

Redescription of *Polydactylus macrochir* (Günther, 1867), a senior synonym of *P. sheridani* (Macleay, 1884) (Perciformes: Polynemidae)

Hiroyuki Motomura,¹ Yukio Iwatsuki,² Seishi Kimura³ & Tetsuo Yoshino⁴

¹ Miyazaki University, the United Graduate School of Agricultural Sciences, Kagoshima University, 1-1 Gakuen-kibanadai-nishi, Miyazaki 889-2192, Japan (e-mail: a02113u@cc.miyazaki-u.ac.jp)

² Division of Fisheries Sciences, Faculty of Agriculture, Miyazaki University, 1-1 Gakuen-kibanadai-nishi, Miyazaki 889-2192, Japan (e-mail: yuk@cc.miyazaki-u.ac.jp)

³ Fisheries Research Laboratory, Mie University, P. O. Box 11, Wagu, Shima, Mie 517-0703, Japan (e-mail: kimura-s@bio.mie-u.ac.jp)

⁴ Department of Marine Sciences, Faculty of Science, University of the Ryukyus, 1 Senbaru, Nishihara, Okinawa 903-0213, Japan (e-mail: b985005@sci.u-ryukyu.ac.jp)

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Abstract *Polydactylus macrochir* (Günther, 1867), for many years identified as *P. sheridani* (Macleay, 1884), is redescribed as valid and a senior synonym of the latter species, following examination of the holotype of the former and comparative material. *Polydactylus macrochir* is characterized by 14 or 15 pectoral-fin rays (usually 14), five pectoral filaments, 70–76 pored lateral-line scales, 32–35 gill rakers, occipital profile concave in adults, posterior margin of maxilla extending considerably beyond posterior margin of adipose eyelid, depth of posterior portion of maxilla greater than dermal eye opening in adults, second spine of first dorsal fin very strong and long pectoral-fin rays (22–27% of standard length). *Polydactylus macrochir* is currently known only from northern Australia and southern Papua New Guinea, being endemic to those areas.

Key words. — Polynemidae; synonymy; redescription; *Polydactylus macrochir*; *Polydactylus sheridani*.

The polynemid fish *Polydactylus macrochir* (Günther, 1867), originally described from a single specimen from New South Wales, Australia, has been largely overlooked by subsequent researchers (Marshall, 1964; Munro, 1967; Lake, 1971; Grant, 1982, 1995; Kailola and Stewart, 1993; Tuma, 1994), following its later description as *Polynemus* (= *Polydactylus*) *sheridani* Macleay, 1884. The authors examined Australian specimens identified as *P. sheridani* in Australia, and found them to be identical to the holotype of *Polynemus macrochir* in both their meristic and morphological characters.

Polydactylus macrochir (Günther, 1867) is herein redescribed as valid, being a senior synonym of *P. sheridani* (Macleay, 1884), and is compared with related Indo-West Pacific polynemid species characterized by five pectoral filaments: *P. indicus* (Shaw), *P. microstomus* (Bleeker) and *P. plebeius* (Broussonet).

Methods

Counts and measurements generally followed Hubbs and Lagler (1947) and Feltes (1991), being made on the left side wherever possible. In addition, dermal eye opening and orbit diameter were taken as the greatest distance between the fleshy margins of the eye and between the bony margins of the eye, respectively. The length of the pectoral-fin base was measured from the base of the uppermost pectoral-fin ray to the base of the lowermost pectoral filament, and those of the upper and lower caudal-fin lobes from the middle of the posterior margin of the hypural plate to the posterior tip of the longest caudal-fin ray of the upper and lower lobes, respectively. Gill-raker counts were made on the first arch, the upper count being given first (lower counts including a raker at angle). Standard length is expressed as SL. Terminology of the supraneural bones follows Mabey

(1988), and the formula for configuration of the supraneural bones, anterior neural spines and anterior dorsal fin pterygiophores, Ahlstrom et al. (1976). The configuration of supraneural bones, and vertebral and epipleural rib counts were checked in all specimens (except NTM specimens) by X-ray radiographs. The swimbladder was observed in all MUFS specimens following dissection of the right side. Institutional codes follow Leviton et al. (1985), with additional institutional abbreviations as follows: Fisheries Science Course, Department of Animal Science, Miyazaki University, Japan (MUFS); Phuket Marine Biological Center, Thailand (PMBC); Shanghai Fisheries University, China (SFU).

