

Record of *Polydactylus sexfilis* (Perciformes: Polynemidae) from Hachijo-jima, Izu Islands, Japan with Comments on Morphological Changes with Growth and Speciation of Related Species

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Abstract. Recently, a single large example of *Polydactylus sexfilis* (Valenciennes in Cuvier & Valenciennes, 1831) was collected from Hachijo-jima, Izu Islands, off the Pacific coast of central Honshu Island, Japan. The specimen (456 mm in standard length) represents the first record from the Izu Islands and the largest confirmed record of the species, and is described in detail. Comments on morphological changes with growth of *P. sexfilis* and speciation of related species are also included.

Key words: Polynemidae, *Polydactylus sexfilis*, record, Hachijo-jima, morphology, speciation

The genus *Polydactylus* Lacepède, 1803, distributed from tropical to temperate regions world-wide, is defined by a simple tooth plate on the vomer, the tooth band on the upper and lower jaws wider than the space separating the tooth bands on the opposing premaxilla, the basisphenoid in contact with the prootic, the pectoral fin base (including base of pectoral filaments) being less than the upper jaw length and a simple swimbladder, not extending beyond the anal fin origin (Feltes, 1993; Motomura and Iwatsuki, 2001a). The genus is represented by 14 species in the Indo-Pacific region (Motomura and Iwatsuki, 2001a, b; Motomura *et al.*, 2000b, 2001a-d), although only 3 species, *P. plebeius* (Broussonet, 1782), *P. sexfilis* (Valenciennes in Cuvier & Valenciennes, 1831) and *P. sextarius* (Bloch & Schneider, 1801), have been reported from Japanese coastal waters (Motomura *et al.*, 1999, 2000a, 2001a; Senou, 2000).

Recently, a single large example of *P. sexfilis* was collected from Hachijo-jima, Izu Islands, off the Pacific coast of central Honshu Island, Japan. In Japanese waters, the species has been to date recorded only from Chichi-jima (Ogasawara Islands), Iriomote Island, Ishigaki Island and Amami-oshima (Ryukyu Islands), the Satsunan Islands and Miura Peninsula (Pacific coast of central Honshu Island), the overall total being only 14 specimens

(Motomura *et al.*, 2000a). The present specimen (456 mm in standard length) represents the first record from the Izu Islands and the largest confirmed record of the species (the standard length of the previously largest recorded specimen being 265 mm; see Motomura *et al.*, 2001a). The specimen is herein described in detail, and comments are made on morphological changes with growth of *P. sexfilis* and speciation of related species.

Counts and measurements generally follow Hubbs and Lagler (1947) and Feltes (1991), with some modifications following Motomura *et al.* (2000b). Counts of pectoral fin rays and pectoral filaments were made from the uppermost element and anteriormost (ventralmost) element, respectively. Standard and total lengths are abbreviated as SL and TL, respectively. Institutional codes follow Eschmeyer (1998).

Polydactylus sexfilis

(Valenciennes in Cuvier & Valenciennes, 1831)

(English name: Golden sixthread tasselfish)

(Japanese name: Nan'you-agonashi)

(Fig. 1; Table 1)

Polynemus sexfilis Valenciennes in Cuvier and Valenciennes, 1831: 515 (type locality: Mauritius).

Polynemus kuru Bleeker, 1853: 600 (type locality: Jakarta, Java, Indonesia).

Polydactylus sexfilis: Motomura *et al.*, 2001a: 83, fig. 1 (Indo-Pacific; redescription; designation of lectotype).

Material examined. KPM-NI 8127, 456 mm SL (600 mm TL), off Ishizumi, Hachijo-jima, Izu Islands, off Pacific coast of central Honshu Island, Japan, gill net, depth 10 m, 17 June 2001, coll. by Y. Okiyama.

