

Revision of the Deep-Sea Anglerfish Genus *Acentrophryne* Regan (Lophiiformes: Ceratioidei: Linophrynidae), with the Description of a New Species from off Peru

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The deep-sea ceratioid anglerfish genus *Acentrophryne* is revised on the basis of all known material. Two species are recognized: the type species *Acentrophryne longidens*, represented by two specimens collected in the Gulf of Panama and from off the Pacific coast of Costa Rica and a new species described here on the basis of three specimens, all from off Peru. The new species differs from *A. longidens* in having a much longer distal esca appendage, a longer illicium, a narrower head, and fewer pectoral-fin rays. Diagnoses and descriptions are given for all taxa and a key to the species is provided.

THE genus *Acentrophryne* and its type species, *Acentrophryne longidens*, were originally described by Regan (1926) on the basis of a single 50-mm female specimen collected in 1922 by the Danish research vessel DANA in the Gulf of Panama. Its huge jaw teeth and few dorsal- and anal-fin rays clearly indicated placement within the family Linophrynidae, while the absence of a hyoid barbel and spine on the posterior margin of the preopercle easily distinguished it from the other four genera of the family (Bertelsen, 1951). Beebe and Crane (1947) described a second female *A. longidens* collected in 1938 off the Pacific coast of Costa Rica. Slightly smaller than the holotype at 42 mm, this tentatively identified specimen, obviously a linophrynid, was similar in lacking a preopercular spine, but said to differ in having smaller teeth, a shorter illicium, and a slightly longer distal esca appendage. Bertelsen (1951), in his worldwide revision of the Ceratioidei, redescribed the species (correcting the erroneous fin-ray counts of Regan, 1926) and compared it with other linophrynid taxa, but he was otherwise unable to add any new data. Recent collections made off Peru by the Japan Deep-Sea Trawlers Association, in collaboration with the Instituto del Mar del Peru, have yielded three additional specimens of the genus. This new material was initially thought to represent the first appearance of *A. longidens* since the 1938 capture of Beebe and Crane's (1947) specimen nearly 70 years ago, but closer examination has shown these specimens to represent a new species. The new form is described below, along with a revised diagnosis and description of the genus.

MATERIALS AND METHODS

Standard length (SL) is used throughout. Head length is measured from the tip of the

snout to the anteriormost edge of the opercular opening. Head width is the distance between the tips of the sphenotic spines. Head depth is the distance between the tips of the sphenotic and quadrate spines. Illicium length is the distance from the articulation of the pterygiophore of the illicium and illicial bone to the distal surface of the esca bulb, excluding the distal esca appendage. The esca bulb is the distal swelling of the illicium that contains the bacteria-mediated photophore, excluding the esca appendage. Terminology used in describing the various parts of the angling apparatus follows Bradbury (1967). Symbolic codes for institutions are those provided by Leviton et al. (1985).

Genus *Acentrophryne* Regan, 1926

Females:

Acentrophryne Regan (1926):23, Pl. 1, Fig. 2 (type species *Acentrophryne longidens* Regan, 1926, by monotypy).

Males and larvae unknown.

Diagnosis.—Metamorphosed females of *Acentrophryne* differ from those of all other genera of the family Linophrynidae in lacking a spine on the preopercle. They differ further in having the following combination of character states: frontal, epiotic, and posttemporal spines absent; teeth in jaws few (6–26 on each premaxilla, 9–16 on each dentary), extremely long (longest about 20% SL), arranged in two or three overlapping, oblique longitudinal series; vomerine teeth 2–6; ninth caudal-fin ray about one-half length of eighth; length of illicium 35.7–70.5% SL; esca with a single, unpigmented distal appendage; hyoid barbel absent; skin uniformly black except on distal parts of esca. Material is

TABLE 1. COUNTS AND MEASUREMENTS (IN PERCENT OF STANDARD LENGTH) OF KNOWN MATERIAL OF *Acentrophryne*.