Polydactylus macrochir (Günther, 1867)

(English name: King threadfin)

(Figs. 1, 2)

Polynemus macrochir Günther, 1867: 60 (type locality: New South Wales, Australia [but probably erroneous; see Distribution]).

Polynemus sheridani Macleay, 1884: 21 (type locality: Mary River, Queensland, Australia); Marshall, 1964: 416, pl. 56, fig. 401 (Queensland, Australia); Menon, 1974: POLYN Poly 1, 2 (locality not provided, as comparative material for *P. indicus* and *P. plebeius*); Grant, 1995: 287, fig. 629a, 629b (northern Australia).

Polydactylus sheridani; Munro, 1967: 190 (Gulf of Papua, Papua New Guinea, listed only in key); Lake, 1971: 43 (Australia); Kailola, 1975: 183 (Daru and Pie River, Gulf of Papua, Papua New Guinea); Grant, 1982: 530, pl. 272 (Queensland, Australia); Kailola and Stewart, 1993: 334 (northern Australia); Tuma, 1994: 72, unnumbered color figure (Queensland and Northern Territory, Australia).

Polydactylus macrochir; Feltes, 1991: 303 (locality not provided, name only in comparative material); Feltes, 1993: 207 (locality not provided, name only in comparative material).

Holotype. BMNH 1866.2.13.17, 171 mm SL, New South Wales, Australia (probably erroneous from present distributional evidence; see Distribution), collection date unknown.

Non-type specimens ($n=35$, 58–442 mm SL, all from Australia). AMS I. 6047, 263 mm SL, Port Darwin, Northern Territory (12°27'S, 130°48'E); AMS I. 12568, 266 mm SL, Burnett River, Queensland (24°S, 152°E); AMS I. 15557-090, 154 mm SL, Gulf of Carpentaria, Queensland (17°25'S, 140°10'E); AMS I. 26859-011, 249 mm SL, Karumba, Queensland (17°29'S, 140°50'E); AMS IA. 7768, 249 mm SL, Charles Point, west of Darwin, Northern Territory (12°23'S, 130°37'E); AMS IB. 1264, 58 mm SL, Fitzroy River, Mackenzie Island, Queensland (23°31'S, 150°52'E); MUFS 17787–17789, 3 specimens, 372–442 mm SL, mouth of Mary River, Queensland (25°26'S, 152°55'E); MUFS 17814–17815, 2 specimens, 285–346 mm SL, Reynolds River, Northern Territory (13°10'S, 130°08'E); NTM S. 11478-006, 226 mm SL, Kahlin Beach, Darwin, Northern Territory; NTM S. 11929-002, 163 mm SL, Kahlin Beach, Darwin, Northern Territory; NTM S. 14424-005, 161 mm SL, Pockock Beach, West Alligator Head, Northern Territory; NTM S. 14433-003, 224 mm SL, creek on west side of West Alligator River, Northern Territory

