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A new species of short unpatterned moray eel (Anguilliformes: Muraenidae) from the northwestern Indian Ocean, including the Socotra Archipelago, with a redescription of *Gymnothorax pseudoherrei* Böhlke

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Abstract

A new species of short brown unpatterned moray eel, *Gymnothorax. arabicus* sp. nov., is described based on specimens collected from the northwestern Indian Ocean, including the Red Sea, Socotra Archipelago, and Arabian Gulf. The new species is characterized by having the dorsal-fin origin before the gill opening, two branchial pores, one or two median intermaxillary teeth, biserial maxillary teeth, total vertebrae 114–120, and a plain brown head and body with dark yellow color at the tip of the tail. The new species formerly has been confused with *G. pseudoherrei* but is distinguished from it by having slightly more total vertebrae (114–120 vs. 111–116), dark stripes on the throat and side of the head, and a larger maximum size (ca. 300 mm TL vs. ca. 200 mm TL). *Gymnothorax pseudoherrei*, currently known from the Maldives and Sri Lanka to the Philippines, Solomon Islands, and northern Australia, is redescribed in the present study. A comparison of the COI mtDNA in BOLD, in association with published phylogenetic evidence, confirms that *G. arabicus* and *G. pseudoherrei* form two separate genetic lineages, corroborating the morphological data.

Key words: taxonomy, molecular analysis, Muraeninae, Red Sea, Arabian Gulf, distribution

Introduction

The moray eels (family Muraenidae) constitute one of the largest families of the order Anguilliformes, the true eels, and occur primarily in tropical and subtropical seas worldwide (Nelson *et al*. 2016; Fricke *et al*. 2024). Two subfamilies are currently recognized. The Muraeninae, containing 189 valid species, are characterized by having the anal-fin origin at the anus and the dorsal-fin origin over the anterior part of the body; 143 species of these are currently assigned to the genus *Gymnothorax* Bloch. The Uropterygiinae, with 38 valid species, have the dorsal and anal fins restricted to the posterior end of the tail.

Morays are known for their conspicuous and complex markings, consisting of spots, lines, and various combinations of these. There are, however, a significant number of moray species that have hardly any markings and whose bodies are a nearly uniform brown. This makes them difficult to distinguish and requires close examination. Böhlke (1997, 2000) reviewed these species and split them into two informal groups: “elongate brown unpatterned” morays, and “small brown unpatterned” morays (short brown morays sensu Ray *et al*. 2015), the latter characterized by having fewer than 150 vertebrae. Eight valid species were included in the latter group, with four more such species added subsequently (summarized by Kodeeswaran *et al*. 2023). Smith *et al*. (2019) reviewed 38 Red Sea species of the family, including two species of the short brown unpatterned group sensu Böhlke (2000), *Gymnothorax pindae* Smith, 1962 and *G. pseudoherrei* Böhlke, 2000.

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Gymnothorax pseudoherrei is part of a complicated story that begins with the description by Herre (1923: 212) of a new species of short, brown moray eel from the Philippines as *Gymnothorax brunneus*. The name was preoccupied by *Gymnothorax brunneus* Nichols, 1920. Beebe & Tee-Van (1933: 138) subsequently renamed it *Gymnothorax herrei*. Böhlke (2000) redescribed *Gymnothorax herrei* in detail and designated a neotype, ANSP 164931. She also determined that two species had been confused under that name and described the other one as *Gymnothorax pseudoherrei*. A closer study by Smith *et al*. (2019) found that *Gymnothorax pseudoherrei* itself was composed of two distinct populations. One population occurs in the waters around the Arabian Peninsula in the northwestern Indian Ocean, including the Red Sea, Arabian Gulf, Gulf of Oman, and Socotra Archipelago. It is characterized by a larger maximum size (ca. 300 mm TL vs. ca. 200 mm), a slightly higher vertebral count (114–120 vs. 111–116), and the presence of dark grooves on the throat and the side of the head (vs. plain brown). The other population was found from the Maldive Islands in the central Indian Ocean eastward to the Solomon Islands in the western Pacific.

Smith *et al*. (2019) had no genetic data from *Gymnothorax pseudoherrei* outside the northwestern Indian Ocean and did not apply a name to the western population. One of the authors of the present paper (JD) acquired a live specimen of what appeared to be *Gymnothorax pseudoherrei* from Sri Lanka. He took a genetic sample and sent it to the Smithsonian Institution for analysis. The result closely matched a specimen from the Philippines identified as *Gymnothorax pseudoherrei*. These two specimens differed genetically from Red Sea and Socotra specimens confirming the presence of two distinct species with allopatric distributions (Fig. 1).

