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A new species of *Neenchelys* (Anguilliformes: Ophichthidae: Myrophinae) from the eastern Indian Ocean

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Abstract

A new worm eel, *Neenchelys andamanensis*, is described based on a single specimen collected from a depth of 520–531 m, Andaman Sea, eastern Indian Ocean. The new species is similar to *N. daedalus*, *N. nudiceps*, and *N. similis* in its total vertebral count and slender body, however, it differs from the latter three in having a shorter tail (60% TL vs. 70–76%), more numerous preanal vertebrae (77 vs. 59–71), and shorter pectoral fins (2.4% HL vs. 21–27%). Although the new species resembles *N. mccoskeri* in some proportional characters, the former species is distinguishable from the latter by its higher total vertebral count (221 vs. 172–184), position of the dorsal-fin origin (horizontal distance from the origin to a vertical through mid-anus 65% of trunk length vs. 46–59%) and width of the interorbital region (4.5% of head length vs. 8.2–16%). A revised key to the species of *Neenchelys* is provided.

Key words: *Neenchelys*, new species, Andaman Sea, Indian Ocean, key to species

Introduction

The Indo-Pacific genus *Neenchelys* Bamber 1915 (Ophichthidae, Myrophinae) was recently revised by Ho *et al.* (2013) including the descriptions of three "new species" and a key to the species. However, all nomenclatural acts performed in that article are unavailable under the Code [ICZN (2012: Article 8.5.3.)] because no ZooBank number was represented in that online article, and immediate solutions were required for that problem (Tashiro *et al.* 2015). That problem was resolved by re-publication in this volume (Ho *et al.* 2015). After Ho *et al.* (2013), three undescribed species were found from various locations by various ichthyologists. One species was already described (Tashiro *et al.* 2015), and other one is described in this volume (Ho & Loh 2015). We found a single unique specimen from the collection of the Phuket Marine Biological Center during YH and SK's visit in March 2014. The specimen can be clearly distinguished from all other congeners, we herein describe it as a new species, and provide a modified key from that of Ho *et al.* (2013).

Materials and methods

Counts and measurements generally follow Castle & McCosker (1999) except for the following measurements; preanal length: distance from the tip of snout to mid-anus; upper-jaw length: distance from the tip of snout to the posterior margin of maxilla, inferred from surface; length of mouth gape: distance from the tip of snout to the posterior end of mouth rictus. Total and head lengths are abbreviated as TL and HL, respectively. Vertebral counts were made from soft-X ray photos. Institutional abbreviations of materials deposited follow Fricke & Eschmeyer (2014). The revised key is based on that of Ho *et al.* (2013) including the species described by Ho & Loh (2015), Ho *et al.* (2015) and Tashiro *et al.* (2015).

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Revised Key to Species of the *Neenchelys*

