

A new species of anglerfish (Lophiidae: *Lophiodes*) from the western Pacific

Hsuan-Ching Ho · Kwang-Tsao Shao

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Abstract *Lophiodes endoi* sp. nov. is described from the western Pacific Ocean. Within the genus *Lophiodes*, the new species belongs in the *L. mutilus* group mainly defined by the absence of the fourth dorsal fin spine and differs from other species in the *L. mutilus* group in having a rounded esca with a paler tip, a third dorsal spine bearing a pair of black tendrils at two-thirds its length, 20–21 pectoral fin rays, a relatively short head, a relatively short illicium, a relatively short third dorsal spine, and a relatively long fifth dorsal spine, reaching the third soft dorsal fin ray when folded back. Comments on a similar species, *L. bruchius*, newly collected from the Kyushu–Palau Ridge, and notes on the distribution of congeneric species in the northwestern Pacific are provided.

Keywords Taxonomy · Lophiiformes · *Lophiodes endoi* · *Lophiodes bruchius*

Introduction

The family Lophiidae comprises 25 species in four genera (Nelson 2006). In his revision of *Lophiodes*, Caruso (1981) recognized 11 species as valid around the world. Five of them were distributed in the Indo-West Pacific. Caruso

(1981) divided the genus *Lophiodes* into three species groups: the *Lophiodes naresi* group, the *Lophiodes caulinaris* group, and the *Lophiodes mutilus* group. The *L. mutilus* group comprised five species and was mainly characterized by having the fourth dorsal fin spine absent, the fifth and sixth dorsal fin spine reduced or embedded under the skin, the inner sphenotic spines well developed and directed upward, not recurved, and the interorbital area slightly concave, but not forming a deep U-shaped trough.

Yamakawa (1982) and Nakabo (1984) recorded various species of *Lophiodes* from Japan in which their *Lophiodes miacanthus* (Gilbert 1905) is identified here as *Lophiodes bruchius* Caruso 1981 and their *Lophiodes* sp. is identified here as *Lophiodes mutilus* (Alcock 1894) by us. Subsequently, two additional species were described, *Lophiodes fimbriatus* Saruwatari and Mochizuki 1985 from Japan and *Lophiodes abdituspinus* Ni, Wu, and Li 1990 from the South China Sea.

An unidentified species of *Lophiodes* was reported by Okamura (1984) and Ho and Shao (2007) from the western Pacific Ocean, respectively. Here we describe this species as new on the basis of 41 specimens. Comments on a similar species, *L. bruchius*, newly collected from the Kyushu–Palau Ridge, southern Japan, and notes on the distribution of congeners in the western Pacific are provided.

Materials and methods

Methods and definitions of the characters used in this study follow Caruso (1981). Standard length (SL) is used throughout. Vertebral counts, including the hypural plate, were made from radiographs. Terminology for describing the angling apparatus follows Bradbury (1967). All specimens collected from Taiwan were obtained by bottom

H.-C. Ho
Institute of Marine Biology, National Taiwan Ocean University,
Biodiversity Research Center, Academia Sinica, No.128,
Sec. 2, Academia Rd., Nankang, Taipei 115, Taiwan
e-mail: ogcoho@gmail.com

K.-T. Shao (✉)
Biodiversity Research Center, Academia Sinica, No.128,
Sec. 2, Academia Rd., Nankang, Taipei 115, Taiwan
e-mail: zoskt@gate.sinica.edu.tw

trawlers; otherwise collecting methods are described in the material examined. Symbolic codes for institutions are those provided by Leviton et al. (1985) with exception of the Biodiversity Research Center, Academia Sinica, Taipei, Taiwan (ASIZP). Data of congeners used for comparison were presented in Caruso (1981) and Ho and Shao (2007). Specimens used here for comparison are listed in the last section.

***Lophiodes endoi* sp. nov.** (New English name: Endo's Anglerfish) (New Japanese name: Endou-himeankou) (Figs. 1, 2, 3a, 4a, 5a, 6a)

Lophiodes sp.: Okamura 1984:267, 376 (one specimen, BSKU 32471, is included as paratype); Ho and Shao 2007:28 (all specimens used are included in type series).