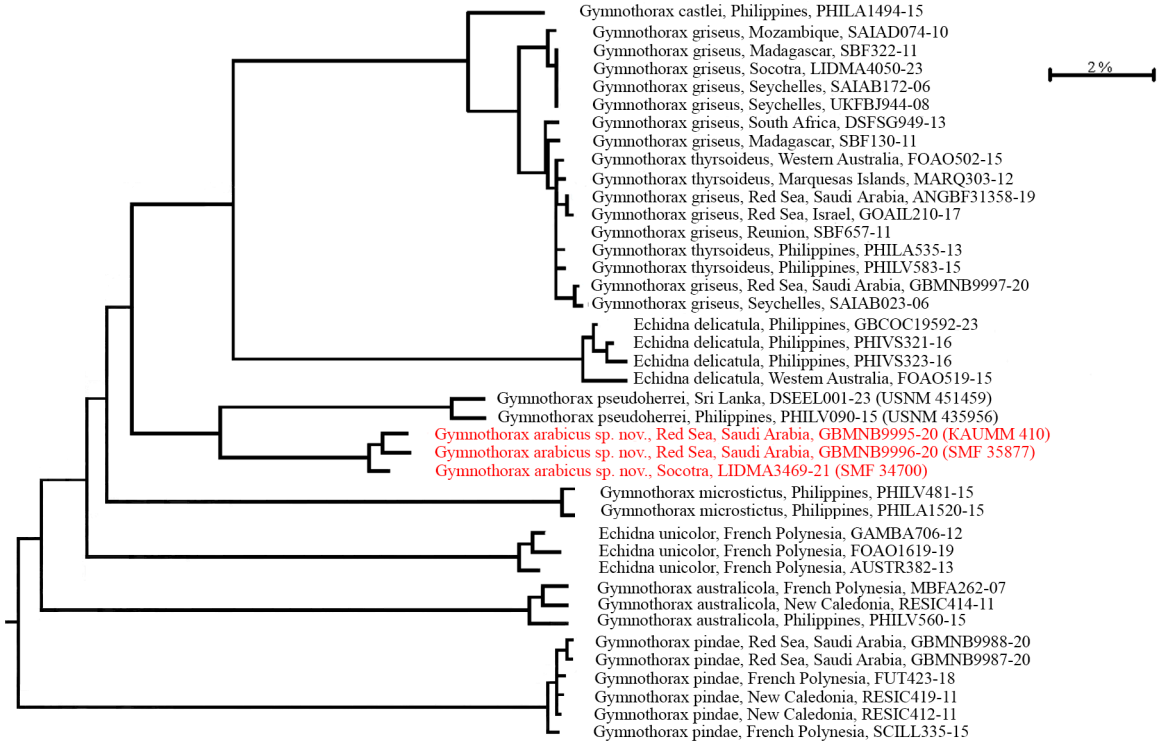

FIGURE 1. Neighbor-joining phenetic tree of COI mtDNA sequences of *Gymnothorax arabicus* and *G. pseudoherrei* following the Kimura two-parameter model (K2P) generated by BOLD (Barcode of Life Database, *http://www. boldsystems.org*); the scale bar represents a 2% sequence difference.

Zajonz & Khalaf (2002) first reported the species as *Gymnothorax herrei* from the Socotra Archipelago in the eastern Gulf of Aden. Later, Zajonz *et al*. (2019) corrected the identification to *Gymnothorax pseudoherrei.* Jointly with another co-author (SB) he obtained another specimen from the Socotra Archipelago in 2018, including genetic data, allowing us to refer that population to the western clade. With this confirming genetic evidence, we formally describe the new species and redefine the true *Gymnothorax pseudoherrei*.

Materials and methods

Specimens from the following institutions have been examined: Bernice P. Bishop Museum, Honolulu (BPBM); Hebrew University of Jerusalem (HUJ); King Abdulaziz University Marine Museum, Jeddah (KAUMM); Senckenberg Research Institute and Natural History Museum, Frankfurt am Main (SMF); and Smithsonian Institution National Museum of Natural History, Washington (USNM). Additional specimens cited in the literature but not personally examined by us are housed at the Academy of Natural Sciences of Drexel University, Philadelphia (ANSP); California Academy of Sciences, San Francisco (CAS); Field Museum of Natural History, Chicago (FMNH); Museum of Comparative Zoology, Harvard University, Cambridge (MCZ); Royal Ontario Museum, Toronto (ROM); and Stanford University, California (SU), now at CAS.

The live specimen of *Gymnothorax pseudoherrei* was acquired almost four years ago through a licensed U.S. fish importer from a certified ornamental fish trader based in Sri Lanka. The individual has been kept alive and well-fed three times a week in a 37-liter tank by one of the authors (JD).

Type specimens of the new species include only those that were directly examined by us and for which all counts and measurements were taken. Non-type specimens are those identified by observation or from literature, or in distorted preservation condition, but for which complete counts and measurements were not taken. Measurements were taken with a digital caliper and rounded to the nearest 0.5 mm. Vertebrae were counted from radiographs. Morphometric data are given as follows: Total length (TL) from tip of snout to posterior end of body including caudal fin; preanal length (PAL) from tip of snout to origin of anal fin; predorsal length (PDL) from tip of snout to origin of dorsal fin; head length (HL) from tip of snout to anterior margin of gill opening; snout length (SnL) from tip of snout to anterior edge of orbit; eye diameter (E) greatest horizontal diameter of orbit; upper jaw (UJ) from tip of snout to rictus (posterior corner of mouth where upper and lower jaws meet); depth at gill opening (D/GO) measured at a vertical line running through the gill opening; depth at anus (D/A) measured at posterior end of anus. Meristic data are given as follows: predorsal vertebrae (PDV) counted to the vertebra directly below the dorsal-fin origin; preanal vertebrae (PAV) counted to the vertebra directly over the anal-fin origin; total vertebrae (TV) including the hypural complex. Abbreviations for pores: IO = infraorbital, LL = lateral line, POM = preoperculo-mandibular, SO = supraorbital.

Length data and relative positions of morphological landmarks of the Sri Lanka specimen are estimates from photos of the live individual in a tank. The number and position of the branchial pores have been established from a negative color photograph of the live individual.

The DNA sequence of a 652-bp segment of the mitochondrial cytochrome c oxidase (COI) gene (the "barcode" marker) was obtained for the Socotra and Sri Lanka specimens and compared to sequences for moray relatives available on the BOLD database (www.boldsystems.org). The following specimens with their BOLD access numbers were included in the phenetic tree (Fig. 1): *G. arabicus*, Red Sea (GBMNB9995-20 and GBMNB9996-20, associated with KAUMM 410 and SMF 35877, respectively), *G. arabicus*, Socotra (LIDMA3469-21, associated with SMF 34700), *G. pseudoherrei*, Philippines (PHILV090-15, associated with USNM 435956), and *G. pseudoherrei*, Sri Lanka (GenBank access number OR785803, associated with USNM 451459).

