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THE SNAKE EELS (PISCES, OPHICHTHIDAE) OF THE HAWAIIAN ISLANDS, WITH THE DESCRIPTION OF TWO NEW SPECIES

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ABSTRACT: The ophichthid eels of the Hawaiian Islands (including Johnston and the Leeward islands) are reviewed; included are species new to Hawaii and extralimital records of species previously considered to be endemic. A key to species identification is provided. Two new species captured in deepwater traps off Oahu are described: *Muraenichthys puhioilo*, subfamily Myrophinae, captured at 275 m, and *Ophichthus kunaloa*, subfamily Ophichthinae, captured at 350 m. Data concerning the following species are provided: *Schismorhynchus labialis, Muraenichthys cookei, M. macropterus, Apterichtus flavicaudus, Ichthyapus vulturis, Phaenomonas cooperae, Callechelys luteus, Myrichthys maculosus, M. bleekeri, Cirrhimuraena playfairii, Brachysomophis sauropsis, B. henshawi, Phyllophichthus xenodontus, Ophichthus polyophthalmus* and *O. erabo*. Differences in vertebral number of populations of *Myrichthys maculosus* are discussed and the eastern Pacific nominal species *M. xysturus* (Jordan & Gilbert), *M. tigrinus* Girard and *M. pantostigmius* Jordan & McGregor are placed in its synonymy. The endemism (5 of the 15 species) of the Hawaiian ophichthid fauna and the problems of populations and species differences are discussed.

Introduction

The snake eels, family Ophichthidae, of the Hawaiian Islands (including Johnston and the Leeward islands) were first treated by Jordan and Evermann (1905) and subsequently reviewed by Gosline (1951) and Gosline and Brock (1960). Recent collections by the George Vanderbilt Foundation, John E. Randall of the Bishop Museum, and Thomas A. Clarke of the University of Hawaii have added important additional specimens. The Hawaiian Archipelago contains a particularly interesting eel fauna in terms of its abundance and the range of distributional conditions which exist, including species that are endemic to the islands as well as those that are distributed eastward to Australia and the Red Sea. This, while recognizing the dispersal mechanism allowed by the leptocephalus larva, provides an intriguing study for marine zoogeographers. Those considerations, as well as the recent capture of other Hawaiian ophichthids and two apparently undescribed deepwater species, have prompted this review.

Methods

All measurements are straight-line (point to point). Standard length, trunk length, and tail length were read on a 300-mm ruler with 0.5-mm gradations and were recorded to the nearest 0.5 mm. All other measurements were made with dial calipers and were recorded to the nearest 0.1 mm. Head length was measured from the snout tip to the posterodorsal margin of the gill opening; trunk length was taken from the end of the head to mid-anus; body depth does not include the fin. Vertebrae (which include the last centrum) were counted from radiographs.

Comparisons are based in part on specimens

extralimital to the Hawaiian Islands when material was insufficient. Partial synonymies are provided where applicable to the Hawaiian Islands taxa and where new synonymies are proposed.

Specimens utilized in this study are deposited in the following institutions: Australian Museum, Sydney (AMS); Academy of Natural Sciences of Philadelphia (ANSP); British Museum (Natural History) (BMNH); Bernice P. Bishop Museum (BPBM); California Academy of Sciences (CAS), now including the George Vanderbilt Foundation (GVF) and the Stanford University collections (SU); Hawaii Institute of Marine Biology (HIMB); Los Angeles County Museum of Natural History (LACM); Scripps Institution of Oceanography (SIO); University of Hawaii (UH); and the National Museum of Natural History (USNM).

Key to the Ophichthid Eels of Johnston and the Hawaiian Islands

1a. Caudal fin rays conspicuous, confluent with dorsal and anal; tail tip flexible; gill openings mid-lateral, a constricted opening; pectoral fin absent in Hawaiian species. Subfamily Myrophinae 2

1b. Tail tip a hard or fleshy, finless point; gill openings mid-lateral to entirely ventral, unconstricted; pectoral fin present in some species. Subfamily Ophichthinae 7

2a. A prominent median toothed groove on ventral side of snout, bordered by dermal folds, extending forward to anterior nostrils; anterior nostrils elongated tubes equal to eye in length ..... *Schismorhynchus labialis*

2b. Ventral side of snout without a prominent groove bordered by dermal folds; anterior nostrils less than eye in length 3

3a. Teeth absent on vomer, absent or embedded on intermaxillary, those on maxillary and dentary minute or villiform; dorsal fin origin (DFO) behind anus ..... *Schultzidia johnstonensis*

3b. Teeth present on intermaxillary, maxillary, dentary, and vomer; DFO either before or behind anus 4

4a. Posterior nostril entirely outside of mouth; teeth on maxillary, dentary, and vomer in broad bands; snout bluntly rounded ..... *Muraenichthys schultzei*

4b. Posterior nostril inside mouth, covered externally by a flap; teeth uniserial or biserial, not in broad bands; snout either blunt or acute 5

5a. DFO anterior to anus, about midway to gill openings ..... *Muraenichthys puhioilo* n.sp.