(12°15.49'S, 132°16.11'E); NTM S. 14440-005, 258 mm SL, mouth of Wildman River, Northern Territory (12°18.48'S, 132°04.01'E); NTM S. 14444-002, 175 mm SL, creek near South Alligator River, Northern Territory; NTM S. 14456-013, 211 mm SL, mouth of East Alligator River, Northern Territory; NTM S. 14458-001, 306 mm SL, creek on west side of East Alligator River, Northern Territory (12°09.02'S, 132°42.06'E); NTM S. 14656-009, 5 specimens, 59–72 mm SL, mouth of East Alligator River, Northern Territory (12°05.68'S, 132°38.29'E); NTM S. 14659-003, 58 mm SL, East Alligator River, Northern Territory (12°05.57'S, 132°37.76'E); NTM S. 14671-001, 230 mm SL, mouth of East Alligator River, Northern Territory (12°07.92'S, 132°38.80'E); NTM S. 14672-001, 184 mm SL, Rookery Creek, East Alligator River, Northern Territory (12°08.49'S, 132°40.65'E); NTM S. 14675-002, 172 mm SL, West Alligator River, Northern Territory (12°15.17'S, 132°16.39'E); NTM S. 14679-001, 2 specimens, 171–177 mm SL, reef south of Pockocks Beach, West Alligator Head, Northern Territory (12°11.15'S, 132°12.45'E); NTM S. 14681-002, 172 mm SL, 20 km (from river mouth) in upper stream of South Alligator River, Northern Territory (12°20.24'S, 132°25.38'E); QM I. 1913, 206 mm SL, Raine Island, Queensland; QM I. 25816-1. 258187, 3 specimens, 212–223 mm SL, mouth of Arthurs Creek, Gulf of Carpentaria, Queensland (16°53'S, 138°57'E).

Diagnosis. A species of *Polydactylus* with the following combination of characters: 14 or 15 pectoral-fin rays (usually 14); five pectoral filaments; 70–76 pored lateral-line scales; 32–35 gill rakers; occipital profile concave in adults (Fig. 2C); posterior margin of maxilla extending considerably beyond posterior margin of adipose eyelid; depth of posterior portion of maxilla greater than dermal eye opening in adults (over ca. 200 mm SL); second spine of first dorsal fin very strong; pectoral-fin rays long (22–27% of SL).

Description. Counts and proportional measurements as percentages of SL of the holotype and non-type specimens of *Polydactylus macrochir* are given in Table 1. Characters given in the diagnosis are not repeated.

Body oblong, compressed; maxilla covered with scales; orbit diameter approximately equal to snout length, shorter than interorbital; lower lip well-developed; dentary teeth restricted to dorsal surface of lower jaw; posterior margin of preopercle serrated; teeth villiform in broad bands on vomer, palatines and ectopterygoids; all pectoral-fin rays unbranched; tip of fourth pectoral filament extending beyond base of anal fin; third spine of first dorsal fin longest; second dorsal-fin base slightly shorter than or equal to anal-fin base; distance between pelvic-fin base and anal-fin base shorter than head length; body depth about one-fourth of SL; lateral line simple, extending to upper end of lower caudal-fin lobe; formula for configuration of supraneural bones, anterior neural

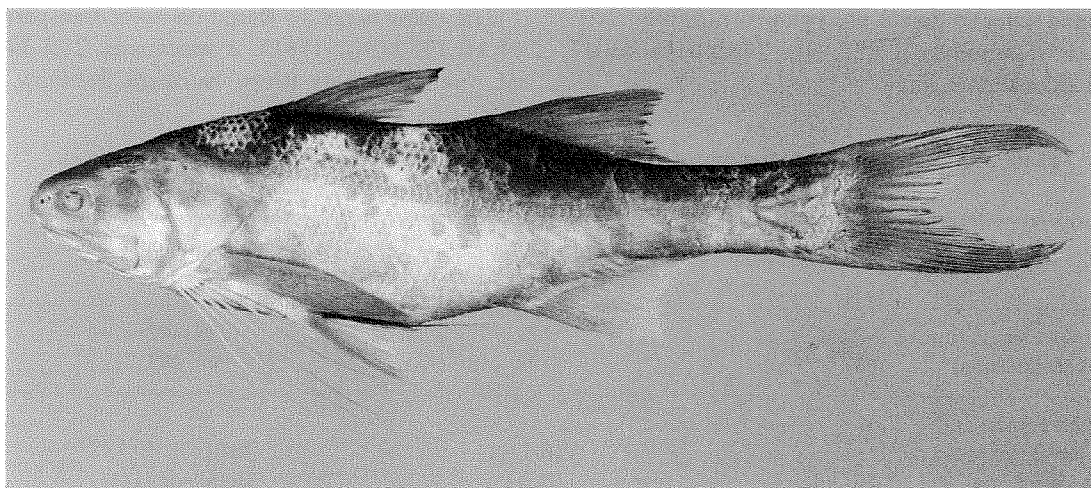


Fig. 1. Holotype of *Polynemus macrochir* Günther, 1867. BMNH 1866.2.13.17, 171 mm SL.