The DNA procedure used a variety of primers (Ivanova *et al*. 2007). DNA extractions were performed with the NucleoSpin96 (Machery-Nagel) kit under automation with a Biomek NX liquid-handling station (Beckman-Coulter) equipped with a filtration manifold. PCR amplifications were performed in 12.5 µL volume including 6.25 µL of 10% trehalose, 2 µL of ultra-pure water, 1.25 µL of 10× PCR buffer (10 mM KCl, 10 mM (NH4)2SO4, 20 mM Tris-HCl (pH 8.8), 2 mM MgSO4, 0.1% Triton X-100), 0.625 µL of MgCl2 (50 mM), 0.125 µL of each primer (0.01 mM), 0.0625 µL of each dNTP (10 mM), 0.0625 µL of Taq DNA polymerase (New England Biolabs), and 2 µL of template DNA. The PCR conditions consisted of 94°C for 2 min, 35 cycles of 94°C for 30 sec, 52°C for 40 sec, and 72°C for 1 min, with a final extension at 72°C for 10 min. Sequences were compiled and analyzed using the Barcode of Life Data Systems (Ratnasingham & Hebert 2007; Ward *et al*. 2009) and the Kimura 2-parameter (K2P) model used by BOLD generated a mid-point rooted neighbor-joining (NJ) phenogram to provide a graphic representation of the species' sequence divergences.

***Gymnothorax arabicus* sp. nov.**

Arabian false brown moray
(Figures 2 & 3, Table 1)

Gymnothorax herrei (non Beebe & Tee-Van)—Randall & Golani 1995: 860 (Red Sea, description); Randall 1995: 56 (Oman & Arabian Gulf, description); Zajonz & Khalaf 2002 (Socotra Archipelago).
Gymnothorax pseudoherrei (non Böhlke)—Böhlke 2000: 408 (description, in part); Zajonz *et al*. 2019: 62 (Socotra Archipelago, listed); Smith *et al*. 2019: 51 (Red Sea, description).

Holotype. SMF 34700 (tissue sample SOC18-087, corresponding to BOLD access number LIDMA3469-21), 205 mm TL, Yemen, Socotra Archipelago, Socotra Island, Di Hamri, a large coral block, 12°40' N, 54°11' E, 8–10 m, 29 April 2018, S.V. Bogorodsky & F. Saeed.

Paratypes. Red Sea: KAUMM 409 (1, 112 mm), Saudi Arabia, Farasan Archipelago, Dumsuk Island, 16°31' N, 42°01' E, 26 February 2012; KAUMM 410 (1, 116 mm, corresponding to BOLD access number GBMNB9995-20), Saudi Arabia, Al Lith, 20°16' N, 39°59' E, 6–9 m, 18 November 2014; SMF 33616 (1, 107 mm), Saudi Arabia, Al Lith, 20°15' N, 39°55' E, 29 March 2011; SMF 35822 (1, 171 mm), Red Sea, Saudi Arabia, Farasan Archipelago, Dumsuk Island, 16°31' N, 42°01' E, 26 February 2012; SMF 35877 (1, 127 mm, corresponding to BOLD access number GBMNB9996-20), Saudi Arabia, Farasan Archipelago, Abkar Island, 16°37' N, 41°55' E, 6–10 m, 11 February 2017; USNM 312234 (8, 116–204 mm), Eritrea, Dahlak Archipelago, Sheik el Abu, 16°13' N, 39°44' E, 0–4.6 m, 14 August 1969; USNM 312247 (1, 150 mm), Eritrea, Melita Bay, 15°25' N, 39°82' E, 0–7 m, 13 August 1969; USNM 397542 (1, 179 mm), Yemen, Hanish Island, 3 m, 23 October 2009. **Socotra Archipelago:** SMF 34701 (1, 185 mm), Abd al-Kuri Island, north coast, 700 m off Bir al Agooz, 12°12' N, 52°19' E, 8–11 m, 06 April 2000. **Arabian Gulf:** BPBM 33328 (1, 291 mm), west side Jana Island, reef flat, 1.5 m, 13 September 1985 [also paratype of *Gymnothorax pseudoherrei*]; BPBM 33356 (3, 208–256 mm), southeast side of Jana Island, 16.8 m, 13 September 1985 [also paratype of *Gymnothorax pseudoherrei*]. **Oman, Gulf of Oman:** BPBM 21473 (1, 208 mm), Doha, south side of harbor of Mutrah, 1–3 m, 17 March 1977 [also paratype of *Gymnothorax pseudoherrei*].