5b. DFO above or behind anus 6

6a. Snout blunt; DFO above or slightly before anus ..... *Muraenichthys cookei*

6b. Snout acute; DFO slightly behind anus ..... *Muraenichthys gymnotus*

7a. Body entire finless; coloration either uniform or darker dorsally, without large spots or saddles 8

7b. At least a minute, short, dorsal fin present; coloration variable, either uniform, banded, or spotted, or somewhat darker dorsally 9

8a. Posterior nostril opening outside mouth, with a flap; anterior nostril tubular; body extremely elongate; head 15–20 times in TL ..... *Apterichtus flavicaudus*

8b. Posterior nostril opening inside mouth; anterior nostril flush with snout; body moderately elongate; head 11–12 times in TL ..... *Ichthyapus vulturis*

9a. Only fin a short dorsal originating just behind occiput and ending in anterior trunk region; body extremely elongate, the depth 120–150 times in TL ..... *Phaenomonas cooperae*

9b. Dorsal and anal fins present, the dorsal extending nearly to the tail tip; body moderately to extremely elongate, but the depth less than 120 times in TL 10

10a. Dorsal fin orgin (DFO) on nape; pectoral fins absent; gill openings inferior, converging forward; coloration pale to tan, overlain with small dark spots ..... *Callechelys luteus*

10b. DFO behind nape, either on head or slightly behind gill openings; pectoral fins present; coloration either uniform, spotted, or banded 11

11a. DFO well in advance of gill openings; teeth molariform or granular; pectoral fins broad-based, short and rounded 12

11b. DFO before, above, or behind gill openings; teeth pointed; pectoral fin base re-

stricted, opposite upper half of gill openings and longer than broad 13

12a. Coloration consists of several longitudinal series of dark spots along sides and dorsal surface ..... *Myrichthys maculosus*

12b. Coloration consists of about 30 dark saddles reaching approximately to the lateral line ..... *Myrichthys bleekeri*

13a. DFO well ahead of gill openings; edge of upper lip fringed with a conspicuous row of barbels ..... *Cirrhimuraena playfairii*

13b. DFO above or behind gill openings; upper lip either naked or fringed 14

14a. Postorbital region with a conspicuous transverse depression; lips fringed; canine teeth in jaws and on vomer; coloration uniform 15

14b. Dorsolateral profile on head even; lips entire; jaw and vomerine teeth not excessively developed; coloration uniform, spotted, or banded 16

15a. Dorsal fine pale; snout contained about 15 times in head length ..... *Brachysomophis sauropsis*

15b. Dorsal fin dark with a white border; snout contained about 10 times in head length ..... *Brachysomophis henshawi*

16a. Conspicuous leaflike appendages on anterior nostrils; head and trunk equal to or greater than tail (coloration uniform; vomerine teeth absent) ..... *Phyllophichthus xenodontus*

16b. No leaflike appendages on anterior nostrils; head and trunk equal to or less than tail 17

17a. Vomerine teeth absent or 1–3; head and body coloration light to tan, overlain with a series of black saddles ..... *Leiuranus semicinctus*

17b. A series of teeth on the vomer; coloration uniform or spotted, not as above 18

18a. DFO above pectoral tips; pectoral fin elongate, attenuate; coloration uniform, darker dorsally ..... *Ophichthus kunaloa* n.sp.

18b. DFO above gill openings; pectoral fin rounded; coloration not uniform, markedly spotted 19

19a. Head and body overlain with numerous ocellated spots; those on body in 3 regular alternating rows, the spots separated by pale interspaces; vertebrae of 1 specimen 148 ..... *Ophichthus polyophthalmus*

19b. Head and body overlain with numerous dark spots; those on body in 2 irregular rows, the spots about equal in size to their interspaces; vertebrae of 6 specimens 152–155 ..... *Ophichthus erabo*

Muraenichthys puhioilo, new species

(Figures 1–2)

Holotype: CAS 29115 (originally SIO 70-32), 355 mm total length, captured in a benthic shrimp trap set overnight at 275 m depth, N of Barber's Point, Oahu, Hawaiian Islands, by Thomas A. Clarke on 28 October 1969.

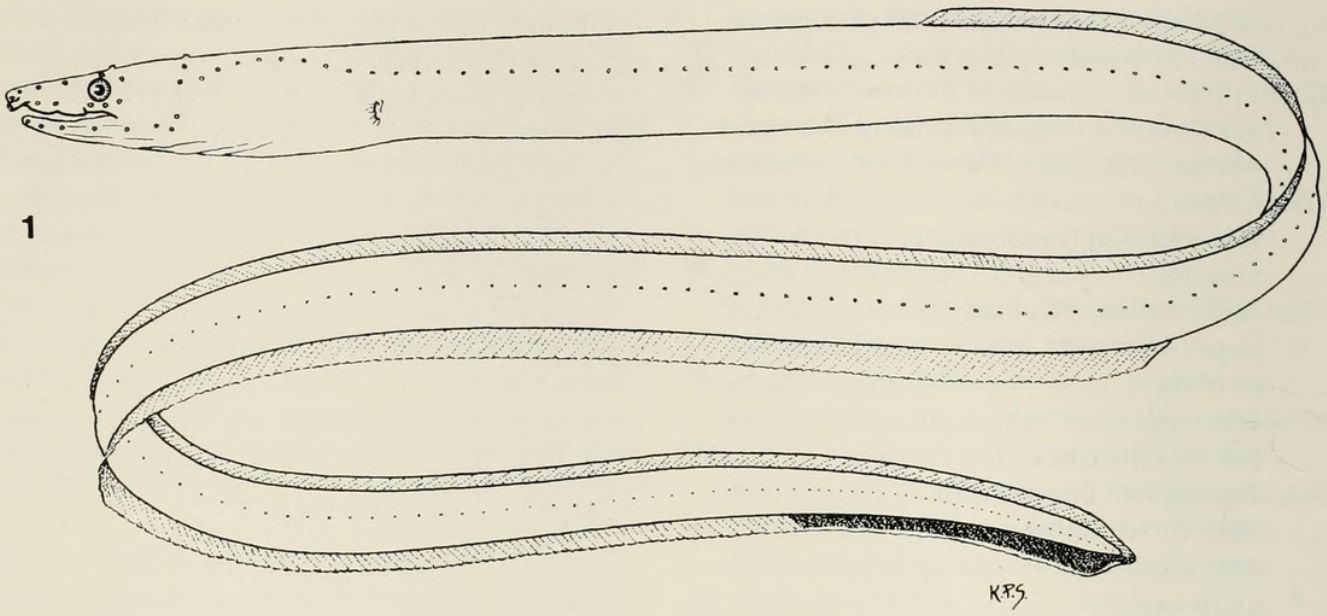
COUNTS AND MEASUREMENTS (in mm).—The description of this new species is based on the holotype and only known specimen. Total length 355 mm; head length 37.3; trunk length 120; tail length 198; body depth at gill openings 15; body width at gill openings 8; body depth at anus 12; body width at anus 7.5; origin of dorsal fin 86; snout length 8.2; upper jaw length 10.7; eye diameter 3.2; interorbital distance 4.4. Total vertebrae 160; preanal vertebrae 62.