	<i>Acentrophryne longidens</i>		<i>Acentrophryne dolichonema</i> n. sp.		
	AMNH 51440	Holotype ZMUC P921981	Paratype HUMZ 189134	Paratype HUMZ 167353	Holotype HUMZ 175257
Standard length (mm)	42	50	55	56	105
Length					
Head	46.0	57.0	56.4	57.1	66.7
Premaxilla	38.1	52.9	damaged	51.8	45.7
Lower jaw	32.1	55.9	54.5	57.1	50.9
Illicium	35.7	54.9	63.6	67.9	70.5
Distal escaI appendage	2.3	2.5	34.5	35.7	27.6
Ninth caudal-fin ray	22.6	18.6	17.3	15.2	10.5
Longest tooth					
Premaxilla	5.0	14.9	damaged	9.5	11.0
Dentary	8.8	19.6	16.4	15.7	18.1
Head width	35.7	37.3	26.4	25.0	28.1
Head depth	47.6	58.8	54.5	53.6	54.3
Esca width	6.2	8.2	damaged	7.1	6.7
Tooth counts					
Premaxilla	6–7	12–14	damaged	15–15	25–26
Dentary	9–9	10–11	10–10	10–12	16–16
Vomer	2	4	4	3	6
Dorsal-fin rays	3	3	3	3	3
Anal-fin rays	3	3	3	3	3
Pectoral-fin rays	18–18	19–19	16–16	16–16	16–16

unavailable for internal anatomical examination.

Description.—Metamorphosed females with body short, globular, depth 50–60% SL; length of head about 46–67% SL; length of lower jaw 32–57% SL; caudal peduncle unusually short, dorsal and anal fins terminating nearly at base of caudal-fin rays; sphenotic spines prominent; dorsolateral margin of frontal smooth, without spines or projections; lower jaw without symphyseal spine; posterior tip of angular forming a sharp spine. Anterior end of pterygiophore of illicium protruding slightly from snout; relative length of illicium increasing with growth: 35.7% SL in 42-mm specimen, 67.9% SL in 56-mm specimen, 70.5% SL in 105-mm specimen; escaI bulb relatively large (width 6.2–8.2% SL), bearing a single, unpigmented distal appendage, 2.3–35.7% SL; additional escaI appendages and filaments absent (Table 1). Skin of head and body uniformly black to dark red-brown, except for distal part of escaI bulb and escaI appendage.

Jaw teeth relatively few: 42-mm specimen with 6–7 teeth in each premaxilla, 9 in each dentary; 56-mm specimen with 15 teeth in each premax-

illa, 10–12 in each dentary; 105-mm specimen with 25–26 teeth in each premaxilla, 16 in each dentary; longest premaxillary tooth 5.0–14.9% SL, longest dentary tooth 8.8–19.6% SL. Dorsal and anal-fin rays 3; pectoral-fin rays 16–19; pelvic fins absent; caudal-fin rays 9, ninth ray (ventralmost) about one-half length of eighth caudal-fin ray (Table 1).

Acentrophryne longidens Regan, 1926

Figure 1, Table 1

Females:

Acentrophryne longidens Regan (1926):23, Pl. 1, Fig. 2 (original description, single specimen). Regan and Trewavas (1932):106 (after Regan, 1926). Fowler (1944):528 (Gulf of Panama). Beebe and Crane (1947):170, Fig. 15 (additional specimen, questionably referred to *A. longidens*). Bertelsen (1951):192 (after Regan, 1926, and Beebe and Crane, 1947). Grey (1956):278 (distribution). Nielsen (1974):98 (holotype listed in type catalog). Pietsch and Lavenberg (1980):906, Figs. 1, 2 (first known fossil ceratioid, Late Miocene of California). *Borophryne apogon*: Nigrelli (1947):183 (misiden-

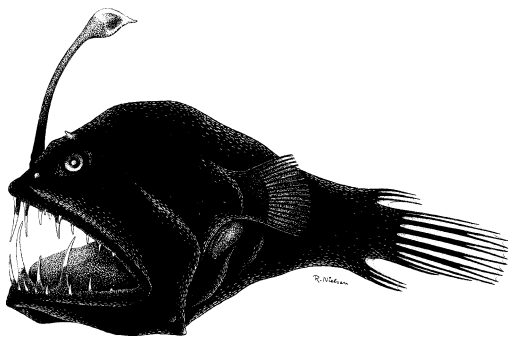


Fig. 1. *Acentrophryne longidens*, holotype, ZMUC P921981, 50 mm SL. Drawing by R. Nielsen.

tification based on AMNH 51440, 42 mm; histology of stomach tumor). Males and larvae unknown.