Non-types. Red Sea: HUJ 15110 (2, 185–193 mm), Eritrea, Dahlak Archipelago, Romia Island, 29 March 1962 (erroneously reported as HUJ 15113 by Smith *et al*. 2019),; USNM 312218 (1, 51 mm), Eritrea, Dahlak Archipelago, Shumma, 15°32' N, 40°00' E, 0–7 m, 09 August 1969; USNM 312233 (21, 115–215 mm), Eritrea, Dahlak Archipelago, Delemmi, 15°31' N, 39°54' E, 0–3 m, 07 August 1969; USNM 312699 (1, 85 mm), Egypt, Gulf of Aqaba, bay at El Himeira, 9–12 m, 08 September 1969. **Socotra Archipelago:** SMF 34702 (4, 155–193 mm), Abd al-Kuri Island, north coast, east off Badh Issa, 12°12' N, 52°17' E, 5–7 m, 12 April 1999. **Oman** (all from Böhlke 2000; also paratypes of *Gymnothorax pseudoherrei*): BPBM 21473 (1, 208 mm), off village of Doha, south side of harbor of Mutrah, 1–3 m, 17 March 1977; ROM 40446 (1, 127 mm), Kalhat (Qualhat), 50 m north of tip of gravel spit at outlet of Kalhat Wadi, 200 m before start of cliffs, 22°42' N, 59°25' E, 23 January 1981; ROM 40447 (1, 247 mm), 5 miles southeast of town adjacent to second beach that breaks the line of cliffs, 22°33' N, 59°36' E, 04 November 1981; ROM 40646 (3, 51–55 mm), Kalhat, 1 mile northwest of end of wadi, 200 m before start of cliffs, 22°43' N, 59°22' E, 23 January 1981.

Diagnosis. Small size, less than about 300 mm TL; dorsal-fin origin before gill opening; maxillary teeth biserial; two branchial pores; total vertebrae 114–120; body plain brown in color, with dark grooves on throat and posterior part of head; tail at tip dark yellow, becoming uniform brown in large adults.

Description (data from the holotype first, for paratypes in parentheses)**.** In TL: preanal length 2.1 (2.0–2.4), predorsal length 9.2 (8.1–12), head length 9.0 (6.8–9.5), depth at gill opening 27 (16–27), depth at anus 20 (16–25). In HL: snout length 6.6 (5.7–6.8), eye diameter 7.9 (8.0–11), upper-jaw length 3.0 (2.7–3.6). Predorsal vertebrae 8 (5–8), preanal vertebrae 48 (42–50), total vertebrae 115 (114–120).

A relatively small, moderately stout, moray eel, to ca. 300 mm TL. Anus slightly before midlength. Dorsal-fin origin before gill opening. Snout relatively short and tapering, upper and lower jaws equal in length. Eye moderate, over middle of upper jaw. Anterior nostril tubular, moderate in length, barely reaching edge of lip when depressed. Posterior nostril broadly oval, with a low rim, above anterior half of eye.

Lateral line with two small pores (branchial pores) at anterior end of canal, above and before gill opening and behind level of dorsal-fin origin. Supraorbital canal with three pores: the first below and slightly before level of anterior nostril, about midway between base of nostril and upper jaw; the second lateral to and slightly above

base of anterior nostril; the third on top of snout, slightly closer to level of anterior nostril than to eye. Infraorbital canal with four pores: the first slightly behind level of anterior nostril; the second between anterior nostril and eye, slightly closer to eye than to nostril; the third below eye, slightly behind its anterior margin; the fourth below eye, slightly before its posterior margin. Preoperculo-mandibular canal with six pores: the first and smallest near tip of lower jaw; the second slightly behind level of first; the third almost directly below level of second infraorbital pore; the fourth directly below third infraorbital pore; the fifth slightly behind level of fourth infraorbital pore; the sixth slightly behind level of rictus.

Teeth stout, sharp, and smooth, without serrations. Intermaxillary teeth curved, in a single peripheral series, with about 6–8 on each side, increasing in size posteriorly, 1–2 median teeth, relatively stout, the posterior one larger (Fig. 2). Maxillary teeth biserial: about 7–14 larger, curved and more acute teeth in the inner row; 19–22 smaller and more bluntly pointed teeth in the outer row; the length of the two rows about equal. Mandibular teeth in general uniserial in adults except for 1–4 larger, conical teeth anteriorly on inner row; about 17–27 smaller, blade-like teeth on outer row. About 7–13 stout, blunt vomerine teeth, uniserial or slightly staggered.

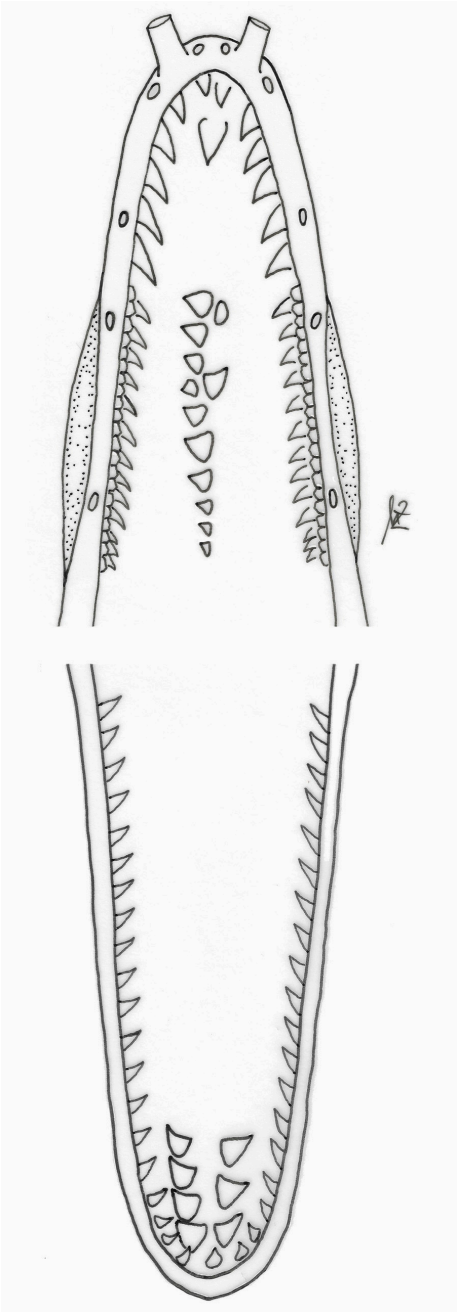

FIGURE 2. Dentition pattern on upper jaw and lower jaw of *Gymnothorax arabicus* sp. nov. (SMF 34701, paratype). Drawing by U. Zajonz.