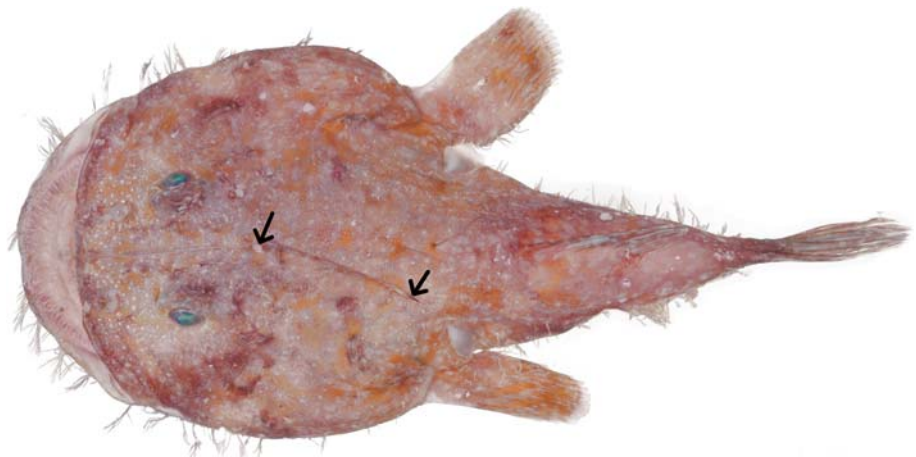
Holotype. ASIZP 63175, male, 192 mm, 24°53'N, 122°13'E, Nan-fang-ao, Su-ao, northeastern Taiwan, northwestern Pacific, 280–310 m, 9 May 2004.

Paratypes. 54–380 mm SL, 40 specimens. Taiwan (near type locality): AMS I.43853-001, 2 specimens, 240–270 mm; ASIZP 63170, 245 mm, 9 May 2004; ASIZP 63171, 218 mm, 9 May 2004; ASIZP 63176, 200 mm, 9 May 2004; ASIZP 65418, 275 mm, 22 May 2004; ASIZP 65419, 273 mm, 22 May 2004; ASIZP 65423, 249 mm, 30 June 2004; ASIZP 66348, 295 mm, 16 March 2005. Taiwan (Ta-shi, northeastern Taiwan, ca. 300 m): ASIZP 63214, 288 mm, 24 April 2004; ASIZP 63215, 330 mm, 24 April 2004; ASIZP 63275, 165 mm, 27 March 2004; ASIZP 64572, 3, 203–295 mm, 7 July 2004; ASIZP 65424, 350 mm, 13 June 2004; ASIZP 65425, 343 mm, 13 June 2004; ASIZP 65426, 380 mm, 13 June 2004; ASIZP 65427, 320 mm, 30 June 2004; ASIZP 65428, 368 mm, 30 June 2004; ASIZP 65429, 285 mm, 30 June 2004; CAS 223996, 2, 210–235 mm, 7 July 2004. Japan: BSKU 32314, 148 mm, 28°06.42'N, 134°39.56'E, Kyushu–Palau

Ridge, bottom trawl, 19 December 1979; BSKU 32319, 126 mm, same data as BSKU 32314; BSKU 32471, 260 mm, 25°48'N, 124°25.50'E, Okinawa Trough, bottom trawl, 19 December 1979; BSKU 44481, 243 mm, central Tosa Bay, R/V *Kotaka-maru*, bottom trawl, 300 m, 1 December 1987; BSKU 55304, 136 mm, Mimase fish market, Tosa Bay, 18 January 2001; BSKU 80110, 132 mm, Mimase fish market, Tosa Bay, 5 March 1992; BSKU 86095, 146 mm, 33°14'N, 133°38.30'E, R/V *Kotaka-maru*, 261–273 m, 5 March 1999; HUMZ 75231, 149 mm, 26°14.10'N, 135°46.70'E, Kyushu–Palau Ridge, 360 m, 23 January 1978; HUMZ 75232, 143 mm, 28°05'N, 134°38.50'E, Kyushu–Palau Ridge, 535 m, 25 January 1978. Australia: AMS I.43862-001, 213 mm, FRV *Kapala*, 37°13'S, 150°22'E; Gabo Island, New South Wales, 369–404 m, 25 July 1996; AMS I.19375-002, 135 mm, 35°30'S, 150°44'E, eastern Ulladulla, New South Wales, 329 m, 10 November 1976; AMS I.22817-034, 2, 54–131 mm, 18°06'S, 117°45'E, northwest Shelf, 240 km north of Port Hedland, engel trawl, 492–520 m, 7 April 1982; NMV A 8815, 130 mm, 37°41.10'S, 150°13.90'E, 25 km southeast of Gabo Island, Bass Strait, Victoria, otter trawl, 466 m, 3 August 1985; NMV A 22075, 153 mm, 33°38'S, 162°21'E, Lord Howe Rise, Tasman Sea, demersal trawl, 300–750 m, 2 April 2001; NMV A 22076, 320 mm, data as NMV A 22075; NMV A 20454, 149 mm, 35°05.20'S, 151°04.20'E, off Wollongong, New South Wales, bottom trawl, 426–459 m, 2 December 1998; NMV A 21947, 255 mm, 33°20'S, 162°30'E, Lord Howe Rise, Tasman Sea, bottom trawl, 423–750 m.