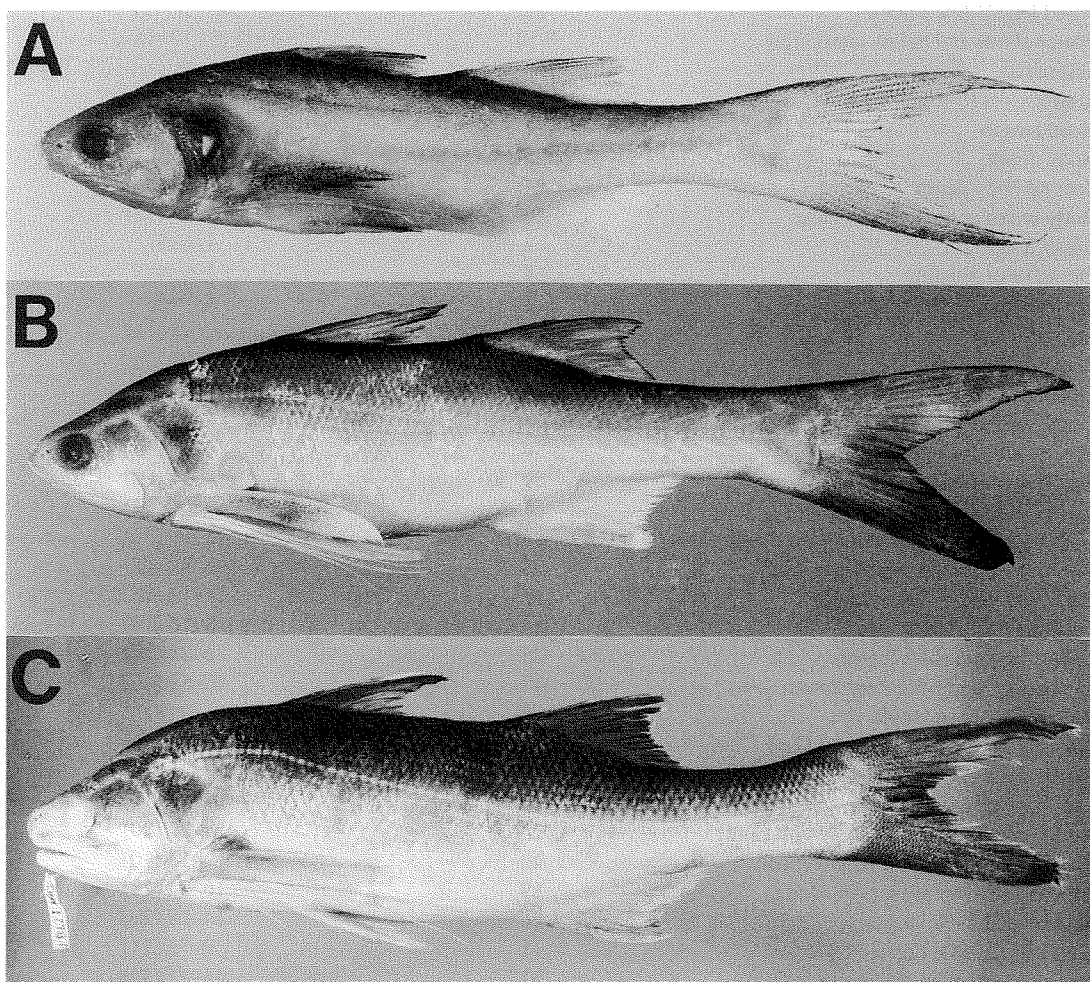


Fig. 2. Life stages of *Polydactylus macrochir*. A, NTM S. 14656-009, 60 mm SL, mouth of East Alligator River, Northern Territory, Australia; B, NTM S. 14444-002, 175 mm SL, creek near South Alligator River, Northern Territory, Australia; C, MUFS 17787, 442 mm SL, mouth of Mary River, Queensland, Australia.

spines and anterior dorsal pterygiophores 0/0/0+2/1
+1/1/1/1/1/; vertebrae 10+14; 6 or 7 epipleural ribs;
swimbladder simple, large.

