

A Gigantic Deepwater Worm Eel (Anguilliformes: Ophichthidae) from the Verde Island Passage, Philippine Archipelago

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A new species of a deepwater ophichthid worm eel was collected from the Verde Island Passage of the Philippine Archipelago. *Pylorobranchnus hearstorum* sp. nov., subfamily Myrophinae, is described and illustrated from a specimen trawled in 892–966 m. It is much larger than any known myrophine and differs from its only congener, *P. hoi*, in its longer tail (66% of TL vs. 52–59%), shorter head (8.8% of TL vs. 11.0–11.8%), body depth (39 times in TL vs. 29–31), dorsal-fin origin (ahead of mid-trunk vs. behind mid-trunk), vertebral number (226 vs. 182–183), and its coloration (brownish black vs. uniform brown). The known ophichthid fauna of the Philippines is discussed and listed.

KEYWORDS: Ophichthidae; *Pylorobranchnus hearstorum* sp. nov.; Verde Island Passage, Philippines

The center of diversity of fishes in the Indo-Malay-Philippines archipelago is said to be in the Philippines (Carpenter and Springer 2005). The California Academy of Sciences recently mounted an expedition sponsored by William and Margaret Hearst to further investigate the diversity of plants and animals at several Philippine localities. Shallow water collections were made using scuba and deepwater collections were made aboard the M/V *DA-BFAR* in the vicinity of the Verde Island Passage, between Luzon and Mindoro islands. Preliminary findings have added several new marine fish species including a shallow water, coral reef-inhabiting snake eel, *Myrichthys paleracio*, collected from southern Luzon Island and described by McCosker and Allen (2012), and a deepwater myrophine trawled from the Verde Island Passage. Other eels collected, including two deepwater morays, are currently under investigation and may represent either new species or slightly different of rare and poorly known muraenids. The collections, although not comprehensive considering the diversity of habitats and the enormity of space in the Philippines, do indicate that additional unknown taxa remain to be discovered.

The center of diversity of ophichthid eels in the Indo-Malay-Philippines archipelago has not been adequately analyzed such that a confident prediction of comparative insular biodiversity can be made. Unpublished studies by systematists at the California Academy of Sciences (this author), the National Museum of Natural History (David G. Smith), and Silliman University (Abner Bucol) have advanced us toward that goal. The Philippine snake eels and worm eels of the family Ophichthidae were previously treated by Weber and de Beaufort (1916), Fowler (1918), Herre (1923), and subsequent authors including Allen and Erdmann (2012) and my published and unpublished works, resulting in a list comprising approximately 50 valid and six questionable species.¹ Whereas the Philippine ichthyofauna comprises many ophichthids (Appendix 1), several of which (*Muraenichthys philippinensis*, *M. thompsoni*, and *Myrichthys paleracio*) are known only from the archipelago, there are many species and genera known from Malaysia and Indonesia that have yet

¹ The type specimens of *Muraenichthys malaboensis* and *Ophichthus manilensis*, destroyed during WWII, have not been subsequently observed and probably are not valid species.

to be found in the Philippines (Allen and Adrim 2003; Allen and Erdmann 2012; and unpub. data). Included are: *Brachysomophis cirrocheilos*, *B. henshawi*, *Callechelys catostoma*, *C. marmorata*, *C. papulosa*, *Hemerorhinus heyningi*, *Phyllophichthus xenodontus*, *Schultzidia johnstonensis*, *Scolecenchelys acutirostris*, and *Xestochilus nebulosus*.

Whereas most ophichthids are benthic and occupy 100 m or less, more recent deepwater trawling and trapping have demonstrated that many deepwater ophichthids remain to be discovered (McCosker 2010). I herein describe an additional worm eel known from a single specimen and collected in deep water from the Verde Island Passage. It is closely related to the deep water *Pylorobranchnus hoi* McCosker et al. (2013) from Taiwan and is remarkable in that it is nearly twice as long and three times heavier than any known myrophine.