Diagnosis. A species of the *Lophiodes mutilus* group differing from congeners by the following characters: a rounded esca with paler tip (Fig. 3a); third dorsal spine bearing a pair of black tendrils located at two-thirds of illicial length (Fig. 4a); 18–22 (mainly 20–21) pectoral fin rays; a relatively short head (33.4–39.6% SL, \bar{x} = 35.7% SL); a relatively short illicium (16.5–26.7% SL, \bar{x} = 21.7%

Fig. 1 *Lophiodes endoi* sp. nov., holotype, ASIZP 63175, male, 192 mm SL. Photo by H.-C. Ho. *Left arrow* indicates the esca and *right arrow* indicates the tendrils on the third dorsal spine



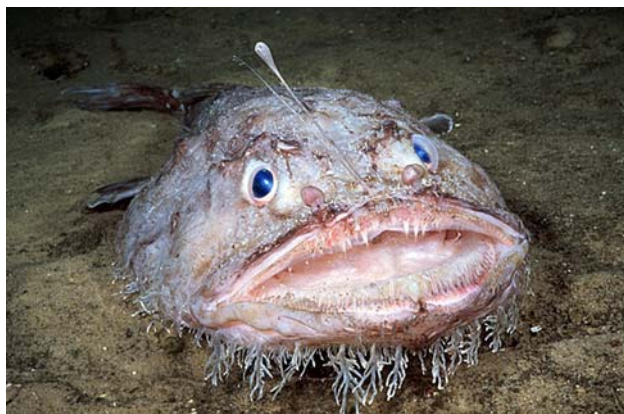


Fig. 2 Underwater photograph of *Lophiodes endoi* sp. nov., male, ca. 260 mm TL. Specimen not obtained. Photo by K. Aitken from an underwater vehicle at Greenwell Point, New South Wales, Australia, at depth about 160 fathoms (used with authority)

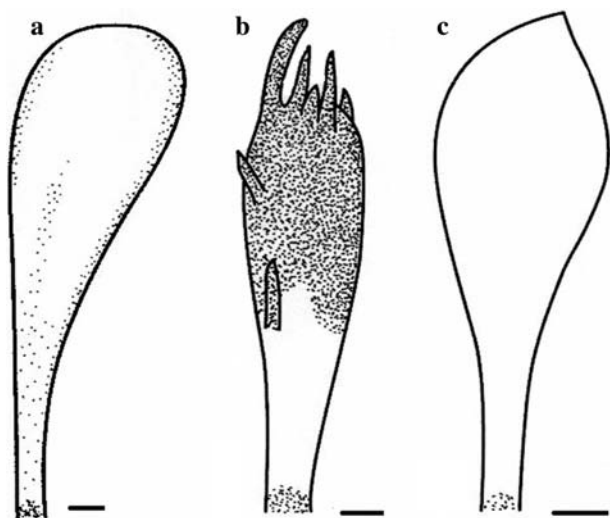


Fig. 3 Escae of three *Lophiodes* species. **a** *L. endoi* sp. nov., from the holotype; **b** *L. bruchius*, BSKU 32034, 310 mm SL; **c** *L. monodi*, from the holotype. Bar 1 mm