FIGURE 3. *Gymnothorax arabicus* sp. nov., freshly collected specimen, SMF 34700 (sample tissue SOC18-087), holotype, 205 mm TL, Di Hamri, Socotra Island, Socotra Archipelago. **A:** whole moray; **B:** head close-up. Photos by S.V. Bogorodsky.

Color (based on the holotype, Fig. 3, and specimens reproduced in Randall (1995) and Smith *et al*. (2019)): larger specimens medium to dark brown, without prominent markings; head somewhat paler than body, more so ventrally. Smaller specimens with posterior one-fourth of body yellowish; yellow area diminishes with growth,

becoming restricted in adults to posterior tip of tail and adjacent fins. Longitudinal dark grooves on throat and posterior part of head, present in specimens at least as small as 85 mm TL.

Size and development. Based on the specimens examined, the maximum size appears to be about 300 mm TL. The five largest specimens from the Arabian Gulf and Gulf of Oman (208–291 mm TL) are larger than any of those collected in the Red Sea (largest specimen 215 mm TL) but this may just be an artifact of collection, i.e., perhaps different collection methods. The largest specimen from the Socotra Archipelago is the holotype of 205 mm TL. As pointed out by Smith *et al*. (2019: 51), this species grows considerably larger than *Gymnothorax pseudoherrei*, with which it was initially confused—to 291 mm TL vs. 182 mm respectively. None of the specimens appeared to be ripe.

Distribution and habitat. This species has been recorded from the Red Sea, the Arabian Gulf, the Gulf of Oman, and the Socotra Archipelago at depths of 0–17 m. It has not been reported from the coast of Yemen to central Oman, but perhaps these areas have not been sufficiently collected. The specimens show no obvious differences between localities. The species occurs in coastal coral habitats deep in crevices and is very rarely seen at night.

Etymology. Named for the area in which the species is found, the waters around the Arabian Peninsula.

Remarks. *Gymnothorax arabicus* and *G. pseudoherrei* belong to the group of morays characterized by uniform brown body color and vertebrae fewer than 150. The informal group was created by Böhlke (2000), who recognized eight species: *Gymnothorax atolli* (Pietschmann, 1935); *G. australicola* Lavenberg, 1992; *G. herrei* Beebe & Tee-Van, 1933; *G. kontodontos* Böhlke, 2000; *G microstictus* Böhlke, 2000; *G. panamensis* (Steindachner, 1876); *G. pindae* Smith, 1962; and *G. pseudoherrei* Böhlke, 2000. The group was expanded to 12 species with descriptions of four species from Indian waters: *Gymnothorax andamanensis* Mohapatra *et al.*, 2019; *G. mishrai* Ray *et al.*, 2015; *G. odishi* Mohapatra *et al.*, 2018; and *G. tamilnaduensis* Kodeeswaran *et al.*, 2023. Kodeeswaran *et al*. (2023: 259, Table 2) provided a comparison of all 12 species of the group.

Of those species, only four have vertebral counts that overlap that of *Gymnothorax arabicus*. *Gymnothorax herrei* differs in having only one branchial pore (vs. two pores) and the dorsal-fin origin over or posterior to the gill opening (vs. dorsal-fin origin anterior to gill opening). *Gymnothorax microstictus* has a dark and indistinctly mottled color pattern (vs. plain brown) and one row of maxillary teeth in adults (vs. two). *Gymnothorax pindae* has a stouter body (depth at gill opening 11–15 in TL vs. 16–27), greater head length (5.0–7.0 in TL vs. 6.8–9.5), grows to a larger size (to 450 mm TL vs. 300 mm), and the maxillary teeth are either uniserial or, when biserial (young specimens), the inner row is shorter than the outer row (vs. biserial with inner row as long as outer). *Gymnothorax pseudoherrei* is discussed separately below.

Gymnothorax pseudoherrei Böhlke, 2000

(Figure 4, Table 1)

Gymnothorax pseudoherrei Böhlke, 2000: 408 (part), Figs. 2F, 3D, 7. Type locality Philippines, Mindanao. Holotype, USNM 357430.

Material examined (including those from Böhlke 2000)**. Maldive Islands:** CAS 35657 (5, 66–141 mm), Male Atoll, east side of Hulele Island, on outer reef, 04°11’ N, 73°31’ E, 08 November 1964; CAS 52094 (1, 102 mm), Male Atoll, 04°11’ N, 73°31’ E, 08 November 1964; FMNH 75523 (1, 123 mm), Miladumadulu Atoll, SW shore Kendikolu Island, 05°56’ N, 73°24’ E, 27 March 1964; FMNH 75540 (4, 123–134 mm), Tiladummati Atoll, Filadu Island, 31 March 1964. **Sri Lanka:** ANSP 138609 (2, 46–122 mm), Trincomalee, south side of bay north of harbor, 10–22 m, 04 April 1970; ANSP 138701 (1, 111 mm), Hikkaduwa, 1 mile N of rest house, 15 m, 13 February 1970; MCZ 46958 (2, 140–166 mm), Trincomalee Bay, 03 April 1970; USNM 357433 (3, 116–155 mm), southeast side of bay at Galle, coral heads, 6–9 m, 16 February 1970; USNM 451459 (1, ~200 mm, corresponding to GenBank OR785803; alive in aquarium at the present time). **Philippines:** ANSP 144451 (7, 102–148 mm), Palawan, 09°48’ N, 118°44’ E, 7–13 m, 03 July 1979; ANSP 164646 (1, 152 mm), Mindanao, 08°51’ N, 123°24’ E, 0–4.6 m, 04 May 1979; ANSP 177712 (7, 115–152 mm), Mindanao, Zamboanga del Norte, west side of Solino Island, 08°51’ N, 123°24’ E, 0–4.6 m, 03 May 1979; ANSP 177769 (1, 174 mm), same as ANSP 177712; ANSP 177775 (2, 151–156 mm), collected with holotype; CAS 52575 (1, 130 mm), Sulu Prov., Siluag Island, 23 June 1948; CAS-SU 26801 (1, 118 mm), Negros Oriental, Dumaguete, June–August 1931; USNM 357430 (holotype, female, 147 mm), Mindanao, Zamboanga del Norte, W side of Solino Island, 08°51’ N, 123°24’ E, 0–4.6 m, 03 May 1979; USNM