Holotype.—ZMUC P921981, 50 mm, R/V DANA station 1203(14), Eastern Tropical Pacific, Gulf of Panama, 7°30'N, 79°19'W, open conical ring-trawl, 2500 m wire out, bottom depth 2550 m, 2030 h, 11 January 1922.

Additional specimen.—AMNH 51440 (formerly NYZS 28411), 42 mm, Eastern Pacific Zaca Expedition station 210 T-10, south of Cape Blanco, Costa Rica, 9°11'N, 85°08'W, 1 m diameter tow-net, 500 fathoms (910 m), 27 February 1938.

Diagnosis.—Metamorphosed females of *A. longidens* differ from those of *A. dolichonema* in having a much shorter distal escal appendage (2.3–2.5% SL vs. 27.6–35.7% SL), a shorter illicium (35.7–54.9% SL vs. 63.6–70.5% SL), a wider head (35.7–37.3% SL vs. 25.0–28.1% SL), and a greater number of pectoral-fin rays (18–19 vs. 16).

Description.—Metamorphosed females with body short, globular, head length 46.0–57.0% SL, head depth 47.6–58.8% SL, head width 35.7–37.3% SL; length of premaxilla 38.1–52.9% SL; length of lower jaw 32.1–55.9% SL; length of illicium 35.7–54.9% SL; width of escal bulb 6.2–8.2% SL; a short distal escal appendage, with smooth rounded distal tip, showing no signs of damage, length 2.3–2.5% SL (Fig. 1, Table 1). Jaw teeth relatively few, 6–14 in each premaxilla, 9–11 in each dentary; longest premaxillary tooth 5.0–14.9% SL, longest dentary tooth 8.8–19.6% SL; dorsal- and anal-fin rays 3; pectoral-fin rays 18–19; caudal-fin rays 9, ninth ray (ventralmost) 18.6–22.6% SL (Table 1). Remaining description as given for the genus.

Acentrophryne dolichonema, new species

Figure 2, Table 1

Holotype.—HUMZ 175257, 105 mm, R/V SHINKAI-MARU, Eastern Tropical Pacific, off Peru, 8°10.6–11.9'S, 80°32.0–32.4'W, Bacalao Trawl-net-586 MSK (non-closing otter trawl), bottom depth 1061–1105 m, 27 April 2000.

Paratypes.—HUMZ 167353, 56 mm, R/V SHINKAI-MARU, Eastern Tropical Pacific, off Peru, 9°28.4–27.0'S, 79°33.5–34.8'W, Bacalao Trawl-net-586 MSK (non-closing otter trawl), bottom depth 201–223 m, 30 July 1999; HUMZ 189134, 55 mm, R/V HUMBOLDT, Eastern Tropical Pacific, off Peru, 8°44.00–42.98'S, 80°06.66–07.16'W, Nordsea Balloon Trawl (non-closing otter trawl), bottom depth 966 m, 9 October 2003.

Diagnosis.—Metamorphosed females of *A. dolichonema* differ from those of *A. longidens* in having a much longer distal escal appendage (27.6–35.7% SL vs. 2.3–2.5% SL), a longer illicium (63.6–70.5% SL vs. 35.7–54.9% SL), a narrower head (25.0–28.1% SL vs. 35.7–37.3% SL), and fewer pectoral-fin rays (16 vs. 18–19).

Description.—Metamorphosed females with body short, globular, head length 56.4–66.7% SL, head depth 53.6–54.5% SL, head width 25.0–28.1% SL; length of premaxilla 45.7–51.8% SL; length of lower jaw 50.9–57.1% SL; length of illicium 63.6–70.5% SL; width of escal bulb 6.7–7.1% SL; an elongate distal escal appendage, constricted at base, tapering gradually to form a smooth rounded distal tip, length 27.6–35.7% SL (Fig. 2, Table 1). Jaw teeth relatively few, 15–26 in each premaxilla, 10–16 in each dentary; longest premaxillary tooth 9.5–11.0% SL, longest dentary tooth 15.7–18.1% SL; dorsal- and anal-fin rays 3; pectoral-fin rays 16; caudal-fin rays 9, ninth ray (ventralmost) 10.5–17.3% SL (Table 1). Remaining description as given for the genus.

