Descriptions of two new species of moray eels (Pisces: Muraenidae) from northwestern Flores, Indonesia

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Abstract
Two new species belonging to the muraenid genus Gymnothorax are described from northwestern Flores, Indonesia. Gymnothorax longinaris is described from a single specimen, 236.5 mm TL. It differs from all other members of the genus in having a combination of enlarged posterior nasal appendages, 117 total vertebrae, and a colour pattern consisting of 14 dark-brown bars and 14 large, ocelli markings (when viewed dorsally) on the dorsal fin. Gymnothorax paucivertebralis is described from two specimens, 183.0-227.0 mm TL. Although it exhibits a colour pattern that is similar to G. kidako from the Indo-Pacific region, it differs from that species and all other western Pacific congenerics in having an exceptionally low number of total vertebrae (101-103). The colour in life is pale yellow with a brown reticulated network and prominent brown banding on the dorsal and anal fins.

Zusammenfassung

Sommario
Sono qui descritte due nuove specie di murenidi appartenenti al genere Gymnothorax provenienti dalla regione noroccidentale di Flores, Indonesia. Gymnothorax longinaris è descritto da un singolo esemplare di 236,5 mm TL. Si differenzia da tutti gli altri membri del genere per la segnente combinazione di caratteri: appendici nasali posteriori allargate, 117 vertebre totali e una colorazione contraddistinta da 14 barre marrone scuro e 14 grandi occhi (se visti dorsalmente) sulla pinna dorsale. Gymnothorax paucivertebralis è descritto da due esemplari di 183,0-227,0 mm TL. Sebbene mostrì un modello di colorazione simile alla specie dell’Indo-Pacifico G. kidako, differisce da questa e da tutti gli altri congneri del Pacifico occidentale per avere un numero eccezionalmente basso di vertebre totali (101-103). La colorazione naturale è di un giallo pallido con un disegno reticolare marrone e prominenti strisce marroni sulle pinne dorsale e anale.

INTRODUCTION
Moray eels of the family Muraenidae are common inhabitants of coral and rocky reefs in tropical and warm temperate seas, although due to their cryptic, mainly nocturnal habits, most species are seldom seen. The family contains 207 currently recognized species in 16 genera (Eschmeyer et al. 2018). Morays are particularly well represented in Indonesian seas and adjacent regions with at least 72 species in 13 genera (Allen & Erdmann 2012).
The present paper describes two new species of Gymnothorax, which is by far the largest genus in the family and contains approximately 60% of the species. Both species were captured at the same site in northwestern Flores (Pulau Seraya Besar) by the second author after being alerted of their presence by underwater photographers, who were unable to match their photographs with any existing species. Our investigations reveal that they are undescribed species, characterised by low vertebral counts and one species that has unusual elongate, posterior nostril appendages.

**MATERIALS AND METHODS**

Lengths of specimens are given as total length (TL) measured from snout tip to the end of the tail; body length is the combined head and trunk lengths; head length (HL) 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 the anus; tail length is measured from the anus to the tail tip; body depth does not include the adjacent dorsal fin; body width is the maximum width just posterior to the gill opening; snout length is measured from the snout tip to the anterior edge of the eye; eye diameter is the horizontal fleshy diameter, and interorbital width the least fleshy width; upper jaw length is taken from the front of the upper lip to the rear extent of the mouth gape. Digital x-rays were utilized for vertebral counts. Vertebral counts follow the method of Böhlke (1982) in which predorsal vertebrae are those anterior to the origin of the dorsal fin, preanal vertebrae are those anterior to the anal fin, and the total count includes all elements from the base of the skull to the tip of the tail.

Proportional measurements of type specimens, expressed as percentage of the total length, are provided in Table I. Type specimens are deposited at the Museum Zoologicum Bogoriense, Cibinong, Java, Indonesia (MZB) and Western Australian Museum, Perth (WAM).

**Gymnothorax longinaris n. sp.**

_Nasal-flap Moray_ (Figs 1-7; Table I)

**Holotype:** M ZB 24606, 236.5 mm TL, Pulau Seraya Besar, 08°23.255’S, 119°52.485’E, northwest Flores, Indonesia, 18 m, clove oil and hand net, M. V. Erdmann, 7 August 2016.

**Diagnosis:** A small, moderately robust moray with body length slightly less than tail length; posterior nostril encased within unusual elongate dermal flap, its length 7.1 in HL; dorsal fin origin anterior to level of gill opening; vertebral count relatively low for genus, total vertebrae 117; colour in life pale reddish brown on upper two-thirds and white below, with 14, broad dark brown bars, pale spaces between bars and adjacent pale areas of dorsal fin profusely covered with red-brown spotting; dorsal fin with 14, white-edged black bars, appearing as ocelli, when viewed from above.

