



## Rediscovery of *Lophiodes triradiatus* (Lloyd, 1909), a senior synonym of *L. infrabrunneus* Smith and Radcliffe (Lophiiformes: Lophiidae)

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### Abstract

Examination of the holotype and three recently collected additional specimens from the Indian Ocean has revealed that *Lophius triradiatus* Lloyd, 1909 (now under *Lophiodes*) is a valid species and a senior synonym of *Lophiodes infrabrunneus* Smith & Radcliffe, 1912 and *Lophiodes abdituspinus* Ni, Wu & Li, 1990. A detailed description of the additional specimens is provided.

**Key words:** Pisces, taxonomy, *Lophius triradiatus*, *Lophiodes infrabrunneus*, Indian Ocean

### Introduction

Lloyd (1909a) described *Lophius triradiatus* based on a single specimen (ZSI 878/1, 55 mm TL; Fig. 1A) collected from the Laccadive Sea (off Kerala coast, 549 m), India. The species is characterized by having three free dorsal-fin spines in the cephalic position only, lacking the post-cephalic dorsal-fin spines. Caruso (1981) reassigned the species to *Lophiodes*, but designated it a *nomen dubium* due to the very poor condition of the holotype (Fig. 1B). Smith & Radcliffe in Radcliffe (1912) described *Lophiodes infrabrunneus* based on specimens collected from the Philippines that also have only three dorsal-fin spines. Caruso (1981) recognized it as a valid species and diagnosed the species by all three dorsal-fin spines relatively short and other characters.

Ni *et al.* (1990) described a third species with three dorsal-fin spines, *Lophiodes abdituspinus*, from the South China Sea. Ho *et al.* (2009) redescribed *Lophiodes infrabrunneus* and placed *Lophiodes abdituspinus* as its junior synonym.

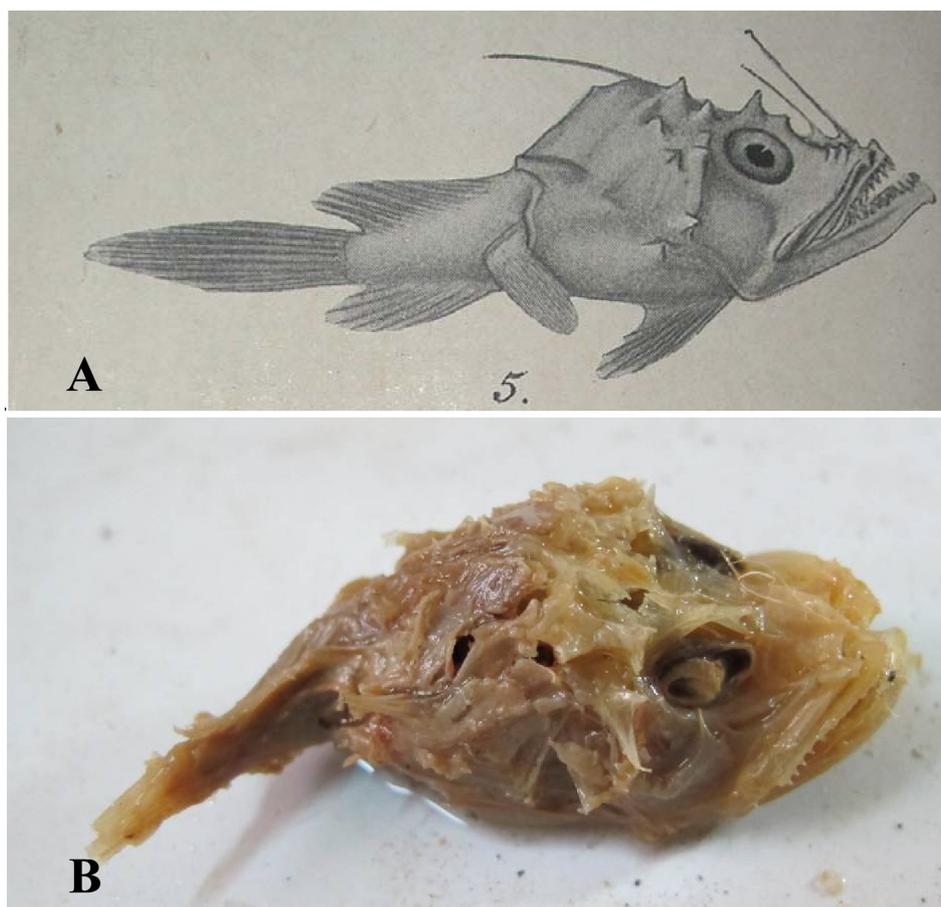
Although there was a suspicion that *Lophiodes triradiatus* and *L. infrabrunneus* might be conspecific, the validity of *L. triradiatus* was still unknown. Because they were not able to examine the holotype or any additional specimen from India, Ho *et al.* (2009: 67) followed Caruso's (1981) opinion and "redescribed *Lophiodes infrabrunneus* Smith & Radcliffe 1912 rather than resurrecting *L. triradiatus*."

