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Deepwater Indo-Pacific species of the snake-eel genus *Ophichthus* (Anguilliformes: Ophichthidae), with the description of nine new species

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Abstract

The 19 Indo-Pacific species of the snake-eel genus *Ophichthus* (family Ophichthidae, subfamily Ophichthinae) that live at or below 200 m are reviewed. Included are: *Ophichthus aphotistos*, *O. brachynotopterus*, *O. echeloides*, *O. exourus*, *O. genie*, *O. kunaloa*, *O. megalops*, *O. mystacinus*, *O. serpentinus*, *O. urolophus*, and nine new species which are described: *O. alleni* from 115–200 m off eastern Australia; *O. aniptocheilos* from 391–421 m off Tonga; *O. congroides* from 300 m off the Tuamotu Islands; *O. hirritus* from 600 m off the Seychelle Islands; *O. humanni* from 254–300 m off Vanuatu; *O. ishiyamorum* from 258–400 m off the Gulf of Aden, Somalia; *O. lentiginosus* from 400 m off Vanuatu and New Caledonia; *O. microstictus* from 362–450 m off Tonga, Fiji, and possibly New Caledonia; and *O. tomioi* from 300–423 m off the Philippines, Marquesas, Fiji, and the Seychelle Islands. The range and depth distributions of the following are expanded to include: *O. brachynotopterus* to New Caledonia and Vanuatu between 541–580 m; *O. mystacinus* to Tonga, Fiji, and the Philippines between 371–824 m; and *O. urolophus* to Western Australia and Indonesia between 40–420 m. An identification key is provided. Characteristics and the behavior of species of the subgenus *Coecilophis*, to which all treated species except *O. aphotistos* belong, is discussed. *Ophichthys madagascariensis* Fourmanoir (1961) is proposed to be a junior synonym of *Pisodonophis cancrivorus* (Richardson 1848).

Key words: Pisces, Ophichthidae, deepwater *Ophichthus*

Introduction

The snake eels of the tropical and subtropical eel family Ophichthidae are the most species rich of anguilliform fishes, comprising as many as 260 species worldwide (McCosker *et al*., 1989, and unpublished data). Ophichthids occupy a variety of marine habitats, ranging from midwater to reefs to sand and mud substrates, usually at depths less than 100 m. The genus *Ophichthus*, currently known from approximately 66 valid nominal species (Eschmeyer, 2010), is the largest in the family and typifies the range of habitats and depths occupied, ranging from tidepools to a depth of 1300 m. Several undescribed species of *Ophichthus* have been collected in recent years as a result of deepwater trapping and trawling. My analysis of the specimen holdings of the Muséum National d'Histoire Naturelle, Paris, the United States National Museum of Natural History, the California Academy of Sciences, and the Museum of New Zealand Te Papa Tongarewa have uncovered an additional nine undescribed species from depths at or below 200 m.

During this project I also considered the status of *Ophichthys madagascariensis* Fourmanoir (1961) which was described on the basis of one intact and four digested specimens found in the stomach of an *Etelis carbunculus* caught at 230 m off Iranza Island, Madagascar. The type specimens are apparently lost, but based on its description and coloration I propose that it is a junior synonym of *Pisodonophis cancrivorus* (Richardson, 1848).

All but one (*Ophichthus aphotistos*) of the deepwater Indo-Pacific species of *Ophichthus* belong to the subgenus *Coecilophis*. The subgenus *Coecilophis* Kaup 1856 (type species *Ophisurus apicalis* Anonymous (Bennett) 1830 = *Ophisurus compar* Richardson 1848) was recognized as a subgenus of *Ophichthus* by McCosker (1977). *Ophichthus apicalis* is a widespread shallow-water (to 22 m depth) Indo-Pacific species that shares the specializations of the deepwater Indo-Pacific species treated herein. Five of the 11 species of eastern Pacific species of *Ophichthus* live below 200 m, only one of which (*O. arneutes*, from the Galápagos Islands) is within the subgenus *Coecilophis*. Nine of the 13 species of western Atlantic *Ophichthus* live below 200 m, and only one (*O. brevirostris*, from 406–440 m of North Carolina) is within the subgenus *Coecilophis*. In their description of *O. brevirostris* McCosker and Ross (2007:785) suggested that it and *O. arneutes* may be considered an Amphi-American species pair. The ophichthid fauna of the eastern Atlantic is poorly known and future deepwater trawling and trapping will likely uncover additional new species.

And finally, it is useful to comment on my observations of the behavior of an eastern Pacific species of the subgenus *Coecilophis*. I encountered, observed, and collected *O. arneutes* while diving aboard the manned submersible *Johnson Sea-Link* at 485 m off the Galápagos Islands in 1995 (McCosker & Rosenblatt 1998). It was observed on three occasions at 434–557 m. Individuals were observed feeding somewhat like heterocongrine garden eels, their heads and trunks extending from the sand slopes within which they were buried, picking at passing plankton in the current. They withdrew when frightened by the submersible, leaving

only their snout tips exposed. Species of the subgenus *Coecilophis* are generally pale and weakly pigmented, and some have darkened snouts, chins, and anterior nostrils, whereas others have anterior nostril tubes that are much paler than the surrounding snout. Such coloration may be correlated with camouflage when they are withdrawn into the substrate, and with signaling behavior between those individuals which have contrasting coloration of their snouts and anterior nostril tubes.

Material and methods

Specimen measurements are straight-line, made either with a 300 mm ruler with 0.5 mm gradations (for total length, trunk length, and tail length) and recorded to the nearest 0.5 mm, or with dial calipers (all other measurements) and recorded to the nearest 0.1 mm. Body length comprises head and trunk lengths. Head length is measured from the snout tip to the posterodorsal margin of the gill opening; trunk length is taken from the end of the head to mid-anus; maximum body depth does not include the median fins. Head-pore terminology follows that of McCosker *et al*. (1989: 257), such that the supraorbital pores are expressed as the ethmoidal pore + pores in supraorbital canal, *i.e*., 1+3; and the infraorbital pores are expressed as pores along the upper jaw + those in vertical part of canal behind eye (the "postorbital pores"), *i.e*., 4+2, in that frequently the last pore included along the upper jaw is part of the postorbital series. Vertebral counts (which include the hypural) were taken from radiographs. Radiographic techniques are described in Böhlke (1989). The mean vertebral formula (MVF) is expressed as the average of predorsal, preanal, and total vertebrae (Böhlke 1982). All of the specimens examined in this study had been fixed in formaldehyde; hence genetic analysis of the tissues was not possible. Institutional abbreviations follow the Standard Symbolic Codes for Institutional Research Collections in Herpetology and Ichthyology (Leviton *et al.* 1985).

Key to species of deepwater Indo-Pacific species of *Ophichthus* (living at or below 200 m)

1. DFO (dorsal-fin origin) behind gill opening by more than 2 pectoral-fin lengths; rear margin of orbit above or in advance of rictus 2
   DFO in advance of, above, or slightly behind (less than one pectoral-fin length) gill opening; rear margin of orbit in advance of, not above, rictus 8
2. Base of anal fin pale to tail tip 3
   Base of anal fin blackened approximately 1 head length in advance of tail tip (Figure 1) 5
3. Pectoral fin rounded (Figure 2); rear margin of orbit above rictus of jaw (Figure 3) 4
   Pectoral fin wedge-shaped; rear margin of orbit in advance of rictus of jaw by the length of the eye (Figure 4) ..... *Ophichthus humanni*
4. Head length 11.9–12.6 in TL; 3 preopercular pores ..... *Ophichthus hirritus*
   Head shorter, its length 14.7–15.6 in TL; 2 preopercular pores ..... *Ophichthus serpentinus*
5. Rear margin of orbit slightly in advance of rictus; pectoral fin wedge-shaped or elongate 6
   Rear margin of orbit above or slightly behind rictus; pectoral fin rounded ..... *Ophichthus exourus*
6. Pectoral fin pointed; 3 preopercular pores (Figure 5) ..... *Ophichthus megalops*
   Pectoral fin elongate; 2 preopercular pores (Figure 6) 7
7. Pectoral fin wedge-shaped, its length 3.6–4.0 in head length; jaw length 2.2–2.6 in head length; snout tip black ..... *Ophichthus brachynotopterus*
   Pectoral fin longer, its longest rays filamentous, its length 2.0–2.6 in head length; jaw length 1.8–2.0 in head length; snout area darker, but not blackened, its tip pale ..... *Ophichthus mystacinus*
8. DFO above or less than 0.5 pectoral-fin length behind gill opening; dorsal fin pale; body stout to moderately elongate, its depth at gill opening less than 34 times in TL; lower jaw teeth biserial or uniserial; pectoral fin rounded or elongate 9
   DFO approximately 1 pectoral-fin length behind gill opening; dorsal fin dark; body elongate, its depth at gill opening more than 34 times in TL; lower jaw teeth biserial; pectoral fin rounded ..... *Ophichthus aphotistos*
9. Pectoral fin lanceolate, its dorsal rays filamentous (Figure 7); head length more than 10 in TL 10
   Pectoral fin rounded, paddle-shaped or wedge-shaped, its dorsalmost rays not filamentous; head length less than 10 in TL 14

10. Head length less than 12 in TL; DFO above pectoral fins or slightly behind their tips; total vertebrae less than 200 11
    Head length more than 12.5 in TL; DFO slightly in advance of tips of pectoral fins; total vertebrae more than 200 ... . *Ophichthus congroides*
11. Base of anal fin black in posterior tail region (Figure 1); eye large, 5.4–6.3 in head length 12
    Base of anal fin not blackened in posterior tail region; eye moderate in size, 6.9–8.7 in head length..... ..... *Ophichthus genie*
12. Pectoral fin elongate, its dorsalmost rays filamentous; jaw length/eye length 2.0–3.5..... 13
    Pectoral fin wedge-shaped, lacking filamentous rays; jaw longer relative to eye, jaw length/eye length 3.6–4.2 .... *Ophichthus kunaloa*
13. Lower jaw teeth biserial; snout, nape, and ventral margin of upper lip not darkly pigmented; total vertebrae 166–189 ..... *Ophichthus tomioi*
    Lower jaw teeth uniserial; snout, nape, and ventral margin of upper lip darkly pigmented; total vertebrae 140 .... *Ophichthus aniptocheilos*
14. Pectoral-fin length 2.7–3.8 in head length, 0.8–1.2 in jaw length; 6–9 mandibular pores..... 15
    Pectoral fin shorter, 4.2–4.7 in head length, 0.5–0.7 times in upper jaw length; 9–10mandibular pores..... ..... *Ophichthus alleni*
15. Head length 7.7–10 times in TL 16
    Head longer, 6.7–7.1 times in TL ..... *Ophichthus ishiyamorum*
16. Eye length 8.7–9.8 in head length, 2.8–3.4 in upper jaw; total vertebrae 125–139 17
    Eye length 7.1–7.6 times in head length, 2.4–2.7 times in upper jaw; total vertebrae 140–156 18
17. Dorsal-fin origin slightly ahead of end of pectoral fins; jaw teeth biserial; total vertebrae 125 .... *Ophichthus echeloides*
    Dorsal-fin origin slightly behind end of pectoral fins; jaw teeth uniserial; total vertebrae 134–139 .... *Ophichthus urolophus*
18. Dorsal-fin origin slightly ahead of end of pectoral fins; irregular faint white blotches along ventral surface of trunk; maxillary dentition uniserial for some of its length; total vertebrae 151–156..... *Ophichthus microstictus*
    Dorsal-fin origin slightly behind end of pectoral fins; ventral surface of trunk lacks irregular white blotches; maxillary dentition biserial throughout its length; total vertebrae 140–142 ..... *Ophichthus lentiginosus*

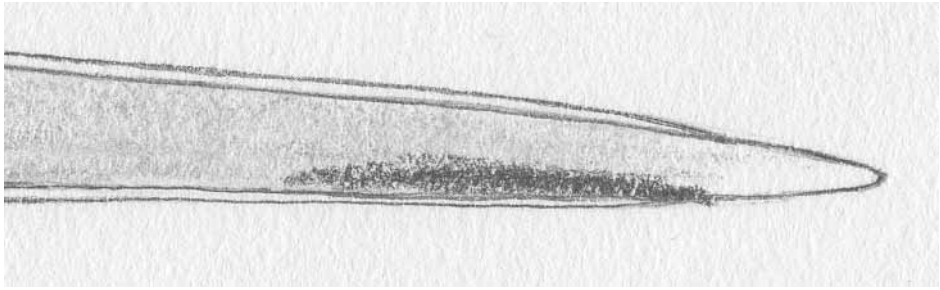

FIGURE 1. Anal-fin base blackened posteriorly.

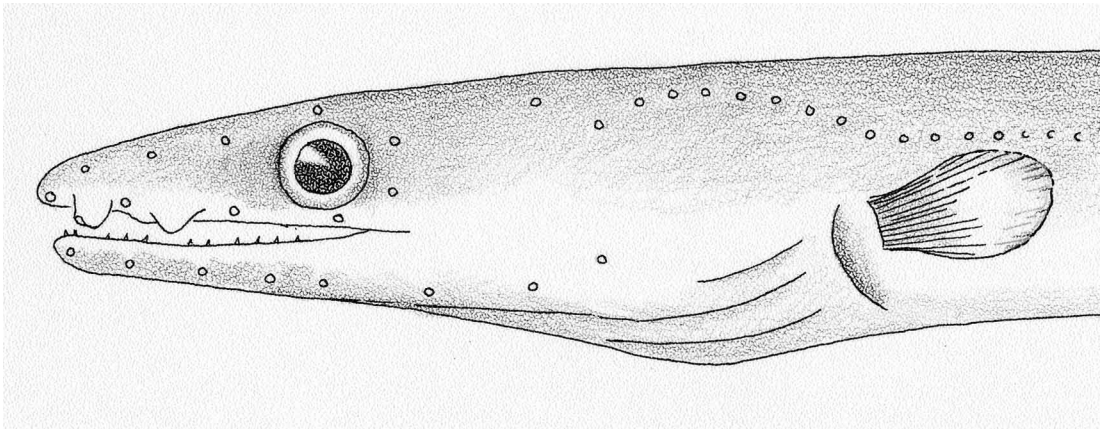

FIGURE 2. Pectoral fin rounded.

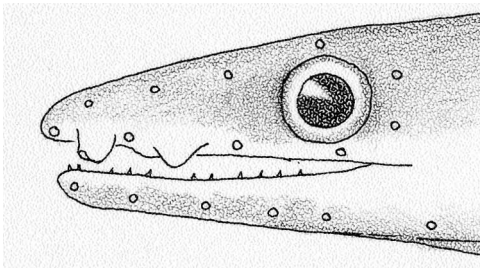

FIGURE 3. Rear margin of orbit above rictus of jaw.

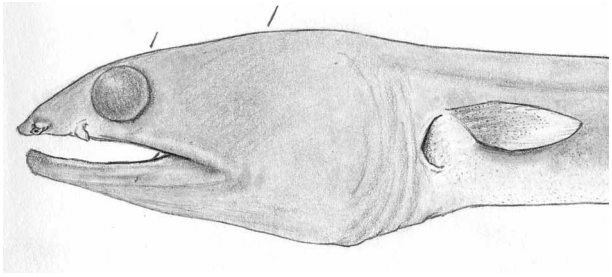

FIGURE 4. Pectoral fin wedge-shaped; rear margin of orbit in advance of rictus of jaw.

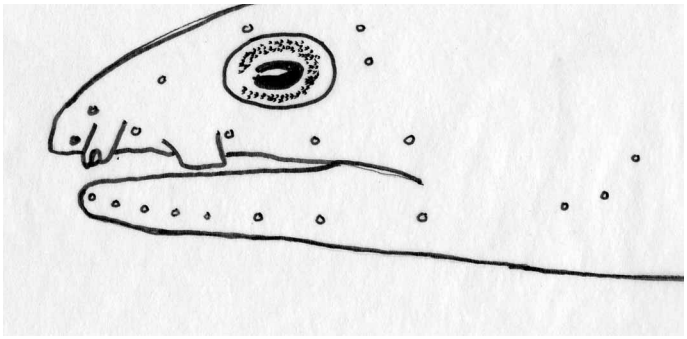

FIGURE 5. Three preopercular pores.

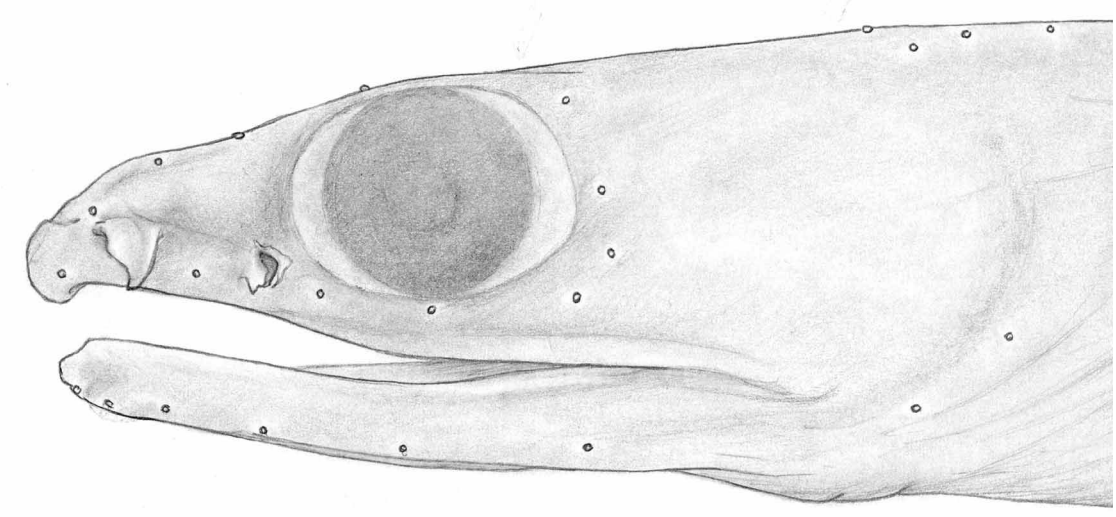

FIGURE 6. Two preopercular pores.

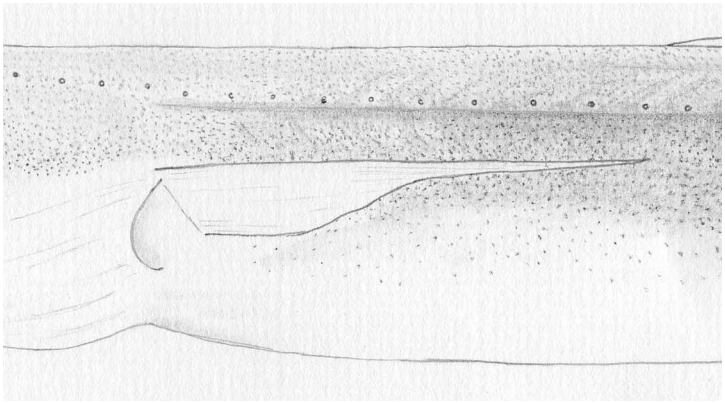

FIGURE 7. Pectoral-fin rays filamentous.

***Ophichthus alleni* sp. nov.**
Figures 8–10, Table 1

Holotype. AMS I.36257-001, 674 mm, female, from off Newcastle, New South Wales, Australia, trawled between 33º01'S, 151º59'E and 33º03'S, 152º01'E in 118–121 m, Field no. K 94-220-08, aboard *FRV Kapala* by K. Graham, at 0635 hrs on 09 Sept. 1994.