**Description:** Depth of body at level of gill opening 15.7 in TL, depth at anus 14.9 in TL; body width 3.4 in HL; tail longer than body, distance from snout to anus 2.1 in TL; head 7.8 and trunk 2.9 in TL; dorsal-fin origin anterior to level of gill opening, predorsal distance 9.9 in TL; maximum height of dorsal fin 4.0, snout 4.8, upper jaw 2.3, eye 6.9, fleshy interorbital width 6.5, all in HL. Predorsal vertebrae 5; preanal vertebrae 41; total vertebrae 117.

Jaws subequal, mouth closing completely; teeth (Fig. 3) in jaws uniserial, stout, conical to triangular, and non-serrated, nearly subequal, except posteriormost teeth smaller; three intermaxillary teeth continuous with row of nine maxillary teeth, three pairs of depressible canines behind intermaxillary symphysis; mandible with three teeth at symphysis and 10 on each side of jaw.

Anterior nostril tubular, its length 13.9 in HL, extending beyond snout tip; posterior nostril situated above front corner of eye, opening large and encased within elongate dermal flap (Fig. 4), its length 7.1 in HL, flap solid on anterior and lateral sides, but hollow posteriorly.

Head pores (Fig. 5) consisting of three pores on snout (including two on dorsal surface and third medial to and slightly below anterior nostril), five pores along upper jaw, and six pores along the mandible.

Colour in life (Figs 1-2): generally pale reddish brown on upper two-thirds and white below, with 14, broad dark brown bars, pale spaces between bars and adjacent pale areas of dorsal fin profusely covered with red-brown spotting, with larger and fewer spots on dorsal fin; dark bars continuous around ventral surface of body (Figs 6-7) and much wider than pale spaces between; anteriormost brown bar (below front of dorsal fin) interrupted on lower half by irregular white and dark brown markings connected to brown zone above rictus of mouth, continuing below eye; white bar...
across lower jaw below rictus of mouth with remainder of jaw dark brown, except lighter brown at tip and white spot in middle portion; upper half of head with continuation of red-brown spotting of body, also larger, irregular brown blotches, especially prominent both anterior and posterior to eye; anterior nostril tubes and posterior nasal flaps white with brown variegations; ventral surface of head (see Fig. 7) immediately behind mandible with large black area and irregular white and black patches on anterior half; dorsal fin with 14, white-edged black bars, appearing as ocelli, when viewed from above; anal fin mainly blackish with seven narrow white bars (continuation of white interspaces of tail).

Colour in alcohol (Figs 6-7): similar to live
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**Comparisons:** The new species is the only species in the genus that possesses enlarged posterior nasal appendages and also has relatively few total vertebrae (117, see below Comparisons section for *G. paucivertebralis*). The only other moray with similar posterior nasal appendages is *Enchelycore pardalis* (Temminck & Schlegel, 1846), which ranges widely in the Indo-Pacific region from Mauritius to the Hawaiian and Pitcairn Islands, occurring mainly at oceanic islands (Allen & Erdmann 2012; Böhlke & Randall 2000). However, it markedly differs in colour pattern (Fig. 8), and like other members of the genus *Enchelycore*, possesses long slender, “hooked” jaws with a visible gap when the mouth is closed, and long slender canine teeth arranged in more than one row. Moreover,

coloration except generally tan with greyish bars and greyish markings on head.

**Fig. 3A-B.** Lateral view showing jaw teeth of new species of *Gymnothorax*: A) *G. longinaris*, holotype, and B) *G. paucivertebralis*, holotype. Photos by G. R. Allen.
Figs 4A-B. Gymnothorax longinaris, holotype, anterior (A) and posterior (B) views of enlarged nasal appendage. Photos by G. R. Allen.

Fig. 5. Gymnothorax longinaris, live holotype, showing position (arrows) of cephalic sensory pores. Photo by M. V. Erdmann.
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Fig. 6. Gymnothorax longinaris, preserved holotype, 236.5 mm TL, Pulau Seraya Besar, NW Flores, Indonesia. Photo by G. R. Allen.

Fig. 7. Gymnothorax longinaris, preserved holotype, 236.5 mm TL, ventral view of head and trunk. Photo by G. R. Allen.

Figs 8A-B. Enchelycore pardalis: A) underwater photograph, approximately 400 mm TL, Midway Island, Hawaiian Islands (photo by G. R. Allen), and B) freshly collected specimen, 763 mm SL, Oahu, Hawaiian Islands. Photo by J. E. Randall.
the posterior nasal appendage forms a tubular structure, unlike that of G. longinaris, which forms a solid anterior flap, but is largely hollow on its posterior side (Fig. 4B).

**Etymology:** The new species is named longinaris (Latin: long nostril) with reference to the elongate posterior nasal appendages.

**Distribution and habitat:** Known only from northwestern Flores, including the type locality of Pulau Seraya Besar and also from numerous photographs from nearby Wainilu Island in the Komodo National Park, though presumably more widespread. The type specimen was captured at night in coral reef habitat at a depth of 18 m.