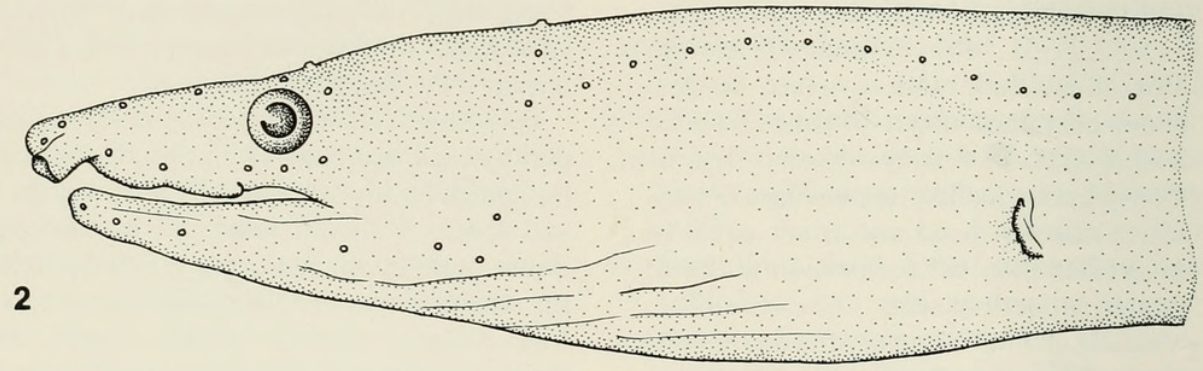
GENERAL DESCRIPTION.—Body elongate, depth at gill openings 23.7 in total length, tapering and laterally compressed posteriorly. Head and trunk 2.26 and head 9.5 in total length. Snout moderately acute; lower jaw included, its tip reaching the posterior edge of anterior nostrils. Anterior nostrils tubular, slightly shorter than eye diameter. Posterior nostril entirely inside upper lip, before anterior margin of the eye, opening inward, appearing externally as a flap. Eye less than twice in fleshy interorbital distance. Interorbital region flat. Rictus of jaw slightly behind posterior margin of eye.

Median fins low, except near tail tip and anterior portion of anal fin. Dorsal fin arises closer to gill openings than to anus. Paired fins absent. Median fins confluent with caudal.

Head pores minute. Single temporal and interorbital pores present. Five pores along mandible, three overlying preopercle. Lateral-line pores difficult to discern posteriorly; 10 pores before gill opening; approximately 140 pores along left side, 65 before the anus. Last lateral-line pore occurs about a head length before tail tip.

Teeth slender, small and conical, uniserial throughout. The pattern of dentition is nearly





FIGURES 1 and 2. Fig. 1. Left lateral view of holotype of *Muraenichthys puhioilo* McCosker, new species, CAS 29115, 355 mm TL. Fig. 2. Head region of holotype of *Muraenichthys puhioilo* McCosker, new species.

identical to that of *Muraenichthys chilensis* (cf. McCosker 1970, fig. 4), except that the new species lacks the anteriormost intermaxillary tooth. None is extremely elongate although the anteriormost vomerine tooth is slightly larger than all jaw teeth. Four intermaxillary teeth, forming an inverted V, are followed by 14 uniserial vomerine teeth. The maxillary teeth are equal in size, 15 right and 17 left. Teeth of lower jaw separated at symphysis, about 17 on each side.

Body coloration in isopropyl alcohol uniform tan, although the belly and lateral-line are slightly darker. Median fins pale except for the posterior portion (slightly longer than head length) of anal fin which is dark. (The functional significance of this highly contrasting fin coloration is not known.) Eyes dark blue.

ETYMOLOGY.—From the Hawaiian *puhi oilo*, small eels about as large in diameter as a finger, here considered a noun in apposition. Eels, particularly *puhi oilo*, were highly esteemed as food by ancient Hawaiians. Mary Kawena Pukui (1902) wrote that "the eel was a fish of which chiefs were fond . . . so much prized by those of Koolau, Maui . . . that they said only beloved guests were served with eels . . . for eels were considered choicer than wives."