Paratypes. CAS 227496 (previously AMS I.34211-001), 760 mm, female, from off Newcastle, New South Wales, Australia, trawled between 33º01'S, 151º56'E and 33º01'S, 151º59'E in 115–121 m, aboard *FRV Kapala* by K. Graham, on 02 Mar. 1993; CSIRO H 1102-2, 574 mm, female, SE of Cairns (17º43'S, 146º49'E), Queensland, Australia, Field no. S00685/53, lobster trawl in 200 m, 30 Nov. 1985.

Diagnosis. A stout species of *Ophichthus*, subgenus *Coecilophis*, with: tail 57% and head 12% of total length; dorsal-fin origin above pectoral-fin base; pectoral fins small, rounded; posterior nostril in upper lip, covered by a flap; head pores minute, numerous, SO 1+4, IO 4+3, POM 3+9-10; teeth small and pointed, none elongate, uniserial on mandible and posterior half of vomer, biserial on maxillary; coloration pale, slightly darker dorsally, median fins pale. Mean vertebral formula 11/52.5/132, total vertebrae 131–133 (n=3).

Counts and measurements (in mm) of the holotype. Total length 674; head 80; trunk 210; tail 384; predorsal distance 83; pectoral-fin length 18.0; pectoral-fin base 6.8; body depth at gill openings ~30; body width at gill openings ~28; body depth at anus ~30; body width at anus ~27.5; snout 14.8; tip of snout to rictus 26.1; eye diameter 7.2; interorbital distance 10.6; gill-opening height 8.3; isthmus width 19.7. Vertebral formula 10/52/131.

Description. Body stout (Figure 8), compressed in tail region, depth at gill openings 21–23 in TL. Branchial basket wider and deeper than body. Head and trunk short, 2.3 in TL; head 8.4–8.5 in TL, 2.6–2.7 in trunk. Snout not elongate, rounded when viewed from above. Snout not bisected on underside by a groove. Jaws subequal, upper and lower lips meet when mouth is closed. Mouth not elongate, rictus about 1/2 eye length behind rear margin of eye. Eye 3.4–4.9 in upper jaw and 10–11 in head, its center well behind middle of upper jaw. Tube of anterior nostril short, hardly capable of being deflected forward. Lip barbels absent. Posterior nostril a hole above upper lip, completely covered by a flap that extends below edge of lip. Dorsal-fin origin above pectoral fin, above or slightly behind pectoral base. Median fins low, in grooves that deepen posteriorly for their entire length. Pectoral fins rounded, not elongate, less than jaw in length. Pectoral-fin base in upper half of gill opening.

Head pores (Figure 9) numerous, small and inconspicuous. Single median interorbital and temporal pores. Supraorbital pores 1+4, infraorbital pores 4+3, lower jaw pores 9–10 (the third slightly enlarged), preopercular pores 3. Numerous minute (approximately 1/2 cephalic pore diameter) surface sensory neuromasts along cheeks and nape. Lateral-line pores minute, very difficult to enumerate.

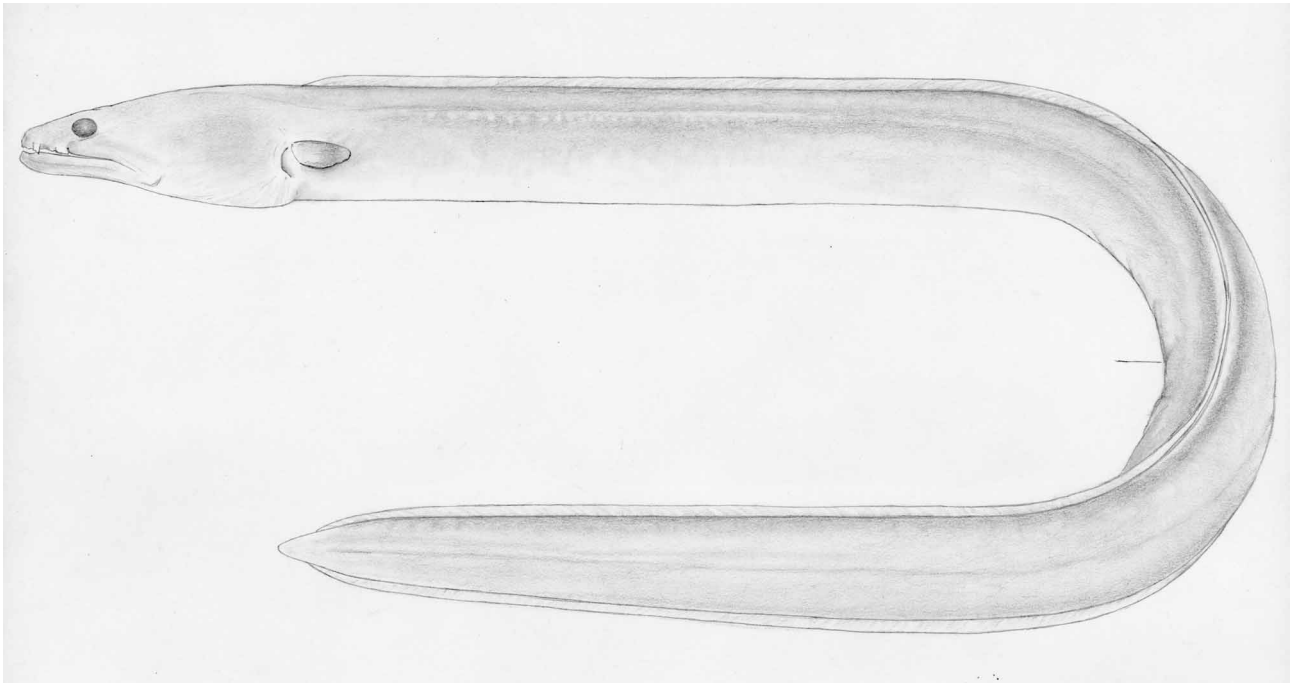

FIGURE 8. Holotype of *Ophichthus alleni,* AMS I. 36257-001, 674 mm, from Australia.

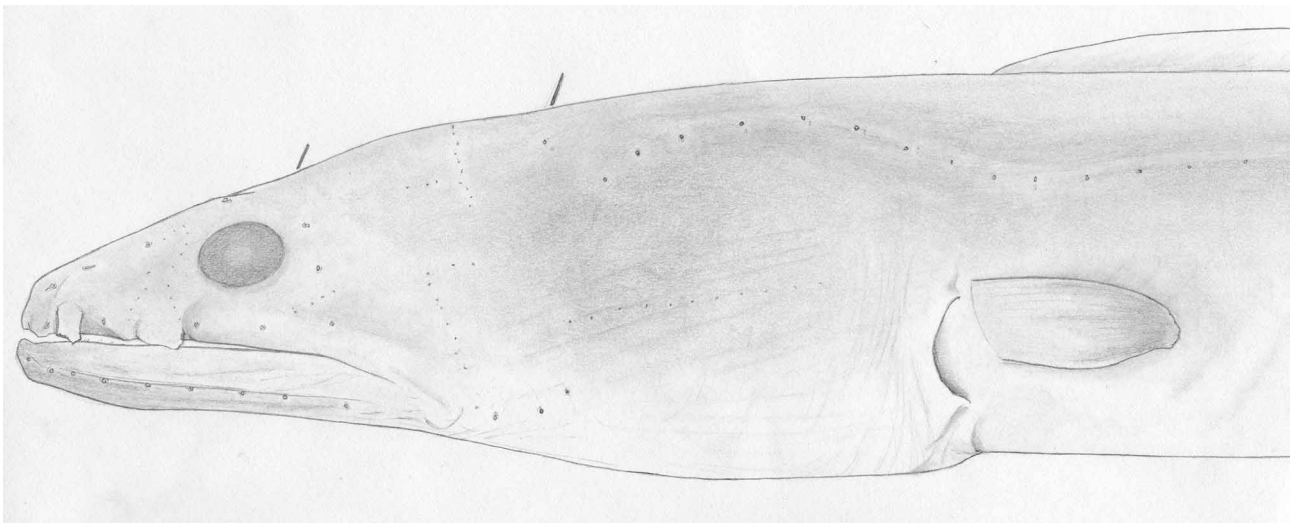

FIGURE 9. Head of holotype of *Ophichthus alleni*, AMS I. 36257-001, 674 mm.

Teeth (Figure 10) small and pointed, not close set, none elongate. Intermaxillary with a rosette of 7 small teeth, then 3 irregular pairs, followed by a nearly linear row of 13 small teeth on the vomer, becoming smaller posteriorly. Maxillary dentition biserial. An inner row of 8–11 teeth begins behind level of anterior nostril, flanked by an outer row of 25–27 teeth, becoming smaller and closer set posteriorly. Mandibular teeth in a single row of 27–29 teeth, becoming smaller posteriorly, flanked by a short anterior inner row of 4–5 teeth.

Color in ethanol uniform tan, darker dorsally, without markings, paler ventrally in head and trunk regions. Throat, inside of mouth and median fins pale. Snout, anterior nostrils and nape darker like dorsal surface of trunk and tail. Pectoral fins tan. Anus within a gray-brown halo equal to diameter of orbit. Peritoneum pale.

Size. Largest known specimen is 760 mm. All types are ovigerous females.

Etymology. I take pleasure in naming this new species *alleni* to honor Gerald R. Allen, in recognition of his numerous and diverse contributions to the knowledge of fishes of Australia and beyond.

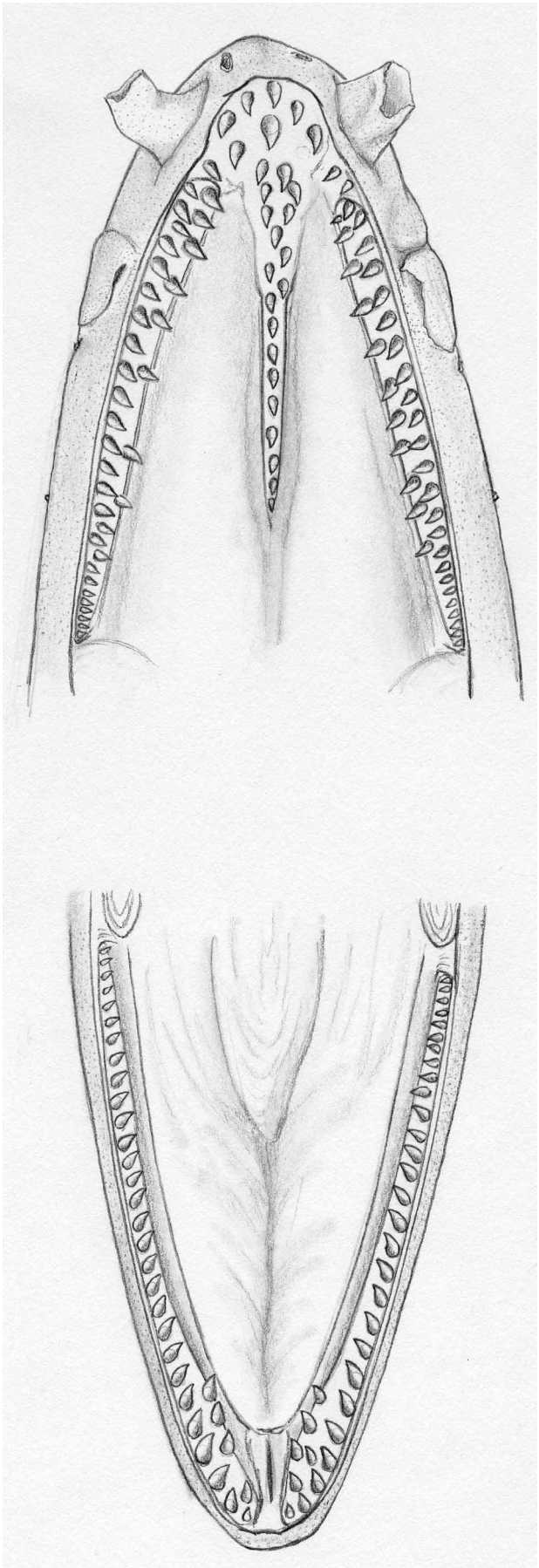

FIGURE 10. Dentition of holotype of *Ophichthus alleni*, AMS I. 36257-001, 674 mm.

TABLE 1. Counts and proportions (in thousandths) of the holotype and two paratypes of *Ophichthus alleni* **sp. nov.** TL = total length. HL = head length.

	Mean	Range
TL (mm)	---	574–760
HL/TL	118	117–119
Head and trunk/TL	431	430–434
Tail/TL	569	566–570
Depth at gill opening/TL	45	44–46
Dorsal-fin origin/TL	132	123–138
Pectoral-fin length/HL	225	213–236
Upper jaw/HL	374	326–444
Snout/HL	187	173–204
Eye/HL	94	90–103
Predorsal vertebrae	11	10–12
Preanal vertebrae	52.5	52–53
Total vertebrae	132	131–133

Distribution. Known from Queensland and New South Wales, Australia, trawled and trapped between 115–200 m.

Remarks. The new species is most similar to *Ophichthus echeloides* and *O. urolophus*. Among the species of the subgenus *Coecilophis* these three are stouter than most (body depth of *O. alleni* is 21-23 in TL, *O. echeloides* is 23.5 in TL, and *O. urolophus* is 21–25 in TL), have a dorsal-fin origin slightly behind the pectoral-fin base (slightly more so in *O. urolophus*), rounded pectoral fins, fewer total vertebrae than most *Coecilophis* (*O. alleni* has 131–133, *O. echeloides* 125, and *O. urolophus* 134–139), uniserial mandibular dentition, and three preopercular pores. The location and proportions of the eye and jaw to each other and to the head length are also very comparable. *Ophichthus alleni* and *O. echeloides* have biserial maxillary dentition, whereas that of *O. urolophus* is mostly uniserial.

Ophichthus alleni also differs from other *Coecilophis* in the degree of development of its free sensory neuromasts. Whereas other large shallower water ophichthines such as *Ophisurus serpens* (*cf.* Allis 1903: Figs. 1–8) have obvious arrays of papillae along their cheeks and nape, the development appears to be reduced in many of the species of the subgenus *Coecilophis.* The degree of development of free sensory neuromasts is probably related to the soft bottom habitats that they occupy (McCosker 1977: 38). The apparent development of such neuromasts in *O. alleni* may also be related the large size of the specimens.

***Ophichthus aniptocheilos* sp. nov.**
Figures 11–12

Holotype. MNHN 2001-1061, 142 mm, sex not apparent, from Tonga (21°40.65'S, 175°19.37'W), Field no. DW 1537, captured by Warren dredge, in 391–421 m on 5 Jun 2000.

Diagnosis. A moderately elongate species of *Ophichthus*, subgenus *Coecilophis*, with: tail 56%, head 10%, and depth at gill openings 3.5% of TL; dorsal-fin origin above pectoral-fin tips; pectoral fins moderate, elongate and lanceolate; posterior nostril in upper lip; head pores small, SO 1+4,IO 4+2, PO 2, mandibular pores 6; teeth slender, pointed, uniserial on vomer and mandible and biserial on maxillary; coloration brown dorsally and pale ventrally, head speckled, tail dark posteroventrally. Mean vertebral formula 16/59/140.

Counts and measurements of holotype (in mm). Total length 142; head 14.5; trunk 27.5; tail 82; predorsal distance 24.3; pectoral-fin length 7.6; pectoral-fin base ~1.2; body depth at gill openings ~5; body width at gill openings ~3.2; body depth at anus 3.8; body width at anus ~3; snout 2.9; tip of snout to rictus 6.2;

eye diameter 2.3; interorbital distance 1.4; gill-opening height ~1.4; isthmus width ~1.5. Vertebral formula 16/59/140.

Description. Body moderately elongate (Figure 11), compressed throughout, depth at gill openings 28 in TL. Branchial basket wider and deeper than body. Head and trunk short, 2.3 in TL; head 9.8 in TL, 1.9 in trunk. Snout moderately acute when viewed from above. Snout not bisected on underside by a groove. Lower jaw included, upper and lower lips meet when mouth is closed. Mouth moderately elongate, rictus about 0.7 eye lengths behind rear margin of eye. Eye 2.7 in upper jaw and 6.3 in head, its center slightly behind middle of upper jaw. Tube of anterior nostril laterally directed. Lips without barbels. Posterior nostril within a short tube barely above upper lip. Dorsal-fin origin slightly behind appressed tip of most elongate pectoral ray. Dorsal fin low, in a groove that deepens posteriorly for its entire length. Anal fin higher, in a groove similar to that of dorsal. Pectoral fins pointed, elongate, longer than jaw, the posterior-most ray an extended filament. Pectoral-fin base in upper half of gill opening.

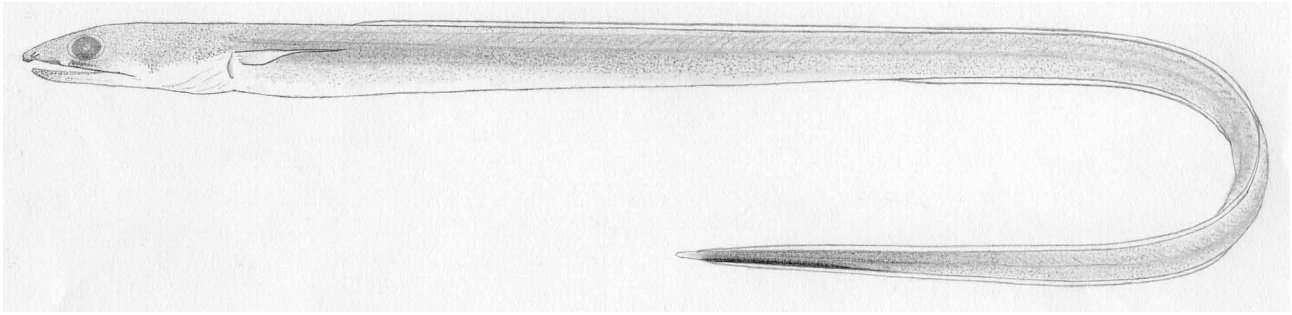

FIGURE 11. Holotype of *Ophichthus aniptocheilos*, MNHN 2001-1061, 142 mm, from Tonga.

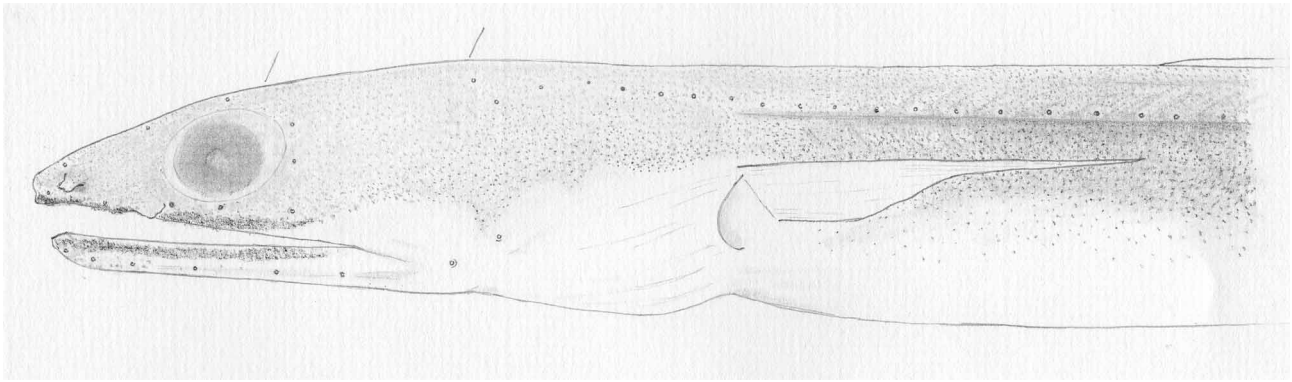

FIGURE 12. Head of holotype of *Ophichthus aniptocheilos*, MNHN 2001-1061, 142 mm.