Recently, three specimens lacking post-cephalic dorsal-fin spines collected from near the type locality were found in Indian and South African collections. These specimens are similar to the specimens of *Lophiodes infrabrunneus* examined by Ho *et al.* (2009). We also examined the holotype of *Lophius triradiatus* and determined that it is a valid species of *Lophiodes*, and that *L. infrabrunneus* and *L. abdituspinus* Ni, Wu & Li, 1990 are junior synonyms.

Hence, we resurrect *Lophius triradiatus* Lloyd, 1909 (now under *Lophiodes*) and synonymize two junior synonyms under the Articles 23.1 and 23.2 of the International Code of Zoological Nomenclature (ICZN, 2013, online version). A detailed description of the recently collected specimens is provided.

## Methods and material

Methods for taking morphometric and meristic data and definitions of head spines and other terminology followed Caruso (1981), with the additional measurement of caudal-fin length taken from the end of the hypural plate to the rear end of the caudal fin. Comparative data are those taken from Ho *et al.* (2009). Specimens are deposited in the Centre for Marine Living Resources and Ecology, Cochin (CMLRE) and Zoological Survey of India, Kolkata (ZSI).



**FIGURE 1.** A. Original drawing of *Lophius triradiatus* Lloyd, 1909, 55 mm TL, after Lloyd, 1909: pl. xlv, fig. 5. B. Holotype of *Lophius triradiatus* Lloyd, 1909, ZSI F878/1. Photo by H.-C. Ho.

## Results

### *Lophiodes triradiatus* (Lloyd, 1909)

*Lophius triradiatus* Lloyd, 1909: 166 (Holotype: ZSI 878/1, Laccadive Sea, 10°08'43"N, 75°33'30"E, 300 fms [549 m]).

*Lophiodes infrabrunneus* Smith & Radcliffe in Radcliffe, 1912: 202 (Holotype: USNM 70265; the Philippines, 10° N, 125°06'45" E, 772 fms [1412 m]). Ho *et al.*, 2009: 63.

*Lophiodes abdituspinus* Ni, Wu & Li, 1990: 341 (Holotype: SCSFRI D-2583; South China Sea, 20°22' N, 115°52' E, 649–665 m).

**Material examined.** ZSI 878/1, 337 mm SL, 10°08'43" N, 75°33'30" E, off south India, Laccadive Sea, Investigator station 259, 300 fms [549 m]. ZSI 2446, 337 mm SL, off the Kerala coast, 9°21' N, 75°48' E, 230 m, May 2012. CMLRE 2810311, 243 mm SL, Laccadive Sea, 8°21'601" N, 76°10'171" E, 995 m, 12 Oct. 2010. SAIAB 3838, 62 mm SL, possibly off Mozambique (no other data).

**Condition of specimens.** The holotype of *Lophius triradiatus* (ZSI 878/1) is in very poor condition (Fig. 1B).

The skin has been totally lost and the muscles and skeleton are fragile. Three cephalic dorsal-fin spines are complete, except for the third spine, which is somewhat shorter than in the original drawing. The leaf-like esca, one of the diagnostic characters, is somewhat dried but detectable, and is identical to that of specimens examined by Ho *et al.* (2009). The first author took a series of photos, but no measurement can be made due to the fragile condition. The three newly found specimens are in excellent condition, except that the esca is somewhat dried in the 337-mm specimen, which is by far the largest known for the species. The esca of 62-mm and 243-mm specimens are in good condition.