MATERIALS AND METHODS

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 ethmoid pore + pores in supraorbital canal, e.g., 1 x 3, and the infraorbital pores are expressed as pores along the upper jaw + those in vertical part of canal behind eye (the “postorbital pores”), e.g., 4 x 2, in that frequently the last pore included along the upper jaw is part of the postorbital series. Osteological examination of the gill arches involved clearing and counterstaining with alcian blue and alizarin red dyes (Dingerkus and Uhler 1977). Other osteological examinations were made from radiographs. Vertebral counts, which include the hypural, were taken from a radiograph. Radiographic techniques are described in Böhle (1989). The vertebral formula (VF) is expressed as the predorsal/preanal/total vertebrae (Böhle 1982). Institutional abbreviations are as listed at <http://asih.org/codons.pdf>. The holotype of the new species is deposited in the fish collection of the California Academy of Sciences. Comparative material is deposited at both the CAS and at Taiwan Ocean University (TOU)

Genus *Pylorobranchnus* McCosker & Chen 2013

Type species *Pylorobranchnus hoi* McCosker, Loh & Lin 2013, by original designation

Pylorobranchnus hearstorum McCosker, sp. nov.

Figures 1–4

Gigantic worm eel

MATERIAL EXAMINED.— HOLOTYPE: CAS 235464, 1218 mm TL, female, field number DC-1426, from the Verde Island Passage, Philippine Archipelago, captured by beam trawl at 892–966 m between 13.583°–13.575°N, 120.382–120.411°E over a muddy substrate, aboard M/V *DA-BEAR*, Sta. HEPD 016, between 1405–1440 hrs. on 31 May 2011.

DIAGNOSIS.— An elongate myrophine with the following characteristics: tail 66% of TL; dorsal fin arising in posterior trunk region; dorsal fin slightly elevated, anal fin very elevated; pectoral fin wedge-shaped, developed, about four times eye diameter; eye moderate, 17 in HL; rear margin of orbit above posterior third of upper jaw; cephalic pores small, SO 1 x 3, IO 5 x 2, POM 7 x 3 (2 right), and ST 3 present; teeth needle-shaped, not enlarged, slightly retrorse, uniserial on jaws and vomer; coloration brownish black, median fins grayish black, anal-fin membrane black posteriorly. Vertebral formula 39/66/226.

COUNTS AND MEASUREMENTS OF THE HOLOTYPE (IN MM).— Total length 1218; head length

139; trunk length 278; tail length 801; body depth at gill openings ~42; body width at gill openings ~31; body depth at branchial basket ~48; body width at branchial basket ~42; body depth at anus ~35; body width at anus ~25; origin of dorsal fin 267; pectoral-fin length 32.8; pectoral-fin base 11; gill-opening length ~12; isthmus width ~23; snout length 27.7; tip of snout to tip of lower jaw 5.6; upper-jaw length 44.6; eye diameter 8.3; interorbital distance 18.9. Total left-lateral pores ~210 lateral-line pores present, 17 above branchial basket, 59 before anus. Vertebral formula 39/66/226. Wet weight after preservation 526 g.

DESCRIPTION.— Body elongate (Fig. 1), depth at gill openings 29 in TL, laterally compressed throughout, more so in tail region. Head and trunk 3.6 and head 8.8 in TL. Snout acute (Fig. 2), rounded but not blunt at tip, without a median groove on its underside. Jaws moderately elongate, slightly curved, incapable of closing completely; center of eye in posterior 1/3 of upper jaw. Lower jaw included, its tip slightly beyond anterior base of anterior nostrils. Anterior nostrils directed anterolaterally, in very short tubes, without marginal extensions; posterior nostril an open horizontal slit along outside of upper lip at level beginning slightly above ventral margin of orbit in advance of anterior margin of eye. Eye moderate, its center at midpoint of upper lip and top of head, its diameter about 2.3 in interorbital distance. Interorbital region slightly elevated. Gill openings below lateral mid-line, larger than orbit, located in advance of ventral base of pectoral-fin. Dorsal fin low in trunk and anterior tail