Head pores (Figure 12) small, inconspicuous. Single median interorbital and temporal pores. Supraorbital pores 1+4, infraorbital pores 4+2, lower jaw pores 6 (difficult to discern), preopercular pores 2. Lateral-line pores present but difficult to enumerate, 8 before gill opening.

Teeth mostly small, conical. (Dentition was not illustrated in order to avoid damage to the specimen.) Intermaxillary with a rosette of 3 small teeth, followed by a gap, then 3 irregular, larger erect pointed teeth, abutted by a nearly linear row of 13 teeth on the vomer, becoming smaller posteriorly. Maxillary dentition biserial. An inner row of about 8–10 slightly recurved teeth begins behind level of posterior nostril. An outer row of 22–24 smaller erect teeth commences at level of anterior margin of eye. Mandibular teeth small, close set, about 32–33 in a single row.

Color in ethanol brown on dorsal surface and flanks resulting from numerous fine brown punctations. Throat, chin anteromedial edge of anterior nostrils pale; head and mid-ventral chin region overlain with brown speckling, densest along edge of lips. Inside of mouth, lateral-line pores, and all fins and tail tip pale. Base of anal fin blackened posteriorly, extending about 1/2 HL before tail tip. Peritoneum pale, overlain with numerous dark punctations comparable in size to those of flanks.

Size. Known from a single apparently juvenile (gonads undeveloped) specimen.

Etymology. From the Greek *aniptos* (unwashed) and *cheilos* (lips), in reference to its facial coloration; to be treated as a noun in apposition.

Distribution. Known from the holotype, taken in 391–421 m from off Tonga.

Remarks. I am hesitant to describe this single small specimen as new, however it is so unique in several of its characteristics that I presume that the adult, when discovered, will be easily identifiable.

The new species is similar to other species of *Ophichthus*, subgenus *Coecilophis*, which also occupy deep sand and mud substrates. All possess small dentition, posterior nostrils along the lip (rather than opening into the mouth) and proceeded by a flap, two rather than three preopercular pores, a lanceolate pectoral fin, and a plain coloration, some with a dark smudge along the anal fin near the tail tip. Its closest relatives appear to be *Ophichthus genie*, described from 350–500 m specimens from New Caledonia and the Maldives (McCosker 1999), *O. kunaloa*, a deepwater Hawaiian species (McCosker 1979, 2002), and *O. tomioi*, described herein from specimens from the Seychelles, Fiji, the Philippines, and the Marquesas. *Ophichthus genie* is most similar in vertebral number (139–147 *vs*. 140) and proportions, but differs in having biserial rather than uniserial mandibular dentition, in lacking comparable head spotting, and in having a pale posterior anal-fin base. *Ophichthus kunaloa* is similar in coloration and proportions, but has biserial mandibular dentition and more vertebrae (180–185 *vs.* 140). *Ophichthus tomioi* is similar in proportions and appearance but has biserial mandibular dentition and more vertebrae (166–189 *vs.* 140).

Ophichthus aphotistos McCosker & Chen 2000

Ophichthus aphotistos McCosker & Chen 2000: 354 (Tung-Kong Channel, Taiwan, holotype CAS 209192).

Diagnosis. An elongate species of *Ophichthus*, subgenus *Omochelys*, with: tail 59–60%, head 7.7–8.1%, and body depth at gill opening 2.5–2.9% of TL; dorsal-fin origin behind pectoral fin by the pectoral-fin's length; pectoral fin rounded, not elongate and not well-developed; eye moderate, above center of upper jaw, its posterior margin well ahead of rictus; posterior nostril a hole above the upper lip, covered by a flap that extends to or below edge of mouth; upper lip lacks barbels between anterior and posterior nostrils; pores small but conspicuous, SO 1+4, IO 4+2, POM 2+6; teeth small and conical, biserial on anterior vomer and jaws; coloration uniform gray brown to nearly black, pectoral and median-fin margins gray black; mean vertebral formula 17.6/59/160.3, total vertebrae 158–162 (n= 3).

Size. Largest known specimen is 628 mm, a spent female.

Distribution. Known from the type series, from 700–800 m depth, collected off Taiwan.

Remarks. *Ophichthus aphotistos* is the sole deepwater Indo-Pacific species of the subgenus *Omochelys*. It would not be mistaken for any other deepwater Indo-Pacific *Ophichthus* on the basis of its elongation, posterior dorsal-fin origin, biserial jaw dentition and vertebral formula. The holotype of *O. aphotistos* has 18/59/161 vertebrae.

Ophichthus aphotistos is most closely related to the deepwater *O. cruentifer* (Goode and Bean 1896) of the northwestern Atlantic Ocean, from which it differs in its coloration and vertebral formula (McCosker & Chen 2000), and to the eastern Atlantic deepwater *O. pullus* McCosker (2005), from which it differs in its dentition, in its head length, dorsal-fin origin, pectoral-fin length, and vertebral number.

Material examined. CAS 209192, the holotype, 580 mm TL, from Tung-Kong Channel, SW Taiwan (22°22'N, 120°19'E), 700–800 m; and USNM 356862, 628 mm, and NSYSU 3657, 480 mm, paratypes, collected with the holotype.

Ophichthus brachynotopterus Karrer 1982

Ophichthus brachynotopterus Karrer 1982:73 (type locality, NE Madagascar, holotype MNHN 1979-21).

Diagnosis. A moderately elongate species of *Ophichthus*, subgenus *Coecilophis*, with: tail 55–59%, head 10.2–10.8%, and depth at gill openings 3.0–3.7% of TL; dorsal-fin origin a head length behind gill opening; pectoral fins wedge-shaped, not elongate; eye large, rear margin of orbit slightly in advance of rictus; posterior nostril a hole in upper lip, barely covered with a flap; head pores minute, not obvious, SO 1+4, IO 4+2, POM 2+6; teeth small, numerous, biserial on jaws, uniserial on vomer; coloration tan, pale ventrally, snout tip dark, anterior nostrils and fins pale, anal-fin base black posteriorly; mean vertebral formula 24.5/60/172, total vertebrae 167–178 (n=5).

Size. To 461 mm, a male.

Distribution. Known from Madagascar, New Caledonia and Vanuatu, at depths between 355–580 m.

Remarks. The holotype of *Ophichthus brachynotopterus* was reported by Karrer (1982: 75) to have 178 total vertebrae and its dorsal-fin origin "at the level of the 27–31 vertebra". The paratype was reported to have 72–74 abdominal vertebrae and 104 caudal vertebrae. Originally described from Madagascar, subsequent material from the collections of the MNHN include specimens from New Caledonia and Vanuatu, trawled at depths between 541–580 m.

Material examined. MNHN 1979-21, the holotype, 438 mm, Madagascar, Nosy-Bé (13ºS, 48ºE), 355–428 m. And paratypes: MNHN 1979-22, 442 mm, and MNHN 1979-23, 413 mm, collected with the holotype. Other material examined: MNHN 1997-0599, 461 mm, Vanuatu (16º39' S, 168º01'E) 541–577 m, Sta. CP 1050. MNHN 2001-1098, 3(399–454 mm), New Caledonia (21º13'S, 165º55'E), 515–580 m, pelagic net, 12 Mar. 1993.

***Ophichthus congroides* sp. nov.**
Figures 13–15

Holotype. NMNZ P.41177, 522 mm, an immature male, from Akiaki Island (18º33'S, 139º12'W), Tuamotu Islands, Polynesia, trapped in 300 m by J. Poupin on 10 June 1989.

Paratype. CAS 229328, 472 mm, an immature male, captured with the holotype.

Diagnosis. An elongate species of *Ophichthus*, subgenus *Coecilophis*, with: tail 60–63% and head 8.3–8.4% of total length; dorsal-fin origin above mid-pectoral fin; pectoral fins elongate, lanceolate; posterior nostril opens within outer lip, with a small anterior flap; head pores small but apparent, SO 1+4, IO 4+2-3, POM 2+6; teeth small, conical and numerous, biserial anteriorly and uniserial posteriorly on vomer, biserial on maxillary and partially biserial on mandible; coloration uniform brown-gray, paler on ventral and dorsal surfaces, fins pale. Mean vertebral formula 21/76/206, total vertebrae 204–208 (n=2).

Counts and measurements (in mm) of the holotype and those of the paratype (in parentheses). Total length 522 (472); head 43.1 (39.6): trunk 163.9 (137.4); tail 315 (295); predorsal distance 72 (64); pectoral-fin length 18.3 (damaged); pectoral-fin base 3.9 (3.9); body depth ~14.2 (damaged) at gill openings; body width at gill openings ~10.6 (damaged); snout 8.5 (8.1); tip of snout to rictus 18.5 (17.6); eye diameter 7.7 (6.7); interorbital distance 6.9 (6.2); gill-opening height ~4 (~5); isthmus width ~6 (damaged). Vertebral formula 22/77/208 (20/75/204).

Description. Body elongate (Figure 13), compressed in tail region, depth at gill openings 37 in TL. Branchial basket slightly wider and deeper than body. Head and trunk short, 2.5–2.7 in TL; head 11.9–12.0 in TL, 3.5–3.8 in trunk. Snout not elongate, nearly rounded when viewed from above. Snout not bisected on underside by a groove. Lower jaw included, upper and lower lips meet when mouth is closed. Mouth moderately elongate, rictus about one eye length behind rear margin of eye. Eye 2.4–2.6 in upper jaw and 5.6–5.9 in head, its center slightly behind middle of upper jaw. Tube of anterior nostril very short, barely capable of being deflected forward. Lips without barbels. Posterior nostril a hole above upper lip, partially covered along anterior quarter by a minute flap. Dorsal-fin origin slightly above mid-pectoral fin. Median fins very low, in a groove that deepens posteriorly for its entire length. Pectoral fins pointed, dorsal-most rays elongate, nearly equal to jaw in length. Pectoral-fin base in upper half of gill opening.

Head pores (Figure 14) small but apparent. Single median interorbital and temporal pores. Supraorbital pores 1+4, infraorbital pores 4+3 (paratype has 4+2), mandibular pores 6, preopercular pores 2. Lateral-line pores present but difficult to enumerate, 9 before gill opening, 78 before mid-anus.

Teeth (Figure 15) minute, conical. Intermaxillary with a rosette of 6 small teeth, then 6 pairs of erect, pointed teeth, and a linear uniserial row of 11 smaller teeth on the vomer, becoming smaller posteriorly. Maxillary teeth irregularly biserial, an outer row of about 40 teeth flanked by an inner row of 32–33 teeth. Mandibular teeth irregularly biserial, an outer row of 38–40 close-set teeth flanked by an inner row 18–22 teeth.

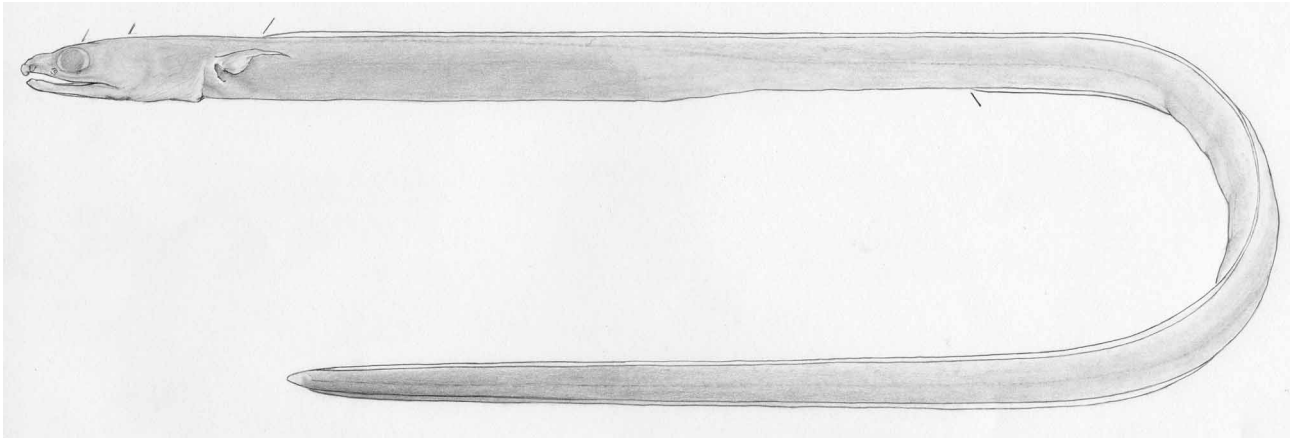

FIGURE 13. Holotype of *Ophichthus congroides*, NMNZ P.41177, 522 mm, from Tuamotu Islands.

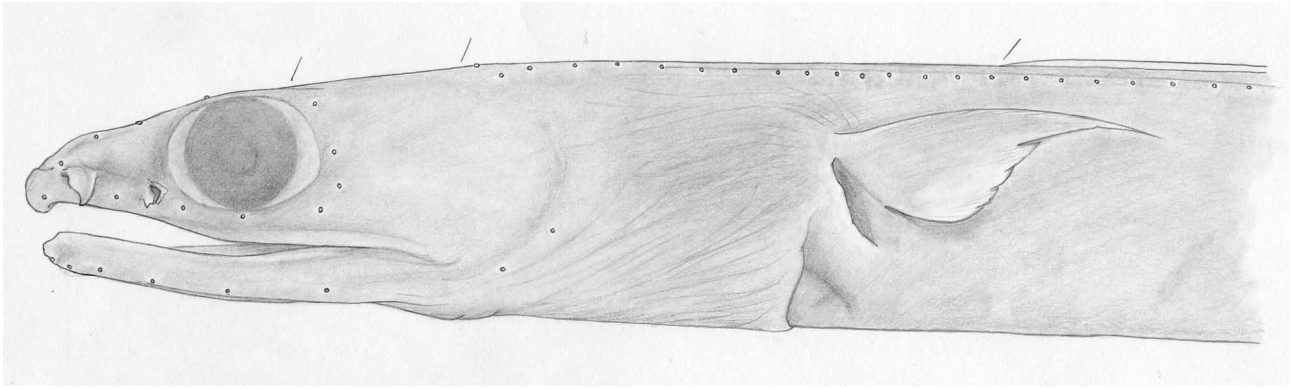

FIGURE 14. Head of holotype of *Ophichthus congroides*, NMNZ P.41177, 522 mm.

Color in isopropanol tan, darker along mid-flanks. Throat region and posterior half of head gray. Belly region grayish-black. Fins pale, except dorsal which is dark about a head length before tail tip. Anterior nostrils, inside of mouth, and tail tip pale. Peritoneum black.

Size. The holotype, an immature male, is 522 mm.

Etymology. Named *congroides* because of the similarity of its posterior nostril condition to that of certain congrids.

Distribution. Known only from the type series, trapped in 300 m off Akiaki Island, Tuamotu Islands, Polynesia.

Remarks. The holotype of the new species is in excellent condition. The paratype has been eviscerated and its pectoral fins are damaged. There is some confusion as to the precise locality of their collection. The collector, Joseph Poupin, had set deep traps and had collected two *Gymnothorax intesi*, presumably along with the new species. He identified the new species as congrids and gave them, along with the morays, to John E. Randall of the Bishop Museum of Natural History. The eels were then loaned to Peter Castle of Victoria University of Wellington, and ultimately deposited at the Museum of New Zealand Te Papa Tongarewa. The paratype was subsequently deposited at the California Academy of Sciences.

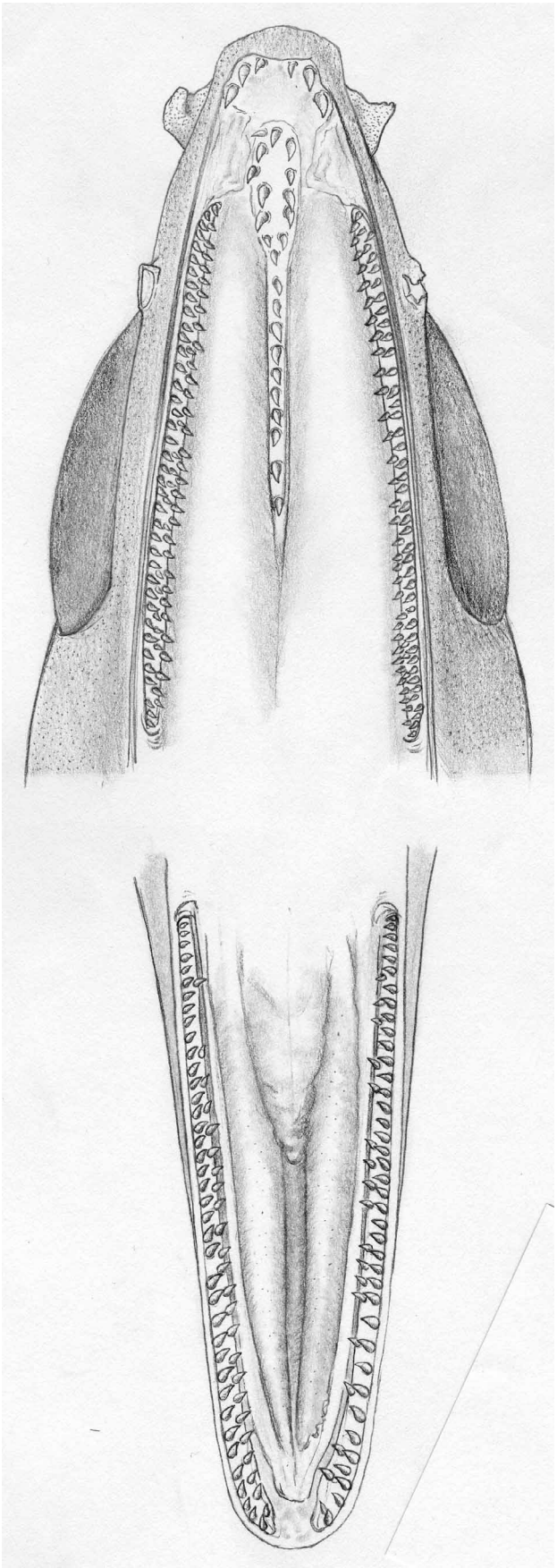

FIGURE 15. Dentition of holotype of *Ophichthus congroides*, NMNZ P.41177, 522 mm.

The new species is most closely related to those species of the subgenus *Coecilophis* with elongate pectoral fins, two preopercular pores, and biserial maxillary and mandibular dentition, *viz. O. aniptocheilos, O. brachynotopterus, O. genie, O. kunaloa, O. mystacinus* and *O. tomioi*. It has more total vertebrae (204–208) than all of those species, and its dorsal-fin origin (slightly in advance of the pectoral-fin tips) is significantly different than that of *O. brachynotopterus* and *O. mystacinus*, which arises in mid-trunk, and that of the other species which arises in advance of the pectoral-fin tips. It is similar to *O. echeloides, O. genie, O. hirritus, O. humanni, O. microstictus, O. serpentinus,* and *O. urolophus* in lacking black pigmentation along the posterior base of the anal fin.

Ophichthus echeloides (D'Ancona 1928)

Leptocephalus echeloides D'Ancona 1928:69, Pl. 4 (type locality, Perim, Red Sea, holotype MSNV P-10).
Ophichthus echeloides: McCosker, Baranes & Golani 1993:165.