Etymology.—The name *dolichonema* is derived from the Greek *dolichos*, meaning long, and *nema*, meaning filament or thread, in allusion to the long, filamentous, distal escal appendage of this species.

Acentrophryne sp.

Acentrophryne longidens. Pietsch and Lavenberg (1980):906, Figs. 1, 2 (first known fossil ceratioid, Late Miocene of California).

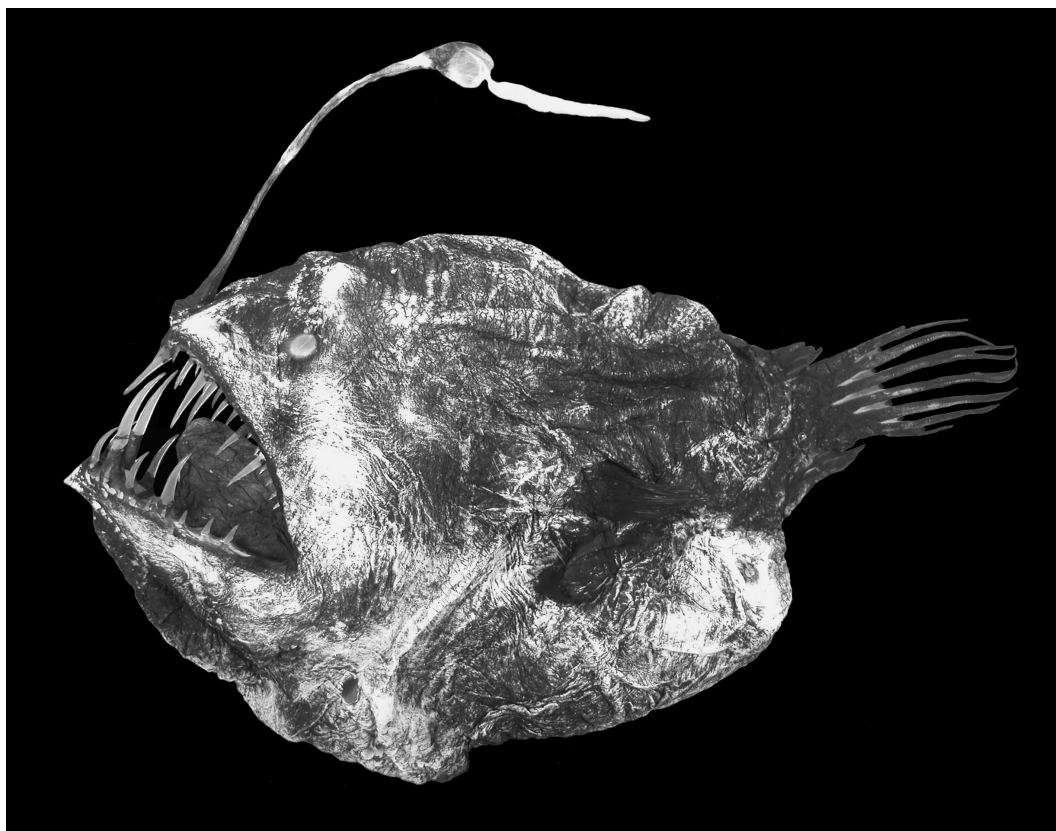


Fig. 2. *Acentrophryne dolichonema* n. sp., holotype, HUMZ 175257, 105 mm SL.

Material.—Fossil female from the Late Miocene of California: LACM, Department of Vertebrate Paleontology, 117685, accession no. A-6839-78-167, 28 mm, finely laminated, light to medium brown diatomite, Clarendonian, Late Miocene (7.2–8.6 Mya), Puente Formation, Locality No. 6908, Chalk Hill, Hacienda Heights, Los Angeles County, California, August 1977.