357432 (2, 115–124 mm), Palawan Prov., Sulu Sea, Puerto Princesa Bay, Pagnagtaran Point, 09°44' N, 118°45' E, 7–13 m, 02 July 1979; USNM 435956 (1, 186 mm, corresponding to PHILV090-15), Puerto Galera, Boquete Island [Paniquian Island], 13°51' N, 120°94' E, 1–3 m, 30 March 2015 (specimen cannot be found). **Indonesia:** ANSP 131300 (4, 93–126 mm), Mentawei Island off Pulu Siburu, 02°00' S, 99°35' E, 1–2 m, 30 November 1963; ANSP 138523 (1, 125 mm), Pulo Jarak, 03°59' N, 100°06'E, 0–4 m, 30 October 1963; USNM 210269 (1, 148 mm), Moluccas, northeast side of Ambon Island., ca. 2 km east of Sawa Telu, 0–8 m, 03 January 1973; USNM 274957 (1, 103 mm), Sulawesi, Buton Island, 05°41' S, 122°62' E, 1–8 m, 25 March 1974. **Thailand:** ANSP 131179 (10, 73–163 mm), Goh Huyong, Similan Islands, coral heads, 08°29' N, 97°39'E, 2.5 m, 03 November 1963. **Australia (Queensland):** ANSP 144601 (2, 145–182 mm), Endeavour Reef, ca. 15°46′ S, 145°35′ E, middle of north side of eastern half, 1–2 m, 13 January 1969. **Papua New Guinea:** ANSP 145110 (1, 109 mm), Trobriand Islands, Kiriwana Island, west side of Boli anchorage, 08°31' S, 150°59' E, 16 June 1979; USNM 357431 (2, 127–156 mm), Louisade Archipelago, southwest shore of Panapompom Island, 10°47' S, 152°24' E, 0–6 m, 15 June 1979. **New Britain:** ANSP 131136 (11, 74–134 mm), Rabaul, Dawapia Rocks, near entrance to Simpson Harbor, 14°14' S, 152°10' E, 27 February 1965. **Palau:** CAS 208442 (3, 118–154 mm), lagoon edge of barrier reef 8 miles northwest of Korror Island, 07°24'30" N, 134°21'20" E, 1–2 m, 19 July 1955. **Solomon Islands:** ANSP 138525 (5, 90–134 mm), Tautsina Island, east of Kieta Peninsula, coral head, 1–8 m, 11 March 1965.

Diagnosis. Small size, to about 200 mm TL; dorsal-fin origin before gill opening; maxillary teeth biserial; two branchial pores; total vertebrae 111–116; plain brown in color, without dark grooves on throat and posterior part of head.

Description. In TL: preanal length 2.1–2.4, predorsal length 8.1–9.6, head length 6.1–8.7, depth at gill opening 15–24, depth at anus 16–25. In HL: snout 5.3–7.8, eye diameter 8.7–10.6, upper jaw length 2.8–5.1. Predorsal vertebrae 5–8, preanal vertebrae 45–49, total vertebrae 111–116.

A small eel, maximum size about 200 mm TL, moderately stout. Anus slightly before midlength. Dorsal-fin origin before gill opening (Fig. 4A). Snout relatively short and tapering, upper and lower jaws equal in length. Eye moderate, over middle of upper jaw. Anterior nostril tubular, barely reaching edge of lip when depressed. Posterior nostril broadly oval, with a low, dark-edged rim, above anterior margin of eye.