Diagnosis. A stout, cylindrical species of *Ophichthus*, subgenus *Coecilophis*, with: tail 58%, head 11.9%, and depth at gill openings 4.2% of TL; dorsal-fin origin above middle of pectoral fin; pectoral fins rounded; posterior nostril in edge of upper lip, covered by a flap; head pores not obvious, SO 1+4, IO 4+2, POM 3+9; teeth small, conical, pointed, uniserial on vomer and biserial in jaws; coloration tan, paler ventrally, fins pale. Vertebral formula 11/50/125 (n=1).

Size. Attains 520 mm, an adult male.

Distribution. From the Red Sea, known from the holotype (a leptocephalus) and an adult male caught by trammel net off Eilat at 276–300 m.

Remarks. This description is based upon the adult specimen from the Red Sea described by McCosker *et al.* (1993). Their description of its left pectoral-fin length (p. 167) was in error; its actual length is 17.8 mm and not 7.8 mm.

Material examined. HUJ 14133, 518 mm TL, Eilat, Red Sea, 300 m.

Ophichthus exourus McCosker 1999

Ophichthus exourus McCosker 1999: 575 (type locality New Caledonia, holotype MNHN 1995-425).

Diagnosis. A moderately elongate species of *Ophichthus*, subgenus *Coecilophis*, with: tail 59–60%, head 8.1–8.3% and greatest body depth 3.4–3.8% of TL; dorsal-fin origin in anterior third of trunk; pectoral fins small, paddle-shaped; posterior margin of orbit above rictus; posterior nostril in upper lip, covered by a flap; cephalic pores small, inconspicuous, SO 1+4, IO 3+2, POM 2+6; teeth conical, numerous and small, biserial on maxillary, uniserial on mandible and vomer; coloration yellowish tan, brown dorsally, the fins pale, membrane of anal fin darkened before tail tip; mean vertebral formula 19.7/60/177.3, total vertebrae 176–179 (n=3).

Size. To 669 mm, a female with developing ova.

Distribution. Known from New Caledonia and from Fiji, at 400–520 m.

Remarks. Originally described from the holotype and a paratype, an additional specimen of *O. exourus* was found in the collection of the MNHN (see below). It agrees in all characters and in its vertebral formula (18/59/179) with those of the type specimens. The holotype has 20/61/176 vertebrae.

Material examined. MNHN 1995-425, the holotype, 590 mm, New Caledonia (18º56'30 S, 163º12'90 E), 520 m. And paratype: CAS 89552, 429 mm, Fiji, Viti Levu, off Suva Barrier Reef, 400 m. Other material examined: MNHN 2001-1062, 525 mm, male, New Caledonia (21.13º'S, 165.55º'W), captured by pelagic trawl in 515–580 m by the Bathus Expedition on 12 Mar. 1993.

Ophichthus genie McCosker 1999

Ophichthus genie McCosker 1999: 577 (type locality New Caledonia, holotype MNHN 1998-43).

Diagnosis. A moderately elongate species of *Ophichthus*, subgenus *Coecilophis*, with: tail 55–58%, head 9.3–10.1%, and depth at gill openings 2.4–3.2% of TL; dorsal-fin origin before pectoral tips; pectoral fins elongate, lanceolate; posterior margin of orbit in advance of rictus; cephalic pores very reduced but discernible, SO 4+1, IO 4+2, POM 2+6–7; teeth small, conical, biserial in jaws and uniserial on vomer; coloration pale, overlain on dorsal half with fine brown punctations, fins pale; mean vertebral formula 14/57/142, total vertebrae 139–147 (n=6).

Size. To 337 mm, a female with developing ova.

Distribution. Known from New Caledonia and the Maldives, at 435–500 m.

Remarks. The holotype of *O. genie* has 14/59/142 vertebrae.

Material examined. MNHN 1998-43, the holotype, 230 mm, New Caledonia (18°57'00 S, 163°12'60 E), 485 m. And paratypes: MNHN 1998-44, 217 mm, CAS 89551, 232 mm, and ANSP 174853, 206 mm, from New Caledonia (18°57'80 S, 163°14'00 E), 435 m; MNHN 1998-45, 196 mm, New Caledonia (18°55'80 S, 163°13'80 E), 500 m; BPBM 34923, 337 mm, Maldive Islands (04°19' N, 72°55' E), 215 m.

Ophichthus hirritus sp. nov.

Figures 16–18, Table 2

Holotype. MNHN 1989-0747, 518 mm, female with developed ova, from Seychelle Is. (04°21'S, 56°19'E), captured by trap in 600 m by A. Intes on 22 Oct. 1987.

Paratypes. CAS 229178 (originally MNHN 1989-0747), 534 mm, female with developed ova, collected with the holotype; MNHN 1989-0749, 528 mm, mature male, from Seychelle Is. (04°34'S, 56°26'E), captured by trap in 600 m by A. Intes on 22 Oct. 1987.

Diagnosis. A moderately elongate, slender species of *Ophichthus*, subgenus *Coecilophis*, with: tail 58–59% and head 7.9–8.4% of total length; dorsal-fin origin 3 pectoral-fin lengths behind gill opening; pectoral fins rounded; posterior nostril a hole in upper lip covered by a flap; head pores inconspicuous, SO 1+4, IO 4+2, POM 3+5; teeth conical, stout and numerous, not enlarged, biserial anteriorly and uniserial posteriorly on vomer, biserial on maxillary and biserial anteriorly on mandible; coloration uniform brown, paler ventrally, fins pale. Mean vertebral formula 19/62/171, total vertebrae 171–172 (n=3).

Counts and measurements (in mm) of the holotype. Total length 518; head 40.9; trunk 173.1; tail 304; predorsal distance 73; pectoral-fin length 9.1; pectoral-fin base 3; body depth at gill openings ~13.5; body width at gill openings ~12; body depth at anus ~13; body width at anus ~11.5; snout 6.7; tip of snout to rictus 12.1; eye diameter 4.7; interorbital distance 4.7; gill-opening height ~4.5; isthmus width ~8. Vertebral formula 19/63/172.

Description. Body moderately elongate (Figure 16), compressed throughout, depth at gill openings 33–38 in TL. Branchial basket slightly wider and deeper than body. Head and trunk short 2.3–2.4 in TL; head 11.9–12.6 in TL, 4.0–4.2 in trunk. Snout rounded when viewed from above. Snout bisected on underside by a groove flanking anteriormost tooth. Lower jaw included; jaws slightly hooked such that jaw teeth are exposed and lips do not meet when mouth is closed. Mouth not elongate, rictus about one-half eye length behind rear margin of eye. Eye 3.2–3.5 in upper jaw and 10.5–10.7 in head, its center well behind middle of upper jaw. Tube of anterior nostril short, hardly capable of being deflected forward. Lips without barbels. Posterior nostril a hole above upper lip, entirely covered by a flap that does not extend to edge of mouth. Dorsal-fin origin approximately 3 pectoral-fin lengths behind gill opening. Median fins low. Pectoral fins rounded, less than jaw in length. Pectoral-fin base in upper half of gill opening.

Head pores (Figure 17) small, inconspicuous. Single median interorbital and temporal pores. Supraorbital pores 1+4, infraorbital pores 4+2, lower jaw pores 5, preopercular pores 3. Lateral-line pores present but difficult to discern.

Teeth (Figure 18) stout, conical, and numerous, not enlarged. Intermaxillary with a rosette of 7–9 teeth surrounding a central tooth, followed by 3, then 2 pairs, then a nearly uniserial row of 15 vomerine teeth descending in size. Maxillary dentition irregularly biserial comprising 18–20 pairs. Mandibular teeth close set, an irregular row of 3–5 teeth followed by 15–17 uniserial teeth. Larger paratype has irregularly triserial teeth in jaws and on vomer, rather than the more regular biserial and uniserial dentition of the holotype and smaller paratype.

Color in ethanol uniform brown, paler on tip of chin, throat and belly. Anterior nostrils pale. Lips with a faint brown edging along posterior half. All fins pale. A large indistinct white spot surrounds anus. Peritoneum pale.

TABLE 2. Counts and proportions (in thousandths) of the holotype and two paratypes of *Ophichthus hirritus* **sp. nov.** TL = total length. HL = head length.

	Mean	Range
TL (mm)	---	518–534
HL/TL	81	79–84
Head and trunk/TL	416	412–422
Tail/TL	584	578–588
Depth at gill opening/TL	27	26–29
Dorsal-fin origin/TL	147	139–161
Pectoral-fin length/HL	241	219–283
Upper jaw/HL	312	296–335
Snout/HL	201	164–225
Eye/HL	94	93–95
Predorsal vertebrae	19	18–21
Preanal vertebrae	62	61–63
Total vertebrae	171	171–172

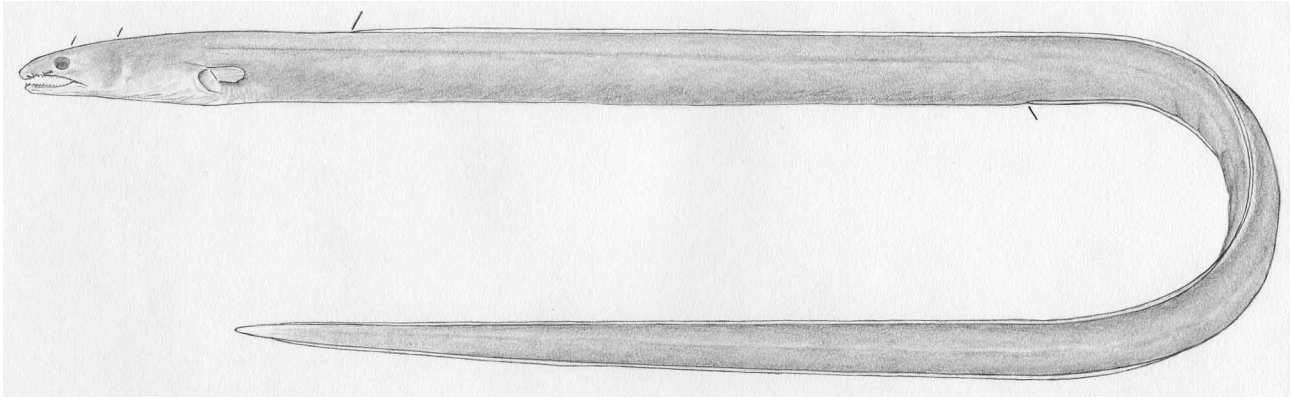

FIGURE 16. Holotype of *Ophichthus hirritus*, MNHN 1989-0747, 518 mm, from Seychelle Islands.

Size. Largest known is a 530 mm female with developed ova.

Etymology. From the Latin *hirritus*, to snarl like a dog, in reference to its facial appearance.

Distribution. Known from three specimens trapped in 600 m off the Seychelle Islands.

Remarks. The new species is most similar to *Ophichthus serpentinus* Seale (1917) but differs in having a longer head (11.9–12.6 *vs.* 14.7–15.6 in TL), a slightly more posterior dorsal-fin origin, slightly more total vertebrae (171–172 *vs.* 162–167), and in having 3 rather than 2 preopercular pores. The new species differs from many of its deepwater congeners in having a rounded pectoral fin, a short upper jaw, a posterior eye location relative to the rictus, and in that its anal-fin base is pale rather than darkened posteriorly.

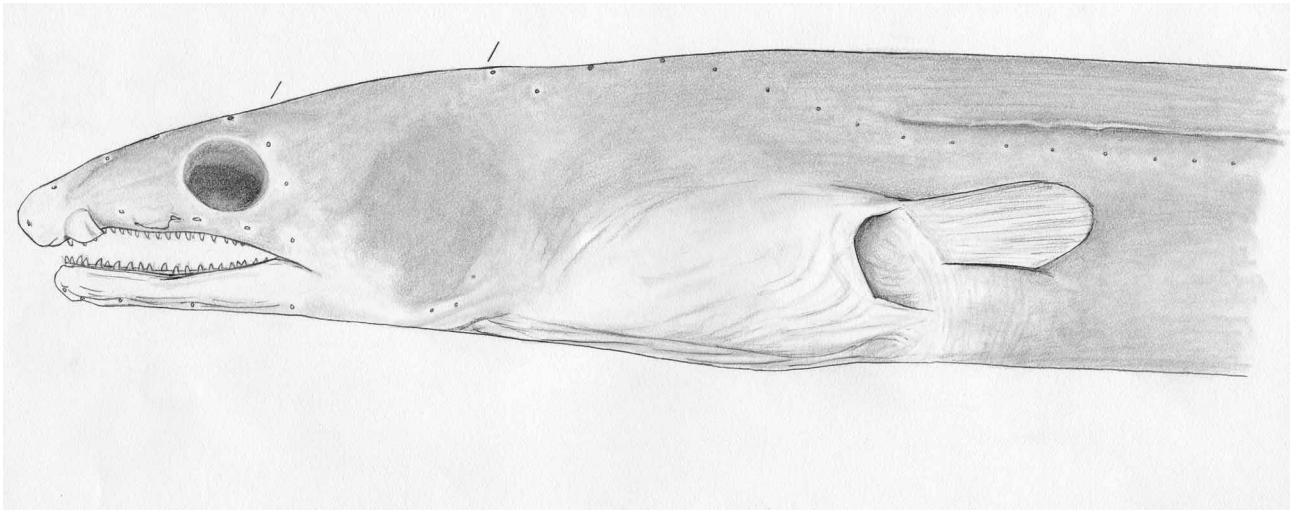

FIGURE 17. Head of holotype of *Ophichthus hirritus*, MNHN 1989-0747, 518 mm.

***Ophichthus humanni* sp. nov.**
Figures 19–21

Holotype. MNHN 1997-0600, 669 mm, a male, from Vanuatu (15º08'S, 166º53'E), Campaigne Musorstom 8, 1994, Sta. CP 1119. captured by otter trawl in 254–300 m in Oct. 1994.

Diagnosis. An elongate species of *Ophichthus*, subgenus *Coecilophis*, with: tail 54% and head 8% of total length; dorsal-fin origin 3.5 pectoral-fin lengths behind head; pectoral fins rounded, not elongate; posterior nostril in upper lip, covered by a flap; head pores minute, SO 1+2, IO 4+2, POM 2+6; teeth pointed, stout, not numerous, irregularly biserial on vomer and maxillary, mostly uniserial on mandible; coloration uniform tan, pale ventrally, fins pale. Vertebral formula 19/70/168.

Counts and measurements (in mm) of the holotype. Total length 669; head 54; trunk 252; tail 363; predorsal distance 101; pectoral-fin length 13.4; pectoral-fin base 3.8; body depth at gill openings ~16.5; body width at gill openings ~15; body depth at anus ~16; body width at anus ~15; snout 10.7; tip of snout to rictus 20.4; eye diameter 5.0; interorbital distance 7.5; gill-opening height 6.2; isthmus width 7.5. Vertebral formula 19/70/168.

Description. Body elongate (Figure 19), compressed in posterior tail region, depth at gill openings 40.5 in TL. Branchial basket wider and deeper than body. Head and trunk 2.2 in TL; head 12.3 in TL, 4.7 in trunk. Snout not produced, rounded when viewed from above. Snout not bisected on underside by a groove. Jaws subequal. Lips do not meet when mouth is closed. Mouth moderately elongate, rictus about 1.5 eye lengths behind rear margin of eye. Eye 4.1 in upper jaw and 11 in head, its center slightly behind middle of upper jaw. Tube of anterior nostril reaches middle of lower lip. A small rectangular patch between anterior and posterior nostrils, slightly slit in advance of posterior-nostril flap. Posterior nostril a hole above upper lip, entirely covered by a flap that extends well below edge of lip. Dorsal-fin origin far behind pectoral-fin tips, nearly a head length behind gill openings. Median fins low, lying in grooves. Pectoral fins rounded, not elongate, about 1.5 in jaw length. Pectoral-fin base in upper half of gill opening. Tail tip barely pointed, nearly blunt, slightly expanded dorsally and ventrally.

Head pores (Figure 20) small, inconspicuous. Single median interorbital and temporal pores. Supraorbital pores 1+2 (posteriormost appears to be missing), infraorbital pores 4+2, lower jaw pores 6, preopercular pores 2. Lateral-line pores minute, difficult to enumerate.

Teeth (Figure 21) stout, conical, pointed, slightly recurved. Intermaxillary with a rosette of 5 small teeth, then 3 irregular pairs of erect, larger vomerine teeth, followed by 11 irregular smaller teeth. Maxillary dentition biserial. An inner row of 12 pointed, slightly recurved teeth begins well ahead of level of orbit. An

outer row of 15–17 more evenly-spaced teeth commences slightly ahead of anterior margin of eye. Mandibular teeth pointed, not close set, 3 irregular pairs anteriorly followed by 12–14 in a single row.

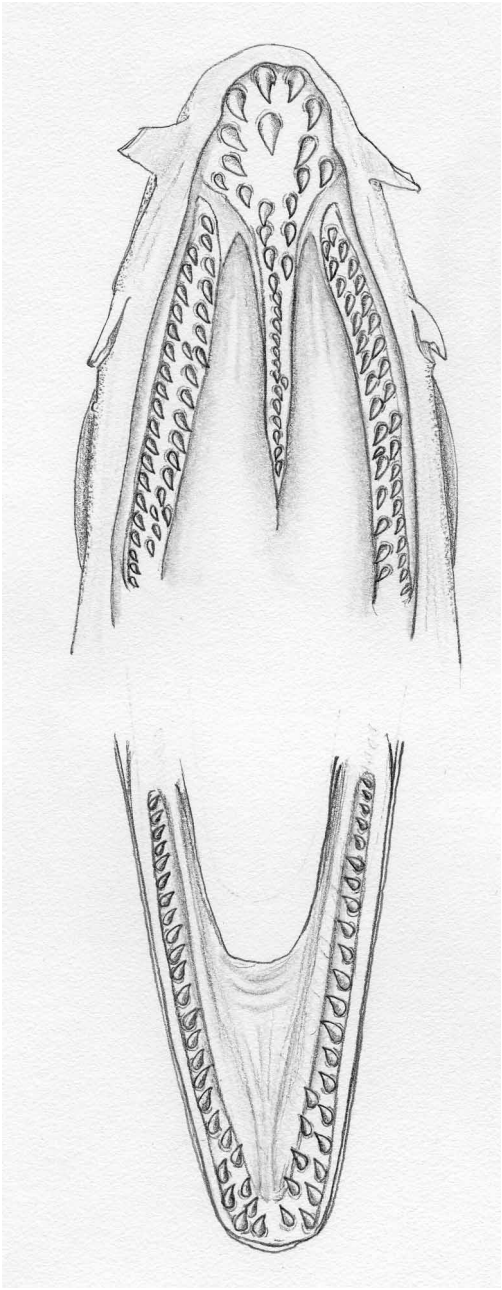

FIGURE 18. Dentition of holotype of *Ophichthus hirritus*, MNHN 1989-0747, 518 mm.

Color in ethanol uniform tan, ventral surface pale. A short dark smudge about 1/2 eye diameter present on posterior dorsal surface of tail (this smudge is much smaller and paler than that of those congeners with dark posterior anal-fin bases). All fins pale. Pectoral-fin base overlain with fine dark speckling forming a rectangular blotch. Snout and lips overlain with a diffuse minute speckling. Mandibular pores surrounded by minute speckling. Cheeks, throat, palate, and medial surface of anterior nostrils pale. Peritoneum pale ventrally, with a few fine dark speckles along dorsal surface.

