Zoological Studies **58:** 43 (2019)
doi:10.6620/ZS.2019.58-43

Zoological Studies

Open Access

A New Species of the Snake Eel Genus *Ophichthus*, with Additional Records from Viet Nam (Anguilliformes: Ophichthidae)

Quang Van Vo[1,2,*], Yusuke Hibino[3], and Hsuan-Ching Ho[4]

[1]Institute of Oceanography, Vietnam Academy of Science and Technology (VAST), Vietnam
*[2]Graduate University of Science and Technology (GUST), VAST, Vietnam. *Correspondence: E-mail: quangvanvo@gmail.com*
[3]Kitakyushu Museum of Natural History and Human History, Kitakyushu, Fukuoka, Japan. E-mail: yusukeelology@gmail.com
[4]National Museum of Marine Biology & Aquarium, Pingtung, Taiwan. E-mail: ogcoho@gmail.com

Received 20 August 2019 / Accepted 28 November 2019 / Published 18 December 2019
Communicated by Hin-Kiu Mok

A new species of snake eel, *Ophichthus vietnamensis* sp. nov., is described on the basis of two specimens collected from off Ky Ha, central coast of Viet Nam. The new species is distinguishable from four similar congeners by having two preopercular pores, a less elongate body (both depth 20–25 times in TL) and the following combination of characters: tail length 56% TL; teeth moderately large and conical, biserial along the entire upper jaw, biserial anteriorly and uniserial posteriorly on lower jaw, uniserial on vomer, and total vertebrae 121–130. Five *Ophichthus* species are also found in Vietnamese waters, including *O. asakusae*, *O. erabo*, *O. lithinus*, *O. rutidoderma* and *O. urolophus*. Detailed descriptions are provided for all species.

Key words: Pisces, Taxonomy, Ichthyology, Snake eel, New species.

BACKGROUND

The family Ophichthidae is the largest anguilliform family, possessing more than 300 species distributed among 61 genera (McCosker et al. 2012; Ho et al. 2013 2015; Hibino and Kimura 2016; Tashiro et al. 2016; Tawa et al. 2018; Hibino et al. 2019). Many genera have been revised during the last four decades; however, several large and complicated genera are still problematic, and none more so than *Ophichthus* Ahl, 1789 (McCosker and Ho 2015). The family is a highly diverse group of eels that occurs in a wide variety of habitats from muddy estuaries to coral reefs to the midwater realm. Ophichthids are more characteristic of continental waters than of islands. They are found from the shore to depths of 700 to 800 m or more, but most occur at less than 200 m (Smith and McCosker 1999).

Studies of the eels of Vietnam began with the surveys of the fish fauna in the early 20 century (Pellegrin 1905; Chevey 1932). Kuronuma (1961) published 729 species in the fish fauna of Vietnam, which included 14 snake eels (13 species in Ophichthidae and one in Neenchelyidae) (Nguyen 1995). Fourmanoir and Do (1965) published a list of fishes in Nha Trang waters, including 306 species with 16 species belonging to Anguilliformes and five to Ophichthidae. Orsi (1974) listed 9 families and 35 species of freshwater and marine eels in Vietnam; of them, six nominal and two unidentified species were listed in Ophichthidae. Nguyen and Nguyen (1994) listed 44 species in Anguilliformes and 13 species of snake eels. Le et al. (2013) reviewed the literature records of eel species of Vietnam between 1974–2012 and listed nine families, 34 genera and 96 species, of which 11 genera and 28 species are in Ophichthidae. Hibino (2018) recorded 13 species of Ophichthidae from Ha Long Bay, including five unidentified species of *Ophichthus*, which may require further descriptions.

During investigations of the fish fauna along the coastal line and fishing forts between Da Nang and Kien

Citation: Vo QV, Hibino Y, Ho HC. 2019. A new species of the snake eel genus *Ophichthus*, with additional records from Viet Nam (Anguilliformes: Ophichthidae). Zool Stud **58:**43. doi:10.6620/ZS.2019.58-43.

Giang provinces, large numbers of eels were collected. This study reports a new species collected from off Kỳ Hà fishing harbor, Nui Thanh district, Quảng Nam, and five species newly recognized in Vietnam, collected during 2016–2018. Detailed descriptions of all species are provided.

MATERIALS AND METHODS

Sampling locality

The specimens of the new species were collected from Kỳ Hà fishing harbor, Núi Thành district, Quảng Nam, and five other species were collected from Hàm Tử fishing harbour, Quy Nhơn city, Bình Định province; Lương Sơn fishing harbour, Lương Sơn Commune, Nha Trang city, Khánh Hòa province; and Cần Giờ fishing grounds, Hồ Chí Minh city.

Morphological analysis

Methods for taking counts and measurements and terminology generally followed (McCosker 1977; McCosker et al. 1989; McCosker and Ho 2015). Vertebral counts (which include the hypural) were taken from radiographs. Radiographic techniques are described in (Böhlke 1989). The mean vertebral formula (MVF) is expressed as the average of predorsal, preanal, and total vertebrae (Böhlke 1982). Total and head lengths are abbreviated as TL and HL, respectively. All of the specimens examined in this study had been fixed in formaldehyde; hence genetic analysis of the tissues was not possible. Specimens are deposited in the National Museum of Marine Biology and Aquarium, Taiwan (NMMB-P), the Museum of Oceanography, Institute of Oceanography, Vietnam (OIM) and the California Academy of Sciences, USA (SU).

Comparative materials

Ophichthus asakusae: SU 6478, holotype, 584 mm TL, outside Bay of Tokyo, near Misaki, Japan; ASIZP57968, 443 mm TL, Daxi, 8 Feb. 1990; NMMB-P16463, 346 mm TL, NMMB-P16465, 344 mm TL, NMMB-P16469, 273 mm TL, NMMB-P16887, 282 mm TL, Ko-tzu-liao, Kaohsiung, Taiwan, 9 May 2012; NMMB-P16888, 440 mm TL, Ko-tzu-liao, Kaohsiung, Taiwan, 22 Jul. 2012; NMMB-P24986, 443 mm TL, Ko-tzu-liao, Kaohsiung, Taiwan, 10 Apr. 2015; NMMB-P25286, 2, 357–321 mm TL, Ko-tzu-liao, Kaohsiung, Taiwan, 31 Oct. 2016; NMMB-P25455, 518 mm TL, Ko-tzu-liao, Kaohsiung, Taiwan, 31 Oct. 2016; NMMB-P25832, 376 mm TL, Dong-gang, Pingtung, Taiwan, 21 Feb. 2017; NMMB-P26612, 640 mm TL, Ko-tzu-liao, Kaohsiung, Taiwan, 29 Mar. 2017; NMMB-P26709, 411 mm TL, Dong-gang, Pingtung, Taiwan, 17 Aug. 2017; NMMB-P28604, 404 mm TL, Ko-tzu-liao, Kaohsiung, Taiwan, 8 Feb. 2018.