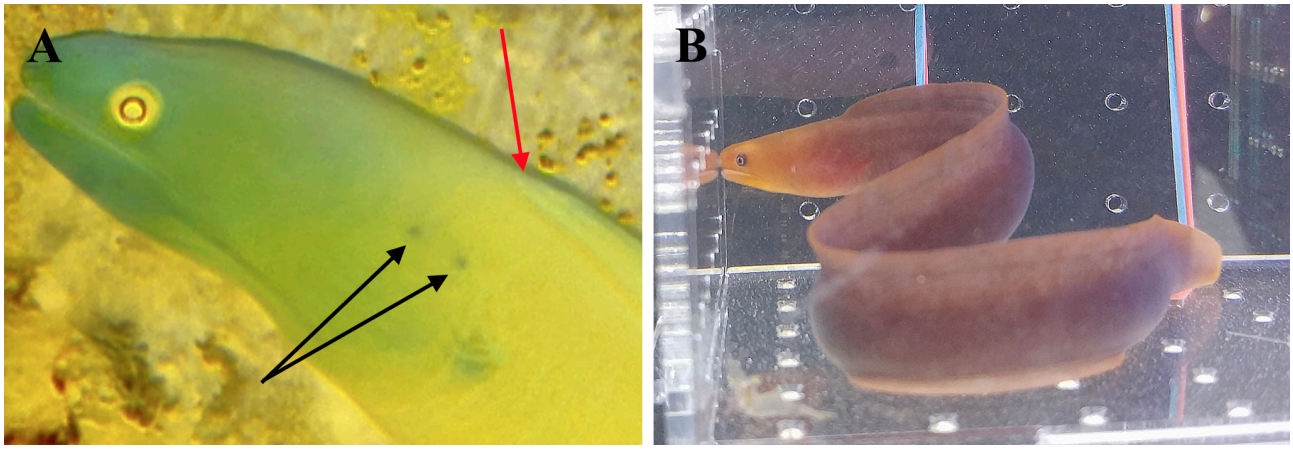

FIGURE 4. *Gymnothorax pseudoherrei*, live aquarium specimen, ca. 200 mm TL, Sri Lanka. **A:** negative color photograph shows the presence and position of the two branchial pores (two black arrows), and the dorsal-fin origin (red arrow); **B:** photograph shows typical coloration. Photo by J. Dandar.

Lateral line with two small pores at anterior end of canal, before level of gill opening and near level of dorsal-fin origin (Fig. 4A). Supraorbital canal with three pores; the first on upper lip, before and below base of anterior nostril; the second lateral to and slightly above base of anterior nostril; the third on top of snout, closer to level of anterior nostril than to eye. Infraorbital canal with three pores; the first slightly behind and below base of anterior nostril; the second on upper lip about midway between level of eye and anterior nostril; the third below anterior margin of eye; the fourth below mideye. Preoperculo-mandibular canal with six pores; the first and smallest at edge of lower lip near anterior end; the second below first infraorbital pore; the third below second infraorbital pore; the fourth below third infraorbital pore; the fifth very slightly before posterior edge of eye; the sixth slightly behind level of rictus.

TABLE 1. Number of vertebrae in *Gymnothorax arabicus* n. sp. and *G. pseudoherrei*. Asterisk indicates the number of vertebrae in the holotype of *G. arabicus* and *G. pseudoherrei*.

Total vertebrae	111	112	113	114	115	116	117	118	119	120
Gymnothorax arabicus			3	7	6	2	1	2*	1	
Gymnothorax pseudoherrei	1	1	4*	1	1					

Maxillary teeth biserial, rows subequal; teeth of the outer row about twice as large as teeth of the inner row. Intermaxillary teeth with a single outer series of about 5–6 triangular and pointed teeth on each side, increasing in size from anterior to posterior; two median teeth, conical and pointed, the posterior one larger. Vomerine teeth small, uniserial, about 13. Mandibular teeth biserial in juveniles, teeth of the outer row smaller and more numerous, triangular, pointed, becoming smaller posteriorly, about 25 in number; mandibular teeth generally uniserial in adults, with about two larger teeth anteriorly on each side, the posterior one larger.

Color (Fig. 4B): medium brown, head somewhat lighter; a narrow dark ring at anterior margin of eye, some dark pigment at posterior margin of eye; no dark throat grooves, and no obvious markings on body.

Size and development. This is a small species, distinctly smaller than *Gymnothorax arabicus*; the largest of 84 specimens reported by Böhlke (2000) was only 182 mm TL. The living individual from Sri Lanka (USNM 451459) measures approximately 200 mm, it has not grown beyond this size in four years. Indeed, this is one of the smallest known species of Muraenidae. Böhlke (2000: 410) reported a ripe female as small as 123 mm TL. A specimen of 148 mm TL examined here (USNM 210269) was noticeably swollen and contained large eggs.

Distribution and habitat. This species is known from the Maldive Islands and Sri Lanka in the central Indian Ocean eastward to Thailand, Indonesia, northern Australia, the Philippines, Papua New Guinea, New Britain, Palau, and the Solomon Islands. It occurs in shallow water; the deepest collection site was 22 m.

Etymology. Named for its superficial resemblance to and confusion with *Gymnothorax herrei* Beebe & Tee-Van (1933).

Remarks. As explained above, *Gymnothorax pseudoherrei* is one of four species among the group of 12 short brown *Gymnothorax* species (sensu Böhlke 2000) whose vertebral counts and most of the proportions overlap those of *Gymnothorax arabicus*. It differs from 11 of these by lacking any conspicuous markings. It differs from *G. herrei* and *G. pindae* in the same characters as *G. arabicus* does (see above). It differs from *G. arabicus* primarily in its smaller size (not exceeding 200 mm TL vs. up to about 300 mm TL), the lack of dark throat and head grooves, and slightly fewer total vertebrae (111–116 vs. 114–120). In addition, it differs genetically from *G. arabicus* (Fig. 1).

Allen & Erdmann (2012) included the species in their book and reproduced a photograph of it with the locality given as Indonesia. However, they used a photograph taken by J.E. Randall from Jana Island in the Arabian Gulf, and the specimen in fact is *G. arabicus*. A photograph of the true *Gymnothorax pseudoherrei* has never been published until now.

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References

Allen, G.R. & Erdmann, M.V. (2012) *Reef fishes of the East Indies*. *Volumes I–III*. Tropical Reef Research, Perth, 1260 pp. https://doi.org/10.1896/054.064.0104

Beebe, W. & Tee-Van, J. (1933) Nomenclatural notes on the shore fishes of Bermuda. *Zoologica*, 13 (7), 133–158. https://doi.org/10.5962/p.190349

Böhlke, E.B. (1997) Notes on the identity of elongate unpatterned Indo-Pacific morays, with description of a new species (Muraenidae, Subfamily Muraeninae). *Proceedings of the Academy of Natural Sciences of Philadelphia*, 147, 89–109.