Size. The holotype is a 669 mm male with mature gonads.

Etymology. Named in honor of Paul Humann, underwater photographer, author, and friend, who has generously aided ichthyologists with his photographs and observations.

Distribution. Known only from the holotype, from Vanuatu, captured in 254–300 m.

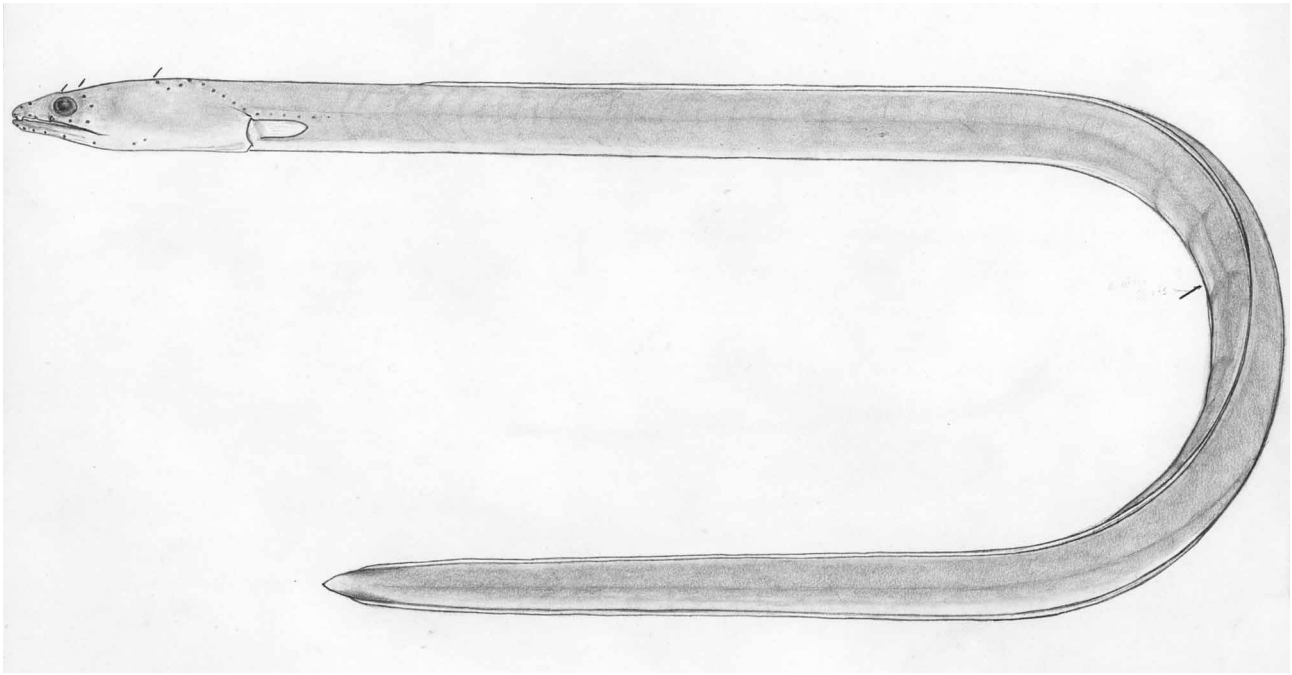

FIGURE 19. Holotype of *Ophichthus humanni*, MNHN 1997-0600, 669 mm, from Vanuatu.

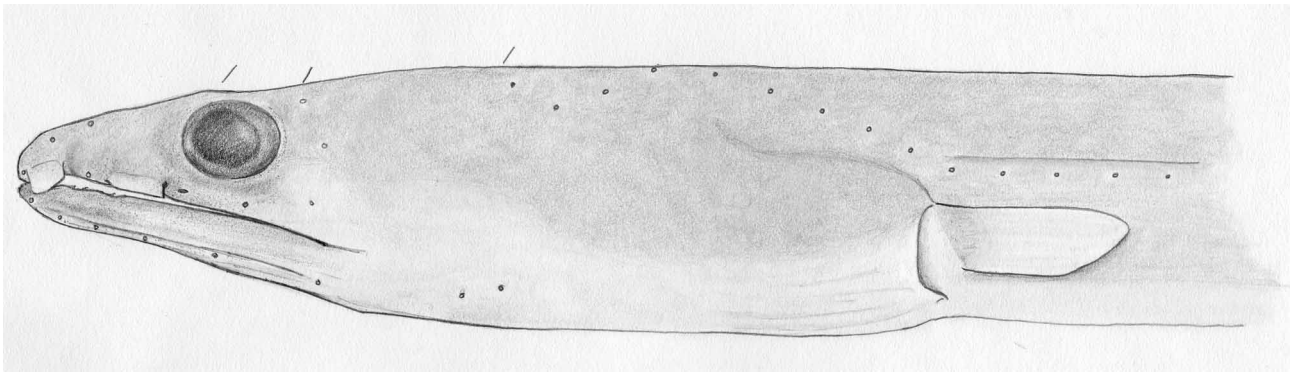

FIGURE 20. Head of holotype of *Ophichthus humanni*, MNHN 1997-0600, 669 mm.

Remarks. Although known only from the holotype, the specimen is in such excellent condition that an analysis of its relationships is possible. The new species possesses a unique amalgam of character states, several of which are possessed by other long-jawed species of the subgenus *Coecilophis*. In combination, however, those characters are possessed only by the new species. It differs in pectoral-fin shape from all those which possess an elongate filamentous pectoral fin (*O. tomioi, O. congroides, O. aniptocheilos, O. genie, O. kunaloa* and *O. mystacinus*) as well as those with a paddle-shaped pectoral fin (*O. alleni and O. hirritus*). It has two rather than three preopercular pores, a condition shared with *O. alleni, O. echeloides, O. hirritus, O. ishiyamorum, O. megalops, O. hirritus, O. lentiginosus, O. megalops*, and *O. microstictus*. It lacks the blackened posterior anal-fin base and its dorsal fin arises well behind the pectoral fin. Not only is it unique in this combination of character states, but it is also lacks two supraorbital pores (1+2 rather than 1+4), has fewer, more stout teeth, and possesses a small labial flap (its function unknown) between the anterior and posterior nostrils.

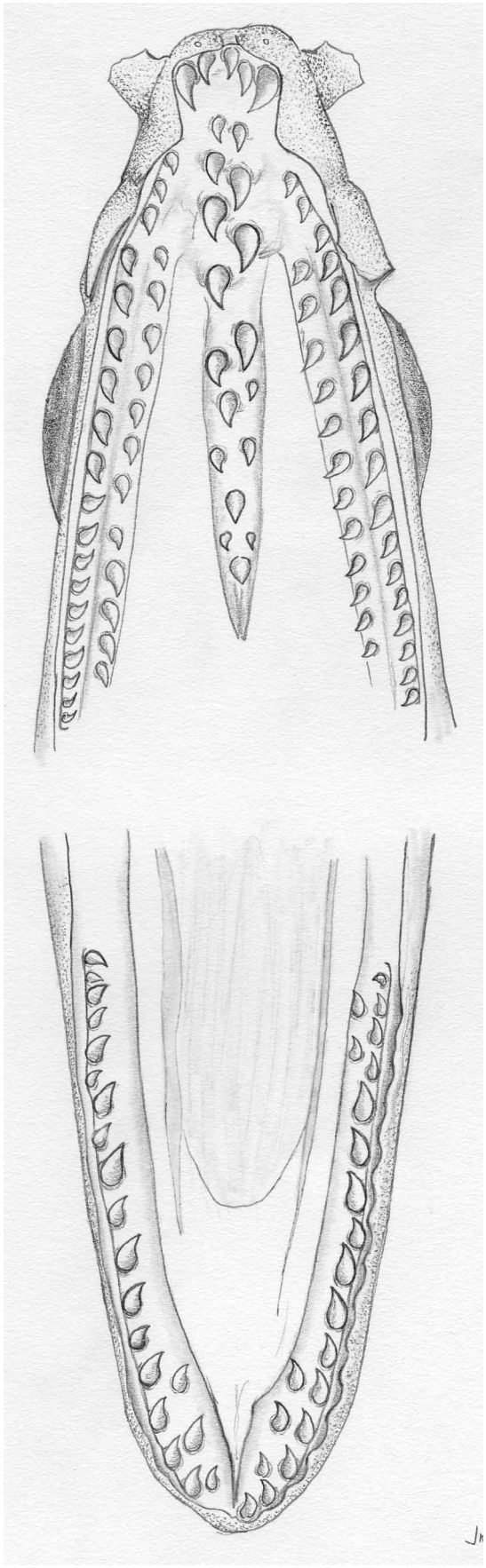

FIGURE 21. Dentition of holotype of *Ophichthus humanni*, MNHN 1997-0600, 669 mm.

***Ophichthus ishiyamorum* sp. nov.**
Figures 22–25

Holotype. USNM 394260, 437 mm, mature male, Gulf of Aden, Somalia (10º51'40"N, 43º56'35"E), captured by shrimp trawl at 258–326 m on 6 Sept. 1986, Station 4, SOSC field number 860906.

Paratype. CAS 227329, 429 mm, mature male, Gulf of Aden, Somalia (10º55'22"N, 46º51'14"E), captured in a lobster pot at 400 m on 23 Aug. 1986, Station BAST 11–23, SOSC field number 860823.

Diagnosis. A stout species of *Ophichthus*, subgenus *Coecilophis*, with: tail 52–55% and head 14–15% of total length; dorsal-fin origin ahead of pectoral-fin tips; pectoral fins wedge-shaped; posterior nostril in upper lip, covered by a flap; head pores inconspicuous, SO 1+4, IO 4+2, POM 3+7–9; teeth small, conical, widely spaced, nearly uniserial on vomer and jaws; coloration uniform tan, fins pale. Mean vertebral formula 15/50/131, total vertebrae 130–132 (n=2).

Counts and measurements (in mm) of the holotype and those of the paratype (in parentheses). Total length 437 (429); head 63.5 (62.8); trunk 143.5 (132.2); tail 230 (234); predorsal distance 82.0 (82.5); pectoral-fin length 22.8 (22.4); pectoral-fin base 5.8 (5.5); body depth at gill openings ~20 (18); body width at gill openings 17; body depth at anus ~18 (~15); body width at anus ~13.5 (~15); snout 12.0 (11.6); tip of snout to rictus 18.7 (21.8); eye diameter 6.5 (6.5); interorbital distance 9.8 (8.7); gill-opening height ~9.5 (~9); isthmus width ~10 (~9). Vertebral formula 15/50/132 (15/49/130).

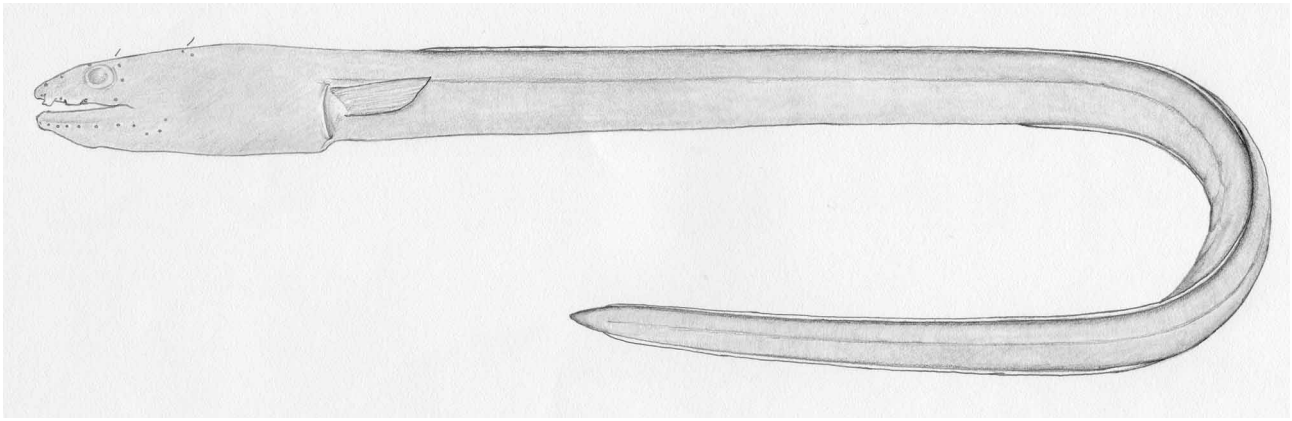

FIGURE 22. Holotype of *Ophichthus ishiyamorum*, USNM 394260, 437 mm, from Somalia**.**

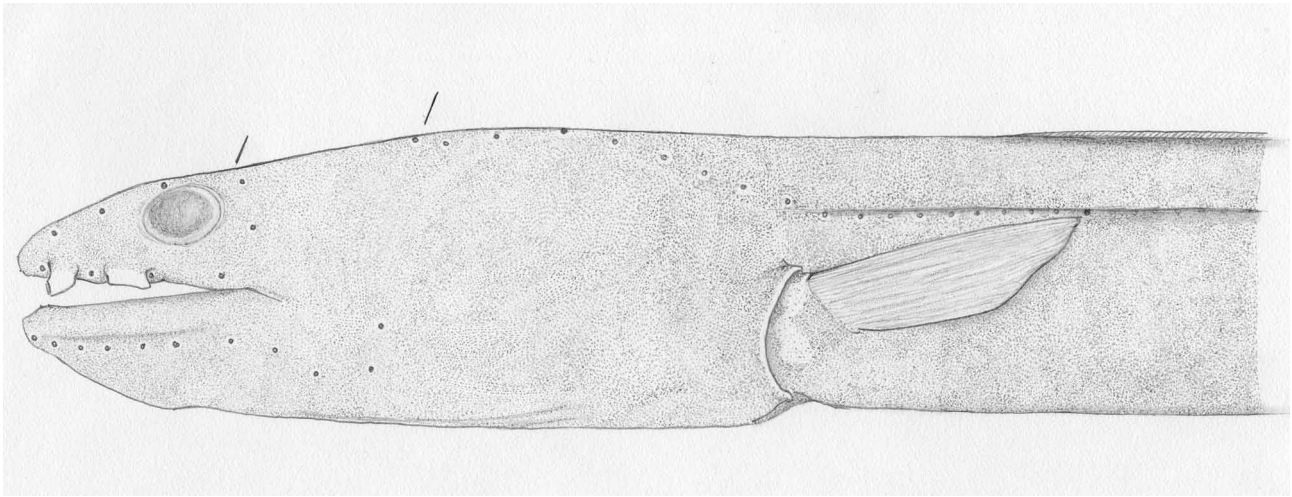

FIGURE 23. Head of holotype of *Ophichthus ishiyamorum*, USNM 394260, 437 mm.

Description. Body stout (Figure 22), compressed throughout, depth at gill openings 22–24 in TL. Branchial basket deeper and slightly wider than body. Head and trunk short, 2.1–2.2 in TL; head 6.8 in TL, 2–

2.3 in trunk. Snout short, broad, slightly swollen in appearance. Snout not bisected on underside by a groove. Jaws subequal. Lips meet when mouth is closed. Mouth moderately elongate, rictus about one-fourth eye length behind rear margin of eye. Eye 2.9–3.4 in upper jaw and 9.6–9.8 in head, its center behind middle of upper jaw. Tube of anterior nostril short, barely extending beyond lip of lower jaw. Posterior nostril a hole above upper lip, entirely covered by a flap that extends below edge of upper lip. Dorsal-fin origin slightly ahead of end of pectoral fin. Dorsal fin low, in a shallow groove. Anal fin low, in a groove similar to that of dorsal. Pectoral fins wedge-shaped, slightly longer than jaw in length. Pectoral-fin base in upper half of gill opening.

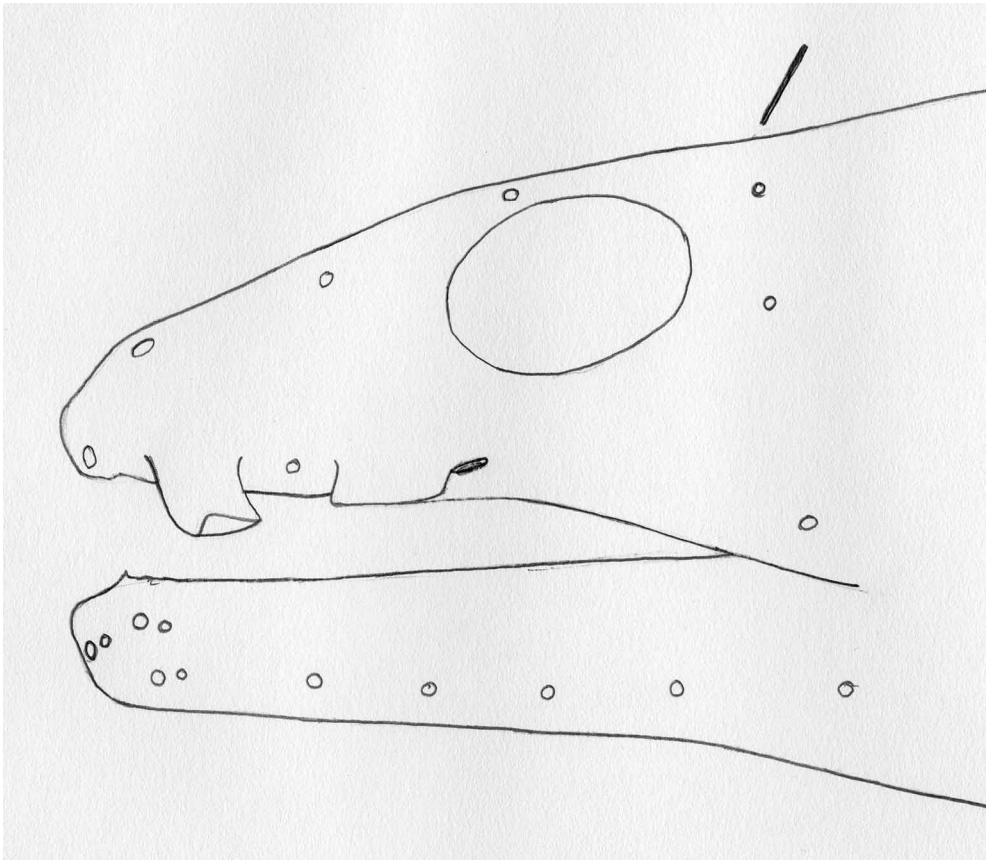

FIGURE 24. Head of paratype of *Ophichthus ishiyamorum*, USNM 394260, 437 mm.

Head pores (Figure 23) small, inconspicuous. Single median interorbital and temporal pores. Supraorbital pores 1+4, infraorbital pores 4+2, lower jaw pores 7–9, preopercular pores 3. Lateral-line pores present but difficult to discern. The anterior-most left mandibular pores of the paratype are abnormal in that a small pair exists just above and another just anterior to the anterior-most normal pair (Figure 24). Ophichthid eels (and other eels) occasionally possess additional pores, however such an abnormality has not been reported from other ophichthids.

Teeth (Figure 25) small, conical, sharp. Intermaxillary with a rosette of 5 small teeth, then 2 irregular pairs, and a linear row of 12 vomerine teeth, becoming smaller posteriorly. Maxillary dentition mostly uniserial, 14–15 widely spaced small teeth flanked by 3–4 larger teeth that begin behind level of posterior nostril. Mandibular teeth pointed, widely spaced, about 14–15 in a single row.