Ophichthus urolophus: OIM-E.55790, 11 specimens, 373–638 mm TL, Dong-gang, Pingtung, Taiwan, bottom trawl, 21 Mar. 2018.

RESULTS

TAXONOMY

Genus *Ophichthus* Ahl, 1789

Ophichthus vietnamensis sp. nov.
New English name: Vietnamese Snake Eel

(Figs. 1–2; Table 1)

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Holotype: OIM-E.55769, 387 mm TL, male, Ky Ha, Tam Quang commune, Tam Ky district, Quang Nam province (collected from the fish landing ground), by hook and line at depth 40–60 m, 27 Jun., 2017, collected by Tran T.H.H.

Paratype: OIM-E.55768, 421 mm TL, a female with ripe eggs, collected with the holotype.

Diagnosis: A species of *Ophichthus* with posterior nostril above upper lip, covered by a flap that extends well below the edge of mouth and a less elongate body than other members of the genus (both depth 20–25 times in TL). It can be distinguished by the following combination of characters: tail length 56% TL; posterior end of tail thick, broadly pointed; dorsal origin above tip of appressed pectoral fin; pectoral fin broad and rounded; upper lips with a knob-like barbel at anterior margin of posterior nostril; cephalic sensory pores: SO 1 + 4, POM 8 – 9 + 2; teeth moderately large and conical, biserial along entire upper jaw, biserial anteriorly and uniserial posteriorly on lower jaw, uniserial on vomer; coloration yellowish-tan, slightly contrasting with white throat and belly; dorsal fin grayish with pale base, pectoral fin light brownish and anal fin uniformly pale; total vertebrae 121–130, mean vertebral formula 12-52-125.

Counts and measurements of the holotype (in mm): Total length 387; head 43.4; trunk 126.6; tail 217; predorsal distance 55.4; pectoral-fin length 10.5; head depth 19.1; head width 17.3; body depth at anus ca. 15.1; body width at anus ca. 14.9; body depth at branchial basket ca. 19.1; snout 9.2; tip of snout to rictus 20.7 snout overhang beyond tip of lower jaw 2.0;

eye diameter 5.4; interorbital width 8.3; gill opening height 8.3; isthmus width 13.7. Lateral-line pores: 9 on head, 13 before DFO, 51 before anus, and 122 in total. Vertebral formula 13-52-125.

Description: Body moderately elongate (Fig. 1), subcircular to posterior portion of tail, then becoming slightly compressed, its depth at gill openings 19–20 times in TL. Branchial basket slightly expanded. The skin wrinkled on nape and lateral side of tail tip. Head 8.6 (8.2–8.9) in TL. Head and trunk 2.3 in TL. Snout short, broadly rounded when viewed from above and side; underside of snout bisected by a groove. Lower jaw included, its tip reaching to anterior margin of anterior nostril tube. Upper jaw moderately elongated, rictus well behind a vertical from posterior margin of eye. Eye moderate, at center of upper jaw, 3.8 (3.8) in upper jaw and 8.4 (8.0–8.7) in head. Anterior nostril tubular, extending ventrolaterally from snout, reaching below upper lip and chin when directed downward. Posterior nostril a hole above upper lip, covered by a flap that extends well below edge of mouth. A single stout barbel at anterior base of posterior nostril on upper lip; no barbel below eye. Dorsal-fin origin at level of tip of pectoral fin. Median fins low but obvious, ending