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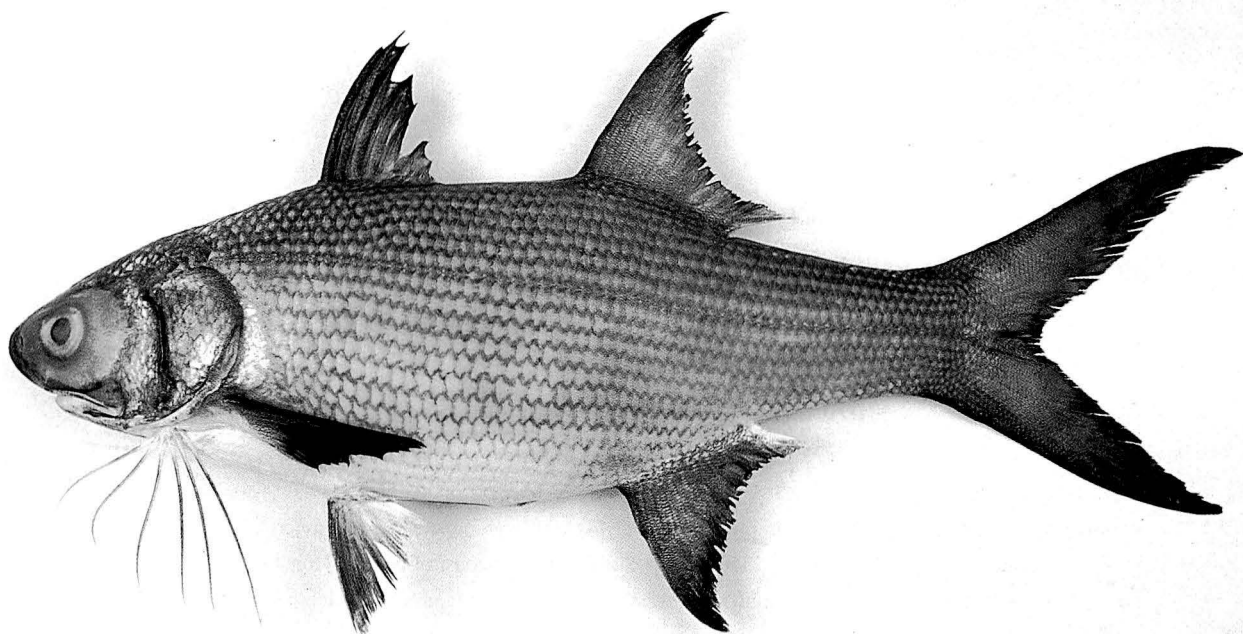


Fig. 1. *Polydactylus sexfilis*, KPM-NI 8127, 456 mm SL (600 mm TL), off Ishizumi, Hachijo-jima, Izu Islands, off Pacific coast of central Honshu Island, Japan.

Description. Counts and proportional measurements as percentages of SL of the specimen examined are given in Table 1. Body oblong, compressed; maxilla covered with scales; lower lip well-developed; posterior margin of maxilla just reaching to level of posterior margin of adipose eyelid; depth of posterior portion of maxilla shorter than dermal eye opening; teeth villiform in broad bands on vomer, palatines and ectopterygoids; third pectoral fin ray bifurcated at tip, fourth and fifth pectoral fin rays divided into 3 at tip, and remaining pectoral fin rays unbranched; first (counting from anteriormost filament) pectoral filament shortest, not reaching to level of pelvic fin origin; second to fifth pectoral filaments extending beyond level of pelvic fin origin; sixth pectoral filament longest, just reaching to level of posterior tip of upper part of pectoral fin; thickness of base of all first dorsal fin spines similar; lateral line simple, extending from upper end of gill opening to upper end of lower caudal fin lobe.

Color when fresh—Based on a color transparency (registered as KPM-NR 61656) of KPM-NI 8127, 456 mm SL: upper sides of head and trunk tinged silvery-brown, becoming more silver on lower sides; first dorsal fin black; posteriormost ray of second dorsal fin white, remainder of fin grayish-black; base of pectoral fin grayish-black, becoming dense black posteriorly; bases and tips of pectoral filaments white, middle parts of filaments grayish-black; anterior part of pelvic fin grayish-black, remainder of fin white; posteriormost ray of anal fin white, remainder of fin grayish-black; caudal fin uniformly grayish-black; 8 prominent dark stripes along longitudinal scale rows above lateral line, 12 faint stripes below.