Color in ethanol tan, the result of minute brown punctations which overlay the entire body, more numerous and denser along dorsal midhalf. Dorsal-fin base dark in trunk region, its margin pale throughout. Nostrils pale. Fins pale. Base of anal fin in posterior region not darkened. Peritoneum unpigmented.

Size. Largest known specimen is 437 mm, a mature male.

Etymology. I am pleased to name this interesting eel in honor of Nelson and Patsy Ishiyama for their interest in and generous support of ichthyological research.

Distribution. Known only from the Gulf of Aden, Somalia, where it was trapped and trawled between 258–400 m.

Remarks. The new species is most similar to *Ophichthus urolophus* in terms of its pectoral fin shape, body coloration, dentition, and vertebral number (total vertebrae 130–132 *vs.* 134–139). It differs from *O. urolophus* in its dorsal-fin origin, arising before the pectoral-fin tips rather than slightly behind them, and, as well, from all other *Coecilophis* in having the longest head length (14–15% of TL *vs.* 13% or less for all others).

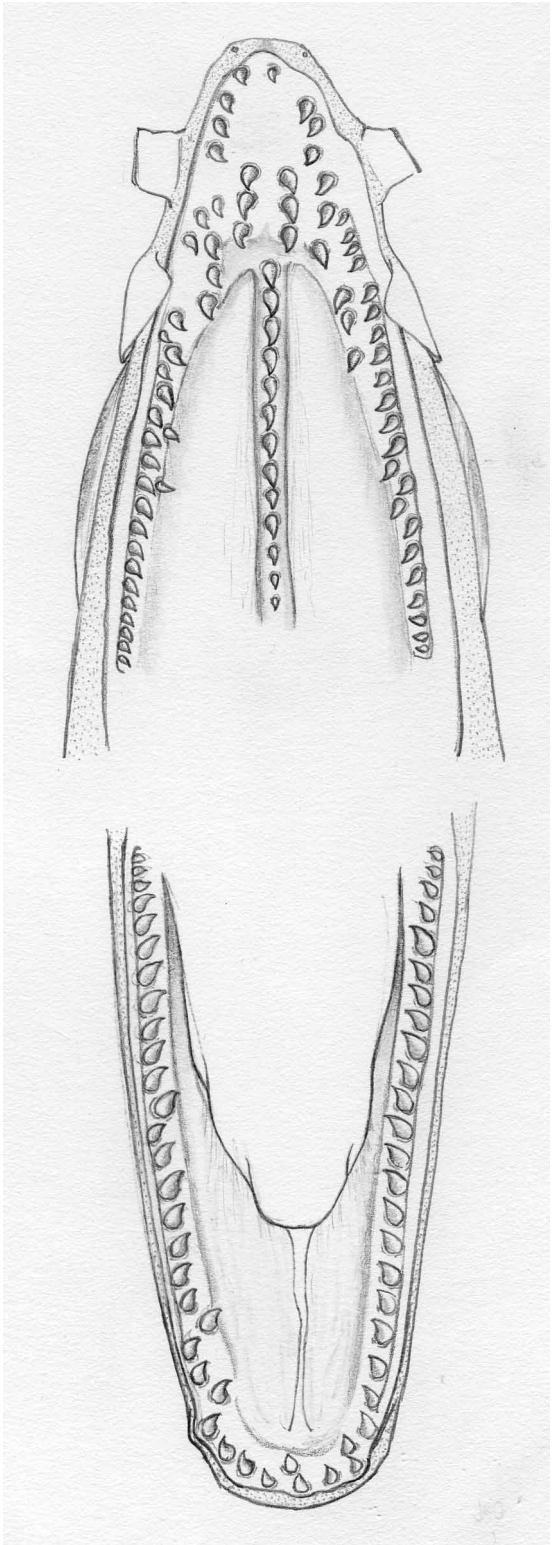

FIGURE 25. Dentition of holotype of *Ophichthus ishiyamorum*, USNM 394260, 437 mm.

***Ophichthus kunaloa* McCosker 1979**

Ophichthus kunaloa McCosker 1979: 61 (type locality Oahu, Hawaiian Islands, holotype CAS 29136)

Diagnosis. A moderately elongate species of *Ophichthus*, subgenus *Coecilophis*, with: tail 59–60%, head 9.6–10.1%, and body depth at gill opening 3.2–3.7% of TL; dorsal-fin origin above mid pectoral fin; pectoral fin elongate, but not filamentous; posterior margin or orbit in advance of rictus; posterior nostril a hole above the upper lip, covered by a flap; lip barbels absent; cephalic pores small but conspicuous, SO 1+4, IO 4+2, POM 2+5; teeth small and conical, biserial on anterior vomer and jaws; coloration uniform gray brown, lighter ventrally, all fins pale except anal which has a dark patch at posterior base; MVF 15-66-182, total vertebrae 180–185 (n=5).

Size. To 473 mm, specimen eviscerated, sex undeterminable.

Distribution. Known from Oahu and Hawaii, Hawaiian Islands, trapped at 350–475 m.

Remarks. The second known capture of this species was reported by McCosker (2002). The holotype of *O. kunaloa* has 14/66/185 vertebrae.

Material examined. CAS 29136, 440 mm, female with maturing ova, SE of Barber's Point, Oahu, Hawaiian Islands, 350 m; paratypes BPBM 21086, 473 mm, and USNM 218274, a partially eaten specimen, both collected with the holotype. Other material examined: CAS 47991, 2(383–423 mm) and BPBM 28120, 402 mm, NE of Hilo, Hawaii.

***Ophichthus lentiginosus* sp. nov.**
Figures 26–28

Holotype. MNHN 1997-0601, 563 mm, female, from Vanuatu (15°40'S, 167°01'E), Campaigne MUSORSTOM 8, Sta. no. CP 1136. captured by otter trawl in 398–400 m during Oct. 1994.

Paratype. MNHN 1987-1244, 628 mm, male, from Hienghene, New Caledonia (20°40'S, 164°55'E), Sta. p1-78-05, from 400 m, presumably trapped (as were other Laboute specimens) by P. Laboute in 1978.

Diagnosis. A stout species of *Ophichthus*, subgenus *Coecilophis*, with: tail 55–56% and head 10.6–12% of total length; dorsal-fin origin behind pectoral-fin tips; pectoral fins not elongate, shorter than upper jaw; posterior nostril a hole in upper lip covered by a flap; head pores minute, SO 1+4, IO 1+4, POM 3+6; teeth not enlarged, conical and stout, biserial on maxillary, uniserial on vomer and mandible; coloration uniform brown, pale ventrally, overlain throughout with minute dark punctations, median fins pale. Mean vertebral formula 16/55.5/142, total vertebrae 140–144 (n=2).

Counts and measurements (in mm) of the holotype and those of the paratype (in parentheses). Total length 563 (628); head 59.6 (74.2); trunk 192.4 (203.8); tail 311 (350); predorsal distance 92 (104); pectoral-fin length 20.6 (~21); pectoral-fin base ~5 (8.9); body depth at gill openings ~26 (~27); body width at gill openings ~22 (~27); body depth at anus ~23 (~25); body width at anus ~21 (~23); snout 11.6 (14.0); tip of snout to rictus 21.6 (23.6); eye diameter 8.1 (10.0); interorbital distance 11.6 (12.2); gill-opening height ~7 (~11); isthmus width ~16 (~15). Vertebral formula 17/57/144 (15/54/144).

Description. Body stout (Figure 26), compressed in posterior tail region, depth at gill openings 22–23 in TL. Branchial basket wider and deeper than body. Head and trunk 2.2–2.3 in TL; head 8.5–9.4 in TL, 4.7–5.7 in trunk. Snout short, rounded when viewed from above. Snout bisected on underside by a short groove which reaches to anterior base of anterior nostrils. Lower jaw slightly included, curved such that upper and lower lips do not meet when mouth is closed. Mouth moderately elongate, rictus slightly behind rear margin of eye. Eye large, 2.4–2.7 in upper jaw and 7.4 in head, its center well behind middle of upper jaw. Tube of anterior nostril short, barely reaches lower lip when deflected ventrally. Lip barbels absent. Posterior nostril a hole above upper lip, completely covered by an anterior flap. Dorsal-fin origin immediately behind level of pectoral-fin tips. Dorsal fin low, in a groove for its entire length. Anal fin higher, in a groove shallower than that of dorsal. Pectoral fins rounded, not elongate, less than upper jaw in length. Pectoral-fin base in upper half of gill opening.

Head pores (Figure 27) minute, inconspicuous. Single median interorbital and temporal pores. Supraorbital pores 1+4, infraorbital pores 4+2, lower jaw pores 5–7, preopercular pores 3. Lateral-line pores present but difficult to enumerate.

Teeth (Figure 28) small, stout, conical, slightly recurved, not closely spaced. Intermaxillary with a rosette of 7–9 teeth, followed by a pair and then a row of 13 linear vomerine teeth, becoming slightly smaller posteriorly. Maxillary dentition biserial. An inner row of 15–16 begins at level of posterior nostril. An outer row of 15–18 followed by a patch of 2–3 pairs of smaller teeth. Mandibular teeth uniserial, 25–26 in the row.

Color in ethanol tan along flanks and dorsal surface, pale ventrally, the entire body overlain with fine dark freckles. Anterior nostrils, lower half of posterior nostrils, palate, median fins, posterior third of pectoral fins, tail, and peritoneum unpigmented.

Size. The largest known specimen is 628 mm, a mature male.

Etymology. From the Latin *lentiginosus*, meaning freckled, in reference to its general coloration.

Distribution. Known only from the type specimens, from Vanuatu and New Caledonia, at 398–400 m.

Remarks. The new species is most similar to *Ophichthus urolophus* and to *O. microstictus*. It differs from *O. urolophus* in having a larger snout (5.1–5.3 in HL, *vs.* 5.3–6.4) and in having biserial rather than uniserial maxillary dentition. It differs from *Ophichthus microstictus* in its dorsal-fin origin (slightly behind the pectoral-fin tips rather than slightly before) and by having fewer vertebrae (140–144 *vs.* 151–156).

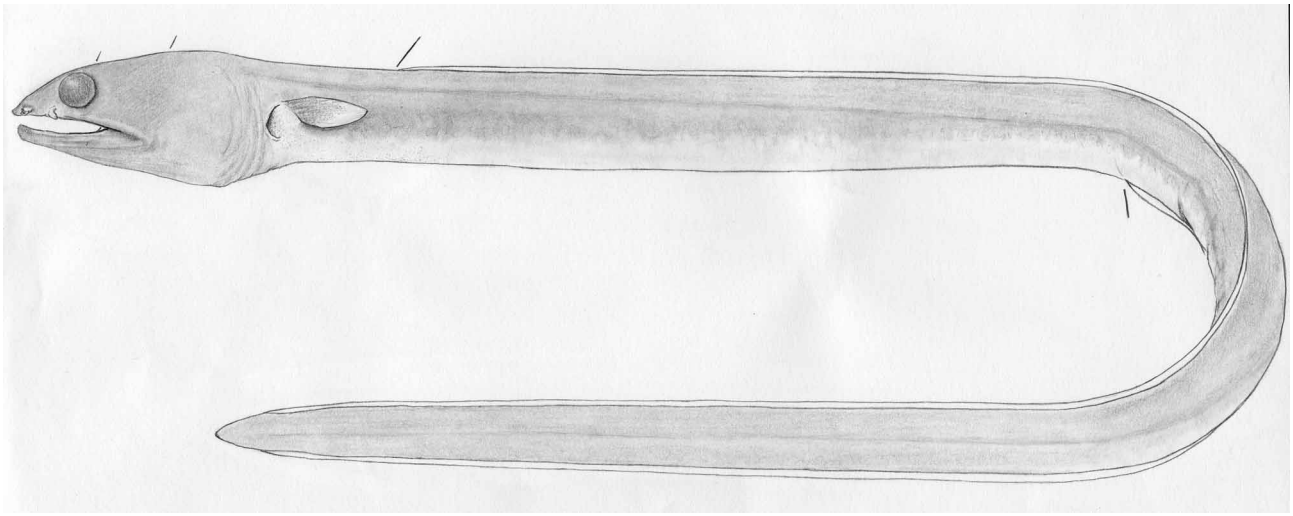

FIGURE 26. Holotype of *Ophichthus lentiginosus*, MNHN 1997-0601, 563 mm, from Vanuatu.

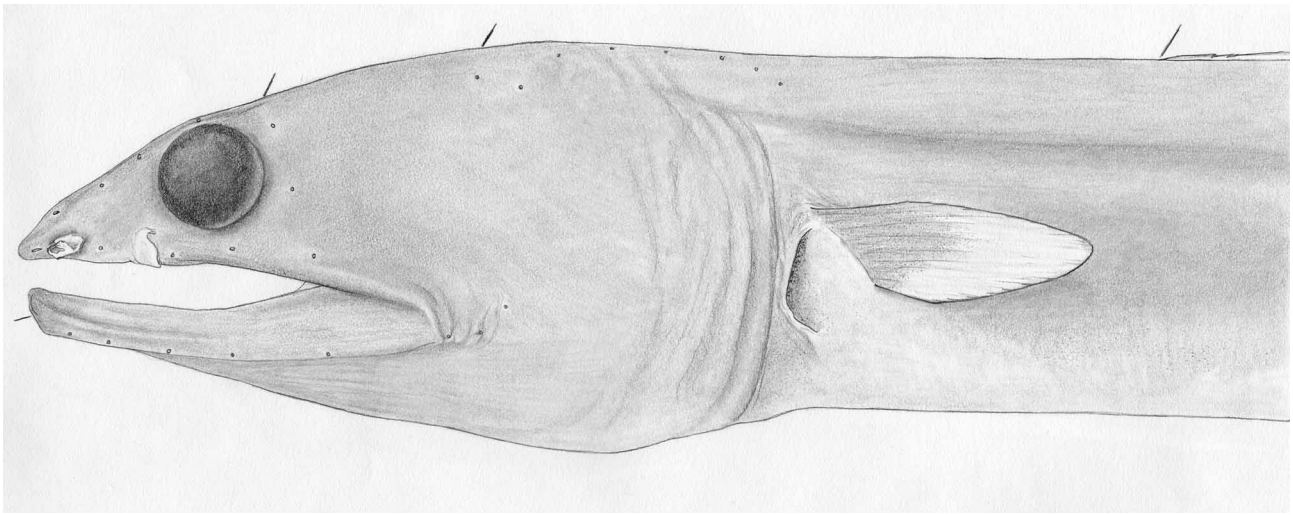

FIGURE 27. Head of holotype of *Ophichthus lentiginosus*, MNHN 1997-0601, 563 mm.

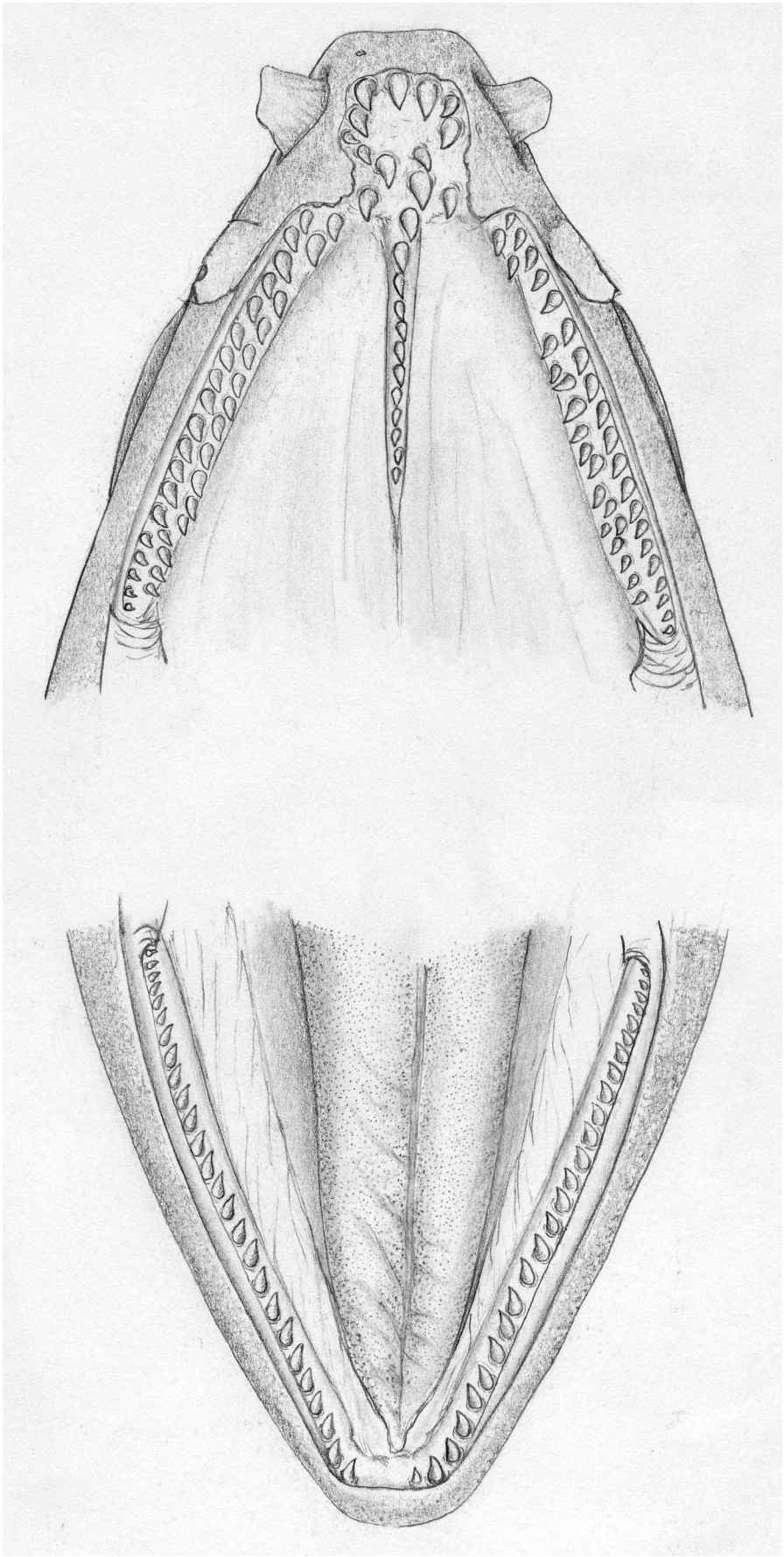

FIGURE 28. Dentition of holotype of *Ophichthus lentiginosus*, MNHN 1997-0601, 563 mm.

***Ophichthus megalops* Asano 1987**

Ophichthus megalops Asano 1987: 135 (Kumano-nada, Japan, holotype FAK 19057).

Diagnosis. A moderately elongate species of *Ophichthus*, subgenus *Coecilophis*, with: tail 55%, head 11.0%, and depth at gill openings ~4% of TL; dorsal-fin origin 3.5 pectoral-fin lengths behind head (more than 1 head length behind gill opening); pectoral fins elongate, not lanceolate; rear margin of orbit in advance of rictus; posterior nostril a hole above upper lip, covered by a flap; head pores conspicuous, SO 1+4, IO 4+2, POM 3+6; teeth numerous, small and conical, biserial on jaws, uniserial posteriorly on vomer, biserial anteriorly; coloration pale, slightly darker dorsally, snout tip and lower jaw darker, fins and anterior nostrils pale, and posterior region of anal-fin base black; vertebral formula 29/60/160.

Size. 332 mm, sex not determined.

Distribution. Known from a single specimen trawled in 360 m off Owase, Mie Prefecture, Japan.