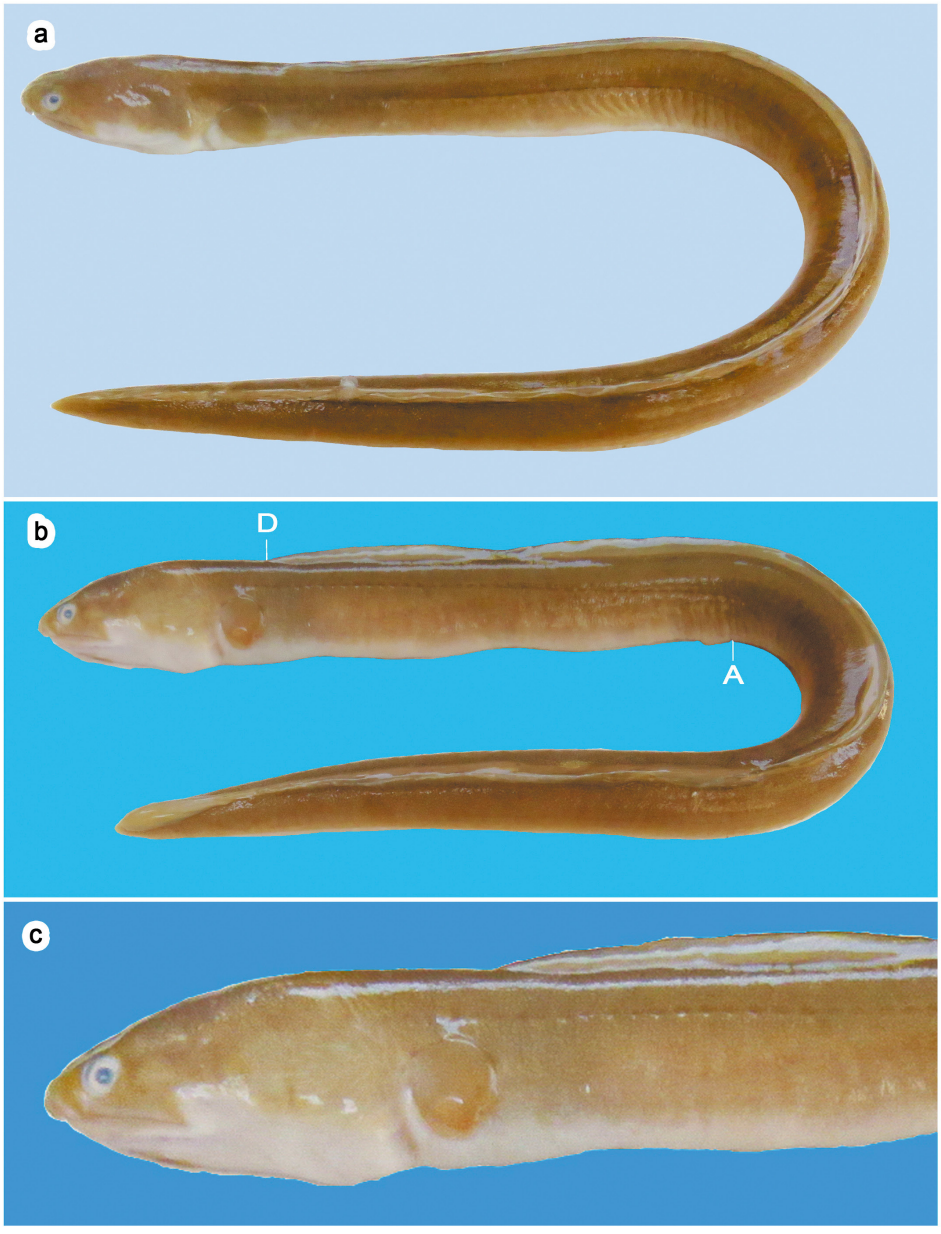

Fig. 1. *Ophicihthus vietnamensis* sp. nov. (a). OIM-E.55769, holotype, 387 mm TL, fresh; (b, c). OIM-E.55768, paratype, 421 mm TL, fresh. A anus and D dorsal-fin origin.

approximately an eye diameter before the broadly pointed tail tip. Pectoral fins broad and rounded, not elongate or lanceolate, the longest rays at mid fin.

Head pores small but apparent (Fig. 2a). Single median interorbital (frontal) and temporal pores. Supraorbital pores 1 + 4, infraorbital pores 4 + 2, mandibular pores 8 on right side and 9 on left side (9 on both sides of the paratype), preopercular pores 2, supratemporal pores 3. Faint rows of minute sensory papillae are present along nape, along anterior margin of orbit, and in a horseshoe-shaped pattern around base of anterior nostril. Lateral-line pores apparent; 9 (8–9) on head, in an arching sequence, 13 (13) before dorsal-fin origin; 51 (51) before anus, 122 (122) in total, the last ca. twice eye diameter before tail tip.

Teeth (Fig. 2b, c) moderately large, conical, and closely spaced. Intermaxillary with 6 (3–6) teeth in a curved row, followed by 18 (16–18) uniserial vomerine teeth, which decrease slightly in size posteriorly. Maxillary teeth biserial, with 21 (19–21) in both rows. Mandibular teeth mostly uniserial, with an inner row of 6 teeth anteriorly, decreasing in size posteriorly.

Coloration: When fresh (Fig. 1) yellowish-brown dorsally, slightly contrasting with the white throat and belly, extending to the anus. Dorsal fin gray-brown with a grey margin; anal fin uniformly creamy white. Pectoral fin yellowish-brown. When preserved, yellowish-brown dorsally, slightly contrasting with white throat and belly extending to anus. Dorsal fin grayish with a white base. Pectoral fin grayish. Mouth cavity, palate and tongue white. Peritoneum, stomach and intestine pale. Tail tip white.

Size: The largest known specimen is 421 mm TL, a ripe female.

Etymology: The specific name refers to the type locality (Vietnam) of the new species.

Remarks: Many Indo-Pacific *Ophichthus* have similar body measurements. They can be generally distinguished by dentition, color patterns or the relative positions of dorsal-fin origins, the shape of pectoral fins, and vertebral formulae. The new species is most similar to *O. asakusae* Jordan and Snyder, 1901 which co-occurs in Vietnam. They have pectoral fins shorter than the jaw; but *O. asakusae* has 3 POP pores (rarely 2) and