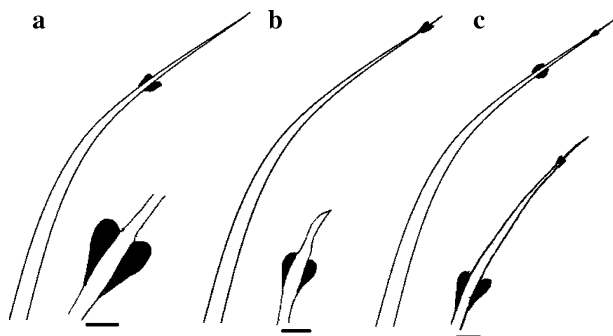


Fig. 4 Tendrils (right side) and their positions on third dorsal spines (left side) of three *Lophiodes* species. **a** *L. endoi* sp. nov., from the type; **b** *L. bruchius*, BSKU 30618, 125 mm SL; **c** *L. monodi*, from USNM 215002, 144 mm SL. Bar 2 mm (for tendrils only)

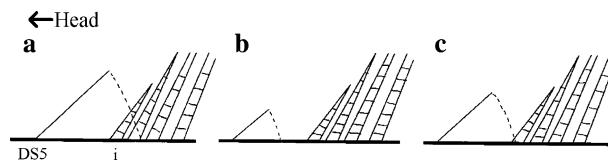


Fig. 5 Comparisons of the fifth dorsal spine lengths of three *Lophiodes* species. **a** *L. endoi* sp. nov., from the holotype; **b** *L. bruchius*, from BSKU 30618, 125 mm; **c** *L. monodi*, from the holotype. DS5 fifth dorsal spine, *i* first dorsal fin ray

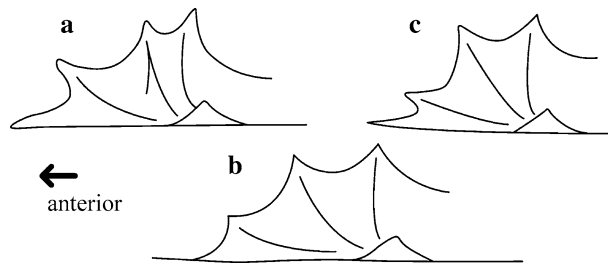


Fig. 6 Frontal spines of three *Lophiodes* species. **a** *L. endoi* sp. nov., from the holotype; **b** *L. bruchius*, BSKU 30714, 194 mm SL; **c** *L. monodi*, from the holotype

SL); a relatively short third dorsal spine (30.0–42.3% SL, \bar{x} = 36.5% SL); fifth dorsal spine relatively long, when folded back reaching base of third dorsal fin ray (Fig. 5a), and anterior frontal spine enlarged (Fig. 6a).

Description. Proportional measurements, expressed in percent of SL and HL, and meristics of the specimens of the type series are given in Table 1.

Head and body moderately depressed; head relatively short (33.4–39.6% SL, \bar{x} = 35.7% SL); tail cylindrical, somewhat depressed, tapering posteriorly; eye large; gill openings extending in front of pectoral fins; both maxilla and frontal ridge smooth, without knobs; frontal divided into three spines, anterior one enlarged, directed forward (Fig. 6a), sometimes divided into two sub-spines; sphenotic with two spines, inner spine well developed, straight and directed upward; inner frontal spine present in specimens smaller than 300 mm and reduced in specimens larger than 300 mm; single interopercular spine; parietal spine present at either side of third dorsal spine base, reduced in larger specimens; hyomandibula with two spines, anterior spine smaller, becoming blunt with three knobs in larger specimens; humeral spine well developed with three to four spines.

All dorsal fin spines, except for the third, devoid of tendrils; second to sixth dorsal spines bearing a tiny dark bulb at tip in most specimens; illicium lightly pigmented, relatively short (16.5–26.7% SL, \bar{x} = 21.7% SL), when folded back reaching third dorsal spine base, reaching sphenotic spines in larger specimens; esca a rounded bulb, slightly darker than illicium, tip pale (Fig. 3a); second dorsal spine slightly longer than illicium, when folded back

Table 1 Morphometric data, expressed in percent SL and HL, and meristics of the type series of *Lophiodes endoi* sp. nov.