Life color notes. — Based on color transparencies
of MUFS 17814–17815, 2 specimens, 285–346 mm
SL from Reynolds River, Northern Territory, Aus-

Table 1. Counts and measurements of the holotype and non-type specimens of *Polydactylus macrochir*,
expressed as percentages of standard length

	Holotype BMNH 1866.2.13.17	Non-type specimens <i>n</i> =35
Standard length (mm)	171	58–442
Fork length (mm)	192	66–484
Counts (modes)		
Dorsal-fin rays	VIII-I, 11	VIII-I, 11–13 (12)
Anal-fin rays	III, 11	III, 10–12 (11)
Pectoral-fin rays	14	14–15 (14)
Pectoral filaments	5	5
Pelvic-fin rays	I, 5	I, 5
Pored lateral-line scales	72	70–76 (72)
Scales above and below lateral line	8/12	8–11 (9)/12–15 (12)
Gill rakers	14+19=33	13–15 (14)=18–20 (20)=32–35 (34)
Measurements (means)		
Head length	28	28–34 (30)
Body depth	25	23–28 (25)
Second body depth	24	23–26 (25)
Body width at pectoral-fin base	10	10–14 (12)
Snout length	5	4–6 (5)
Dermal eye opening	4	3–6 (4)
Orbit diameter	5	4–7 (5)
Interorbital width	7	6–8 (6)
Postorbital length	20	19–22 (21)
Upper-jaw length	14	13–17 (15)
Depth at posterior margin of premaxilla	4	4–5 (4)
Pre-1st dorsal-fin length	34	34–40 (36)
Pre-2nd dorsal-fin length	59	59–64 (60)
Pre-anal-fin length	61	60–66 (62)
First dorsal-fin origin to anal-fin origin	37	35–41 (38)
Pelvic-fin origin to anal-fin origin	28	25–32 (28)
Second dorsal-fin base length	16	14–17 (15)
Anal-fin base length	16	15–18 (16)
Longest pectoral-fin length	25	22–27 (24)
Longest pectoral-filament length (4th)	47	40–53 (46)
Pectoral-fin base length	8	8–9 (8)
Longest pelvic-fin ray length (1st)	17	14–18 (16)
Longest 1st dorsal-fin spine length (3rd)	20	19–21 (19)
Second dorsal-fin spine length	10	9–11 (10)
Longest 2nd dorsal-fin ray length (2nd)	20	18–22 (20)
Longest anal-fin spine length (3rd)	10	9–13 (10)
Longest anal-fin ray length (2nd)	19	16–24 (18)
Caudal-peduncle length	26	24–28 (26)
Caudal-peduncle depth	11	9–13 (11)
Upper caudal-fin lobe length	32	33–41 (35)
Lower caudal-fin lobe length	32	31–46 (33)

Modes or means in parentheses include data from holotype.

tralia: upper sides of head and trunk tinged golden-silver, becoming more silver on lower sides; first and second dorsal fins pale brown; pectoral and pelvic fins vivid yellow; anterior part of anal fin yellow, other parts yellowish-white; pectoral filaments white or yellowish-white; posterior margin of caudal fin grayish-black, other parts grayish.

Color of preserved specimens. — Head and body light brown dorsally, pale brown ventrally; tip of membrane between third and fourth spines of first dorsal fin dark brown; pectoral-fin membranes with a small number of melanophores; other fins, including pectoral filaments, pale brown.