Distribution. *Polydactylus sexfilis* is widely distributed in the Indo-Pacific region, generally in the vicinity of oceanic islands (Motomura *et al.*, 2001a: fig. 2). In Japanese waters, the species has been reported from Chichi-jima (Ogasawara Islands), Iriomote Island, Ishigaki Island and Amami-oshima (Ryukyu Islands), the

Satsunan Islands, and Kanagawa (Pacific coast of central Honshu Island; Motomura *et al.*, 2000a), and Hachijo-jima (Izu Islands, off Pacific coast of central Honshu Island; this study).

Discussion

Hachijo-jima specimen. The specimen collected from Hachijo-jima had the following diagnostic characters: 6 pectoral filaments, not reaching to origin of anal fin; 16 pectoral fin rays; 62 pored lateral line scales; a broad band of villiform teeth on vomer; second dorsal fin ray long (24% of SL). These characters were consistent with those of other previously-examined specimens, including the lectotype (designated by Motomura *et al.*, 2001a) and paralectotypes, of *Polydactylus sexfilis* (see Table 1 for counts and proportional measurements).

While most *Polydactylus* species generally occur on continental shelves, *P. sexfilis* is more common around oceanic islands, the species having been considered less dependent upon large freshwater rivers than other polynemid species (Motomura *et al.*, 2001a). Furthermore, *P. sexfilis* has been considered as not overwintering in Japanese waters, owing to the species being primarily circumtropical and all of the previously-known Japanese specimens having been collected only in summer (Motomura *et al.*, 2000a). The locality (Hachijo-jima) and collection date (June) of the present specimen lend support to these beliefs.

The previously largest-known size of *P. sexfilis* confirmed by a collected specimen was 265 mm SL, being the lectotype of the species (MNHN 9731, collected from Mauritius; Motomura *et al.*, 2001a). The present specimen (456 mm SL) demonstrates that *P. sexfilis* can attain a size significantly greater than formerly thought.

Morphological changes with growth. Prior to the present record, pectoral fin rays of *P. sexfilis* have all been believed to remain unbranched throughout life (Motomura *et al.*, 2000a,

2001a). However, the pectoral fin of the Hachijo-jima specimen was found to have 3 branched rays. Although the first, second, and sixth to sixteenth pectoral fin rays of the specimen were unbranched, the third, and fourth and fifth rays were bifurcated and divided into 3, respectively, near the tips. This change from unbranched to branched fin rays, hitherto unrecorded in *P. sexfilis*, is apparently related to fish growth.

Five similar *Polydactylus* species, viz. *P. malagasyensis* Motomura & Iwatsuki, 2001, *P. microstomus* (Bleeker, 1851), *P. mullani* (Hora, 1925), *P. persicus* Motomura & Iwatsuki, 2001 and *P. sextarius* (Bloch & Schneider, 1801), characterized by having a large black spot anteriorly on the lateral line, are also known to have branched pectoral fin rays (Motomura and Iwatsuki, 2001b). However, the pectoral fin ray condition in these species differs from that of *P. sexfilis* in that all of the rays, except the uppermost 1 or 2, are branched throughout life.

Speciation. *Polydactylus sexfilis* is very similar to *P. plebeius*

and *P. siamensis* Motomura, Iwatsuki & Yoshino, 2001 in overall body appearance and the possession of many common characters, for example, several prominent dark stripes present along the longitudinal scale rows above the lateral line and several faint stripes below, teeth villiform on the vomer, base of all first dorsal fin spines similarly thickened and the lateral line unbranched (see Motomura *et al.*, 2001a, b). Accordingly, these species are likely to have originated from a common ancestral species.