REMARKS.—This individual was captured at a depth far greater than that of any previously

known *Muraenichthys*. The nearly 20 species of the genus are generally known from water shallower than 50 meters.

This specimen was reported by Clarke (1972:312), on the basis of my erroneous identification, as *Muraenichthys macropterus* Bleeker. I have subsequently examined a radiograph of Bleeker's type-specimen (BM 1867.II.28.303) and found it to possess 130 vertebrae, with 22 before the dorsal fin origin and 47 before the anal fin origin. Bleeker's type was from Ambon; a series from Palau (CAS 41186) had 127–132 vertebrae ($\bar{x}$ = 129.8, n = 5). My examination of more than 100 specimens of *M. macropterus* from throughout Oceania found them to differ from the new species in having fewer vertebrae, biserial vomerine dentition (becoming uniserial posteriorly), uniform fin coloration, and in occupying shallower water. The new species differs from all other species of *Muraenichthys*, subgenus *Scolecenchelys*, on the basis of its uniserial dentition, anterior dorsal fin location, coloration, and vertebral number.

In my review of *Muraenichthys* (McCosker 1970), I followed Schultz (1953) in considering *M. breviceps* Günther to be a probable synonym of *M. macropterus*. I have subsequently recognized *M. breviceps* as a distinct species and include *M. devisi* Fowler, *M. ogilbyi* Fowler, and *Aotea acus* Phillipps in its synonymy (McCosker and Allen, MS.). I also examined the other known synonyms of *M. macropterus*, *M. owstoni* Jordan and Snyder from Japan and *Echidna uniformis* Seale from Guam, and determined that they are *M. macropterus*. The holotype of *M. owstoni* (SU 6472) has 131 vertebrae.

Ophichthus kunaloa, new species

(Figures 3–4)

Holotype: CAS 29136 (originally SIO 70–33), 440 mm total length, captured in a benthic shrimp trap set overnight at 350-m depth, SE of Barber's Point, Oahu, Hawaiian Islands, by Thomas A. Clarke on 31 December 1969.

Paratypes: Collected with the holotype. BPBM 21086, 473 mm total length. USNM 218274, only the head and anterior trunk region of a partially eaten specimen.

COUNTS AND MEASUREMENTS (in mm).—The condition of the holotype is parenthetically followed by that of the intact paratype. Total length 440 mm (473 mm); head length 42.0 (45.7); trunk length 135 (144); tail length 263 (283); body depth at gill openings 16 (15); body width at gill openings 13.7 (12.5); origin of dorsal fin 58 (68); left pectoral fin length 20.0 (19.5); left pectoral fin base 4.6 (4.5); snout length 8.6 (7.7); upper jaw length 17.2 (20.0); gill opening height 5.6 (5.5); eye diameter 7.0 (8.0); interorbital distance 6.9 (6.9). Total vertebrae 185 (181); preanal vertebrae 66 (67).

GENERAL DESCRIPTION.—Body elongate, depth at gill openings 10.3–10.5 in total length, tapering posteriorly. Tail slender, laterally compressed posteriorly. Head and trunk 2.49 and head 10.3–10.5 in total length. Snout rounded; lower jaw included, its tip in advance of anterior nostril base. Anterior nostril tubular; posterior nostril at edge of lip, entirely outside of mouth, covered anteriorly by a small flap. Eye large; its center lies slightly behind midpoint of upper jaw. Head broad; interorbital area flat.

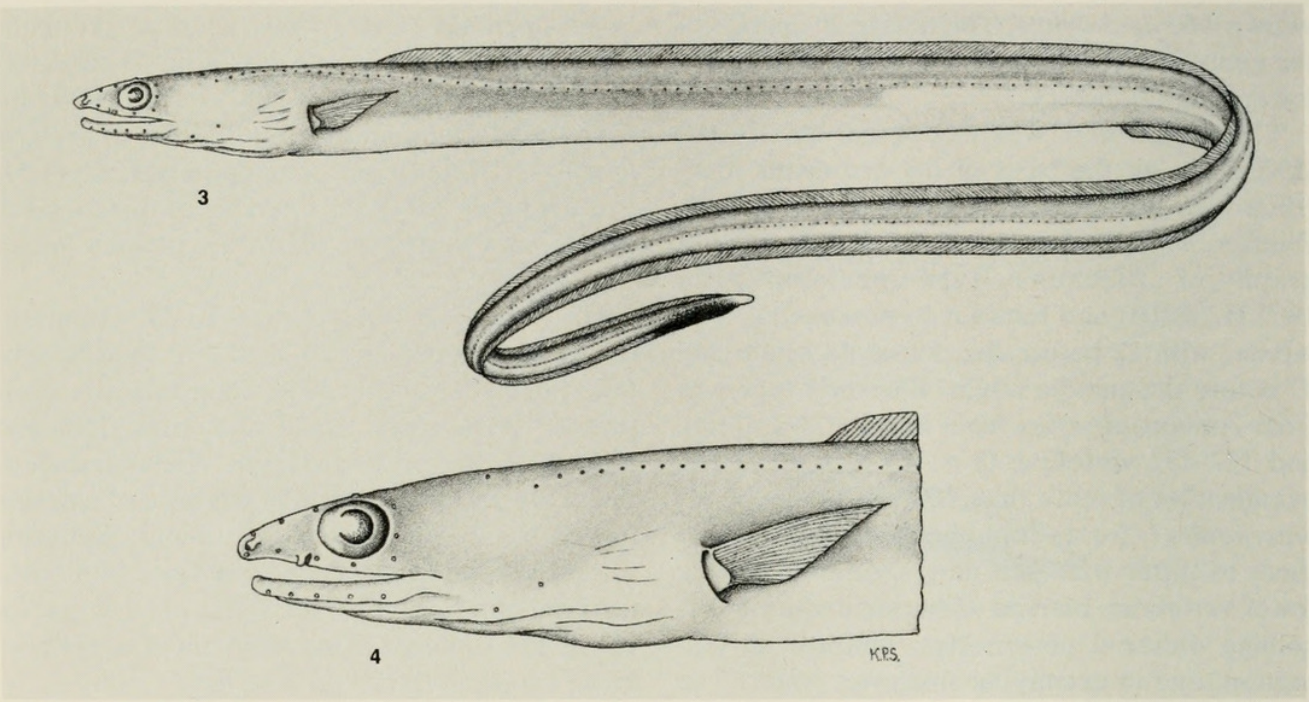
Median fins low, lying partially within a groove. Dorsal fin arises before end of pectoral. Median fins disappear within a flabby groove before the tail tip. Pectoral fins elongate, the dorsalmost rays tapering posteriorly. Caudal tip naked.

