family Ogcocephalidae). *Copeia*, 1967: 399–422.
- Bradbury, M. G. 1980. A revision of the fish genus *Ogcocephalus* with descriptions of new species from the western Atlantic Ocean (Ogcocephalidae; Lophiiformes). *Proceedings of the California Academy of Sciences*, 42: 229–285.
- Bradbury, M. G. 1998. A new species of *Malthopsis* (Lophiiformes: Ogcocephalidae) from the western Atlantic Ocean. *Bulletin of Marine Science*, 63: 207–211.
- Bradbury, M. G. 2000. Ogcocephalidae. Pages 597–598 in J. E. Randall and K. K. P. Lim, eds. A checklist of the fishes of the South China Sea. *The Raffles Bulletin of Zoology*, Supplement 8: 569–667.
- Bradbury, M. G. 2003. Family Ogcocephalidae Jordan 1895 — Batfishes. *California Academy of Sciences Annotated Checklists of Fishes*, 17: 1–17.

- Chave, E. H. and B. C. Mundy. 1994. Deep-sea benthic fish of the Hawaiian Archipelago, Cross Seamount, and Johnston Atoll. *Pacific Science*, 48: 367–409.
- Cuvier, G. 1829. Le Règne Animal, distribué d'après son organisation, pour servir de base à l'histoire naturelle des animaux et d'introduction à l'anatomie comparée. Edition 2. Le Règne Animal, distribué d'après son organisation, pour servir de base à l'histoire naturelle des animaux et d'introduction à l'anatomie comparée. 2nd ed, 2: xv+406 pp.
- Fricke, R. and W. N. Eschmeyer. A Guide to Fish Collections in the Catalog of Fishes database. On-line version. <http://research.calacademy.org/research/ichthyology/catalog/collections.asp> (13 March 2009).
- Gilbert, C. H. 1905. II. The deep-sea fishes of the Hawaiian Islands. Pages 575–713 in Jordan, C. H. and B. W. Evermann, eds. The aquatic resources of the Hawaiian Islands. *Bulletin of the U. S. Fish Commission*, 23: 577–713.
- Gilbert, C. H. and F. Cramer. 1897. Report on the fishes dredged in deep water near the Hawaiian Islands, with descriptions and figures of twenty-three new species. *Proceedings of the United States National Museum*, 19: 403–435.
- Ho, H.-C. and K.-T. Shao. 2008. The batfishes (Lophiiformes Ogocephalidae) of Taiwan, with descriptions of eight new records. *Journal of the Fisheries Society of Taiwan*, 35: 289–313.
- Ho, H.-C., A. M. Prokofiev and K.-T. Shao. 2009. A new species of the batfish genus *Malthopsis* (Lophiiformes: Ogocephalidae) from the northwestern Indian Ocean. *Zoological Studies*, 48: 394–401.
- Jordan, D. S. 1902. A review of the pediculate fishes or anglers of Japan. *Proceedings of the United States National Museum*, 24: 361–381.
- Lee, S.-C. 1988. Fishes of Lophiiformes (Pediculati) of Taiwan. *Bulletin of the Institute of Zoology Academia Sinica*, 27: 13–26.
- Lee, S.-C. 1993. Lophiiformes. Pages 180–185 in S.-C. Shen, ed. Fishes of Taiwan. Department of Zoology, National Taiwan University, Taipei. (In Chinese).
- Matsubara, K. 1955. Fish Morphology and Hierarchy. Part. II. Ishizaki Shoten, Tokyo. 791–1605 pp. (In Japanese)
- Mundy, B. C. 2005. Checklist of the fishes of the Hawaiian Archipelago. *Bishop Museum Bulletin in Zoology*, 6: 1–704.
- Okamura, O. 1984. *Malthopsis jordani*. Page 104 in Masuda, H., K. Amaoka, C. Araga, T. Uyeno and T. Yoshino, eds. The Fishes of the Japanese Archipelago. Tokai University Press, Kanagawa, Japan.
- Ochiai, A and F. Mitani. 1956. A revision of the Pediculate fishes of genus *Malthopsis* found in the waters of Japan (Family Ogocephalidae). *Pacific Science*, 10 (3): 271–285.
- Richardson, J. 1836. The Fish. Fauna Boreali-Americana; or the zoology of the northern parts of British America: containing descriptions of the objects of natural history collected on the late northern land expeditions, under the command of Sir John Franklin, R.N. Fauna Boreali-Americana; or the zoology of the northern parts of British America, Part 3: xv+327 pp.
- Shinohara, G., H. Endo, Matsuura, K., Machida, Y., and H. Honda. 2001. Annotated checklist of the deepwater fishes from Tosa Bay, Japan. *Memoirs of the National Science Museum Tokyo*, (20): 283–343.
- Shinohara, G., T. Sato, Y. Aonuma, H. Horikawa, K. Matsuura, T. Nakabo and K. Sato. 2005. Annotated checklist of deep-sea fishes from the waters around the Ryukyu Islands, Japan. Deep-sea fauna and pollutants in the Nansei Islands. *Memoirs of the National Science Museum Tokyo*, (29): 385–452.
- Tanaka, S. 1908. Descriptions of eight new species of fishes from Japan. *Annotationes Zoologicae Japonenses*, 7: 27–47.
- Yamada, U. 1997. *Malthopsis jordani*. Page 145 in O. Okamura and K. Amaoka, eds. Sea Fishes of Japan. Yamakei Publishers, Tokyo. (in Japanese)
- Yamada, U. 2002. Ogocephalidae. Pages 460–466 in T. Nakabo, ed. Fishes of Japan with Pictorial Keys to the Species, English edition. Tokai University Press.
- Yamakawa, T. 1984. *Malthopsis jordani*. Pages 285, 382 in O. Okamura and T. Kitajima, eds. Fishes of the Okinawa Trough and the Adjacent Waters. Vol. 1. The Intensive Research of Unexploited Fishery Resources on Continental Slopes. Japan Fisheries Resource Conservation Association, Tokyo.

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