In the case of *P. siamensis*, speciation is considered to have resulted from sea level changes in the eastern Indian and western Pacific Oceans during the Pleistocene, the last cold period being about 12 000 years ago (Morley and Flenley, 1987). The species is known only from the Andaman Sea (only 3 specimens having been reported from the Gulf of Thailand), whereas *P. plebeius* (closely related to the former in having 5 pectoral filaments) and *P. sexfilis* are widely distributed in the Indo-Pacific (Motomura *et al.*, 2001a, b). During the last cold period, sea levels have been

Table 1. Counts and proportional measurements of *Polydactylus sexfilis*, expressed as percentages of standard length

	<i>Polydactylus sexfilis</i>	
	from Hachijo-jima <i>n</i> = 1	from Indo-Pacific <i>n</i> = 38*
Standard length (mm)	456	36-265
Counts (modes)		
Dorsal fin rays	VIII-I, 13	VIII-I, 12-13 (13)
Anal fin rays	III, 11	III, 11-12 (11)
Pectoral fin rays	16	15-16 (16)
Pectoral filaments	6	6
Pelvic fin rays	1, 5	1, 5
Pored lateral line scales	62	61-67 (64)
Scales above / below lateral line	9 / 13	8-10 (9) / 12-14 (13)
Gill rakers	12 + 15 = 27	11-14 + 15-18 = 27-31 (30)
Measurements (means)		
Head length	29	27-34 (32)
Body depth at 1st dorsal fin origin	31	26-32 (29)
Second body depth at 2nd dorsal fin origin	33	28-35 (30)
Body width at pectoral fin base	16	9-17 (13)
Snout length	6	5-8 (6)
Dermal eye opening	6	6-9 (8)
Orbit diameter	7	8-11 (9)
Interorbital width	8	8-11 (10)
Postorbital length	17	15-20 (18)
Upper jaw length	13	13-15 (15)
Pre-1st dorsal fin length	37	34-40 (37)
Pre-2nd dorsal fin length	61	59-64 (62)
Pre-anal fin length	64	60-67 (64)
First dorsal fin origin to anal fin origin	43	38-46 (42)
Pelvic fin origin to anal fin origin	29	20-30 (26)
Second dorsal fin base length	17	14-18 (16)
Anal fin base length	15	15-18 (16)
Longest pectoral fin length	20	20-23 (21)
Longest pectoral filament length (6th)	26	28-41 (35)
Pectoral fin base length	11	9-11 (10)
Longest pelvic fin ray length (1st)	15	16-19 (17)
Longest 1st dorsal fin spine length (3rd)	18	18-23 (21)
Second dorsal fin spine length	6	8-11 (9)
Longest 2nd dorsal fin ray length (2nd)	24	21-30 (26)
Longest anal fin spine length (3rd)	6	7-10 (9)
Longest anal fin ray length (2nd)	19	20-26 (23)
Caudal peduncle length	25	23-29 (26)
Caudal peduncle depth	13	13-16 (14)
Upper caudal fin lobe length	36 (tip broken)	39-48 (44)
Lower caudal fin lobe length	33 (tip broken)	37-46 (41)

* Data from Motomura *et al.* (2001a), including data for the lectotype and 2 paralectotypes of *Polynemus sexfilis*.

estimated as being 100 m lower than at present (Morley and Flenley, 1987), the Andaman Sea being an almost enclosed basin due to barriers formed by the Andaman and Nicobar Islands (McManus, 1985). We believe that *P. siamensis* has originated from *P. plebeius* or a common ancestral species which became isolated by the above barriers. Six similar species' patterns exist in Perciformes, viz. *Ecsenius lubbocki* (Blenniidae), *Hapalogenys merguensis* and *Pomadasy andamanensis* (Haemulidae), *Plesiops thysanopterus* (Plesiopidae), and *Pomacentrus alleni* and *P. polyspinus* (Pomacentridae), all endemic to the Andaman Sea (Randall and Satapoomin, 1999; this study), their speciation being considered to have resulted from the barriers formed by the Andaman and Nicobar Islands (Randall and Satapoomin, 1999).