	ASIZP 63175			
	Holotype	Holotype + paratypes		
Standard length	192 mm	54–380 mm ($n = 41$)		
Proportion as % SL		Range	Average	SD
Head length	39.6	33.4–39.6	35.7	1.6
Illicial length	23.2	16.5–26.7	21.7	2.3
Second dorsal spine length	30.0	22.7–30.2	26.9	2.2
Third dorsal spine length	38.5	30.0–42.3	36.5	2.9
Tail length	25.4	20.2–28.4	25.4	1.8
Proportion as % HL				
Head width	49.8	49.8–61.0	56.6	2.7
Head depth	60.1	60.1–72.4	65.7	3.0
Distance between inner sphenotic spines	39.2	39.2–47.9	44.3	2.1
Distance between posterior frontal spines	33.9	33.9–44.0	40.1	2.6
Snout width	16.6	16.6–22.3	19.1	1.5
Snout length	43.1	40.9–58.0	49.2	5.3
Distance between pterotic and sphenotic spines	15.5	14.9–19.3	17.4	1.1
Distance between quadrate and anterior palatine spines	67.7	48.3–87.2	75.7	7.6
Distance between opercular and subopercular spines	36.5	36.5–50.1	43.0	3.4
Meristics	n	Holotype	Range	Frequency
Dorsal fin rays	41	8	7–8	7(5), 8(36)
Anal fin rays	41	6	5–6	5(2), 6(39)
Pectoral fin rays	41	20	18–22	18(1), 19(1), 20(16), 21(21), 22(2)
Vertebrae	12	19	19	19(12)

reaching between third dorsal spine base and end of neurocranium; third dorsal spine relatively short (30.0–42.3% SL, $\bar{x} = 36.5\%$ SL), bearing one pair of darkly pigmented tendrils at about two-thirds its length (Fig. 4a), when folded back reaches third dorsal fin ray base, reaching origin of soft dorsal fin in larger specimens; fourth dorsal spine absent; fifth dorsal spine relatively long, when folded back reaching base of third dorsal fin ray, reaching origin of soft dorsal fin in larger specimens (Fig. 5a); sixth dorsal spine very short, when folded back not reaching origin of dorsal fin, embedded under skin in larger specimens. Anal fin extending beyond caudal fin base in smaller specimens, reaching caudal fin base in larger specimens.

Coloration when fresh (Fig. 1). Based on the holotype and paratypes collected from Taiwan: reddish-brown background with diffuse orange yellowish patches on dorsal surface, those patches disappearing with time; ventral surface pale gray; illicium paler than surface; esca darker than dorsal surface, tip pale; pectoral fin tip pale, dorsal surface of fin as body color; some darker patches associated with spines, fin bases, and caudal peduncle; peritoneum black.

Coloration in life (Fig. 2). Based on a series of underwater photographs of a male specimen taken from Greenwell Point, New South Wales, Australia: dorsal surface pale brown with numerous medium-sized, diffuse light blue or gray patches; illicium paler; esca darker at base and paler at tip; some darker patches associated with head spines and upper jaw; pectoral fin margin pale, dorsal surface with some diffuse pale blue spots.

Coloration in preservative. Uniform gray to dark on dorsal surface, pale gray on ventral surface with some darker patches associated with spines, fin bases, and caudal peduncle; a pair of dark tendrils on the third dorsal spine; peritoneum black.

Size. Up to 380 mm SL (paratype, ASIZP 65426).

Distribution. *Lophiodes endoi* is widely distributed in the western Pacific (Fig. 7), from off Japan, Taiwan and Australia, at depths of 261–750 m. Specimens were collected from southeastern Japan (Okinawa trough, Tosa Bay, and Kyushu–Palau Ridge) at depth range 261–600 m. In Taiwanese waters this species is usually captured together with *Lophiodes mutilus* at depths of about 280–310 m, and some may range deeper. Specimens were collected

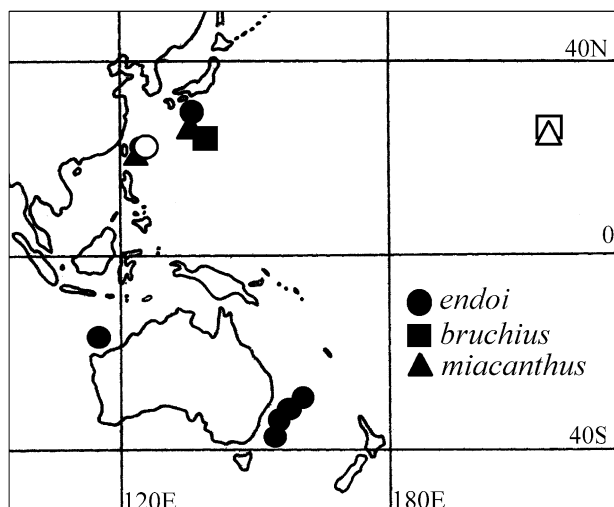


Fig. 7 Distribution map of three *Lophiodes* species from the western Pacific and central Pacific. *Open dots* mean the type localities. One symbol may represent more than one capture