FIGURE 1. Holotype of *Pylorobranchnus hearstorum* sp. nov., CAS 235464, female, 1218 mm TL, photographed soon after capture and before preservation by David Catania. Arrow indicates origin of the dorsal fin



FIGURE 2. Head of holotype of *Pylorobranchnus hearstorum* sp. nov., CAS 235464, female, 1218 mm TL, photographed soon after capture and before preservation by David Catania.

region, becomes elevated posteriorly. Dorsal-fin origin in posterior trunk region, arising 2 HL behind snout tip. Anal-fin membrane elongate, twice in body depth when extended, median fins confluent with caudal; caudal fin short. Pectoral fins wedge-shaped, longer than snout, rays of dorsal quarter the longest.

Head pores minute but apparent (Fig. 3); SO 1 x 3, IO 5 x 2, POM 7 x 3 (2 right, the dorsalmost pore absent), ST 3. A single temporal and interorbital pore. Two infraorbital pores between anterior and posterior nostrils. Approximately 210 lateral-line pores present, 17 above branchial basket, 59 before anus, last pore about 0.37 HL before tail tip.

Teeth (Fig. 4) needle-shaped, recurved, all teeth uniserial and widely spaced, becoming slightly smaller posteriorly on jaws and vomer. An anterior intermaxillary horseshoe-shaped band of 4 teeth, followed by 2 pairs of slightly larger teeth, followed by a uniserial linear row of 6 vomerine teeth. Maxillary teeth 11 in a linear row, decreasing in size and irregularly separated by short gaps. Mandibular teeth lack a symphyseal pair, 10 (right) to 15 (left), decreasing in size and irregularly separated by short gaps.

Gill arches moderately developed: basibranchials 1–4 cartilaginous; hypobranchials 1–2 ossified, 3 cartilaginous; ceratobranchials 1–4 ossified, 5 absent; epibranchials 1–4 ossified; infrapharyngobranchials 1–2 ossified; third upper pharyngeal tooth plate with 3 conical teeth, fourth upper pharyngeal tooth plate with 3 longitudinal rows of 8–9 conical teeth, the plates closely sutured but not fused; lower pharyngeal tooth plate with 10–12 conical teeth in 3 irregular longitudinal rows. Teeth are comparable in size and appearance to those of jaws.

Body coloration in ethyl alcohol uniform dark brown. (Coloration of fresh specimen shown in Figures 1–2). Approximately 20 diffuse black saddles overlay trunk and anterior tail area, their interspaces wider than the saddles. Median fins gray anteriorly, the anal fin becoming black in posterior half of its length, the dorsal black in posterior quarter of its length. Pectoral fins uniformly brownish gray. Interior surface of posterior nostril white. Palate gray-black, teeth reside in white bands. Gill openings and peritoneum black.

ETYMOLOGY.— I take pleasure in naming this remarkable new species in honor of William and Margaret Hearst, friends and philanthropists.

REMARKS.— The new species might be mistakenly identified as a congrid by someone unfamiliar with the subtle characteristics of myrophine ophichthids. Its enormous size, elongation, tail

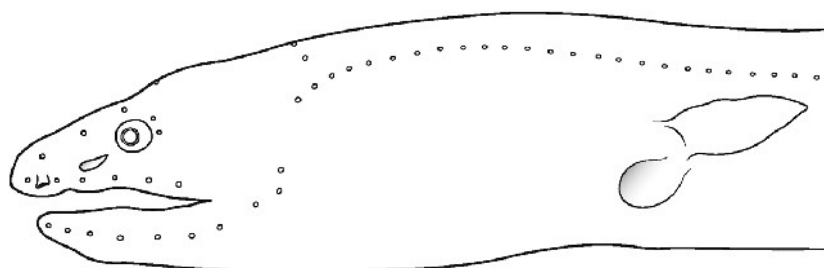


FIGURE 3. Schematic illustration of head of holotype of *Pylorobranhus hearstorum* sp. nov., CAS 235464, female, 1218 mm TL. Illustration prepared by Corlis Schneider.