Only 2 *Polydactylus* species, viz. *P. plebeius* and *P. sexfilis*, are widely distributed in the Indo-Pacific (Motomura *et al.*, 2001a, b), whereas all other Indo-Pacific congeners generally occur on continental shelves only. *Polydactylus sexfilis* is known to generally occur in the vicinity of oceanic islands (Motomura *et al.*, 2000a, 2001a) whereas *P. plebeius* inhabits various environments, including blackish and coastal waters on continental shelves, in addition to the vicinity of oceanic islands, such a diversity of habitats being unknown in other congeners. Since speciation is a response to diversification of habitat environments (Katakura, 1996), *P. sexfilis* probably evolved owing to greater adaptability to an open sea life mode than *P. plebeius*. Because the former has longer second dorsal (mean 26% [range 21-30%] of SL) and anal fin rays (23% [20-26%] of SL) than *P. plebeius* (22% [19-28%] of SL and 19% [17-23%] of SL, respectively; Motomura *et al.*, 2001a), both species being similar in overall body appearance, it is likely that *P. sexfilis* has a greater capacity for swimming in the open ocean.

Acknowledgments

We are most grateful to T. Kikuchi (Tokyo Hachijo Visitor Center, Hachijo-jima, Japan) for providing the specimen of *Polydactylus sexfilis* from Hachijo-jima and information regarding its collection. We thank Y. Motomura (Hiratsuka, Japan) for her assistance and G. S. Hardy (Ngunguru, New Zealand), who read the initial manuscript and offered helpful comments. This study was supported in part by grant awarded to the first author by Research Fellowships of the Japan Society for the Promotion of Science for Young Scientists (Tokyo, Japan).

Literature Cited

- Bleeker, P., 1853. Nieuwe bijdrage tot de kennis der ichthyologische fauna van Ternate en Halmahera (Gilolo). *Natuurkundig Tijdschrift voor Nederlandsch Indië*, 4: 595-610.
- Eschmeyer, W. N. (ed), 1998. Catalog of fishes. Vol. 1. Introductory materials, species of fishes, A-L. California Academy of Sciences, San Francisco, 1-958 pp.
- Feltes, R. M., 1991. Revision of the polynemid fish genus *Filimanus*, with the description of two new species. *Copeia*, 1991 (2): 302-322.
- Feltes, R. M., 1993. *Parapolynemus*, a new genus for the polynemid fish previously known as *Polynemus verekeri*. *Copeia*, 1993 (1): 207-215.
- Hubbs, C. L. & K. F. Lagler, 1947. Fishes of the Great Lakes region. *Bulletin of the Cranbrook Institute of Science*, (26): i-xi + 1-186.
- Katakura, H., 1996. Mechanism of speciation in animal. In Iwatsuki, K. & S. Mawatari (eds.), Species diversity. Shokabo, Tokyo, 190-216. (in Japanese)
- McManus, J. W., 1985. Marine speciation, tectonics and sea-level changes in Southeast Asia. *Proceedings of the Fifth International Coral Reef Congress, Tahiti*, 4: 133-138.
- Morley R. J. & J. R. Flenley, 1987. Late Cainozoic vegetational and environmental changes in the Malay Archipelago. In Whitmore, T. C. (ed.), Biogeographical evolution of the Malay Archipelago. Clarendon Press, Oxford, 50-59.
- Motomura, H., A. I. Burhanuddin & Y. Iwatsuki, 2000a. Distributional implications of a poorly known polynemid fish, *Polydactylus sexfilis* (Pisces: Perciformes), in Japan. *Bulletin of the Faculty of Agriculture, Miyazaki University*, 47 (1-2): 115-20.
- Motomura, H. & Y. Iwatsuki, 2001a. A new genus, *Leptomelanosoma*, for the polynemid fish previously known as *Polydactylus indicus* (Shaw, 1804) and a redescription of the species. *Ichthyological Research*, 48 (1): 13-21.
- Motomura, H. & Y. Iwatsuki, 2001b. Review of *Polydactylus* species (Perciformes: Polynemidae) characterised by a large black anterior lateral line spot, with descriptions of two new species. *Ichthyological Research*, 48 (4): 337-354.
- Motomura, H., Y. Iwatsuki & S. Kimura, 2001a. Redescription of *Polydactylus sexfilis* (Valenciennes in Cuvier and Valenciennes, 1831), a senior synonym of *P. kuru* (Bleeker, 1853) with designation of a lectotype (Perciformes: Polynemidae). *Ichthyological Research*, 48 (1): 83-89.
- Motomura, H., Y. Iwatsuki, S. Kimura & T. Yoshino, 2000b. Redescription of *Polydactylus macrochir* (Günther, 1867), a senior synonym of *P. sheridani* (Macleay, 1884) (Perciformes: Polynemidae). *Ichthyological Research*, 47 (4): 327-33.
- Motomura, H., Y. Iwatsuki & T. Yoshino, 2001b. A new species, *Polydactylus siamensis*, from Thailand and redescription of *P. plebeius* (Broussonet, 1782) with designation of a neotype (Perciformes: Polynemidae). *Ichthyological Research*, 48 (2): 117-126.
- Motomura, H., Y. Iwatsuki, T. Yoshino & S. Kimura, 1999. A record of a polynemid fish, *Polydactylus sextarius*, from southern Japan (Perciformes: Polynemidae). *Japanese Journal of Ichthyology*, 46 (1): 57-61. (in Japanese)
- Motomura, H., S. Kimura & Y. Iwatsuki, 2001c. *Polydactylus bifurcus*, a new species of threadfin from Lombok Island, Indonesia (Perciformes: Polynemidae). *Ichthyological Research*, 48 (3): 299-305.
- Motomura, H., M. Okamoto & Y. Iwatsuki, 2001d. Description of a new species of threadfin (Teleostei: Perciformes: Polynemidae), *Polydactylus longipes*, from Mindanao Island, Philippines. *Copeia*, 2001 (4): 1087-1092.
- Randall, J. E. & U. Satapoomin, 1999. *Archamia ataenia*, a new species of cardinalfish (Perciformes: Apogonidae) from the Andaman Sea and Mentawai Islands. *Phuket Marine Biological Center Research Bulletin*, 62: 1-8.
- Senou, H., 2000. Polynemoidei, Polynemidae. In Nakabo, T. (ed.), Fishes of Japan with pictorial keys to the species, 2nd ed., vol. 2. Tokai University Press, Tokyo, 968, 1581-1582.
- Valenciennes, A., 1831. Des Polynèmes. In Cuvier, G. & A. Valenciennes (eds.), Histoire naturelle des poissons, vol. 7. Levrault, Paris, 512-519.