from the Tasman Sea of southeastern Australia at depths of 300–750 m, and a series of photographs were taken of a specimen at a depth of 288 m at Greenwell Point, New South Wales, Australia, by an underwater vehicle (K. Aitken, personal communication, 20 March 2005). Two specimens were collected from the northwest shelf off Australia at depths of 492–520 m.

Etymology. *Lophiodes endoi* is named in honor of Dr. Hiromitsu Endo, Associate Professor of Faculty of Science, Kochi University, in recognition of his excellent work in ichthyology, his friendship, and for supplying specimens for this study.

Comparisons. *Lophiodes endoi* can be easily distinguished from *L. miacanthus* by having a pale illicium and a rounded esca (vs. a black illicium and a cirrus at tip of esca).

It is most similar to *L. bruchius* from the western and central Pacific in having a pair of dark tendrils on the third dorsal spine, but differs in having a shorter illicium (16.5–26.7% SL vs. 25.0–45.0% SL; Fig. 8), third dorsal spine relative short (30.0–42.3% SL vs. 27.8–62.6% SL; Fig. 9), a rounded esca with a paler tip (vs. darker tip with cirri; Fig. 3b), dark tendrils located at two-thirds of illicial length (vs. four-fifths to near the tip; Fig. 4b), and a longer fifth dorsal spine that reaches the base of first to third dorsal fin ray (vs. short and not reaching base of soft dorsal fin; Fig. 5b). In addition, the length of the third dorsal spine shows slightly negative allometric growth, but the slope is not steeper than that of *L. bruchius* (Fig. 9).

It is similar to *L. mutilus* of the Indo-West Pacific in having the inner frontal spine, but differs in having a shorter third dorsal spine (30.0–42.3% SL vs. 50.0–55.7% SL in Ho and Shao 2007), a pair of dark tendrils on third dorsal fin spine (vs. more than 5 pairs) and a larger esca (>2 mm vs. <2 mm in diameter).

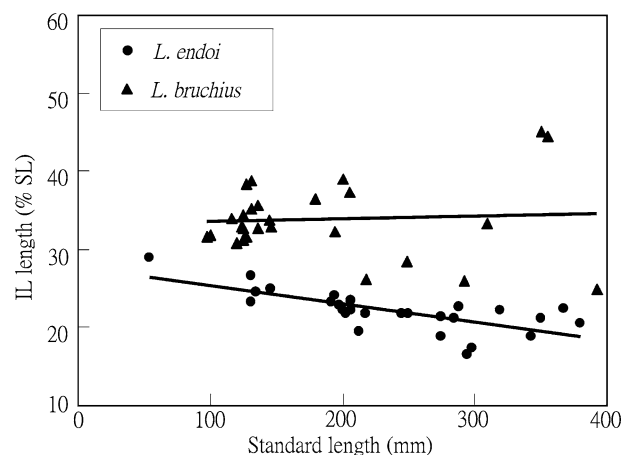


Fig. 8 Proportions of illicial length versus standard length for *L. bruchius* and *L. endoi* sp. nov

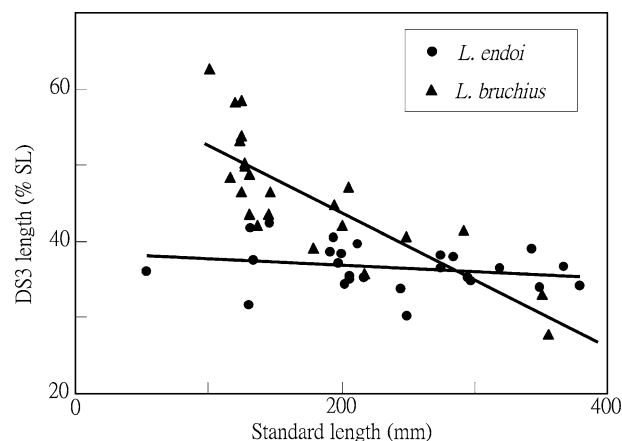


Fig. 9 Proportions of third dorsal spine length versus standard length for *L. bruchius* and *L. endoi* sp. nov

It is also similar to a fourth species, *Lophiodes monodi* Le Danios 1971, in the northwestern Atlantic in having a rounded esca, but differs in having a relatively short illicium (16.5–26.7% vs. 26.0–35.9% SL in Caruso 1981), a single pair of dark tendrils on the third dorsal spine (vs. two pairs; Fig. 4c), and anterior frontal spines enlarged (vs. relatively small; Fig. 6c).