Head pores minute, difficult to locate on preserved specimens. Single temporal and interorbital pores. Five pores along mandible, two overlying preopercle. Lateral-line pores begin above second preopercular pore. Lateral-line pores difficult to discern, about 64 before anal opening.

Teeth small, conical; biserial in jaws, the outer row smaller and closer set. Vomerine teeth biserial anteriorly, followed by a uniserial row of about 10 teeth. Intermaxillary tooth patch surrounded anterolaterally by a ring of 6–8 teeth.

Body coloration in isopropyl alcohol tan, becoming lighter along chin, snout, throat, lower third of trunk region, below the lateral-line of the trunk region, along the dorsal midline, and at the tail tip. A black smudge exists along the lower edge of the tail, about ⅓ head length from the tail tip. Fins pale. Lateral-line pores lie within minute white dots. Eyes blue.

ETYMOLOGY.—Named *kunaloa* in reference to Kuna Loa, the Long Eel, of ancient Hawaiian legends. It is said that the sixth great deed of Maui the Wonder Boy was to behead Kuna Loa after the treacherous eel had assaulted the fair maiden Hina (see Colum 1937). The legend as-



FIGURES 3 and 4. Fig. 3. Left lateral view of holotype of *Ophichthus kunaloa* McCosker, new species, CAS 29136, 440 mm TL. Fig. 4. Head region of holotype of *Ophichthus kunaloa* McCosker, new species.

serts that from the cut tail evolved the common conger eel and from the blood which fell into the fresh and salt water came all of the other Hawaiian eels. This, clearly, was the first attempt at a phylogenetic interpretation of Hawaiian anguilliforms.

REMARKS.—The depth of capture of the new species is remarkable in that most benthic ophichthids live shallower than 100 meters. It is entirely likely that future deepwater collections in outlying areas might reveal this or a closely related species.

In his key to the Hawaiian ophichthids, Gosline (1951:309) mentioned a new species of ophichthine which possessed characters similar to the new species, that was "probably from moderately deep water," and had been killed by the Mauna Loa lava flow of 1950. This specimen was not mentioned in further publications, and neither Gosline (in litt.), John E. Randall of the Bishop Museum (BPBM), nor Leighton Taylor of the University of Hawaii (UH) have been able to locate it after the majority of the UH fish collection had been transferred to the BPBM.

The closest relatives to the new species appear to be those congeners which also possess large eyes, similar dentition, posterior nostrils along the lip (rather than opening into the mouth) and preceded by a flap, two rather than three preopercular pores, and a plain coloration. Those species of *Ophichthus*, mostly within the subgenus *Coecilophis* Kaup (cf. McCosker 1977), share a preference for moderate-depth sand or mud substrates. *Ophichthus kunaloa* is particularly similar to *O. urolophus* (Temminck and Schlegel), an oriental species, which differs in its proportionately shorter tail and much deeper body, and to the eastern Pacific *O. pacifici* Günther, a species with a comparatively longer head, deeper body, and white spots along the lateral-line.

The following comments comprise new records and systematic information concerning the Hawaiian ophichthid fauna.

SUBFAMILY MYROPHINAE

Schismorhynchus labialis (Seale)

Muraenichthys labialis Seale, 1917:79 (type-locality, Arno Atoll, Marshall Islands).
Leptenchelys labialis: Schultz 1953:80.
Schismorhynchus labialis: McCosker 1970:509.

REMARKS.—This wide-ranging species has been collected from the Society Islands (BPBM 12016), Marshall Islands, Johnston Island, and Easter Island, but has not been captured in Hawaii.

Muraenichthys cookei Fowler

Muraenichthys cookei Fowler, 1928:41 (type-locality, Oahu).

REMARKS.—I concur with Gosline (1951), that *M. cookei*, a Hawaiian endemic, is closely related to but distinct from *M. laticaudata*. A comprehensive discussion of specific differences exists in Gosline (1955:469–470).

SUBFAMILY OPHICHTHINAE

Apterichtus flavicaudus (Snyder)

Sphagebranchus flavicaudus Snyder, 1904:516 (type-locality, between Maui and Lanai).
Caecula (Sphagebranchus) flavicauda: Gosline 1951:311.
Verma flavicauda: Böhlke 1968:3.
Apterichtus flavicaudus: Böhlke and McCosker 1975:4.