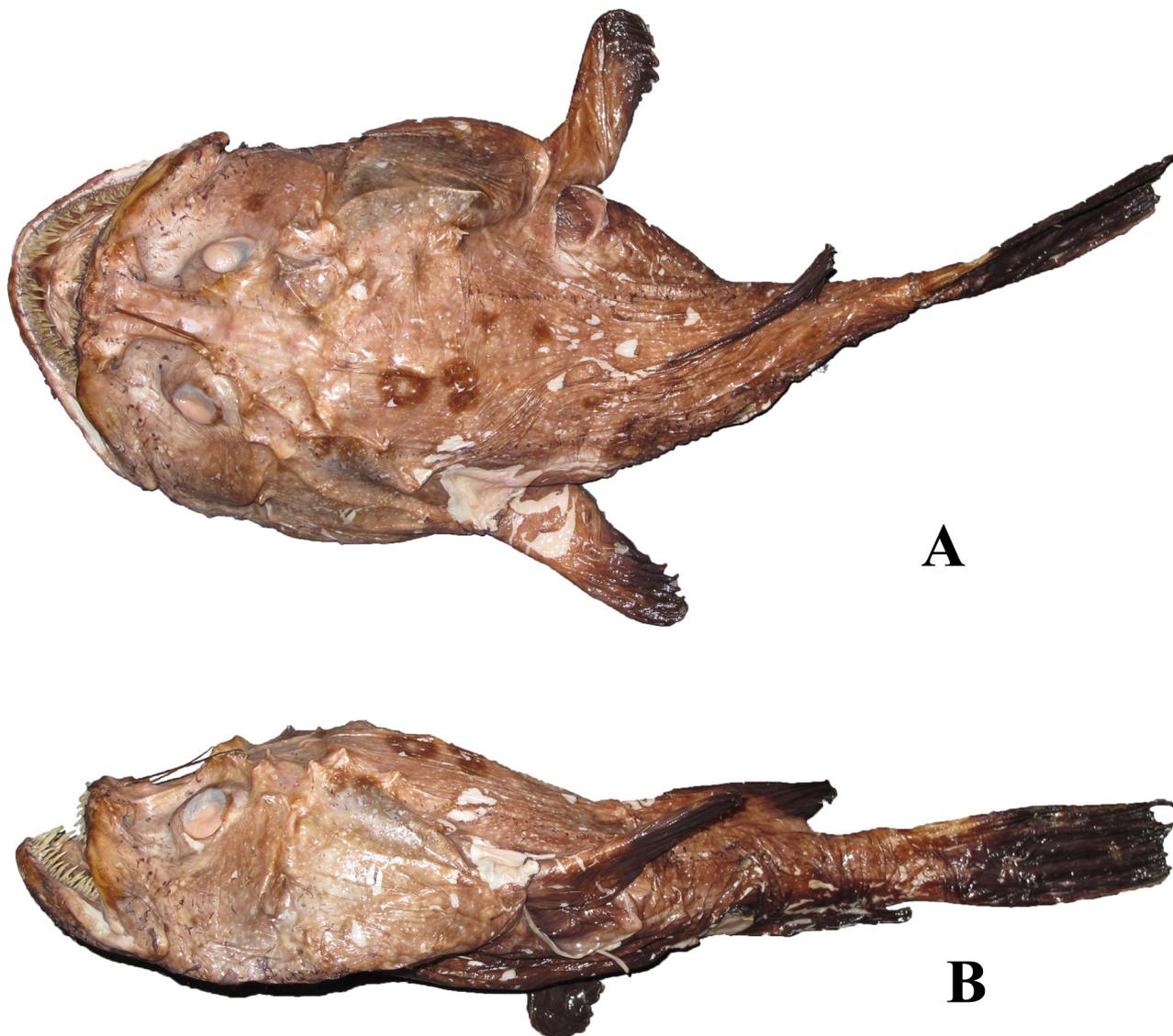
**Description.** The following is based on the three recently discovered specimens listed above. Morphometric and meristic data of the three specimens examined are provided in Table 1.