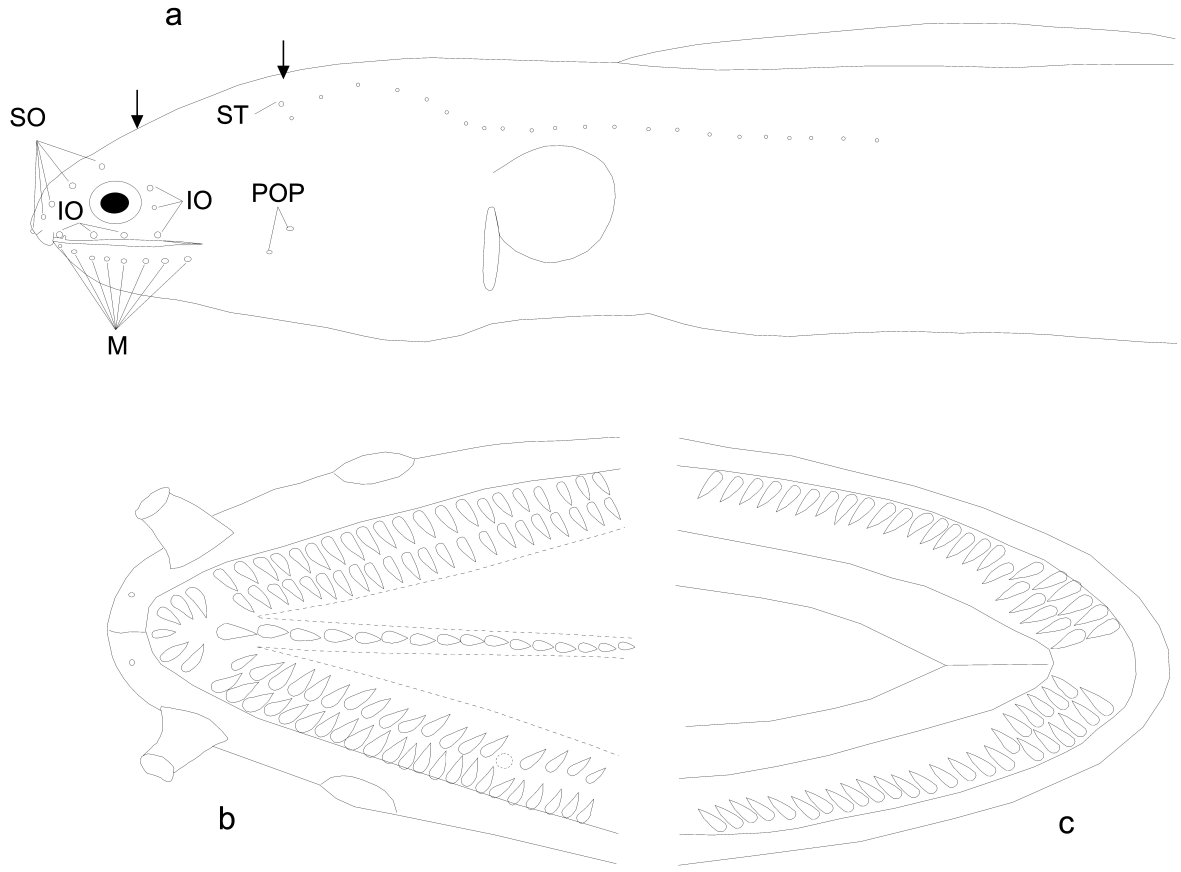

Fig. 2 Lateral view of head (a), teeth on maxilla and palatal area (b) and mandible (c) of *Ophichthus vietnamensis* sp. nov., OIM-Fi.04600, holotype, 387 mm TL. IO-infraorbital pores, M-mandibular pores, POP-preopercular pores, SO- supraorbital pores, ST- supratemporal pore. Arrows indicate interorbital (left) and mid-supratemporal (right) pores.

mostly uniserial maxillary teeth with one to three inner teeth in the middle of the maxilla and the coloration of the dorsal fin has a white margin (vs. 2 POP pores, biserial maxillary teeth and the coloration of the dorsal fins has a grey margin) (Sumida and Machida 2000; Hibino et al. 2019; and the present study). Additionally, *O. vietnamensis* sp. nov. is relatively more robust than *O. asakusae* (body depth at mid-anus 3.9–4.8% TL vs. 3.0–4.2%). *Ophichthus vietnamensis* sp. nov. is also similar to *O. urolophus* (Temminck and Schlegel, 1846) in general appearance, but can be separated by the thick tail tip (vs. tail tip narrowly pointed), fewer vertebrae (121–130 vs. 134–140) and the dorsal-fin origin at the level of tip of pectoral fin (vs. behind of tip of pectoral fin). Two other species also have a thick tail tip (*O. alleni* McCosker, 2010 and *O. brevicaudatus* Chu, Wu and Jin, 1981), but *O. alleni* has 3 POP (vs. 2 in *O. vietnamensis* sp. nov.) and a smaller eye diameter (10.6 in HL vs 8.4); *O. brevicaudatus*, from China, has biserial vomerine teeth (vs. uniserial in *O. vietnamensis* sp. nov.), a shorter head length (9.3 in TL vs 8.6) and a longer head and trunk (1.25 in tail length vs. 1.28) (Table 2).

Ophichthus asakusae Jordan and Snyder, 1901

(Fig. 3; Table 3)

Ophichthus asakusae Jordan and Snyder, 1901: 872, fig. 18 (type locality: outside Bay of Tokyo, near Misaki, Japan).
Ophichthus habereri Franz, 1910: 13, Pl. 3 (fig. 12) (type locality: Yokohama, Japan).
Ophichthus roseus Tanaka, 1917: 39 (type locality: Tokyo fish market, Japan).

Specimens examined: Ten specimens, 388–662 mm TL. OIM-E.55770–71, 2 specimens, 388–519 mm TL, off Kỳ Hà fishing harbour, Tam Quang Commune, Tam Kỳ district, Quảng Nam province, bottom longline 40–60 m, 27 Jun. 2017, collected by H.H.T. Tran. OIM-E.55772–74, 3 specimens, 517–521 mm TL, off Lương Sơn fishing harbour, Lương Sơn Commune, Nha Trang city, Khánh Hòa province, trawl, 60–80 m, 4 Aug. 2018, collected by Q.V. Vo. OIM-E.55775–79: 5 specimens, 405–662 mm TL, off Quy Nhơn fishing harbour, Quy Nhơn city, Bình Định province, trawl, 55–70 m, 23 Aug. 2018, collected by Q.V. Vo.

Description: Body moderately elongate (Fig. 3), subcircular to posterior portion of tail, then becoming slightly compressed, its depth at gill openings 21–29

Table 1. Measurements and counts of *Ophichthus vietnamensis* sp. nov.

	Holotype	Paratype
Total length (TL)	387	421
Measurements		
As %TL		
Head length (HL)	11.2	11.2
Preanal length	43.9	43.9
Predosal length	14.3	14.4
Tail length	56.1	56.1
Head depth at gill opening	4.9	5.2
Head width at gill opening	4.5	4.5
Body depth at mid-anus	3.9	4.8
Body width at mid-anus	3.9	4.5
As % HL		
Snout length	21.2	19.1
Eye diameter	12.4	11.5
Upper jaw length	47.7	43.3
Low jaw length	41.0	39.5
Interorbital	19.1	18.0
Gill opening	19.1	17.8
Isthmus width	31.6	
Pectoral-fin length	24.2	21.1
Counts		
Lateral-line pores before anus	51	51
Predosal vertebrate	13	13
Preanal vertebrate	52	52
Total vertebrate	125	121

Table 2. Comparison of morphological characters among *Ophichthus vietnamensis* sp. nov. and congeneric species. [a]McCosker (2010), [b]Jordan and Snyder (1901), [c]Chiu et al. (2013), [d]Chu et al. (1981)