REMARKS.—This species, previously considered a Hawaiian endemic, has now been collected at several South Pacific locations. I compared all of Snyder's specimens with specimens from Midway Island (SIO 68–487) and Rapa Island (BPBM 12306), and found them to differ only in vertebral number. Six Hawaiian and Midway specimens had 155–166 ($\bar{x}$ = 158.7) vertebrae, whereas six Rapa specimens had 163–166 ($\bar{x}$ = 164).

Ichthyapus vulturis (Weber and de Beaufort)

Sphagebranchus vulturis Weber and de Beaufort, 1916:319 (type-locality, Nasi besar Island, Sumatra).
Caecula (Sphagebranchus) platyrhyncha Gosline, 1951:312 (type-locality, Oahu, Hawaiian Islands).

REMARKS.—Randall and McCosker (1975) synonymized *Caecula platyrhyncha* with *Sphagebranchus vulturis* after comparing Hawaiian specimens with the holotype. Variation exists in the number of preopercular pores (either 3 or 4) of Hawaiian specimens, but the pore number of specimens from other localities was found to be constant.

Phaenomonas cooperae Palmer

Phaenomonas cooperae Palmer, 1970:219 (type-locality, Gilbert Islands).

REMARKS.—This unmistakable elongate species is known from Hawaii on the basis of a specimen (HIMB 68–52) dredged from a depth of 60 m, offshore from Keehi Lagoon, Oahu, in 1968. The specimen has 262 total vertebrae, 169 preanal, and falls within the range of meristic and morphometric variation of its Indo-West-Pacific conspecifics (McCosker 1975).

Callechelys luteus Snyder

Callechelys luteus Snyder, 1904:517 (type-locality, near the southern coast of Molokai).

REMARKS.—This elongate species, unique in dorsal fin condition and coloration, is known only from the Hawaiian Islands and Midway Island (SIO 68–497). Its closest relative appears to be the eastern Pacific endemic *C. galapagensis* McCosker and Rosenblatt. A radiograph of the holotype of *C. luteus* (USNM 50864) evidenced 216 vertebrae, with 123 before the anal fin origin.

Myrichthys maculosus (Cuvier)

Muraena maculosa Cuvier, 1817:232 (type-locality, European Seas?).
Pisoodonophis magnifica Abbott, 1861:476 (type-locality, Hawaiian Islands).
Ophichthus stypurus Smith and Swain, 1882:120 (type-locality, Johnston Island).

REMARKS.—This common species, perhaps better than any other Hawaiian ophichthid, depicts the isolation of the Hawaiian and Johnston population as evidenced by vertebral number. I am unable except by vertebral number to separate the Hawaiian, Midway, and Johnston specimens from those from the Red Sea, Indian Ocean, Oceania, and the eastern tropical Pacific (see Table 1). For this and related faunal studies I have examined many living and dead specimens of *Myrichthys* as well as the types of most of the nominal species. Until now, I have followed the conventional view that the eastern Pacific nominal species *M. xysturus* (Jordan and Gilbert) (which includes *M. tigrinus* Girard and *M. pantostigmius* Jordan and McGregor) differs from *M. maculosus*, although the only significant difference is that of vertebral number. In the absence of any apparent morphological differences, I am resigned to recognize these populations at a subspecific level, and therefore recognize this ophichthid as a trans-Pacific species. The differences in *M. maculosus* population vertebral numbers is thus parallel to the condition of several trans-Pacific species of muraenid eels (Rosenblatt et al. 1972; McCosker and Rosenblatt 1975). I suspect that as data are gathered concerning the duration of larval life, distance of larval transport, and the critical period of leptocephalus transformation, a more lucid view of *Myrichthys* taxonomy will be achieved.

I have examined the holotypes of *M. magni-*

TABLE 1. *Myrichthys maculosus* (CUVIER): VERTEBRAL DATA FOR EASTERN PACIFIC AND INDO-PACIFIC POPULATIONS. All counts made from radiographs of adults.

	mean	range	n
Eastern Pacific[1]	153.1	149–157	19
Revillagigedos and Clipperton Is.	163.1	161–168	10
Hawaii, Johnston, and Midway	178.5	174–182	16
Western Pacific[2]	192.8	190–199	8
Red Sea	194.5	194–195	2

[1] Specimens from the Gulf of California, Tres Marias Islands, Cocos Island, Panama, and the Galapagos Islands.

[2] Specimens from Wake, Palau, Philippines, RyuKyus, and the Line Islands.

ficus and *M. stypurus* and found them to be conspecific. The holotype of *M. stypurus* is aberrant in that its tail had been severed and subsequently healed.

Myrichthys bleekeri Gosline

Ophisurus fasciatus var. *semicinctus* Bleeker, 1864:64 [a homonym of *Ophisurus semicinctus* Lay and Bennett, 1839:66] (type-locality, Indonesia).

Myrichthys bleekeri Gosline, 1951:314 [a substitute name for *Ophisurus fasciatus* var. *semicinctus* Bleeker, 1864, preoccupied].

REMARKS.—This species is known from Johnston Island and the Indo-West-Pacific, but not from Hawaii.

Cirrhimuraena playfairii (Günther)

Ophichthys playfairii Günther, 1870:76 (type-locality, Zanzibar).

Microdonophis macgregori Jenkins, 1903:422 (type-locality, Lahaina, Maui).

Jenkinsiella macgregori: Jordan and Evermann, 1905:82.

Cirrhimuraena playfairii: Barnard, 1925:205.