**TABLE 1.** Morphometric and meristic data of three newly discovered specimens of *Lophiodes triradiatus* examined in the present study. See Caruso (1981) for abbreviations, with one additional measurement: CF =caudal-fin length.

	SAIAB 3838	CMLRE 2810311	ZSI 2446
SL (mm)	62	243	337
	% SL		
HL	35.5	35.7	34
IL	14.5	17.7	17.7
DS2	12.9	15.6	9.7
DS3	29.0	11.3	14.4
TL	31.5	33.3	34.4
CF	36.0	35.7	36.5
	% HL		
HD	86.4	71.2	74.6
HW	68.2	59.2	60.8
SNL	60.5	55.4	56.8
SNW	18.6	19.5	19.1
ISP	51.4	40.3	44.6
IF	35.5	32.2	34.3
PTSP	22.3	20	18.6
QPAL	65.9	68.9	73.8
OPSOP	46.8	44	49.2
Meristics			
Dorsal-fin rays	8	8	8
Pectoral-fin rays	16/15	13/13	16/17
Anal-fin rays	6	6	6

Body relatively high, head elevated. Two blunt spines on palatine, the posterior spine larger than the anterior spine. Frontal ridge and outer surface of premaxilla smooth, posterior portion of frontal ridge elevated, bearing 3 spines on right side, 4 spines on left side in 337 mm specimen, 3 spines on both sides in 243 mm specimen, and 2 spines in 62 mm specimens; spines blunt in two large specimen and sharp in small specimen. Inner frontal spine reduced and not detectable in two larger specimens, present in small specimen. Two sphenotic spines present, inner spine sharply pointed and long, outer spine broad and low. Pterotic spine broad, compressed and blunt in two larger specimens, conical in small specimen. Two blunt and tubercular hyomandibular spines, anterior spine larger than posterior spine in two larger specimens, one single sharp spine in small specimen. Opercular spine tubercular, low in two larger specimens, conical in small specimen. Subopercular and interopercular spines sharply pointed and long. Humeral spine very strong, simple with a knob at its dorsal base in two larger specimens, trifid in small specimen.

Illicium reaches level of inner sphenotic spines when fully laid back in two larger specimens, reaching anterior frontal spine in small specimen. Esca a leaf-like flap (somewhat dried in 337 mm specimen), its base at about distal 1/4 to 1/3 of illicial length. Second dorsal-fin spine slightly shorter than illicial length, reaching level of inner sphenotic spines when fully laid back, reaching posterior frontal spine in small specimen. Third dorsal-fin spine short, reaching level of cleithral spines when fully laid back, relatively long, and reaching nearly origin of soft dorsal fin. Fourth to sixth (post-cephalic) dorsal-fin spines absent.



**FIGURE 2.** *Lophiodes triradiatus* (Lloyd, 1909), ZSI 2246, 337 mm SL, Southern India. A. Dorsal view. B. Lateral view. Photos by H.-C. Ho.

Two irregular rows of small teeth on outer margin of premaxilla, those on outermost row small and fixed; three irregular rows of larger teeth on inner margin of premaxilla, those on innermost row largest. Two to 4 teeth on outer corner of vomer. Palatine with 2 (1 in smallest specimen) irregular rows of strong teeth. All teeth on vomer and palatines fixed.

Anal fin extends well beyond caudal-fin base.

Coloration. Uniformly deep brown with darker fins. Ventral surface dark brown in two larger specimens, uniformly pale brown in small specimen. Peritoneum black.

**Distribution.** *Lophiodes triradiatus* now includes the distribution of *L. infrabrunneus* plus the three newly-

discovered specimens, and is therefore known from southern India, northwestern Australia, the Philippines, South China Sea, East China Sea, Japan, and western Indian Ocean, at depths 208–1412 m.

