

A New Species of Sand Eel, *Yirrkala moorei* (Anguilliformes: Ophichthidae), from the South Pacific

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Yirrkala moorei, a new species of sand eel, subfamily Ophichthinae, tribe Sphagebranchini, is described from specimens captured using ichthyocides and trawls in the Marquesas and American Samoa at depths of 25–454 m. It is most similar to the Indo-Pacific *Y. lumbricoides* and *Y. tenuis*, but differs from them and their congeners in a combination of its body proportions, brown-striped coloration, and its vertebral number (162–173).

KEY WORDS: Ophichthidae; *Yirrkala moorei* sp. nov.; Marquesas Is., American Samoa.

In attempting to distinguish the numerous species of eastern Pacific *Ophichthus*, McCosker and Rosenblatt (1998:423) lamented that “the morphological reduction that is the essence of eelness has resulted in a paucity of characters useful in other fishes for determining species . . . The eel shape presents few landmarks for measurements on the body; gill openings, the anus, and dorsal and anal origins exhaust the list.” And, as a result of the often twisted nature of the poorly preserved specimens, they concluded that “In general, it is a fair statement that measurements on eels may be made with great precision but without much accuracy.” The Indo-Pacific sand eels of the genus *Yirrkala*, tribe Sphagebranchini (*sensu* McCosker 1977), are even more poorly known and difficult to delineate in that they have also lost their paired fins and are for the most part generally small, mostly unpigmented, and uniform in appearance. The discovery of several well-preserved specimens of a previously unknown striped species of *Yirrkala* has, therefore, provided a welcome opportunity to add to the knowledge of the diversity of these eels.

MATERIALS AND METHODS

Specimens were captured by dredge or by rotenone-based ichthyocides. All specimens deposited in the Muséum National d'Histoire Naturelle, Paris (MNHN), were captured using a Warren Dredge during the MUSORSTOM Campagne 9 survey of the Marquesas Islands.

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 a 1 m ruler with 1 mm gradations and recorded to the nearest 1 mm. All other measurements are made with dial calipers or dividers and recorded to the nearest 0.1 mm. Body length is head plus trunk length. 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. The rictus of a paratype was surgically cut on its right side to allow the accurate illustration of its dentition, a necessary procedure. Head pore terminology follows that of McCosker et al.

(1989:257). Vertebral counts (which include the hypural) were taken from radiographs. The mean vertebral formula (MVF) is expressed as the average of predorsal, preanal, and total vertebrae. Type specimens are deposited at the Academy of Natural Sciences, Philadelphia (ANSP); the California Academy of Sciences, San Francisco (CAS), the Muséum National d'Histoire Naturelle, Paris (MNHN), and the National Museum of Natural History (NMNH), Washington DC. Institutional abbreviations follow the Standard Symbolic Codes for Institutional Research Collections in Herpetology and Ichthyology (Leviton et al. 1985).

Genus *Yirrkala* Whitley, 1940

Yirrkala Whitley 1940: 410 (TYPE SPECIES: *Y. chaselingi* Whitley 1940, by original designation).

Yirrkala moorei McCosker, sp. nov.

(Figs. 1–3; Table 1)

Yirrkala sp. McCosker, 1977:16, 69.—Wass, 1984:6.