Cirrhimuraena macgregori: Gosline, 1951:315.

REMARKS.—Smith (1962) synonymized the Hawaiian species *Microdonophis macgregori* with the wide-ranging Indo-Pacific species *Cirrhimuraena playfairii*. He based this action on his comparison of four specimens from Aldabra with published descriptions by Gosline (1951) of Hawaiian specimens and by Weed and Howarth (1961) of specimens from Ceylon. I have examined the type-specimens from Hawaii and compared them with material from Midway (SIO 68–497) and the Marquesas (BPBM 12304), and concur with Smith. The holotype of *M. macgregori* (USNM 50721) has 180 vertebrae; two Marquesan specimens have 186 and 187 vertebrae.

Brachysomophis sauropsis Schultz

Brachysomophis sauropsis Schultz, 1943:18 (type-locality, Samoa).

REMARKS.—Not known from Hawaii. I have been unable to examine Gosline's (1955:443) specimen of *B. sauropsis* from Johnston Island. However, based on his description, I would agree that *B. sauropsis* and *B. henshawi* are distinct species.

Brachysomophis henshawi Jordan and Snyder

Brachysomophis henshawi Jordan and Snyder, 1904:940 (type-locality, Honolulu).

REMARKS.—Apparently, this species is a Hawaiian endemic. A comprehensive revision of *Brachysomophis* is necessary, however, before assumptions concerning its species can be made.

Phyllophichthus xenodontus Gosline

Phyllophichthus xenodontus Gosline, 1951:316 (type-locality, Oahu).

REMARKS.—*Phyllophichthus* is currently recognized to contain a single wide-ranging species, known from the western Indian Ocean, throughout Oceania, and Hawaii (McCosker and Allen, MS). Four specimens from Johnston and Oahu islands had 168–175 vertebrae ($\bar{x}$ = 170.8).

Ophichthus polyophthalmus Bleeker

(Figure 5)

Ophichthys polyophthalmus Bleeker, 1864:43 (type-locality, Ambon).

Microdonophis polyophthalmus: Jordan and Snyder 1907:207.

Ophichthus polyophthalmus: Fowler 1927:5.

REMARKS.—The markedly spotted Hawaiian eels placed by recent authors in either *Microdonophis* or *Ophichthus* is a composite. *Ophichthus polyophthalmus* (Fig. 5), a medium-length adult ophichthid with ocellated spots on the head and body, was reported by Fowler (1927) on the basis of a Kahoolawe (BPBM 3700) dredge specimen. Fowler (1928) subsequently recorded eleven Honolulu market specimens (the largest, 1,039 mm) which possessed dark spots; he considered them to also be *O. polyophthalmus* and recognized the nominal species *Microdonophis fowleri* Jordan and Evermann

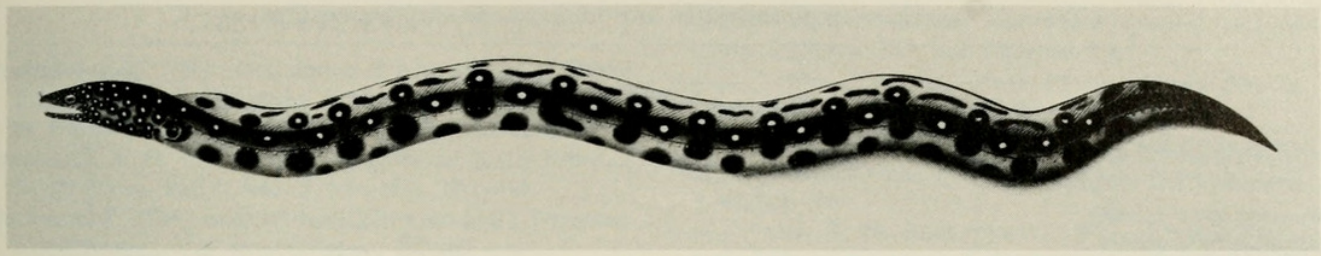


FIGURE 5. Adult specimen of *Ophichthus polyophthalmus*, taken from Bleeker (1864).

and *Ophichthus garretti* Günther to be synonyms which differed only in coloration. *Ophichthus garretti* is a valid and distinctly different species. My comparison of numerous specimens of the large form with solid dark spots (*Ophichthus erabo*, Fig. 6) with the medium-length eel with ocellated spots indicated that they are in fact separate species differing in coloration and vertebral number. Too few specimens of *O. polyophthalmus* were available for a proper morphological comparison, although *O. erabo* appears to possess a proportionately longer tail.

I herein report a second Hawaiian specimen of *O. polyophthalmus*, collected in 1968 by hook and line from Nanakuli, Oahu (BPBM 11981, 399 mm SL). The specimen has 148 vertebrae, 75 before the anal opening.

Ophichthus erabo (Jordan and Snyder)

(Figure 6)

Microdonophis erabo Jordan and Snyder, 1901:780 (type-locality, Misaki, Japan).

Microdonophis fowleri Jordan and Evermann, 1904:164 (type-locality, Honolulu).

Ophichthus erabo: McCosker 1977:81.

REMARKS.—The majority of Hawaiian records of *O. polyophthalmus* are based on specimens of *O. erabo*. I have compared the Japanese holotype (SU 6477) and cotypes (SU 6667 and 6744) of *O. erabo* with specimens from Hawaii (SU 8407; SU 8466; BPBM 12510; and USNM 50613, the holotype of *M. fowleri*) and Taiwan (CAS 15600), and found them not to differ. The vertebral range of six specimens was 152–155 ($\bar{x}$ = 154). The holotype of *O. erabo* has 155 vertebrae and the holotype of *M. fowleri* has 152.