Distribution. *Polydactylus macrochir* is distributed only from northern Australia and southern Papua New Guinea, being endemic to those areas. The species is currently known from Broome, Western Australia to Brisbane River, Queensland, northern Australia (Marshall, 1964; Grant, 1982; Kailola and Stewart, 1993; Johnson, 1999; this study), and Daru and Pie River, Gulf of Papua, southern Papua New Guinea (Kailola, 1975).

Günther (1867) stated that the holotype of *Polynemus* (= *Polydactylus*) *macrochir* was collected from New South Wales, Australia. However, the species has never been collected from that area according to the collection databases of the Australian Museum and Queensland Museum (M. McGrouther and J. Johnson, pers. comm.). The holotype specimen was apparently collected in Queensland, being transferred to a fish market in New South Wales.

Girija Kumari et al. (1985) reported that nine specimens of *Polydactylus macrochir* (as *Polynemus sheridani*) were collected from Bay of Bengal, India. However, the description of those specimens given by Girija Kumari et al. (1985), viz. 19 gill rakers, caudal-fin lobes filamentous and grayish body color, are closer to the diagnosis of *P. indicus* (see Comparisons).

Ecological note. *Polydactylus macrochir* inhabits turbid coastal waters, estuaries and mangrove creeks as well as mangrove-lined rivers. Furthermore, available collection data for the species indicated that specimens had been taken from depths of 0.2–6 m. Although the species was stated to reach a weight of ca. 45 kg (Macleay, 1884), such examples are not seen today (Marshall, 1964). The record weight for one taken at Maryborough, Queensland, Australia was ca. 30 kg (Marshall, 1964).

Remarks. The holotype (BMNH 1866.2.13.17,

171 mm SL) of *Polydactylus macrochir*, examined herein, had five pectoral filaments on both sides, all of the pectoral-fin rays unbranched and 72 pored lateral-line scales. These characters have subsequently been used as the basis for identification of *P. sheridani* (Marshall, 1964; Munro, 1967; Menon, 1974; Grant, 1982).

The type specimen of *P. sheridani* was formerly held in the Macleay Museum, Sydney, Australia, most of the type specimens in that institution being transferred to the Australian Museum, Sydney, in 1972. However, the holotype of *P. sheridani* cannot now be found and is apparently lost (M. McGrouther and S. Norrington, pers. comm.).

The characters of *P. sheridani*, viz. maxilla large, posterior margin of maxilla extending beyond posterior margin of eye and second spine of first dorsal fin very strong, as described by Macleay (1884), were found to be consistent with those of the holotype of *P. macrochir*. Comparison of a range of material with the latter and the original description of *P. sheridani*, led to the conclusion that *P. macrochir* was a senior synonym of *P. sheridani*.

Comparisons. *Polydactylus macrochir* (Günther, 1867) and three other Indo-West Pacific species included in this genus, viz. *P. indicus* (Shaw, 1804), *P. microstomus* (Bleeker, 1851) and *P. plebeius* (Broussonet, 1782), are characterized by five pectoral filaments. The former compared with the other species on the basis of previously-reported principal references and comparative material (*P. indicus*, $n=9$; *P. microstomus*, $n=6$; *P. plebeius*, $n=16$ [see Comparative material examined]).

Polydactylus macrochir can be easily distinguished from *P. microstomus* in lacking a large black spot anteriorly on the lateral line (vs. present in the latter; Weber and de Beaufort, 1922; Menon and Babu Rao, 1984; Talwar and Jhingran, 1992; this study). *Polydactylus macrochir* differs from *P. indicus* in having a golden-silver body, and vivid yellow pectoral and pelvic fins when alive (vs. body, pectoral and pelvic fins grayish-black; Day, 1876; this study), higher counts of gill rakers (32–35 vs. 18–20, this study) and shorter upper and lower caudal-fin lobes (vs. very long, filamentous; Weber and de Beaufort, 1922; Menon, 1974; Menon and Babu Rao, 1984; this study).