Comments on *Lophiodes bruchius*. We examined 27 specimens (98–392 mm SL, listed below) collected from the Kyushu–Palau Ridge, southern Japan. *Lophiodes miacanthus* reported by Yamakawa (1982) and Nakabo (1984) is identified as *L. bruchius* by us. All characters and morphometrics of this species agreed well with the data provided by Caruso (1981) and the type specimens examined by the first author, except for the morphology of the esca and length of illicium.

Most specimens of *L. bruchius* examined by us have a rounded or elongated and cylindrical esca, instead of a leaf-like structure, usually bearing some cirri on its tip

(Fig. 3b). The leaf-like structure reported by Caruso (1981) may somehow be a preservation artifact.

The illicial length is somewhat longer in some specimens. For example, two large specimens (350–356 mm SL) and two smaller specimens (127–131 mm SL) have much longer illicia, about 38.5–45.0% SL (vs. 23.6–34.4% SL in Caruso 1981). In contrast, the largest known specimen (392 mm SL) has a relatively short illicium, only 25% SL. The comparison of the proportion of illicium versus SL does not reflect allometric growth as closely as in *L. endoi* (Fig. 9). Some specimens with a re-grown esca were observed indicating previous damage.

The proportion of the third dorsal spine length versus SL for *L. bruchius* exhibits a negative allometric growth as mentioned by Caruso (1981) (Fig. 8). In addition, the third dorsal spine bears a pair of dark tendrils that are located at four-fifths of the illicial length to near its tip. The tendrils are usually small, and those on specimens larger than 350 mm SL are usually reduced.

Notes on distribution of congeneric species in the western Pacific. The distribution of *L. endoi* is similar to most of the congeners, such as *Lophiodes naresi* (Günther 1880), *Lophiodes insidiator* (Regan 1921) and *L. mutilus* (Alcock 1894), collected mostly along the continental slope of the western Pacific Ocean. In Japan and Taiwan, specimens of *L. naresi*, *L. insidiator*, and most *L. mutilus* were all collected from the Okinawa Trough. However, most *L. endoi* were collected from both the Okinawa Trough and the Kyushu–Palau Ridge, southern Japan.

The three remaining species, *L. fimbriatus*, *L. bruchius*, and *L. miacanthus*, showed somewhat different distributions. *Lophiodes fimbriatus* was described from two specimens collected from the Pacific coast of central Japan at a depth about 15 m. It represents the shallowest record of the genus. *Lophiodes miacanthus* is found from the Hawaiian Islands, northeastern Taiwan, and the Kyushu–Palau Ridge of southern Japan. *Lophiodes bruchius* is found from the Kyushu–Palau Ridge of southern Japan and from off the Hawaiian Islands, but not off Taiwan. If the dispersal mechanism of *L. bruchius* is the same as the other two species, we assume that it should also be found off Taiwan.

Lophiodes miacanthus has been collected from the Hawaiian Islands at depths of 417–512 m and the Kyushu–Palau Ridge at depths of 550–710 m (three specimens only), while *L. bruchius* has been collected from the Hawaiian Islands at depths of 274–340 m and from the Kyushu–Palau Ridge at depths of 332–400 m. These two species may represent an example of resource partitioning by utilizing different habitats at different depths. Further investigations are needed to verify this theory.

In addition, there is a deep-water species, *Lophiodes* sp. [cf. *L. infrabrunneus* Smith and Radcliffe in Radcliffe

(1912)], known from four specimens collected in the East China Sea at depths of 350–800 m (Ho, unpublished data), and a singleton species, *L. abdituspinus*, described from the South China Sea at a depth of 649–665 m. However, the status or validity of both “forms” needs further investigation.