摘 要

H. Motomura & H. Senou, 2002. Record of *Polydactylus sexfilis* (Perciformes: Polynemidae) from Hachijo-jima, Izu Islands, Japan with Comments on Morphological Changes with Growth and Speciation of Related Species. *Bull. Kanagawa prefect. Mus. (Nat. Sci.)*, (31): 27-31. (本村浩之・瀬能 宏, 2002. 伊豆諸島八丈島より得られたナンヨウアゴナシの記録と本種の成長に伴う形態的变化および近縁種の種分化に関する知見. 神奈川県立博物館研究報告(自然科学), (31): 27-31.)

最近、ツバメコノシロ科魚類ナンヨウアゴナシ *Polydactylus sexfilis* (Valenciennes in Cuvier & Valenciennes) の1標本(標準体長456 mm, 全長600 mm)が伊豆諸島八丈島より採集された。本種は従来、日本周辺海域では小笠原諸島父島、琉球列島西表島・石垣島・沖縄島、薩南諸島奄美大島、および三浦半島からのみ報告されていた。本標本は伊豆諸島からの初めての記録であり、本種の標本に基づく最大記録であった。本種の胸鰭軟条は従来不分岐であると考えられていたが、本標本の胸鰭軟条は先端付近で2叉あるいは3叉しており、これは成長に伴う変化であると判断した。本報告では本標本を詳細に記載し、本種とその近縁種ツバメコノシロ *P. plebeius* (Broussonet)および *P. siamensis* Motomura, Iwatsuki and Yoshino の種分化について考察した。

(Received: 30 Oct. 2001; Accepted: 7 Feb. 2002.)