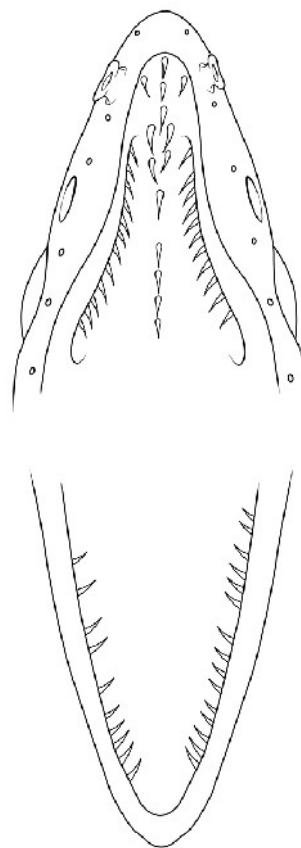


FIGURE 4. Schematic illustration of dentition of holotype of *Pylorobranhus hearstorum* sp. nov., CAS 235464, female, 1218 mm TL. Illustration prepared by Corlis Schneider.

condition, and posterior nostril location above the lip edge are similar in appearance to that of many deepwater congrid. Indeed, the holotype of the new species is remarkable in that it is nearly twice as long as and three times heavier than any known myrophine specimen. The second largest known specimen is the holotype of its conspecific, *Pylorobanchus hoi*, which is 676 mm in total length and 176 g in wet weight. Most myrophines reach no more than 450 mm TL and many are mature at 100 mm TL or less (McCosker unpublished data).

The discovery of this, the second species of *Pylorobanchus*, requires a minor revision of a generic character unique to *P. hoi*. The general osteology of the two species does not differ (as viewed from radiographs). The condition of their gill arches, which were removed and cleared-and-stained, is nearly identical; the first ceratobranchial of *P. hearstorum* is cartilaginous whereas that of *P. hoi* appears to be slightly ossified. Such differences exist within species of other ophichthids (Nelson 1966; McCosker 1977). The degree of median fin elevation, pectoral fin shape and size, body elongation and lateral compression, jaw condition, dentition, posterior nostril condition, and cephalic pore number and location are shared by both. The size and location of the gill opening (McCosker et al. 2013) of *P. hoi* (“at lateral midline, reduced, a small opening smaller than eye diameter, preceded anteromedially by a small lappet-like fleshy protuberance”), does not differ; however, the fleshy protuberance is absent in *P. hearstorum*.

The new species is separable from *Pylorobanchus hoi* by several meristic and morphometric conditions. It has more vertebrae (*P. hearstorum* 226 vs. *P. hoi* 182–183) more lateral-line pores (*P. hearstorum* ~210 vs. *P. hoi* 135), a longer tail (*P. hearstorum* 66% of TL vs. *P. hoi* 52–59%), a shorter head (*P. hearstorum* 8.8% of TL vs. *P. hoi* 11.0–11.8%), a more posterior dorsal-fin origin (*P. hearstorum* ahead of mid-trunk vs. *P. hoi* behind mid-trunk), a more slender body and tail (*P. hearstorum* greatest depth 39 times in TL vs. *P. hoi* 29–31 times), shorter anterior nostrils, and it is darker in coloration (*P. hearstorum* is uniform brownish black vs. *P. hoi*, which is uniform brown, head and trunk gray ventrally). It is unlikely that the new species would be mistaken for any other known myrophine (see the “Key to the Genera of Myrophinae” in McCosker et al. 2013), many of which lack pectoral fins and nearly all of which have their posterior nostril within their upper lip and opening into the mouth.

The holotype is a female with minute undeveloped ova. Based on its dentition and jaw condition it is likely that *Pylorobanchus hearstorum*, like *P. hoi*, feeds upon crustaceans and small fishes. Other fishes collected by deep water traps and by trawls during the Academy Expedition in the Verde Island Passage are listed and explained by Iwamoto et al. (this volume).