MATERIAL EXAMINED.—HOLOTYPE: CAS 46677, 434 mm TL, immature male, American Samoa, Aunu'u Id. (14°17'S, 170°34'W), collected using rotenone over a sandy bottom, 24 m, by R.C. Wass, Nov. 1975. PARATYPES: All paratypes and nonparatypes are from the Marquesas Islands. BPBM 11857, 289 mm TL, Nuku Hiva Id., Hatuatua Bay (08°51'S, 140°00'W), dredged in 53–59 m by D. Devaney et al., 18 Sept. 1967. BPBM 11858, 307 mm TL, cleared and stained, Nuku Hiva Id., Ua Pou (15°40'S, 146°13'W), dredged in 84–93 m by D. Devaney et al., 18 Sept. 1967. BPBM 36172, 119 mm TL, Eiao Id. (07°59'S, 140°48'W), dredged in 55 m by J. Poupin, 19 Jan. 1991. USNM 306545, 410 mm TL, Nuku Hiva Id., Hatuatua Bay (08°51'S, 140°00'W), dredged in 42–59 m by H. Rehder et al., 18 Sept. 1967. ANSP 165122, 375 mm TL, collected with USNM 306545. MNHN 2001-1075, 259 mm TL, Nuku Hiva Id. (08°56'S, 140°06'W), dredged in 45–64 m by J. Poupin & B. Richer de Forges, 24 Aug. 1997. MNHN 2001-1076, 402 mm TL, Hiva Oa Id. (09°50'S, 139°02'W), dredged in 50 m, 29 Aug. 1997. MNHN 2001-1077, 243? mm TL (specimen severed by dredge), Nuku Hiva Id. (08°49'S, 140°03'W), dredged in 31–33 m by J. Poupin & B. Richer de Forges, 26 Aug. 1997. NONPARATYPES: MNHN 2001-1073, 225 mm body length (tail missing, cut by dredge), Moto One Hatutaa Id. (07°47'S, 140°20'W), dredged in 450–454 m, 7 Sept. 1997. MNHN 2001-1074, 181 mm tail length (head and anterior trunk missing, cut by dredge), female with developing ova, Hiva Oa Id. (09°50'S, 139°00'W), dredged in 85 m, 29 Aug. 1997.

DIAGNOSIS.—An elongate species of *Yirrkala* with the unique combination of characters: head 6.3–6.9% of total length (TL); tail 48–52% of TL; dorsal-fin origin in advance of gill openings; eye above middle of upper jaw; teeth conical, minute, uniserial on jaws and vomer; coloration pale, overlain with a broad longitudinal brown stripe above the lateral midline; total vertebrae 162–173; and mean vertebral formula 4-77.5-167.

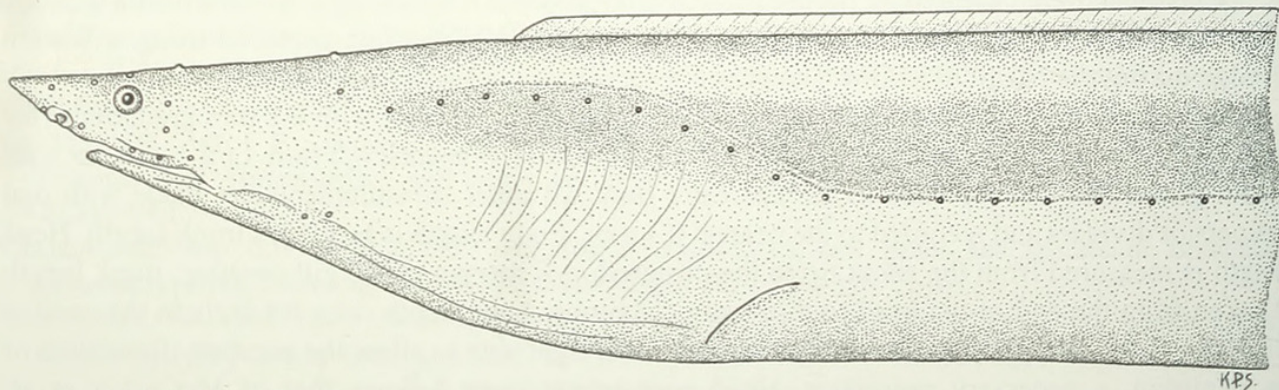


FIGURE 1. Head of holotype of *Yirrkala moorei* sp. nov., CAS 46677, immature male, 434 mm.

COUNTS AND MEASUREMENTS OF HOLOTYPE (IN MM).— Total length 434; head length 27.4; trunk length 182.6; tail length 224; body depth at gill openings 7.9; body depth at anus 6.2; body width at gill openings 5.6; body width at anus 5.5; origin of dorsal fin 17.6; snout length 4.0; upper jaw length 7.8; isthmus 1.5; left gill opening length 4.0; eye diameter 1.2; interorbital distance 2.2. Total vertebrae 173; predorsal vertebrae 4; preanal vertebrae 81.