## Discussion

Caruso (1981) and Ho *et al.* (2009) mentioned that *Lophiodes infrabrunneus* (now *Lophiodes triradiatus*) lacks inner frontal spines whereas the 62-mm specimen examined in the present study has these. The first author reexamined some specimens examined in Ho *et al.* (2009) and found that the inner frontal spines are present in smaller (<100 mm SL) specimens. The inner frontal spines are also present in smaller individuals of *L. mutilus* (Alcock, 1894) and gradually reduce with growth. Thus, this character is revised accordingly.

All known specimens share the following diagnostic characters: absence of post-cephalic dorsal-fin spines, a leaf-like esca, and all three dorsal-fin spines (including illicium) relatively short compared to other congeners. As no other character can be found to distinguish the Indian and western Pacific populations, we herein recognized them as the same species.

It is notable that the 337-mm specimen has 13 pectoral-fin rays on both sides, far less than all other specimens examined, while the two other specimens have 15–16 rays. Lloyd (1909) gave 15 for the holotype, and 16–20 were reported in Ho *et al.* (2009). The variation seems much larger than other congeners (see Caruso, 1981, table 1; Ho *et al.*, 2009, table 1). The proportional measurements of three newly discovered specimens fall within the range of other specimens (see Ho *et al.*, 2009, table 1), except for the following differences. The third dorsal-fin spine of 62 mm specimen is much longer, 29% SL (vs. 9.1–20.6% SL, in Ho *et al.*, 2009). The third dorsal spine is also relatively long in the holotype (Fig. 1A). The head width of 337 mm specimen is somewhat narrower, 59.2% HL (vs. 60.0–93.9% SL). The second dorsal-fin spine is much shorter in the 243 mm specimen, 9.7% SL (vs. 12.2–21.2% SL). The snout width of all three specimens are relatively shorter, 18.6–19.5% HL (vs. 21.7–34.2% HL). These differences may be attributed to allometric growth or individual variation. The proportional ranges are extended accordingly. It is also notable that the Indian specimens have a relatively long caudal fin, about one-third of standard length.

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## References

- Alcock, A.W. (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 1892–93. *Journal of the Asiatic Society of Bengal*, 62 (pt. 2, no. 4), 169–184.
- Caruso, J.H. (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 (3), 522–549.  
<http://dx.doi.org/10.2307/1444556>
- Ho, H.-C., Séret B. & Shao, K.-T. (2009) Redescription of *Lophiodes infrabrunneus* Smith and Radcliffe, 1912, a senior synonym of *L. abdituspinus* Ni, Wu and Li, 1990 (Lophiiformes: Lophiidae). *Zootaxa*, 2326, 62–68.
- Ho, H.-C., Séret, B. & Shao, K.-T. (2011) Records of anglerfishes (Lophiiformes: Lophiidae) from the western South Pacific Ocean, with descriptions of two new species. *Journal of Fish Biology*, 79 (7), 1722–1745.  
<http://dx.doi.org/10.1111/j.1095-8649.2011.03106.x>
- International commission of Zoological Nomenclature (2013) International code on zoological nomenclature. Online version (1 Jan. 2000) Available from: <http://www.nhm.ac.uk/hosted-sites/iczn/code/> (accessed 19 March 2014)
- Lloyd, R.E. (1909) A description of the deep-sea fish caught by the R. I. M. S. ship 'Investigator' since the year 1900, with

- supposed evidence of mutation in *Malthopsis*. *Memoirs of the Indian Museum*, 2 (3), 139–180.
- Lloyd, R.E. (1909) *Illustrations of the zoology of the Royal Indian marine survey ship Investigator. Fishes*. Part X, pl. 44–50.
- Ni, Y., Wu, H.-L. & Li, S. (1990) On a new species of the genus *Lophiodes* (Pisces: Lophiidae) from the South China Sea. *Journal of Fisheries of China*, 14 (4), 341–343.
- Smith, H.M. & 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. *Proceedings of the United States National Museum*, 42 (1896), 199–214.  
<http://dx.doi.org/10.5479/si.00963801.42-1896.199>