	Ophichthus vietnamensis		*O. alleni*[a]		*O. asakusae*		
	Holotype	All types (n = 2)	Holotype	All types (n = 3)	Holotype[b]	Vietnam (n = 10)	Taiwan (n = 22)
Total length (TL)	387	387–421	674	547–760	584	388–662	273–640
As %TL							
Head length (HL)	11.2	11.0–12.2	11.9	11.7–11.9	11.1	10.3–11.1	10.2–13.1
Preanal length	43.9	43.9	43.0	43.0–43.4	45.2	40.6–47.7	42.1–47.5
Predosal length	14.3	14.3–14.4	12.3	12.3–13.8	12.3	12.2–13.5	11.4–13.6
Body depth at mid-anus	3.9	3.9–4.8	4.4		3.9	3.1–4.2	3.0–4.2
As % HL							
Snout length	21.2	19.1–21.2	18.5	17.3–20.4	18.7	16.1–21.0	16.8–21.2
Upper jaw length	47.7	44.3–47.7	32.6	32.6–44.4	39.0	35.6–43.5	34.1–47.4
Eye diameter	12.4	11.5–12.4	9	9.0–10.3	9.2	9.9–13.2	7.9–14.3
Interorbital	19.1	18.0–19.1	13.3		13.8	13.2–18.9	7.9–14.3
As % Trunk length							
Head length	34.3	34.3–38.3	38.1		32.4	30.2–34.6	30.7–39.5
As % Tail length							
Preanal length	78.3	78.3–78.4	75.5		82.5	68.3–91.3	72.6–90.4
Counts							
Preopercular pores	2	2	3	3	3	3	3
Predosal vertebrate	13	13	10	11	11[c]	10–12	10–12
Preanal vertebrate	52	52	52	52.5	54[c]	49–55	49–57
Total vertebrate	125	121–125	131	132	128[c]	123–130	125–132

	O. brevicaudatus[d]	*O. urolophus*	
	Holotype	Japan, Australia & Indonesia[a] (n = 99)	Taiwan (n = 11)
Total length (TL)	542	406–529	373–638
As %TL			
Head length (HL)	10.8	11.0–13.0	11.5–12.9
Preanal length	45.4		43.2–47.1
Predosal length			14.8–17.7
Body depth at mid-anus	4.2		3.4–4.4
As % HL			
Snout length	20.8		15–20.4
Upper jaw length	50		34.7–40.3
Eye diameter	11.2		8.2–13.4
Interorbital	17.2		14.3–18.4
As % Trunk length			
Head length	34.4		33.1–39.2
As % Tail length			
Preanal length	80.0		75.9–88.9
Counts			
Preopercular pores		2–3	3
Predosal vertebrate		16.2	13–16
Preanal vertebrate		54.0	51–56
Total vertebrate		136.5	134–140

times in TL. Branchial basket slightly expanded. Head 9.1–9.6 in TL. Head and trunk 2.2 in TL. The skin wrinkled on nape and lateral side of tail tip. Snout short, broadly rounded when viewed from above and side; underside of snout bisected by a groove. Lower jaw included, its tip reaching to anterior margin of anterior nostril tube. Upper jaw moderately elongated, rictus well behind a vertical from posterior margin of eye. Eye moderate, situated at about center of upper jaw, 3.1–3.9 in upper jaw and 7.6–10.2 in head. Anterior nostril tubular, extending ventrolaterally from snout, reaching below upper lip and chin when directed downward. Posterior nostril a hole above upper lip, covered by a flap. A single stout low barbel at anterior base of

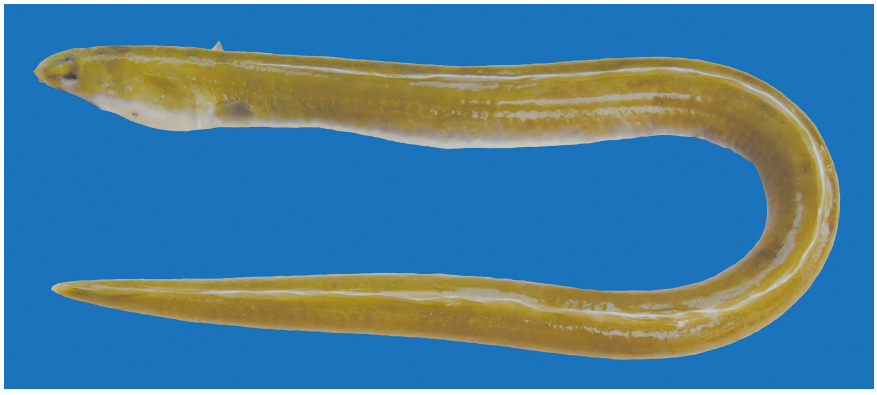

Fig. 3. *Ophichthus asakusae* Jordan & Snyder 1901, OIM-E.55771, 519 mm TL, fresh.

Table 3. Measurements and counts of *Ophichthus asakusae* and *O. erabo*

	O. asakusae		*O. erabo*
	Vietnam (n = 10)	Taiwan (n = 22)	Vietnam (n = 5)
Total length (TL)	388–662	273–640	451–659
Measurements			
As %TL			
Head length (HL)	10.3–11.1	10.2–13.1	7.8–9.6
Preanal length	40.6–47.7	42.1–47.5	50.4–62.3
Predosal length	12.2–13.5	11.4–13.6	7.5 –9.3
Tail length	52.3–59.4	52.5–57.9	37.7–49.6
Head depth at gill opening	3.1–4.7	3.0–4.4	2.7–3.4
Head width at gill opening	2.6–3.5	2.3–4.1 **	2.2–2.7
Body depth at mid-anus	3.1–4.2	3.0–4.2	2.2–2.7
Body width at mid-anus	3.0–4.2	2.8–3.6	2.8–3.4
As % HL			
Snout length	16.1–21.0	16.8–21.2	19.4–22.9
Eye diameter	9.9–13.2	7.9–14.3	10.9–12.6
Upper jaw length	35.6–43.5	34.1–47.4	40.8–46.2
Low jaw length	33.0–39.5	30.9–40.2 **	35–42.3
Interorbital	13.2–18.9	12.2–16.6	16.6–18.4
Gill opening	13,3–17,6	9.8–16.3	14.1–17.9
Isthmus width	18.5–27.0	12.2–27.7	18.4–26.3
Pectoral fin length	19.6–28.4	19.3–29.7	24.6–30.6
Counts			
Lateral-line pores before anus	51–60	55–56	77–80
Predosal vertebrate	10–12*	10–12	6–7
Preanal vertebrate	49–55*	49–57	78
Total vertebrate	123–130*	125–132	154

*counted only for 7 specimens; **measured only for 8 specimens.

posterior nostril on upper lip; no barbel below eye. Dorsal-fin origin at median level of pectoral fin. Median fins low but obvious, ending approximately an eye diameter before the broadly pointed tail tip. Pectoral fins moderate broad and rounded, not elongate or lanceolate, the longest rays at mid fin.