**Gymnothorax paucivertebralis n. sp.**

Reticulated Moray
(Figs 9-11; Table I)

**Holotype:** MZB 24607, 227.0 mm TL, Pulau Seraya Besar, 08°23.255’S, 119°52.485’E, northwest Flores, Indonesia, 16 m, clove oil and hand net, M.V. Erdmann, 7 August 2016.

**Paratype:** WAM P.34628-003. 183.0 mm TL, collected with holotype.

**Diagnosis:** A small, moderately robust moray with body length noticeably greater than tail length; dorsal fin origin about level with gill opening; vertebral count very low for genus, total vertebrae 101-103; colour in life pale yellow with brown reticulated net-

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<th>G. paucivertebralis holotype MZB24607</th>
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**Fig. 9.** Gymnothorax paucivertebralis, underwater photograph of live holotype, 227 mm TL, Pulau Seraya Besar, NW Flores, Indonesia. Photo by M. V. Erdmann.
work and prominent brown banding on dorsal and anal fins, more intense posteriorly.

**Description:** Depth of body at level of gill opening 14.9 (12.5) in TL, depth at anus 14.7 (13.3) in TL; body width 3.2 in HL; tail shorter than body, distance from snout to anus 1.9 in TL; head 6.5 (6.2) and trunk 2.7 in TL; dorsal-fin origin above level of gill opening, predorsal distance 6.8 (6.5) in TL; maximum height of dorsal fin 5.0 (4.8), snout 5.2 (5.3), upper jaw 2.3 (2.4), eye 7.4 (8.4), fleshy interorbital width 9.1 (7.9), all in HL. Predorsal vertebrae 6 (5); preanal vertebrae 47 (46); total vertebrae 103 (101).

Jaws subequal, mouth closing completely; teeth (Fig. 3B) in jaws uniserial, stout, conical to triangular, and non-serrated, nearly subequal, except

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**Fig. 10.** Gymnothorax paucivertebralis, live holotype, showing position (arrows) of cephalic sensory pores. Photo by M. V. Erdmann.

**Fig. 11.** Gymnothorax paucivertebralis, preserved holotype, 236.5 mm TL, NW Flores, Indonesia. Photo by G. R. Allen.

Fig. 13. Gymnothorax kidako, freshly collected specimen, 331 mm TL, Kona, Hawai. Photo by J. E. Randall.
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posterior most teeth smaller; four intermaxillary teeth continuous with row of 8-9 maxillary teeth, three pairs of depressible canines behind intermaxillary symphysis; mandible with 12-13 teeth on each side; four small teeth on vomer.

Anterior nostril tubular, its length 16.7 (15.8) in HL, extending to snout tip; posterior nostril situated just above front corner of eye, opening large (about 2-3 times size of cephalic sensory pores) and conspicuous with slightly elevated, fimbriate rim.

Head pores (Fig. 10) consisting of three pores on snout (including two on dorsal surface and third medial to and slightly below anterior nostril), five pores along upper jaw, and six pores along the mandible.

Colour in life (Fig. 9): pale yellow with brown reticulated network (more or less forming three horizontal rows of hexagonal shaped markings of which central row is largest) and prominent brown banding on dorsal and anal fins, more intense posteriorly.

Colour in alcohol (Fig. 11): similar to colour in life except overall pale tan rather than yellow.

Comparisons: The new species is characterised by a remarkable low number of vertebrae with total counts of 103 and 101 in the respective holotype and paratype. A survey of vertebral counts for the 121 species (95 from the Indo-Pacific) of Gymnothorax indicates a range of 108-233 total vertebrae with most species in the 130-150 range (Smith 2012). Species exhibiting counts that approach those of G. pauivertebralis include G. herrei Beebe & Tee-Van, 1933 with 108-122; G. richardsonii (Bleeker, 1852) with 112-117, G. robinsi Bohlke, 1997 with 105-112, and G. longinaris n. sp. (see above) with 117. However, all of these species exhibit different colour patterns (Figure 12) that are distinctive from G. pauivertebralis. The only Western Pacific species that has a similar pattern is G. kidako (Tennmink & Schlegel, 1846). However, this species (Fig. 13) differs in having 136-149 vertebrae (Smith 2012) and although it is widely distributed (Japan to Queensland and east to Hawaii and Pitcairn Islands), it has an apparent anti-tropical distribution and is absent from Indonesia and adjacent areas in the East Indian region (Randall 2005).

Etymology: The new species is named pauivertebralis (Latin: few vertebrae) with reference to the exceptionally low number of vertebrae.

Distribution and habitat: Currently known only from northwestern Flores, including the type locality of Pulau Seraya Besar, and also from photographs from nearby Wainilu island in the Komodo National Park, though presumably more widespread. The type specimens were captured at night on a sand-rubble bottom adjacent to coral reef at a depth of 16 m.

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REFERENCES