DESCRIPTION OF HOLOTYPE AND PARATYPES.— Body very elongate, its depth at gill openings 55–71 times in TL; body and tail nearly cylindrical, tapering posteriorly to an acute finless point. Head and trunk 1.9–2.1 and head 14.5–15.9 in TL. Snout acute at tip, conical from above, flat on underside and split medially nearly to anterior edge of nostril. Lower jaw included, does not reach anterior nostril edge. Anterior nostril nearly flush with snout, surrounded at base by a prominent groove; posterior nostril within inner edge of lip, not visible externally. Center of eye at middle of upper jaw.

Median fins low but obvious. Dorsal arises behind middle of head. Gill openings low, their major axis nearly horizontal, without an anterior lateral membrane or duplication. Isthmus narrow, its width much less than gill opening.

Head pores reduced but visible (Fig. 1). Four mandibular, 2 preopercular, 1 ethmoidal + 3 supraorbital, 4 + 2 infraorbital, and single interorbital and supratemporal pores. Lateral-line pores minute, covered with a waxy exudate, and difficult to discern. Total left lateral-line pores of the stained-and-cleared paratype 162; 8 before the gill opening and 80 before the anus.

Teeth (Fig. 2) small and conical, slightly recurved, uniserial in jaws. Intermaxillary teeth the largest, 2–3 as an inverted “V” and partially exposed beneath snout, followed by a short gap and 3–4 pairs of smaller vomerine teeth, followed by 7 even smaller uniserial teeth. Approximately 15–17 uniserial upper jaw teeth and 15–16 lower jaw teeth.

Body coloration in isopropyl alcohol uniform yellowish, overlain with a broad longitudinal dark stripe above the lateral line, extending from the branchial basket nearly to the tail tip. Upper

TABLE 1. Proportions (in thousands) and counts of the holotype and 7 paratypes of *Yirrkala moorei*. The smallest paratype, BPBM 37162, is not included. Abbreviations are: TL = total length; HL = head length; DFO = dorsal-fin origin; IO = interorbital width; GO = gill opening length.

	mean	range
Total length (in mm)		243-434
Head/TL	65	63-69
Trunk/TL	494	483-517
Tail/TL	506	483-517
Depth/TL	16	14-18
DFO/TL	42	39-47
Snout/HL	161	146-182
Upper jaw/HL	261	257-296
Eye/HL	39	35-44
IO/HL	70	50-82
GO/HL	109	92-146
Vertebrae		
Predorsal	4	4
Preanal	77.5	75-81
Total	167	162-173

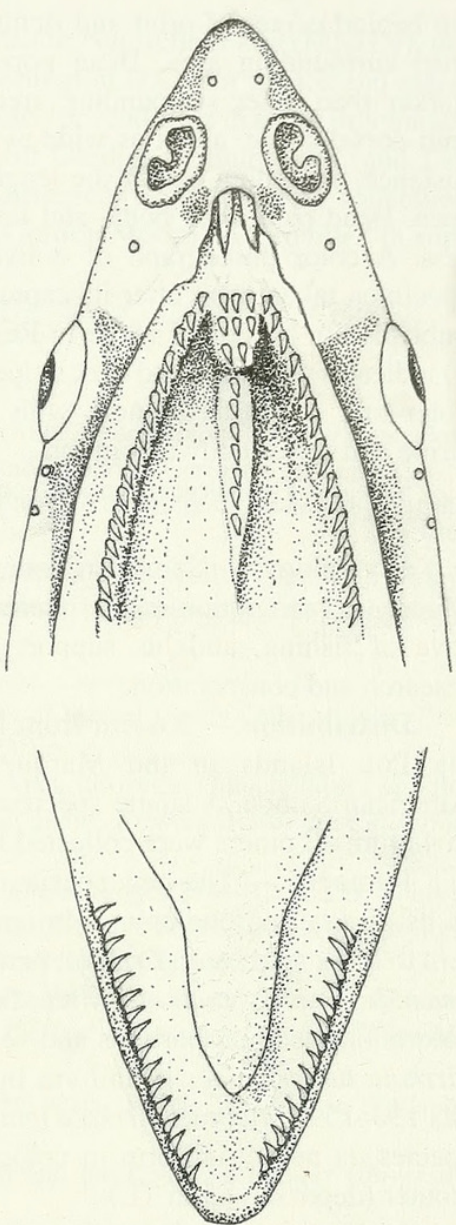


FIGURE 2. Dentition of paratype of *Yirrkala moorei* sp. nov., MNHN 2001-1076, 402 mm TL, an immature male.