Head pores small but apparent. Single median interorbital (frontal) and temporal pores. Supraorbital pores 1 + 4, infraorbital pores 4 + 2, mandibular pores 8–10, preopercular pores 3, supratemporal pores 3. Faint rows of minute sensory papillae are present along nape, along anterior margin of orbit, and in a horseshoe-shaped pattern around base of anterior nostril. Lateral-line pores apparent, 8–9 on head, in an arching sequence, 11–12 before dorsal-fin origin, 55–58 before anus, 125–131 in total, the last ca. 2 eye diameters before tail tip.

Teeth small, conical, and closely spaced. Intermaxillary with 3–6 teeth in a curved row, followed by 16–18 uniserial vomerine teeth, which decrease slightly in size posteriorly. Maxillary teeth an irregularly uniserial row of 21–25 teeth. Mandibular teeth mostly uniserial, with 25–27, plus an outer row of 4–6 teeth at front.

Coloration: When fresh yellowish-brown dorsally, slightly contrasting with the white throat and belly, extending to the anus. Dorsal fin grayish, its base pale and margin white, pectoral fin light brownish, and anal fin uniformly pale to pale brown with white margin. When preserved, yellowish-brown dorsally, slightly contrasting with white throat and belly extending to anus. Dorsal fin grayish with white margin. Pectoral fin grayish. Tail tip white.

Ophichthus erabo **(Jordan and Snyder, 1901)**

(Fig. 4; Table 3)

Microdonophis erabo Jordan and Snyder, 1901: 870, fig. 17 (type locality: Misaki, Japan).

Ophichthus retifer Fowler, 1935: 368, fig. 9 (type locality: Durban, South Africa).

Specimens examined: OIM-E.55780–84, 5 specimens, 451–659 mm TL, off Hàm Tử fishing harbour, Quy Nhơn city, Bình Định province, trawl, 70–80 m, 23 Aug. 2018, collected by Q.V. Vo

Description: The body is rounded and elongate, body depth 37–43 times in TL (Fig. 4). Snout tip pointed, anterior nostril long, it and posterior nostril above the upper lip, covered by a flap that extends well below the edge of the mouth. Head 10.9–12.8 in TL. Head and trunk 1.6–2.0 in TL. Snout short, broadly rounded when viewed from above and side; underside of snout bisected by a groove. Lower jaw included, its tip reaching to posterior margin of anterior nostril tube. Upper lips with a knob-like barbel at anterior margin of posterior nostril. Tail length 2.0–2.7 in TL; end of tail thick, pointed; dorsal origin inserted just a little before gill opening; pectoral fin moderate and slender.

Head pores small but apparent. Single median interorbital (frontal) and temporal pores; SO 1 + 3, IO 4 + 2, POM 5 – 7 + 3; lateral-line pores apparent; 8 on head, in an arching sequence, 15 before dorsal-fin origin; 77–80 before anus, 139–150 in total, the last ca. 2 eye diameters before tail tip. Gill slit situated anterior to base of pectoral fin.

Teeth moderately large and conical, uniserial along the entire upper jaw and lower jaw, uniserial on vomer. Intermaxillary with 3–6 teeth in a curved row, followed by 16–18 uniserial vomerine teeth, which decrease slightly in size posteriorly. Maxillary teeth an irregularly uniserial row of 14 or 15 teeth. Mandibular teeth mostly uniserial, with 17–19 in row.

Coloration: Brownish olive or pale yellow, white below; body marked with rich brown semicircular spots which are smaller and more numerous on head and larger in trunk and tail. The brown spots are of varying sizes, the uppermost on the median line; lower jaw and

Fig. 4. *Ophichthus erabo* (Jordan & Snyder, 1901), OIM-E.55782, 579 mm TL, fresh.

throat. Dorsal fin with oblong-spots and markings, like those on body; anal fin plain white.

Ophichthus lithinus **(Jordan and Richardson, 1908)**

(Fig. 5; Table 3)

Leiuranus lithinus Jordan and Richardson, 1908: 238, fig. 3 (type locality: Cuyo, Philippines).
Ophichthus evermanni Jordan and Richardson, 1909: 172, Pl. 67 (type locality: Kauohsiung, Taiwan).

Specimens examined: OIM-E.55785–86, 2 specimens, 573–704 mm TL, from Hàm Tử fishing harbour, Quy Nhơn city, Bình Định province, catching in trawl net at 70–80 m, 23 Aug. 2018, collected by Q.V. Vo.

Description: Body elongate (Fig. 5), subcircular to posterior portion of tail, then becoming slightly compressed, its depth at gill openings 33–38 times in TL. Branchial basket slightly expanded. Head 10.4–10.6 in TL. Head and trunk 2.0 in TL. Snout short, broadly rounded when viewed from above and side; underside of snout bisected by a groove flanking the anteriormost tooth. Lower jaw included, its tip reaching to anterior margin of anterior nostril tube. Upper jaw moderately elongated, rictus well behind a vertical from posterior margin of eye. Eye moderate, situated at center of upper jaw, 3.1–3.9 in upper jaw and 7.6–10.2 in head. Anterior nostril tubular and half of eye diameter; posterior nostril labial. A single stout barbel right at anterior base of posterior nostril on upper lip; no barbel below eye. Dorsal-fin origin behind gill opening and middle of pectoral fin, predorsal length 8.6 (8.6–8.7) in TL. Median fins low but obvious, ending more than an eye diameter before the broadly pointed tail tip. Pectoral fin well developed with 11 rays and its length more than eye diameter, elongate but not pointed, its length 4.1–4.4 in head length.

Head pores small but apparent. Single median interorbital (frontal) and temporal pores. Supraorbital pores 1 + 4 infraorbital pores 4 + 2, mandibular pores 5, preopercular pores 3, supratemporal pores 3. Faint rows of minute sensory papillae are present along nape, along anterior margin of orbit, and in a horseshoe-shaped pattern around base of anterior nostril. Lateral-line pores apparent; 8–9 on head, in an arching sequence, 12 before dorsal-fin origin; 69–70 before anus, 140–147 in total, the last ca. 2 eye diameters before tail tip.

Teeth moderately large, conical, and well separated from each other at base. Anterior part of maxilla with 4 teeth in rosette arrangement followed by sequence of: gap, two intermaxillary teeth, gap, followed by 17 or 18 uniserial vomerine teeth gradually decreasing in size. Maxillary teeth an irregularly uniserial row 19 or 20 teeth. Mandibular teeth also uniserial, with 20 or 21 in the row.