In overall body appearance, *Polydactylus macrochir* is most similar to *P. plebeius*. However, *P. macrochir* differs from *P. plebeius* in having higher counts of pored lateral-line scales (70–76 vs. 58–65; Day, 1876; Weber and de Beaufort, 1922; Munro, 1955; Senou,

1993), higher counts of gill rakers (32–35 vs. 24–26; Jones and Kumaran, 1980; Senou, 1993), occipital profile concave in adults (vs. nearly straight, this study), posterior margin of the maxilla extending considerably beyond the posterior margin of the adipose eyelid (vs. reaching to or extending only slightly beyond posterior margin of adipose eyelid, this study) and the second spine of the first dorsal fin more robust than the other spines of the first dorsal fin (vs. all spines similar, this study).

Comparative material examined. *Polydactylus indicus*: ANSP 88347, 205 mm SL, Mumbai (=Bombay), India; FSKU 96814, 182 mm SL, Tawau, Sabah, Malaysia; MUFS 16846, 262 mm SL, Kalairt fish landing port, Chennai (=Madras), India; MUFS 17010, 215 mm SL, Chinatown market, Singapore; PMBC 6742, 2 specimens, 161–248 mm SL, Myanmar, north Andaman Sea (15°18.3'N, 97°13.8'E); URM-P 12700, 13776, 2 specimens, 198–294 mm SL, Samyan market, Bangkok, Thailand; URM-P 29076, 129 mm SL, Bangkok, Thailand. *P. microstomus*: FRLM 15773, 91 mm SL, Kuta, Lombok Island, Indonesia; FRLM 23518, 23520, 2 specimens, 101–116 mm SL, Passo, Baguala Bay, Ambon Island, Indonesia; MUFS 14159, 154 mm SL, estuary of Ouenghi River, New Caledonia; ZMH 13649, 128 mm SL, New Guinea; ZMH 13650, 88 mm SL, Manila Bay, Luzon Island, Philippines. *P. plebeius*: FRLM 1624, 9815, 11357, 13712–13714, 6 specimens, 135–245 mm SL, Goza, Shima, Mie, Japan; MUFS 14201–14202, 2 specimens, 271–323 mm SL, Noumea, New Caledonia; MUFS 16847, 16852, 2 specimens, 111–155 mm SL, Shanmugam fish market, Chennai (=Madras), India; NSMT-P 19247, 119 mm SL, off Ito, Shizuoka, Japan; NSMT-P 23943, 2 specimens, 195–223 mm SL, Ishigaki Island, Ryukyu Islands, Japan; SFU 3832, 171 mm SL, Hong Kong, China; URM-P 3048, 331 mm SL, Chinen fish market, Okinawa Island, Ryukyu Islands, Japan; YCM-P 133, 144 mm SL, Manazuru fish market, Kanagawa, Japan.