Remarks. The species is known only from the holotype.

Material examined. This entry is based entirely on the original description.

***Ophichthus microstictus* sp. nov.**
Figures 29–31, Table 3

Holotype. MNHN 2001-0007, 445 mm, male, Tonga, Nkotu Group (19º52'29"S, 174º38'44"E), Sta. CH 1563, trawled in 362–388 m on 8 June 2000.

Paratypes. MNHN 2001-1095, 394 mm, an unripe male, Fiji, Lau Ridge (18º40'S, 178º30'W), Sta. CP 1501, captured by otter trawl in 350–357 m, 13 Mar. 1999. MNHN 2001-1096, 413 mm, Fiji, Lakeba (18º12'S, 178º37'E), Sta. CP 1505 #37, captured by otter trawl in 420–450 m during Mar. 1999; MNHN 2001-1069, 3(357–391 mm), Tonga, N. Ha'apa Group (19º06'27"S, 174º18'11"E), Sta. CH 1596, trawled in 371–437 m on 14 June 2000; CAS 229179, 390 mm, collected with MNHN 2001-1069; MNHN 2001-1070, 2(443–489 mm), Tonga, Nkotu Group (19º52'29"S, 174º38'44"E), collected with the holotype.

Non-paratype. MNHN 1987-1246, 438 mm, New Caledonia, Balade (20º19'S, 164º30'E), captured (presumably trapped) in 200 m by Laboute during 1978.

Diagnosis. A moderately elongate species of *Ophichthus*, subgenus *Coecilophis*, with: tail 57–59% and head 11% of total length; dorsal-fin origin slightly ahead of pectoral-tips; pectoral fins moderately elongate, wedge-shaped, shorter than jaw; posterior nostril a hole in upper lip, covered by a flap; head pores minute, inconspicuous, SO 1+4, IO 4+2, POM 2-3+6; teeth small, conical and numerous, uniserial on vomer, mandible, and anterior and posterior portions of maxillary, which are irregularly biserial; coloration pale, slightly darker dorsally, irregular faint white patches beneath lateral midline, all fins pale. Mean vertebral formula 13/56/154, total vertebrae 151–156 (n=9).

Counts and measurements (in mm) of the holotype. Total length 445; head 48.1; trunk 138.9; tail 258; predorsal distance 63; pectoral-fin length 13.8; pectoral-fin base 4.5; body depth at gill openings ~16; body width at gill openings ~14.5; body depth at anus ~15; body width at anus ~12.5; snout 9.3; tip of snout to rictus 16.8; eye diameter 6.3; interorbital distance 5.8; gill-opening height 7.5; isthmus width 7.3. Vertebral formula 13/57/154.

Description. Body moderately elongate (Figure 29), compressed in posterior tail region, depth at gill openings 24–33 in TL. Branchial basket slightly wider and deeper than body. Head and trunk 2.3–2.4 in TL; head 8.8–9.2 in TL, 2.6–2.9 in trunk. Snout moderate, conical when viewed from above. Snout not bisected on underside by a groove. Lower jaw slightly included, upper and lower lips meet when mouth is closed. Mouth moderately elongate, rictus about 1/3 eye length behind rear margin of eye. Eye large, 2.2–2.7 in upper jaw and 7.1–7.6 in head, its center well behind middle of upper jaw. Tube of anterior nostril short, barely reaching lower lip when deflected downward. Lip barbels absent. Posterior nostril a hole above upper lip, covered by an anterior flap that extends beneath edge of mouth; a short crease in lower lip at anterior edge of posterior

nostril. Dorsal-fin origin slightly in advance of pectoral tips. Dorsal fin low, in a groove that deepens posteriorly. Anal fin higher. Median fins expanded before tail tip. Pectoral fins wedge-shaped, slightly less than jaw in length. Pectoral-fin base in upper half of gill opening. Posterior half of tail markedly tapered, its tip pointed.

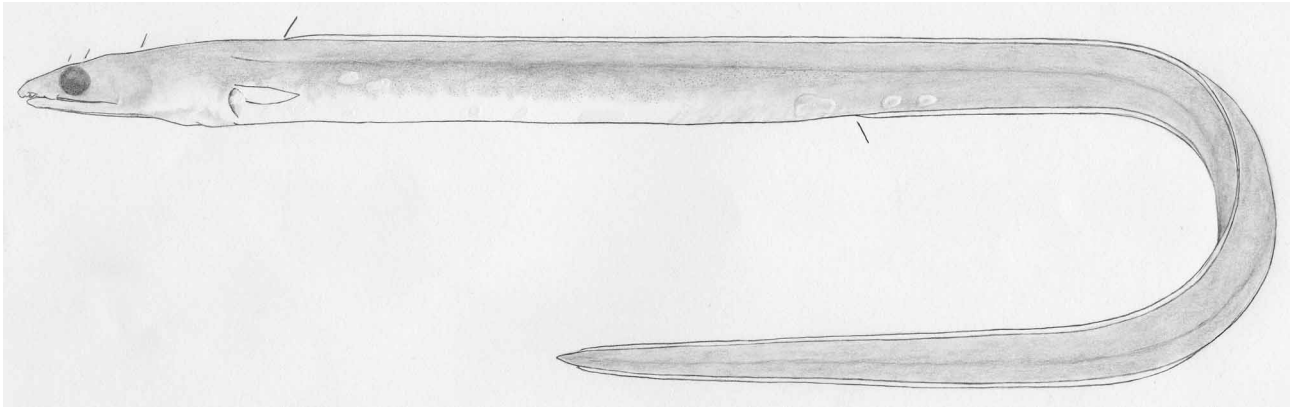

FIGURE 29. Holotype of *Ophichthus microstictus*, MNHN 2001-0007, 445 mm, from Tonga.

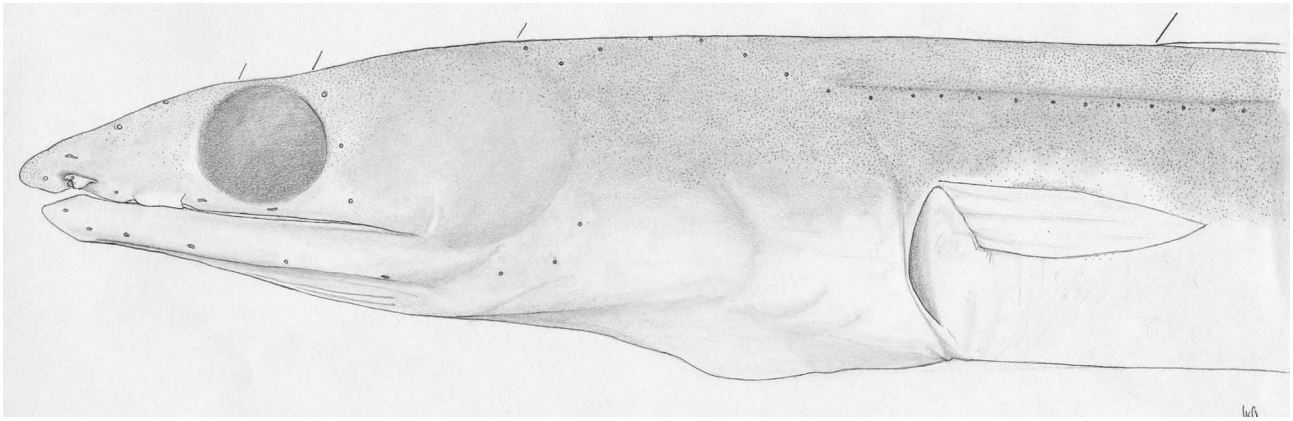

FIGURE 30. Head of holotype of *Ophichthus microstictus*, MNHN 2001-0007, 445 mm.

TABLE 3. Counts and proportions (in thousandths) of the holotype and five paratypes of *Ophichthus microstictus* **sp. nov.** TL = total length. HL = head length. *N = 9

	Mean	Range
TL (mm)	---	389–464
HL/TL	111	108–113
Head and trunk/TL	420	409–429
Trunk/TL	306	297–320
Tail/TL	582	571–591
Depth at gill opening/TL	40	30–42
Dorsal-fin origin/TL	140	135–146
Pectoral-fin length/HL	297	277–317
Upper jaw/HL	343	307–368
Snout/HL	195	184–203
Eye/HL	138	131–141
Predorsal vertebrae*	13	12–15
Preanal vertebrae*	56	55–58
Total vertebrae*	154	151–156

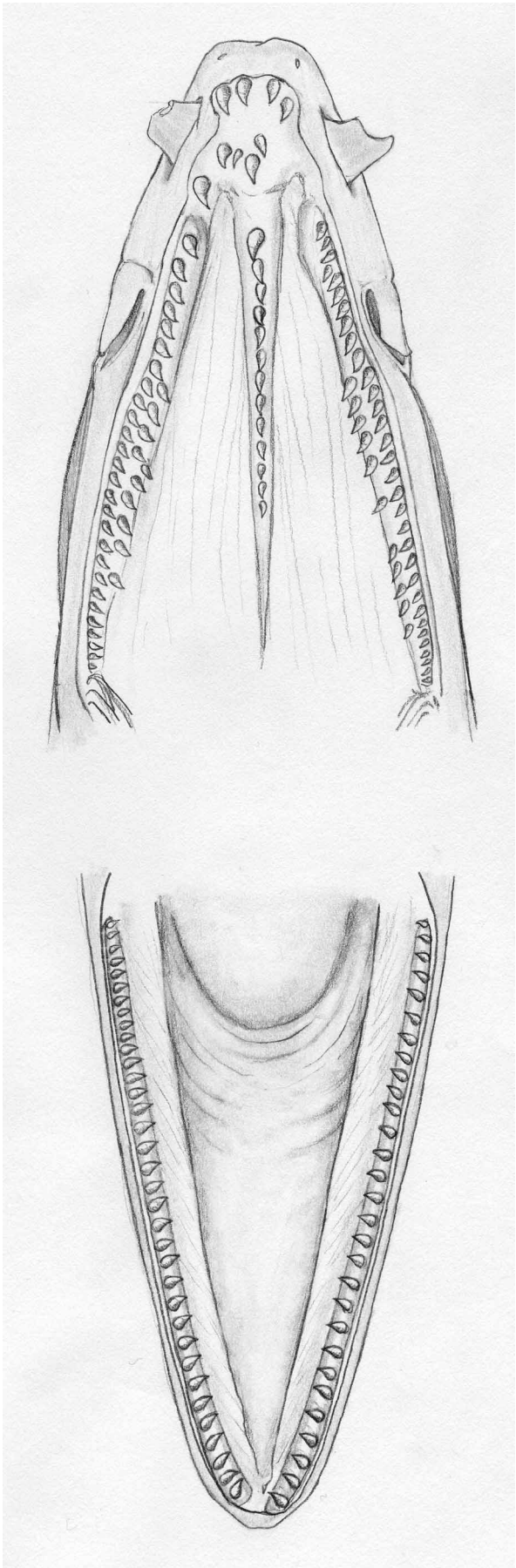

FIGURE 31. Dentition of holotype of *Ophichthus microstictus*, MNHN 2001-0007, 445 mm.

Head pores (Figure 30) small, inconspicuous. Single median interorbital and temporal pores. Supraorbital pores 1+4, infraorbital pores 4+2, lower jaw pores 6, preopercular pores 1–3 (typically 3).

Teeth (Figure 31) mostly small, conical, slightly recurved. Intermaxillary with a rosette of 4 small teeth, then a gap, then 4 small teeth, followed by a short gap and a row of 13 smaller linear vomerine teeth. Maxillary dentition uniserial anteriorly and posteriorly, 27–30 teeth in a row, with a central inner row of 8–11 teeth. Mandibular teeth uniserial, 25–30 teeth in a linear row, similar in size to inner row of mandibular teeth, becoming smaller posteriorly.

Color in ethanol yellow-tan throughout, paler on chin and ventral trunk region. Irregular faint white patches occur beneath the lateral midline of the trunk in all specimens and does not appear to be an artifact of preservation. Tip of chin and snout smudged. Anterior nostrils pale. All fins pale. Peritoneum unpigmented.

Size. The largest known specimen is 489 mm, an unripe male.

Etymology. From the Greek *mikros* (small) and *stiktos* (punctures), in reference to its minute cephalic pores; to be treated as a noun in apposition.

Distribution. Known from Fiji and Tonga at depths from 362–450 m. A single specimen from New Caledonia, captured in 200 m, may be this species.

Remarks. This new species is described on the basis of the holotype and eight paratypes, however three of the paratypes were so badly contorted that accurate measurements could not be taken. For that reason they were excluded from Table 3. The single specimen (MNHN 1987-1246) trapped in 200 m off New Caledonia appears to be this species, however it differs slightly in certain characters and therefore was not made a paratype. (It had also been extensively dissected and much of its neurocranium and brain were removed, such that some of its cephalic characters are compromised.) It differs from the Fijian and Tongan specimens in its slightly shorter head length (10.4% TL *vs.* 10.9–11.3% TL) and more posterior dorsal-fin origin (above the 17th vertebra *vs.* 12th–15th). In all other characteristics it seems to be the new species.

The new species is most similar to those species of subgenus *Coecilophis* that possess wedge-shaped pectoral fins and an anterior dorsal-fin origin, viz. *Ophichthus lentiginosus* and *O. ishiyamorum*. They share, as well, uniserial lower jaw dentition, a pale rather than a darkened posterior anal-fin base, and usually have three preopercular pores. The new species differs from those species in having more vertebrae (151–156 *vs.* 140–142 in *O. lentiginosus* and 130–132 in *O. ishiyamorum*). It further differs from *O. ishiyamorum* in having its eye nearly centered above the upper jaw, rather than nearly reaching the line of the rictus.

The cephalic pores of this species are minute and very difficult to discern. It appears that this species typically has three preopercular pores. The holotype possesses three on each side, whereas four paratypes have 3 left/3 right, one has 3/2, two have 2/2, and one has 1/2. The specimen from New Caledonia has 3/3. Such variation is not atypical among deepwater *Ophichthus*, particularly those with pores reduced in size and number. McCosker and Rosenblatt (1998:417) and McCosker (2009:79) noted that the eastern Pacific deepwater species *O. tetratrema* typically has four preopercular pores but some specimens had three or less.

Ophichthus mystacinus McCosker 1999

Ophichthus mystacinus McCosker 1999: 579 (type locality New Caledonia, holotype MNHN 1998-46).

Diagnosis. A moderately elongate species of *Ophichthus*, subgenus *Coecilophis*, with: tail 59–60%, head 10.7–11.7%, body depth behind gill openings 3.6–4.3% of TL; dorsal-fin origin about mid-trunk; pectoral fins elongate, the central rays threadlike; posterior margin of the orbit ahead of the rictus; cephalic pores small and difficult to discern, SO 1+4, IO 4+2, POM 2+6; teeth conical, numerous and small, biserial in jaws and anteriorly on vomer; coloration yellowish tan, brown dorsally, fins pale, anterior nostrils pale, snout tip smudged, but not blackened; and mean vertebral formula 34.2/61.3/169.7., total vertebrae 162–177 (n=8).

Size. To 429 mm. The holotype, 426 mm, is a male with undeveloped gonads.

Distribution. Known from New Caledonia, Tonga, Fiji, and the Philippines, between 371–824 m depth.

Remarks. Originally described from New Caledonia collections at 450–580 m depth, subsequent material from Fiji and Tonga as shallow as 370 m, and from the Philippines at 810–824 m was identified. The holotype of *O. mystacinus* has 35/62/174 vertebrae.

Material examined. MNHN 1998-46, the holotype, 426 mm, New Caledonia (18º58'00 S, 163º10'50 E), 580 m. And paratypes: CAS 89552, 429 mm, and BPBM 37308, 336 mm, New Caledonia (18º56'80 S, 163º17'70 E), 450 m; MNHN 1998-47, 383 mm, New Caledonia (18º55'80 S, 163º13'80 E), 500 m. **And other material examined**: MNHN 1997-1602, 409 mm, Vanuatu, 469–525 m. MNHN 1997-0603, 433 mm, Vanuatu, 522–527 m. MNHN 2001-1064, 373 mm, Tonga (21º04'S, 175º22'E), 487 m, otter trawl, Sta. CP 1643, 22 June 2001.MNHN 2001-1067, 3(386–451 mm), Tonga (19º06'S, 174º18'E), 371–437 m, otter trawl, 14 June 2001. MNHN 2001-1094, 563 mm, Fiji (17º11'S, 178º41'E), 398–409 m, otter trawl, 3 Mar. 1999. MNHN 2001-1097, 357 mm, Fiji, (16º05'S, 178º28'E), 400–407 m, otter trawl, 26 Feb. 1999. MNHN 1998-0660, 356 mm, an immature male, from off Lubang Island, Philippine Islands, (13º37'N, 120º34'E), Campaigne Musorstom 2, 1998, captured by 4 m otter trawl in 810–824 m on 27 Nov. 1980.

Ophichthus serpentinus Seale 1917

Ophichthys serpentinus Seale 1917: 84 (type locality, Cape of Good Hope, holotype MCZ 9200).
Ophichthus karreri Blache 1975: 733 (type locality, Namibia, holotype ZMB 22065).
Ophichthus bennettai McCosker 1986: 2 (type locality, South Africa, holotype RUSI 20033).

Diagnosis. A moderately elongate species of *Ophichthus*, subgenus *Coecilophis*, with: tail 62.5%, head 6.4–6.8%, and depth behind gill opening 2.8–2.9% of TL; dorsal-fin origin 2–3 pectoral-fin lengths behind pectoral base; pectoral fin rounded; posterior margin of orbit in advance of rictus; head pores small, SO 1+4, IO 4+2, POM 2+6; teeth small, conical, biserial on maxillary, uniserial on mandible, biserial on vomer anteriorly, uniserial posteriorly; coloration yellow, darker dorsally, fins pale; mean vertebral formula 18/62/165, total vertebrae 162–167 (n= 3).

Size. To 680 mm, sex undetermined.

Distribution. From Namibia and South Africa, from 235–372 m.

Remarks. Although this is primarily a southeastern Atlantic species, the holotype was reported to have been captured at the Cape of Good Hope and it is therefore included on the chance that it might be found in the Indian Ocean. *Ophichthus karreri* Blache (1975) was considered a junior synonym of *O. serpentinus* by McCosker (2006). The holotype of *Ophichthus serpentinus* has 166 vertebrae.

Material examined. MCZ 9200, 495 mm, the holotype of *Ophichthys serpentinus*, Cape of Good Hope; RUSI 20033, 680 mm, the holotype of *Ophichthus bennettai*, South Africa (32º14'S, 16º32'E), trawled in 372 m; and RUSI 25504, 581 mm, South Africa (33º41'S, 17º38'E), trawled in 235 m.

Ophichthus tomioi sp. nov.
Figures 32–35, Table 4

Holotype. CAS 214208, 390 mm, immature male, from San Bernadino Strait, Philippine Islands, (12º54'29"N, 124º23'36"E), Field no. TI-95-3, captured by 30 m otter trawl in 376–382 m by Tomio Iwamoto at 1623–1819 hrs on 23 Sept. 1995.