COMPARATIVE MATERIAL EXAMINED.—*Pylorobanchus hoi*: TOU-AE 5574, 676 mm TL, holotype; TOU-AE 5525, 568 mm TL, and CAS 233704, 657 mm TL, paratypes

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APPENDIX

Provisional list of ophichthid eels from the Philippine Islands

Based on specimens in the fish collections of the California Academy of Sciences (CAS) and the National Museum of Natural History (USNM), and my unpublished data. Those species whose identity or status is unclear or uncertain are marked by “?”

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| <i>Apterichtus klazingai</i> (Weber 1913) | <i>Ophichthus bonaparti</i> (Kaup 1856) |
| <i>Bascanichthys myersi</i> (Herre 1932) | <i>Ophichthus cephalozona</i> Bleeker 1864 |
| <i>Benthenchelys cartieri</i> Fowler 1934 | <i>Ophichthus lithinus</i> (Jordan & Richardson 1908) |
| <i>Brachysomophis crocodilinus</i> (Bennett 1833) | <i>Ophichthus macrochir</i> (Bleeker 1853) |
| <i>Brachysomophis umbonis</i> McCosker & Randall 2001 | ? <i>Ophichthus manilensis</i> Herre 1923 |
| <i>Cirrhimuraena chinensis</i> Kaup 1856 | <i>Ophichthus mystacinus</i> McCosker 1999 |
| <i>Cirrhimuraena playfairii</i> (Günther 1870) | <i>Ophichthus polyophthalmus</i> Bleeker 1865 |
| <i>Ichthyapus vulturis</i> (Weber & de Beaufort 1916) | <i>Ophichthus tomioi</i> McCosker 2010 |
| <i>Lamnostoma kampeni</i> (Weber & de Beaufort 1916) | <i>Ophichthus urolophus</i> (Temminck & Schlegel 1846) |
| ? <i>Lamnostoma mindora</i> (Jordan & Richardson 1908) | <i>Phyllophichthys xenodontus</i> Gosline 1951 |
| <i>Lamnostoma orientalis</i> (McClelland 1844) | <i>Pisodonophis boro</i> (Hamilton 1822) |
| <i>Lamnostoma taylori</i> (Herre 1923) | <i>Pisodonophis cancrivorus</i> (Richardson 1848) |
| <i>Leiuranus semicinctus</i> (Lay & Bennett 1839) | ? <i>Pisodonophis copelandi</i> Herre 1953 |
| <i>Leiuranus versicolor</i> (Richardson 1848) | <i>Pylorobranchus hearstorum</i> sp. nov. |
| <i>Muraenichthys gymnopterus</i> (Bleeker 1853) | <i>Schultzidia retropinnis</i> (Fowler 1934) |
| ? <i>Muraenichthys malaboensis</i> Herre 1923 | ? <i>Scolecenchelys godeffroyi</i> (Regan 1909) |
| <i>Muraenichthys philippinensis</i> Schultz & Woods 1949 | <i>Scolecenchelys gymnota</i> (Bleeker 1857) |
| <i>Muraenichthys schultzei</i> Bleeker 1857 | <i>Scolecenchelys laticaudata</i> (Ogilby 1897) |
| <i>Muraenichthys thompsoni</i> Jordan & Richardson 1908 | <i>Scolecenchelys macroptera</i> (Bleeker 1857) |
| <i>Myrichthys colubrinus</i> (Boddaert 1781) | <i>Skythrenchelys macrostomus</i> (Bleeker 1864) |
| <i>Myrichthys maculosus</i> (Cuvier 1816) | <i>Skythrenchelys zabra</i> Castle & McCosker 1999 |
| <i>Myrichthys paleracio</i> McCosker & Allen 2012 | <i>Xyrias revulsus</i> Jordan & Snyder 1901 |
| <i>Myrophis microchir</i> (Bleeker 1864) | <i>Yirrkala kaupi</i> (Bleeker 1858) |
| <i>Ophichthus altipennis</i> (Kaup 1856) | <i>Yirrkala misolensis</i> (Günther 1872) |
| <i>Ophichthus apicalis</i> (Anonymous [Bennett] 1830) | ? <i>Yirrkala philippinensis</i> (Herre 1936) |



PLATE 11. The Deep Sea team aboard the M/V DA-BEAR. Photographer unknown.