Comparative materials. *Lophiodes bruchius*: USNM 213714 (holotype), USNM 213713 (4 specimens, paratypes), and 27 specimens (98–392 mm SL), all collected from the Kyushu–Palau Ridge: BSKU 28856, BSKU 28874-7, 330 m; BSKU 29479, 320–395 m; BSKU 30462, 336 m; BSKU 30618-20, 332–340 m; BSKU30712-4, 360–370 m; BSKU 31352-4, 358–375 m; BSKU 31948-9, 330–350 m; BSKU 32032-5, 320–395 m; BSKU 32315-7; HUMZ 80188. *Lophiodes miacanthus*: 10 specimens as listed in Ho and Shao (2007) and three additional specimens, all collected from the Kyushu–Palau Ridge: BSKU 29490, 685–710 m; BSKU 32313, 550–600 m; BSKU 32318 (C&S). *Lophiodes mutilus*: 37 specimens as listed in Ho and Shao (2007). *Lophiodes monodi*: USNM 208343 (holotype), USNM 213636, USNM 213637, USNM 215002.

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References

- Alcock AW (1894) Natural history notes from H. M. Indian marine survey steamer, ‘Investigator,’ Commander C. F. Oldham, R. N., commanding. Series II., No. 9. An account of the deep sea collection made during the season of 1892–1893. J Asiat Soc Bengal 62:169–184
- Bradbury MG (1967) The genera of batfishes (family Ogcocephalidae). Copeia 1967:399–422
- Caruso JH (1981) The systematics and distribution of the lophiid anglerfishes: I. A revision of the genus *Lophiodes*, with the description of two new species. Copeia 1981:522–549
- Gilbert CH (1905) II. The deep-sea fishes of the Hawaiian Islands. The aquatic resources of the Hawaiian Islands. Bull US Fish Comm 23:577–713
- Günther A (1880) Report on the shore fishes procured during the voyage of H. M. S. Challenger in the years 1873–1876. Report on the scientific results of the voyage of HMS Challenger during the years 1873–1876. Zool Rep Chall Shore Fishes 1:1–82
- Ho H-C, Shao K-T (2007) Taxonomic review of Lophiidae (Pisces: Lophiiformes) in Taiwan. J Natl Taiwan Mus 60:19–32

- Le Danois Y (1971) Description de *Chirolophius monodi*, nouvelle espèce de la famille des Lophiidae (Pédiculates Haploptérygiens). Bull Mus Natl Hist Nat Sér 42:1186–1188
- Leviton AE, Gibbs RH, Heal E Jr, Dawson CE (1985) Standards in herpetology and ichthyology: part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. Copeia 1985:802–832
- Nakabo T (1984) Lophiidae. In: Masuda H, Amaoka K, Araga C, Uyeno T, Yoshino T (eds) The fishes of the Japanese Archipelago. Vol 1. Tokai University Press, Tokyo, pp 101
- Nelson JS (2006) Fishes of the world, 4th edn. Wiley, New York
- Ni Y, Wu HL, Li S (1990) On a new species of the genus *Lophiodes* (Pisces: Lophiidae) from the South China Sea. J Fish China 14:341–343
- Okamura O (1984) Lophiidae. In: Okamura O, Kitajima T (eds) Fishes of the Okinawa Trough and the adjacent waters. The intensive research of unexploited fishery resources on continental slopes, vol 1. Japan Fisheries Resource Conservation Association, Tokyo, pp 267–271, 376–378
- Radcliffe L (1912) New pediculate fishes from the Philippine Islands and contiguous waters. Scientific results of the Philippine cruise of the Fisheries steamer “Albatross,” 1907–1910. No. 16. Proc US Natl Mus 42:199–214
- Regan CT (1921) New fishes from deep water off the coast of Natal. Ann Mag Nat Hist Ser 7:412–420
- Saruwatari T, Mochizuki K (1985) A new lophiid anglerfish, *Lophiodes fimbriatus* from the coastal waters of Japan. Jpn J Ichthyol 32:299–304
- Yamakawa T (1982) Lophiidae. In: Okamura O, Amaoka K, Mitani F (eds) Fishes of the Kyushu–Palau Ridge and Tosa Bay. The intensive research of unexploited fishery resources on continental slopes. Japan Fisheries Resource Conservation Association, Tokyo, pp 187, 356–357