Paratypes. MNHN 2001-1060, 369 mm, female, from Nuku Hiva (08º27'S, 140º10'W), Marquesas, Polynesia, station CP 1175, captured by beam trawl in 300 m by the MUSORSTOM 9 Expedition on 25 Aug. 1997. CAS 229180, 334 mm, an immature male, collected along with MNHN 2001-1060. MNHN 2001-1065, 447 mm, male, from Somo-Somo Strait, Fiji (16º45'S, 179º59'W), Field no. CP 1395, captured by otter trawl in 423 m on 23 Feb. 1999. MNHN 1989-0748, 427 mm, female, Seychelle Islands, (04º22'S, 56º18'E), Sta. Radiale 2, collected by benthic trap in 400 m, by A. Intes in Oct. 1987.

Diagnosis. A moderately elongate species of *Ophichthus*, subgenus *Coecilophis*, with: tail 59–62.5% and head 9.1–10% of total length; dorsal-fin origin slightly in advance of end of pectoral filaments; pectoral fins pointed, elongate and filamentous; posterior nostril a hole in outer lip, covered by an anterior flap; eye large, nearly equal to snout; head pores minute, SO 1+4, IO 4+2, POM 2+6-7; teeth conical, small, and numerous, uniserial on vomer, regularly biserial and close set on maxillary and mandible; coloration yellow, tan along mid-flanks, hindmost ventral surface of tail black. Vertebral formula 16/62/169, total vertebrae 166–189 (n=5).

Counts and measurements (in mm) of the holotype. Total length 390; head 37.5; trunk 119.5; tail 233; predorsal distance 52; pectoral-fin length 17; pectoral-fin base 3.0; body depth at gill openings 12.5; body width at gill openings 11.5; body depth at anus 11.3; body width at anus 10.3; snout 7.3; tip of snout to rictus 16.4; eye diameter 6.0; interorbital distance 5.7; gill-opening height 5.2; isthmus width ~7. Vertebral formula 16/62/169.

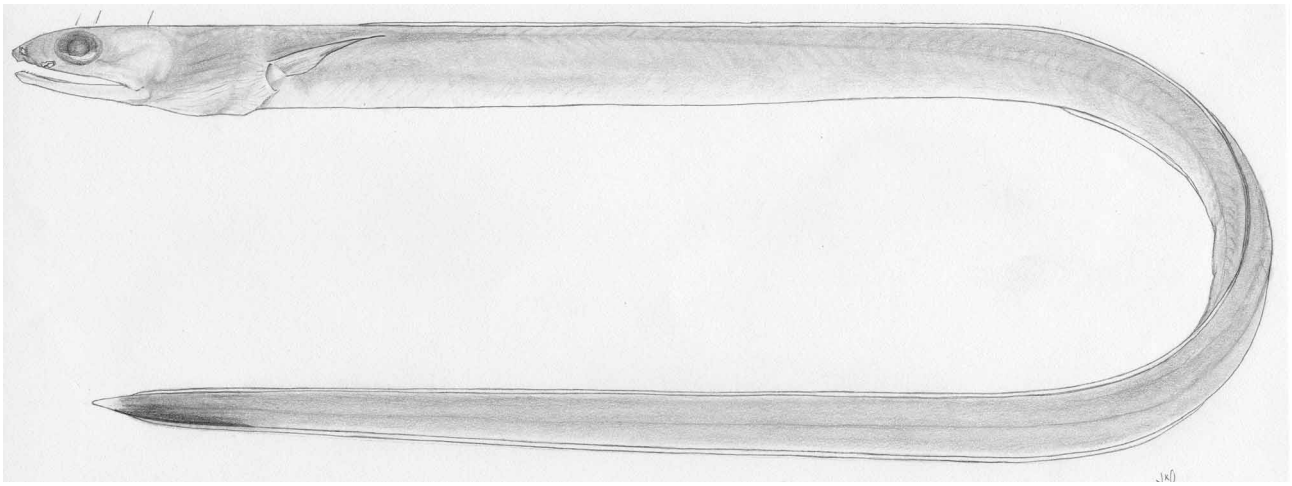

FIGURE 32. Holotype of *Ophichthus tomioi*, CAS 214208, 390 mm, from the Philippines.

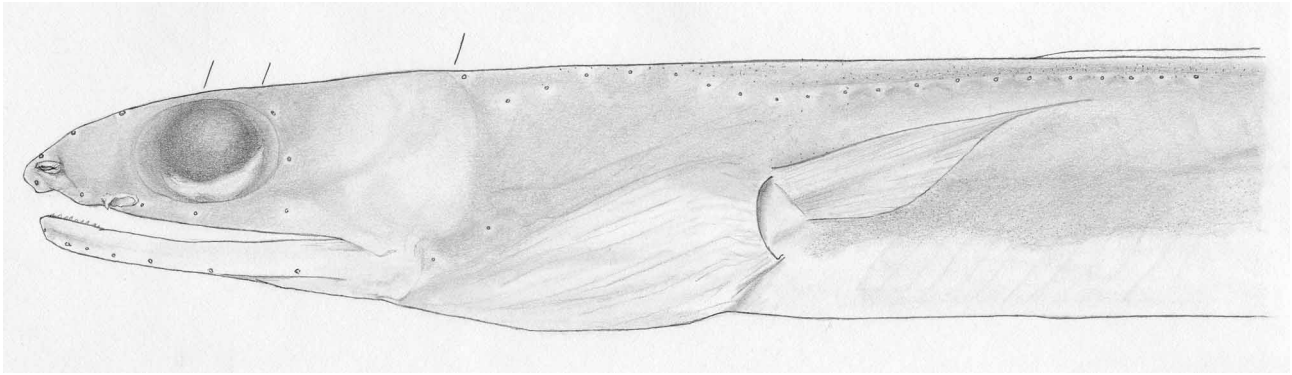

FIGURE 33. Head of holotype of *Ophichthus tomioi*, CAS 214208, 390 mm.

Description. Body moderately elongate (Figure 32), compressed in posterior tail region; depth at gill openings 25–31 in TL. Branchial basket slightly wider and deeper than body. Head and trunk short, 2.5–2.7 in TL; head 10–11 in TL, 3.0–3.8 in trunk. Snout short, rounded when viewed from above. Snout not bisected on underside by a groove. Lower jaw slightly included, upper and lower lips almost meet when mouth is closed. Mouth not elongate, rictus about 1/2 eye length behind rear margin of eye. Eye large, 2.4–2.9 in upper jaw and 5.4–6.6 in head, its center above middle of upper jaw. Tube of anterior nostril short, not reaching snout tip or lip margin. Lips without a barbel between nostrils. Posterior nostril a hole above upper lip, partially covered anteriorly by a small flap that extends slightly beneath edge of lip. Dorsal-fin origin in advance of pectoral-fin tips. Dorsal fin low, in a groove for its entire length. Anal fin higher, in a groove similar to that of dorsal. Pectoral fins pointed, elongate, and filamentous, about equal to jaw in length. Pectoral-fin base in upper half of gill opening.

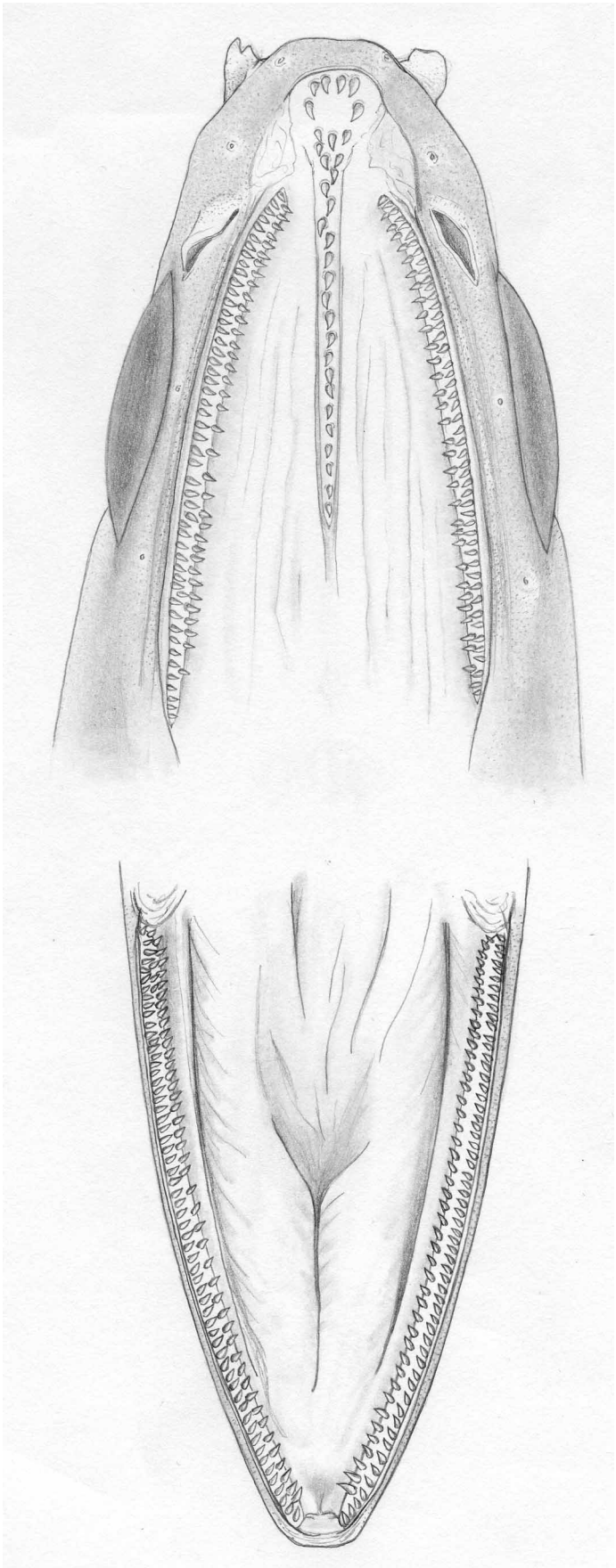

FIGURE 34. Dentition of holotype of *Ophichthus tomioi*, CAS 214208, 390 mm.

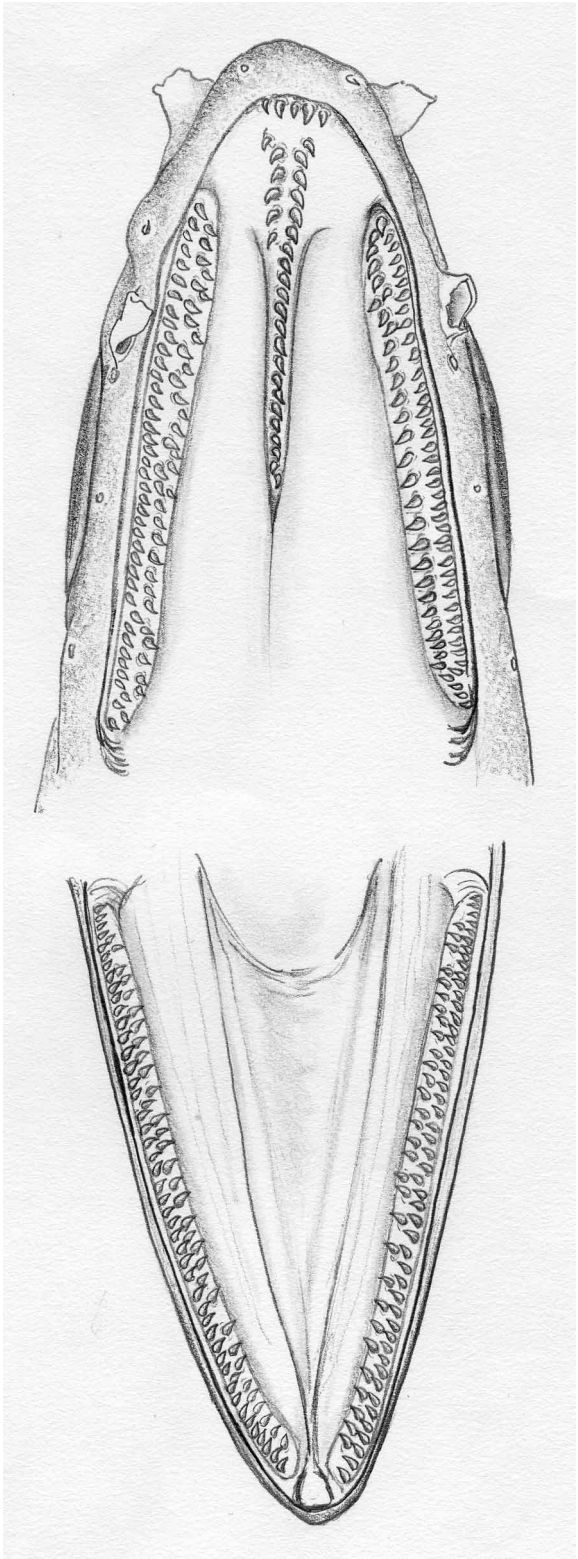

FIGURE 35. Dentition of paratype of *Ophichthus tomioi*, MNHN 2001-1065, 447 mm, from Fiji.

Head pores (Figure 33) small, inconspicuous, difficult to discern. Single median interorbital and temporal pores. Supraorbital pores 1+4, infraorbital pores 4+2, lower jaw pores 6–7, preopercular pores 2. Lateral-line pores present but difficult to enumerate, 8 before gill opening. Total pores of a paratype (MNHN 2001-1065) 160, 62 before anus, last pore 33 mm before tail tip.

Teeth (Figure 34–35) small, conical, numerous. Intermaxillary with a rosette of 5–9 small teeth, then 3–6 irregular pairs and a linear row of 16–19 teeth on the vomer, becoming slightly smaller posteriorly. Maxillary

teeth biserial, close set. An inner row of about 30–40 begins behind level of posterior nostril origin, flanked by an outer row of about 30–45 slightly smaller teeth. Mandibular teeth close set, forming biserial rows of 50–60 teeth. (The number but not the condition of jaw teeth varies considerably between specimens.)

Color in ethanol yellow ventrally, becoming tan along mid-flanks, then paler dorsally. Brown along lateral midline, posterior tail region, snout, lateral edge of anterior nostrils, interorbital region, and shoulders. Chin, throat, fins, inside of mouth, and tail tip pale. Peritoneum gray, darker than exterior surface. Ventral surface of posteriormost tail region (~1 head length) black, including a black smudge on anal fin membrane.

TABLE 4. Counts and proportions (in thousandths) of the holotype and four paratypes of *Ophichthus tomioi* **sp. nov.** TL = total length. HL = head length.

	Mean	Range
TL (mm)	---	334–447
HL/TL	94	91–100
Head and trunk/TL	394	374–407
Tail/TL	606	592–626
Depth at gill opening/TL	35	32–40
Dorsal-fin origin/TL	133	126–138
Pectoral-fin length/HL	447	396–455
Upper jaw/HL	408	378–438
Snout/HL	198	175–211
Eye/HL	171	152–185
Predorsal vertebrae	17	16–18
Preanal vertebrae	63	60–67
Total vertebrae	178	166–189

Size. Largest known is 447 mm, a male.

Etymology. I take pleasure in naming the new species *tomioi* in honor of my friend and colleague Tomio Iwamoto, who captured the holotype.

Distribution. Known from the Philippines, the Marquesas, Fiji and the Seychelle Islands, captured by trap and trawl at 300–423 m depth.

Remarks. The new species is most closely related to those *Coecilophis* with biserial jaw dentition and two preopercular pores, *viz. Ophichthus aniptocheilos, O. brachynotopterus, O. congroides, O. genie, O. kunaloa,* and *O. mystacinus*. All but *O. genie* possess the black anal-fin base coloration posteriorly. The dorsal-fin origin of *O. mystacinus* (mid-trunk), *O. brachynotopterus*, and *O. congroides* (slightly behind pectoral-fin tips) is posterior to that of *O. tomioi*. From *O. kunaloa* the new species differs in the relative length of its eye to its jaw (2.0–2.7 *vs.* 3.6–4.2 in *O. kunaloa*). *Ophichthus aniptocheilos* has fewer vertebrae (140 *vs.* 166–189) and is more darkly pigmented than *O. tomioi*.

Ophichthus tomioi is perhaps the most widely distributed of deepwater Indo-Pacific *Coecilophis*. As stated in the description, the number but not the condition of jaw teeth varies considerably between some of the specimens. For example, the anterior vomerine teeth of the Fijian specimen (MNHN 2001-1065) are neatly biserial, whereas the jaw teeth are irregularly biserial (Figure 35). Those of the Philippine holotype (Figure 34) are similar in size and number but not as neatly arranged. I do not find such differences to be significant. The broad range of vertebral numbers of the holotype and four paratypes is also somewhat perplexing. The vertebral formulae of those specimens are: Seychelles 16/60/166; Fiji 16/67/169; Philippines 16/62/169; and Marquesas 18/63/187 and 18/63/189. I am advised by D.G. Smith of the National Museum of Natural History (pers. comm.) that widely-dispersed species of Indo-Pacific eels occasionally possess endemic forms in the Marquesas. I accept that likelihood here, however lacking other morphometric or meristic characters for those specimens I am hesitant to recognize them as distinct.

***Ophichthus urolophus* (Temminck & Schlegel, 1846)**

Conger urolophus Temminck & Schlegel 1846:260 (type locality Nagasaki, Japan, lectotype RMNH 3688a).
Ophichthys urolophus: Günther 1870: 73.
Ophichthus urolophus: Jordan & Snyder 1901: 872.

Diagnosis. A moderately elongate species of *Ophichthus*, subgenus *Coecilophis*, with: tail 53–58%, head 11–13%, and depth at gill opening 4.0–4.8% of TL; dorsal-fin origin slightly behind pectoral-tips; pectoral fins spatulate, not elongate, slightly less than jaw length; eye large, posterior margin of orbit ahead of rictus; posterior nostril a hole in upper lip covered by a flap; head pores small, inconspicuous, SO 1+3, IO 4+2, POM 2–3+6–7 (typically 3+7); teeth small, conical, uniserial on mandible and vomer, a few interior teeth on maxillary; coloration tan on flanks and dorsum, pale ventrally, all fins pale, anterior nostrils pale, chin and snout dusky. Mean vertebral formula 16.2/54.0/136.5, total vertebrae 134–139 (n=99).

Size. Attains 615 mm sex undetermined.

Distribution. Known from Japan, Indonesia, and NW Australia, generally at depths of 100–420 m. An Indonesian specimen (NTM S-10750-001) was captured by bottom trawl in 40–60 m.

Remarks. The lectotype of *Conger urolophus* was designated by Boesman (1947:187–188). It has 16/54/136 vertebrae. Sumida and Machida (2000) performed an extensive analysis of 89 specimens of *O. urolophus* from Southern Japan, and I have incorporated their counts and measurements (except for the body depth at gill opening, which they did not include) with specimens listed below in the material examined. A color photograph of a 616 mm specimen from Tosa Bay, Japan, appeared in Ida (1982:62).

Originally described from Japan, the range and depth distribution of *Ophichthus urolophus* is herein extended to include western Australia and Lombok, Indonesia, between 40–420 m.

Material examined. RMNH 3688a, 413 mm, the lectotype, from Nagasaki, Japan. Other material examined: AMS I.22821-043, 6(406–490 mm), Western Australia, NW Shelf, N. of Pt. Hedland (18°16'S, 118°12'E), 298–320 m. CSIRO CA 3757, 467 mm, Western Australia, NW Shelf, N. of Pt. Hedland (17°56'S, 118°21'E), prawn trawl at 418–420 m. CSIRO CA 4424, 513 mm, Western Australia, S. of Scott's Reef (14°37'S, 127°47'E), lobster trawl at 300–304 m. NTM S-10750-001, 529 mm, South Lombok, Indonesia (09°00'S, 116°15'E), bottom trawl at 40–60 m.

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