Böhlke, E.B. (2000) Notes on the identity of small, brown, unpatterned Indo-Pacific moray eels, with descriptions of three new species. *Pacific Science*, 54 (4), 395–416.

Fricke, R., Eschmeyer, W.N. & van der Laan, R. (2024) Eschmeyer's Catalog of fishes: Genera, Species, References. Available from: http://researcharchive.calacademy.org/research/ichthyology/catalog/SpeciesByFamily.asp (accessed 9 January 2024)

Herre, A.W.C.T. (1923) A review of the eels of the Philippine Archipelago. *Philippine Journal of Science*, 23 (2), 123–236.

Ivanova, N.V., Zemlak, T.S., Hanner, R.H. & Hebert, P.D.N. (2007) Universal primer cocktails for fish DNA barcoding. *Molecular Ecology Notes*, 4 (5), 544–548. https://doi.org/10.1111/j.1471-8286.2007.01748.x

Kodeeswaran, P., Kantharajan, G., Mohapatra, A., Kumar, T.T.A. & Sarkar, U.K. (2023) A new short brown unpatterned moray eel (Anguilliformes, Muraenidae) from the southeast coast of India, Bay of Bengal. *Zoosystematics and Evolution*, 99 (1), 253–260. https://doi.org/10.3897/zse.99.100461

Lavenberg, R.J. (1992) A new moray eel (Muraenidae: *Gymnothorax*) from oceanic islands of the South Pacific. *Pacific Science*, 46 (1), 58–67.

Mohapatra A., Kiruba-Sankar, R., Praveenra, J. & Mohanti, S.R. (2019) A new short brown unpatterned moray eel *Gymnothorax andamanensis* (Muraenidae: Muraeninae) from Andaman waters, India. *Zootaxa*, 4661 (1), 189–196. https://doi.org/10.11646/zootaxa.4661.1.11

Mohapatra, A., Mohanty, S.R., Smith, D.G., Mishra, S.S. & Roy, S. (2018) *Gymnothorax odishi* s. nov. (Muraenidae: Muraeninae), a short brown unpatterned moray eel from Bay of Bengal, India. *Zootaxa*, 4420 (1), 123–130. https://doi.org/10.11646/zootaxa.4420.1.7

Nelson, J.S., Grande, T. & Wilson, M.V.H. (2016) *Fishes of the World*. John Wiley & Sons, Hoboken, New Jersey, 707 pp.

Nichols, J.T. (1920) A contribution to the ichthyology of Bermuda. *Proceedings of the Biological Society of Washington*, 33, 59–64.

Pietschmann, V. (1935) Eine neue Aalfamilie aus den hawaiischen Gewässern. *Anzeiger der Akademie der Wissenschaften in Wien, Mathematisch-Naturwissenschaftliche Klasse*, 72 (11), 93–94.

Randall, J.E. (1995) *Coastal fishes of Oman*. University of Hawaii Press, Honolulu, 439 pp.

Randall, J.E. & Golani, D. (1995) Review of the moray eels (Anguilliformes: Muraenidae) of the Red Sea. *Bulletin of Marine Science*, 56 (3), 849–880.

Ratnasingham, S. & Hebert, P.D.N. (2007) The Barcode of Life Data System (www.barcodinglife.org). *Molecular Ecology Notes*, 7 (3), 355–364. https://doi.org/10.1111/j.1471- 8286.2006.01678.x

Ray, D., Mohapatra, A. & Smith, D.G. (2015) A new species of short brown unpatterned moray eel of the genus *Gymnothorax* (Anguilliformes: Muraenidae) from the Bay of Bengal. *Zootaxa*, 4027 (1), 140–144. https://doi.org/10.11646/zootaxa.4027.1.8

Smith, D.G., Bogorodsky, S.V., Mal, A.O. & Alpermann, T.J. (2019) Review of the moray eels (Anguilliformes: Muraenidae) of the Red Sea with description of a new species. *Zootaxa*, 4704 (1), 1–87. https://doi.org/10.11646/zootaxa.4704.1.1

Smith, J.L.B. (1962) The moray eels of the western Indian Ocean and the Red Sea. *Ichthyological Bulletin, Department of Ichthyology, Rhodes University*, 23, 421–444.

Steindachner, F. (1876) Ichthyologische Beiträge (V). I. Sitzungberichte der Kaiserlichen Akademie der Wissenschaften. *Mathematisch-Naturwissenschartlich Classe*, 1, 49–240, pls. 1–15.

Ward, R.D., Hanner, R. & Hebert, P.D.N. (2009) The campaign to DNA barcode all fishes, FISH-BOL. *Journal of Fish Biology*, 74 (2), 329–356. https://doi.org/10.1111/j.1095-8649.2008.02080.x

Zajonz, U. & Khalaf, M.A. (2002) Inshore fishes of the Socotra Archipelago: diversity and community structure. *In*: Apel, M., Hariri, K.I. & Krupp, F. (Eds.), *Conservation and Sustainable Use of Biodiversity of Socotra Archipelago. Marine Habitat, Biodiversity and Fisheries Surveys and Management. Final Report of Phase III*. Senckenberg Research Institute and Natural History Museum, Frankfurt a.M., pp. 237–296.

Zajonz, U., Lavergne, E., Bogorodsky, S.V., Saeed, F.N., Aideed, M.S. & Krupp, F. (2019) Coastal fish diversity of the Socotra Archipelago, Yemen. *Zootaxa*, 4636 (1), 1–108. https://doi.org/10.11646/zootaxa.4636.1.1