Remarks.—Although lophioid and antennarioid fishes are well known from Pliocene and Eocene deposits (*Lophius budegassa* Arambourg, Lower Pliocene of Algeria; *L. brachysomus* Agassiz, Eocene of Monte Bolca, Italy; *Histionotophorus bassani* [De Zigno], Monte Bolca), the fossil of *Acentrophryne* from the Late Miocene Puente Formation of Southern California, described by Pietsch and Lavenberg (1980), was the first known fossilized ceratioid. Easily recognized as a female ceratioid by the presence of an illicium and the absence of pelvic fins, the fossil clearly belongs to the family Linophrynidae in having three dorsal- and three anal-fin rays, three pectoral radials, and a single-headed hyomandibu-

lar bone; and to the genus *Acentrophryne* in the absence of a preopercular spine and in having an elongate illicium (Pietsch and Lavenberg, 1980). Because *Acentrophryne* was considered monotypic at the time, the fossil was initially described as *A. longidens*, but in light of the new species described here, the fossil, lacking the information required for specific identification, is here referred to as *Acentrophryne* sp.

Between January and November 1993, about a dozen additional ceratioid fossils were collected from this same formation during earth-moving activities associated with construction of the Metro Rail Red Line, Wilshire Boulevard/Vermont Avenue Subway Station, in Los Angeles. Unfortunately, this material, donated by the Los Angeles Metropolitan Transportation Authority, is rather poorly preserved and currently remains unidentified in the collections of the Department of Vertebrate Paleontology (LACM). The Puente Formation and other southern California diatomite deposits are well known for their meso- and bathypelagic fishes (see Jordan, 1925; Crane, 1966).

DISTRIBUTION

All known material of *Acentrophryne*, including the fossil, was collected in the Eastern Pacific, the five extant specimens all taken in deep tropical waters of this ocean. The two known specimens of *A. longidens* are from the Gulf of Panama (7°30'N, 79°19'W) and from off the coast of Costa Rica (9°11'N, 85°08'W), whereas the three specimens of *A. dolichonema* were all captured farther south, in very close proximity to each other, off the coast of Peru (approximately 8°10'–9°28'S, 79°33'–80°32'W). All were taken in nets fished open between the surface and depths that vary widely, from as shallow as 201 m to as deep as 1280 m. It is significant, however, that the two specimens of *A. longidens* were taken by pelagic gear fished far off the bottom, whereas all three specimens of *A. dolichonema* were captured by bottom trawls at depths ranging from 201 to 1105 m.

DISCUSSION

Acentrophryne dolichonema is distinguished from *A. longidens* by having a much longer distal escal appendage, but it might be argued that the two known specimens of *A. longidens* are simply *A. dolichonema* that have lost the distal escal appendage at some time prior to capture. However, it seems highly unlikely that this could have happened without leaving some evidence of damage, even given ample time for healing and possible tissue regeneration. The short, papilla-like, distal escal appendage of both specimens of *A. longidens* is nearly identical, tapering quickly to form a smooth, rounded distal termination. The two species are further separated by a difference in illicial length. Because the two specimens of *A. longidens* are small (42–50 mm) and all known individuals of *A. dolichonema* are somewhat larger (55–105 mm), it might be argued further that *A. longidens* represents juvenile specimens of the latter. However, if this were true it would necessitate an extremely rapid ontogenetic increase in illicial length, the evidence for which is lacking in all other lophiiform fishes for which adequate material has been studied. These two characters, coupled with distinct differences in the width of the head and in pectoral-fin ray counts, strongly indicate the existence of two species. It should be pointed out also that the two species probably occupy different habitats: the known material of *A. longidens* was taken in pelagic nets fished far above the bottom, whereas all three specimens of *A. dolichonema* were captured in bottom trawls.

KEY TO METAMORPHOSED FEMALES OF SPECIES OF *Acentrophryne*

- 1a. Distal appendage of esca short (2.3–2.5% SL), illicium short (35.7–54.9% SL), head wide (35.7–37.3% SL), pectoral-fin rays 18–19 (Fig. 1) *Acentrophryne longidens* Regan, 1926
(Two known specimens, 42–50 mm, Gulf of Panama and Pacific coast of Costa Rica)
- 1b. Distal appendage of esca long (27.6–35.7% SL), illicium long (63.6–70.5% SL), head narrow (25.0–28.1% SL), pectoral-fin rays 16 (Fig. 2) *Acentrophryne dolichonema* n. sp.
(Three known specimens, 55–105 mm, off Peru)

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