Coloration: Colour of fresh specimens: dorsal surface of head and tail covered with brown irregular blotches along dorsal surface and ending before ventral; ventral region creamy white; dorsal portion of head and gill basket brown, posterior part of eye and gill opening to pectoral-fin base pale; mandible and intermandibular region brown. Dorsal fin pale and light brown in regular intervals, anal fin, pectoral fin, and tip of caudal fin pale.

Ophichthus rutidoderma **(Bleeker, 1852)**

(Fig. 6; Table 4)

Ophisurus rutidoderma Bleeker, 1852: 30 (type locality: Jakarta, Java, Indonesia).
Ophisurus rutidodermatoides Bleeker, 1852: 31 (type locality: Jakarta, Java, Indonesia).
Ophisurus lumbricoides Bleeker, 1852: 32 (locality unknown).
Ophisurus macclellandi Bleeker, 1852: 33 (type locality: Jakarta, Java, Indonesia).
Ophichthus derbyensis Whitley, 1941: 14, fig. 10 (type locality: Derby, Western Australia).

Fig. 5. *Ophichthus lithinus* (Jordan & Richardson, 1908), OIM-E.55785, 704 mm TL, fresh.

Specimens examined: OIM-E.55787, 278 mm TL, from Cần Giờ fishing grounded, Hồ Chí Minh city, caught in a trawl net, at 15–17 m, 20 April, 2016, by Q.V. Vo.

Description: Body very elongate (Fig. 6), trunk subcircular, tail laterally compressed; body depth at gill openings 42.8 in TL. Head 4.2 in trunk. Head and trunk 3.0 and head 16.7 in TL. Snout rounded, moderately acute, short and sharp when viewed from above; a short groove bisecting underside of snout nearly to tip of upper jaw. Lower jaw included, its tip reaching well beyond base of anterior-nostril tubes. Upper jaw not elongated, rictus immediately behind a vertical line at posterior margin of eye. Eye is small and located anteriorly, 3.3 in upper jaw and 11.1 in head. Anterior nostrils tubular, extending ventrolaterally from snout, reaching below upper lip and beyond tip of chin. Posterior nostrils an elongate opening within upper lip, not visible externally, covered by a flap that extends below edge of mouth and lacks a vertical slit. Dorsal-fin origin well behind pectoral fin about smaller than a head length into trunk length. Median fins low but obvious, ending a little more than eye diameter before bluntly pointed and laterally compressed tail tip. Pectoral fins elongate.

Head pores small but apparent. Single median interorbital and temporal pores. Supraorbital pores 1 + 4, infraorbital pores 4 + 2, lower jaw pores 5, preopercular pores 2, supratemporal pores 3. Lateral-line pores apparent; 9 on head, in an arching sequence, 15 before dorsal-fin origin; 64 before anus, 190 in total, the last ca. 2 eye diameters before tail tip.

Teeth small, conical, slightly recurved; uniserial in upper jaw, biserial on vomer and biserial anteriorly and uniserial posteriorly on lower jaw. An intermaxillary rosette of 4, followed by a gap, then followed by two rows of vomerine teeth with 17 teeth. Maxillary tooth separated by a moderate gap, with 16 or 17 small teeth. Mandibular teeth mostly uniserial, with an outer row of 5 or 6 teeth anteriorly, and an inner row with 15–16 descending in size to become very small posteriorly.

Coloration: Colour in ethanol uniformly dark brown; throat, snout and chin slightly darker; anterior nostrils, inside of mouth, anal region and peritoneum pale. Median and pectoral fins pale.

***Ophichthus urolophus* (Temminck and Schlegel, 1846)**

(Fig. 7; Table 3)

Conger urolophus Temminck and Schlegel, 1846: 260, Pl. 114 (fig. 1) (type locality: Japan).

Fig. 6. *Ophichthus rutidoderma* (Bleeker, 1852), OIM-E.55787, 278 mm TL; (a) Lateral view of head (a) preserved in formalin 10%, (b) vertebral column of preanal region.

Ophichthus tsuchidae Jordan and Snyder, 1901: 873, fig. 19 (type locality: Misaki, Japan).

Specimens examined: 2 specimens: OIM-E.55788–89, 384–422 mm TL, collected from Lương Sơn fishing harbour, Lương Sơn Commune, Nha Trang city, Khánh Hòa province, by trawl at 50–60 m, 8 Aug. 2018, by Q.V. Vo.

Description: Body moderately elongate (Fig. 7), subcircular to posterior portion of tail, then becoming slightly compressed, its depth at gill openings 22–26

Fig. 7. *Ophichthus urolophus* (Temminck & Schlegel, 1846), OIM-E.55789, 422 mm TL, fresh.

Table 4. Measurements and counts of *Ophichthus lithinus*, *O. rutidoderma* and *O. urolophus*

	O. lithinus	*O. rutidoderma*	*O. urolophus*	
	Vietnam (n = 2)	Vietnam (n = 1)	Vietnam (n = 2)	Taiwan (n = 11)
Total length (TL)	573–704	278	384–422	373–638
Measurements				
As %TL				
Head length (HL)	9.5–9.6	6.0	11.1–12.0	11.5–12.9
Preanal length	50.3–50.8	33.8	43.6–44.8	43.2–47.1
Predosal length	11.5–11.7	9.0	15.4–15.7	14.8–17.7
Tail length	49.2–49.7	66.2	55.2–58.5	52.9–56.8
Head depth at gill opening	2.7–3.0	2.3	3.9–4.5	3.5–4.7
Head width at gill opening	2.4–2.7	1.2	3.3–3.5	3.1–4.3
Body depth at mid-anus	3.0–3.3	1.3	3.6–4.1	3.4–4.4
Body width at mid-anus	2.9–3.1	1.3	3.7–3.9	3.2–4.0
As % HL				
Snout length	18.7–18.8	18.1	15.4–17.8	15.0–20.4
Eye diameter	9.3–9.8	9.0	12–13.2	8.2–13.4
Upper-jaw length	30.4 –31.2	29.5	34.5–35.6	34.7–40.3
Lower jaw-length	22.2–24.0	22.9	30.4–31.9	31.0–38.7
Interorbital	13.9–14.4	15.1	17.1–18.4	14.3–18.4
Gill opening	13.5– 13.7	16.9	14.6–18.7	11.8–18.4
Isthmus width	17.2 –21.2	15.7	25.3–29.7	18.0–25.8
Pectoral-fin length	23.0–24.4	26.5	33.0–34.3	24.3–36.5
Counts				
Lateral-line pores before anus	69–70	64	56–57	53–58
Predosal vertebrae	12	16	15–16	13–16
Preanal vertebrae	67–70	64	54–55	51–56
Total vertebrae	149–153	198	138–140	134–140