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Literature Cited

- Ahlstrom, E. H., J. L. Butler and B. Y. Sumida. 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.
- Day, F. 1876. The fishes of India, being a natural history of the fishes known to inhabit the seas and fresh waters of India, Burma, and Ceylon. Part 2. William Dawson & Sons, London. 169–368 pp., 41–78 pls.
- Feltes, R. M. 1991. Revision of the polynemid fish genus *Filimanus*, with the description of two new species. *Copeia*, 1991: 302–322.
- Feltes, R. M. 1993. *Parapolynemus*, a new genus for the polynemid fish previously known as *Polynemus verekeri*. *Copeia*, 1993: 207–215.
- Girija Kumari, S., B. Ratnamala and B. V. Seshagiri-Rao. 1985. A new record of the threadfin, *Polynemus sheridani* Macleay from India. *Matsya*, 9: 196–198.
- Grant, E. M. 1982. Guide to fishes. Dept. Harbours and Marine, Brisbane. 896 pp., 459 pls.
- Grant, E. M. 1995. Fishes of Australia. E. M. Grant Pty Ltd., Redcliffe. 457 pp.
- Günther, A. 1867. Additions to knowledge of Australian reptiles and fishes. *Ann. Mag. Nat. Hist.*, ser. 3, 20: 45–68.
- Hubbs, C. L. and K. F. Lagler. 1947. Fishes of the Great Lakes region. *Bull. Cranbrook Inst. Sci.*, (26): i-xi+1–213, 44 pls.
- Johnson, J. W. 1999. Annotated checklist of the fishes of Moreton Bay, Queensland, Australia. *Mem. Qld. Mus.*, 43: 709–762.
- Jones, S. and M. Kumaran. 1980. Fishes of the Laccadive Archipelago. Mathrubhumi Press, Cochin. xii+760 pp.
- Kailola, P. J. 1975. A catalogue of the fish reference collection at the Kanudi Fisheries Research Laboratory, Port Moresby. *Res. Bull. DASFP Moresby*, 16: 1–277.
- Kailola, P. J. and P. C. Stewart. 1993. Threadfin salmon. Pages 334–337 in P. J. Kailola, M. J. Williams, P. C. Stewart, R. E. Reichelt, A. McNee and C. Grieve, eds. Australian fisheries resources. Bureau of Resource Sciences, Department of Primary Industries and Energy, and the Fisheries Research and Development Corporation, Canberra.
- Lake, J. S. 1971. Freshwater fishes and rivers of Australia. Thomas Nelson and Sons Ltd., London. 61 pp.
- Leviton, A. E., R. H. Gibbs, Jr., E. Heal and C. E. Dawson. 1985. Standards in herpetology and ichthyology: Part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia*, 1985: 802–832.
- Mabee, P. M. 1988. Supraneural and predorsal bones in fishes: development and homologies. *Copeia*, 1988: 827–838.
- Macleay, W. 1884. Supplement of the descriptive catalogue of the fishes of Australia. *Proc. Linn. Soc. N. S. W.*, 9: 2–64.

- Marshall, T. C. 1964. Fishes of the Great Barrier Reef and coastal waters of Queensland. Angus and Robertson Ltd., Sydney. xvi+566 pp., 72 color pls., 64 black and white pls.
- Menon, A. G. K. 1974. Polynemidae. Pages 1–2+“POLYN Eleu 1” to “POLYN Poly 5” in W. Fischer and P. J. P. Whitehead, eds. FAO species identification sheets for fishery purposes—eastern Indian Ocean and western Central Pacific. Fishing Area 57 and 71. Vol. 3. FAO, Rome.
- Menon, A. G. K. and M. Babu Rao. 1984. Polynemidae. Pages 1–2+“POLYN Eleu 1” to “POLYN Poly 7” in W. Fischer and G. Bianchi, eds. FAO species identification sheets for fishery purposes—western Indian Ocean. Fishing Area 51. Vol. 3. FAO, Rome.
- Munro, I. S. R. 1955. The marine and freshwater fishes of Ceylon. Dept. External Affairs, Halstead Press, Canberra and Sydney. xvi+351 pp., 56 pls.
- Munro, I. S. R. 1967. The fishes of New Guinea. Dept. Agr. Stock and Fish., Port Moresby. xxxvii+650 pp., 78 pls.
- Senou, H. 1993. Polynemidae. Pages 847, 1338–1339 in T. Nakabo, ed. Fishes of Japan with pictorial keys to the species. Tokai Univ. Press, Tokyo. (In Japanese.)
- Talwar, P. K. and A. G. Jhingran. 1992. Inland fishes of India and adjacent countries. Vol. 2. A. A. Balkema, Rotterdam. pp. 543–1097.
- Tuma, D. 1994. Sea catch: identifying and handling fish and shellfish from Sydney to Shark Bay. Department of Primary Industries, Brisbane. 117 pp.
- Weber, M. and L. F. de Beaufort. 1922. The fishes of the Indo-Australian Archipelago. Vol. 4. Heteromi, Solenichthyes, Synentognathi, Percosoces, Labyrinthici, Microcyprini. E. J. Brill, Leiden. xiii+410 pp.