lip behind center of orbit and rictus of jaw darker than surrounding area. Head pores within spots darker than paler surrounding area. A wide pale mid-dorsal stripe, about as wide as the interorbital distance, extending nearly the length of the specimen. Head paler than body, and fins nearly colorless. A color photograph of a living Marquesan specimen taken soon after its capture (Fig. 3; also published in black and white in Rehder, 1974: fig. 5) indicates that the broad dark stripe is chocolate in color and contrasts strongly with the mid-dorsal stripe and lower body coloration.

Size.— The largest known specimen is 434 mm TL.

Etymology.— Named in honor of Gordon E. Moore, in recognition of his interest in fishes, his love of fishing, and his support of biodiversity research and conservation.

Distribution.— Known from Nuku Hiva and Ua Pou islands in the Marquesas and from American Samoa. A single specimen was dredged in 454 m; all others were collected in 25–93 m.

Remarks.— The new species is quite similar in its general morphology, dentition, and pore pattern to other species of *Yirrkala*, particularly *Y. lumbricoides* and *Y. tenuis*. It differs from them in its coloration, body proportions and vertebral number. *Yirrkala lumbricoides* is uniform in coloration and has 150–159 vertebrae. *Yirrkala tenuis*, an estuarine species, is nearly uniform in coloration (olive brown dorsally, lighter ventrally) and somewhat stouter (depth 41–45 in TL).

A coloration similar to that of the new species is possessed by other ophichthids of the tribe Callechelyini (*sensu* McCosker 1977) including the Indo-Pacific species *Callechelys catostoma* (Forster, in Bloch and Schneider, 1801), *C. randalli* McCosker (1998), and *Xestochilus nebulosus* (Smith, 1962), and the Atlantic species *Aprognathodon platyventris* Böhlke (1967) and *Letharchus aliculatus* McCosker (1974). It is unlikely that such a similarity in coloration would indicate a mimicry relationship with each other or with other striped marine organisms, but rather it is probably advantageous to such a sand-burrowing species when it leaves the substrate. (The coloration of the smallest specimen [BPBM 37162, 119 mm TL], a recently transformed juvenile, appears to be like that of the adults.) At this time, an explanation for such an advantage is not obvious.

ACKNOWLEDGMENTS

I wish to thank: Richard C. Wass, the late Harald Rehder, and John E. Randall for collecting the type specimens; Kathy Smith for preparing figure 1, Beth Herd Guy for preparing figure 2, and the late Harald Rehder for permission to use his photograph as figure 3; the late Eugenie Böhlke of the Academy of Natural Sciences, Philadelphia (ANSP), the staffs of the California Academy of



FIGURE 3. Living paratype of *Yirrkala moorei* sp. nov. (either USNM 306545, 410 mm TL, or ANSP 165122, 375 mm TL) captured by dredge in 42–59 m, Nuku Hiva Id., Hatuatua Bay.

Sciences (CAS), Patrice Pruvost of the Muséum National d'Histoire Naturelle, Paris (MNHN), the staff of the National Museum of Natural History (NMNH), Washington D.C., for advice and assistance with specimens; and David Greenfield and Tomio Iwamoto for reading a draft of this manuscript. And I sincerely thank Craig Barrett, David House, Paul Otellini, Arthur Rock, and Les Vadasz for their generous gift to Trout Unlimited, a North American salmonid and watershed restoration organization, in recognition of the contribution that Gordon Moore has provided in support of biodiversity research and the survival of life on Earth.

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