DISCUSSION

The endemism of the Hawaiian shorefish fauna has been recognized by numerous authors and most recently summarized by Randall (1976). He calculated that 29 percent of the 442 reef and shorefish species were endemic at the specific or subspecific level. He elucidated the situation of the problematical species such as *Acanthurus triostegus*, wherein an identifiable difference in coloration exists between the Hawaiian and extralimital populations, but a consensus of opinion concerning the biological significance of that difference has not been reached. A similar problem exists with the Hawaiian ophichthids.

Of the 15 ophichthids present at Hawaii, five species are endemic. The new species described herein, *Ophichthus kunaloa* and *Muraenichthys puhioilo*, are known only from a single deep-water collection and are therefore of little value

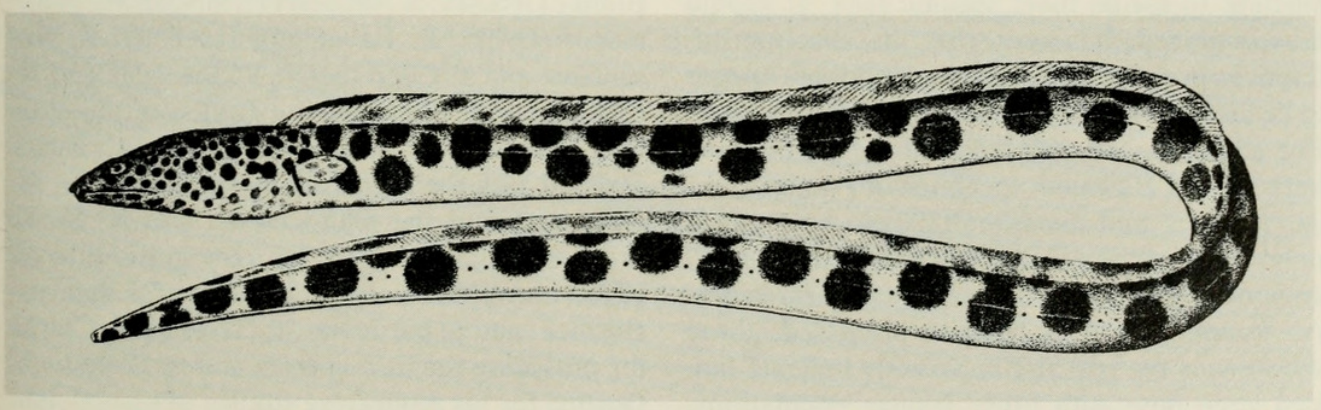


FIGURE 6. Adult specimen of *Ophichthus erabo*, taken from Jordan and Snyder (1901).

TABLE 2. DISTRIBUTION OF HAWAIIAN AND JOHNSTON ISLAND OPHICHTHIDS.

	Hawaiian	Leewards	Johnston	Indo-West Pacific
Schultzidia johnstonensis	x	x	x	x
Schismorhynchus labialis			x	x
Muraenichthys schultzei			x	x
Muraenichthys cookei	x	x	x	
Muraenichthys gymnotus			x	x
Muraenichthys puhioilo	x			
Ichthyapus vulturis	x	x		x
Apterichtus flavicaudus	x	x		x
Callechelys luteus	x	x		
Myrichthys maculosus	x	x	x	x
Myrichthys bleekeri			x	x
Cirrhimuraena playfairii	x	x		x
Phyllophichthus xenodontus	x			x
Phaenomonas cooperae	x			x
Leiuranus semicinctus	x	x	x	x
Brachysomophis sauropsis			x	x
Brachysomophis henshawi	x			
Ophichthus erabo	x			x
Ophichthus polyophthalmus	x			x
Ophichthus kunaloa	x			

to a zoogeographic analysis. The endemics, *Muraenichthys cookei* and *Brachysomophis henshawi*, are perhaps no more different than are several of the other ophichthids discussed here from their Indo-West-Pacific "conspecifics." *Callechelys luteus* is the only Hawaiian ophichthid endemic distinctly different at the specific level from all known congeners. It is most closely related to *C. galapagensis*, another insular endemic (McCosker and Rosenblatt 1972). In my analysis of Hawaiian ophichthids, I have been able to recognize the Hawaiian populations of several species (viz., *Myrichthys maculosus*, *Phaenomonas cooperae*, *Phyllophichthus xenodontus*, *Ichthyapus vulturis*, and probably several others) to be distinct from other Indo-Pacific populations of their conspecifics on the basis of vertebral differences. Yet I am hesitant to assign them specific rank. It should be recognized, however, that the absolute differences in ophichthid vertebral numbers appear to be less when calculated on a percentage basis. For example, the difference of eight vertebrae between the Hawaiian specimen of *Phaenomonas cooperae* and the Gilbert Island holotype is only three percent, which is less than a difference of one vertebra for most perciform fishes. As Randall (1976:49–50) has discussed, these differences are real and apparently indicate limited gene flow with other insular populations. Whether the Hawaiian forms are in fact distinct biological species, incipient species, or whatever taxon a systematist deems them, awaits the discovery of biological data concerning leptocephalus transport, longevity, and gene flow.

Untaxing the taxonomy of the Hawaiian ophichthids, initiated by Maui the Wonder Boy and continued by Jordan, Evermann, and Gosline, remains a challenge.

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