times in TL. Branchial basket slightly expanded. Head 8.3–9.0 in TL. Head and trunk 2.3 in TL. Snout short, broadly rounded when viewed from above and side; underside of snout bisected by a groove. Lower jaw included, its tip reaching to anterior margin of anterior nostril tube. Upper jaw less elongated, rictus well behind a vertical from posterior margin of eye. Eye moderate, situated at anterior margin of upper jaw, 2.6–2.9 in upper jaw and 7.6–8.3 in head. Anterior nostrils tubular, extending ventrolaterally from snout, reaching below upper lip and chin when directed downward. Posterior nostril a hole above upper lip, covered by a flap that extends well below edge of mouth. A single stout barbel on upper lip at anterior base of posterior nostril on upper lip; no barbel below eye. Dorsal-fin origin at or behind tip of pectoral fin. Median fins low but obvious, ending approximately an eye diameter before the broadly pointed tail tip. Pectoral fins elongate but not lanceolate, the longest rays at mid fin.

Head pores small but apparent. Single median interorbital (frontal) and temporal pores. Supraorbital pores 1 + 3, infraorbital pores 4 + 2, mandibular pores 6–7, preopercular pores 2, supratemporal pores 3. Faint rows of minute sensory papillae are present along nape, along anterior margin of orbit, and in a horseshoe-shaped pattern around base of anterior nostril. Lateral-line pores apparent; 9 on head, in an arching sequence, 17 before dorsal-fin origin; 56–57 before anus, 133–135 in total, the last ca. 2 eye diameters before tail tip.

Teeth moderate, conical, and separated from each other at base. Intermaxillary with 3–5 teeth in a curved row, followed by 11–14 uniserial vomerine teeth, which decrease slightly in size posteriorly. Maxillary teeth uniserial with 17–19 in a row, with an inner row of 5–6 teeth at front of the posterior nostrils. Mandibular teeth also uniserial, with 21 in a row, decreasing in size posteriorly.

Coloration: When fresh: yellowish-brown dorsally, slightly contrasting with the white throat and belly, extending to the anus. Dorsal fin grayish; anal fin uniformly white. Pectoral fin light grayish. When preserved: yellowish-brown dorsally, slightly contrasting with the white throat and belly, extending to anus. Dorsal fin grayish. Pectoral fin grayish.

DISCUSSION

Twelve species of *Ophichthus* have been found in Vietnam, including *O. apicalis* (Anonymous [Bennett], 1830); *O. asakusae* Jordan and Snyder, 1901; *O. celebicus* (Bleeker, 1856); *O. cephalozona* Bleeker, 1864; *O. erabo* (Jordan and Snyder, 1901); *O. lithinus* (Jordan and Richardson, 1908); *O. macrochir* (Bleeker, 1853); *O. microcephalus* (Day, 1878); *O. rutidoderma* (Bleeker, 1852); *O. shaoi* McCosker and Ho, 2015; *O. singapurensis* (Bleeker, 1864) and *O. urolophus* (Temminck and Schlegel, 1846) (Nguyen and Nguyen 1994; Nguyen 2001; Le et al. 2013; Hibino 2018; this study). Nguyen (2001) provided descriptions of 4 species, *O. apicalis*, *O.celebicus*, *O. lithinus* and *O. rutidoderma*, based on specimens deposited in the Institute of Marine Environment and Resources, Hanoi, Vietnam (IMER) and Museum of Oceanography, Institute of Oceanography; whereas Nguyen (1994) and Le et al. (2013) provided lists of species only and no vouchers were mentioned. Hibino (2018) recorded four *Ophichthus* based on the specimens deposited in the Fisheries Research Laboratory, Mie University (FRLM). In the present study, five species are recorded from central coast of Vietnam including one new species. *Ophichthus asakusae* is restricted to the northwestern Pacific Ocean, from Viet Nam to southern Japan; *O. erabo* is widespread in the Indo-West Pacific Ocean; *O. lithinus* is widespread from the eastern coast of India to northern Australia, and north to southern Japan; and *O. urolophus* is known from northwestern Australia to southern Japan.

CONCLUSIONS

Knowledge of the snake eel genus *Ophichthus* from Vietnamese waters has been expanded and reviewed. A new species is described, and five species are confirmed from specimens. Data are provided based on type series together with specimens newly collected from a broader range. Additional descriptive characters are employed for recognizing its congeners and to establish the new species. This study provides an additional understanding of snake eel species in Vietnamese waters. Additional collections are needed to help further understand the taxonomy of this group.

Acknowledgments: This work and the new species name have been registered with ZooBank under urn:lsid:zoobank.org:pub:2D927F74-25C3-4334-9C3D-AA63980D4231. We thank R.-R. Chen (NMMB-P) for curatorial assistance. This study is supported by the Ministry of Education and the National Museum of Marine Biology and Aquarium, Taiwan. QVV is supported by the Ministry of Science and Technology through the project "Researching and evaluating marine biological resources and building solutions for rational exploitation and sustainable development in the Ly Son district (Quang Ngai) and neighboring waters". We thank the Museum of Oceanography, Institute of Oceanography, VATS, for support. We also thank H.

H. T. Tran, T. T. T. Le and T. C. Tran of the Institute of Oceanography, VATS, for collecting the specimens.

Authors' contributions: QVV performed the field work, QVV, YH and HCH measured and counted the specimens. QVV, YH and HCH wrote the manuscript. YH edited the draft, improved the taxonomic concepts, and wrote the discussion. All authors participated in revising the manuscript. All authors read and approved the final manuscript.

Competing interests: QVV, YH and HCH declare that they have no conflict of interest.

Availability of data and materials: All data are shown in the paper.

Consent for publication: Not applicable.

Ethics approval consent to participate: Not applicable.

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