1a. Origin of dorsal fin above or behind a vertical through mid-anus . . . . . ***Neenchelys cheni* (Chen &Weng 1967)** (Indo-West Pacific)
1b. Origin of dorsal fin well before a vertical through mid-anus 2
2a. Pectoral fin minute, shorter than snout 3
2b. Pectoral fin well developed, equal to longer than snout 7
3a. Head small, 6.2–7.7% TL; body slender, depth at gill opening 1.3–3.2% TL; total vertebrae 172–221 4
3b. Head large, 10.1–11.3% TL; body robust, depth at gill opening 3.3–6.0% TL; total vertebrae 135–151 6
4a. Numerous filaments along rim of anterior nostril; five mandibular pores on lower jaw; distance from dorsal-fin origin to a vertical through mid-anus 68% of trunk length; row of vomerine teeth restricted to anterior to mid-point of maxillary-teeth row. . . . . ***Neenchelys gracilis* Ho & Loh 2015** (Taiwan)
4b. A single elongate flap along rim of anterior nostril; six or seven mandibular pores on lower jaw; distance from dorsal-fin origin to a vertical through mid-anus 46–65% of trunk length; row of vomerine teeth extends to level of posterior end of maxillary-teeth row 5
5a. Distance from dorsal-fin origin to a vertical through mid-anus 46–59% of trunk length; total vertebrae 172–184; interorbital width relatively wide, 8.2–16% HL . . . . . ***Neenchelys mccoskeri* Hibino, Ho & Kimura 2012** (Japan and Taiwan)
5b. Distance from dorsal-fin origin to a vertical through mid-anus 65% of trunk length; total vertebrae 221; interorbital width narrow, 4.5% HL . . . . . ***Neenchelys andamanensis* sp. nov.** (Andaman Sea)
6a. Distance from dorsal-fin origin to a vertical through mid-anus 74% of trunk length; five mandibular pores on lower jaw; total vertebrae 151 . . . . . ***Neenchelys microtretus* Bamber 1915** (Red Sea)
6b. Distance from dorsal-fin origin to a vertical through mid-anus 78–85% of trunk length; six or seven mandibular pores on lower jaw; total vertebrae 135–148 . . . . . ***Neenchelys parvipectoralis* Chu, Wu & Jin 1981** (East China Sea, South China Sea, and Sulu Sea)
7a. Body slender, depth at gill opening 1.8–3.1% TL; tail long, 70–76% TL; preanal vertebrae 59–71 and total 221–274 8
7b. Body robust, depth at gill opening 3.0–3.5% TL; tail relatively short, 55–67% TL; preanal vertebrae 49–55, and total 135–186 10
8a. Head without papillae; head large, 9.9% TL; body relatively robust, 3.1% TL; total vertebrae 221 . . . . . ***Neenchelys nudiceps* Tashiro, Hibino & Imamura 2015** (eastern Indian Ocean)
8b. Head with small papillae; head small, 5.7–7.8% TL; body extremely slender, 1.8–2.2% TL; total vertebrae 225–274 9
9a. Five mandibular pores on lower jaw; preanal vertebrae 59, and total 225–235 . . . . . ***Neenchelys daedalus* McCosker 1982** (Papua New Guinea)
9b. Six to eight mandibular pores on lower jaw; preanal vertebrae 68–71, and total 251–276 . . . . . ***Neenchelys similis* Ho, McCosker & Smith 2015** (West Pacific)
10a. Head large, 11–14% TL; distance from dorsal-fin origin to a vertical through mid-anus 80–83% of trunk length; preanal vertebrae 49–51, and total 135–140 . . . . . ***Neenchelys buitendijki* Weber & de Beaufort 1916** (Indo-West Pacific)
10b. Head moderate in size, 9.3–10% TL; distance from dorsal-fin origin to a vertical through mid-anus 46–54% of trunk length; preanal vertebrae 52–55, and total 169–186 11
11a. Total vertebrae 169; seven mandibular pores on lower jaw; gill opening length 6.6–7.9% HL. . . . . ***Neenchelys pelagica* Ho, Smith & McCosker 2015** (Taiwan)
11b. Total vertebrae 177–186; six or seven mandibular pores on lower jaw; gill opening length 8.8–13% HL . . . . . ***Neenchelys diaphora* Ho, Smith & McCosker 2015** (Taiwan)

Result

Neenchelys andamanensis sp. nov.

New English name: Andaman Worm Eel
Figs. 1, 2, 3

Holotype. PMBC 25065, 336 mm TL, sex unknown, 7°21'N, 97°26'E, off Phuket, Andaman Sea, eastern Indian Ocean, 520–531 m depth, 27 January 1999, collected by S. Bussarawit and C. Aungtonya.

Diagnosis. A species of *Neenchelys* with the following combination of characters: head 7.4% TL; tail 60% TL; body depth at gill opening 1.4% TL; origin of dorsal fin anterior to mid-trunk, horizontal distance from the origin to a vertical through mid-anus 65% of trunk length; interorbital width 4.5% HL; pectoral fin minute, 2.4% HL; predorsal vertebrae 36, preanal 77, and total 221.

Description. Counts: 36 predorsal, 77 preanal, and total vertebrae 221. Proportional measurements as % TL: head length 7.4; trunk length 33; preanal length 40; tail length 60; predorsal length 19; body depth at gill opening 1.4; body depth at mid anus 1.2; body width at gill opening 0.6; body width at mid anus 1.0. Proportional

measurements as % of trunk length: horizontal distance from origin of dorsal fin to a vertical through mid-anus 65. Proportional measurements as % of head length: head depth 25; head width 14; eye diameter 5.3; interorbital width 4.5; snout length 14; upper-jaw length 33; mouth gape 25; gill-opening length 1.8; pectoral-fin length 2.4.

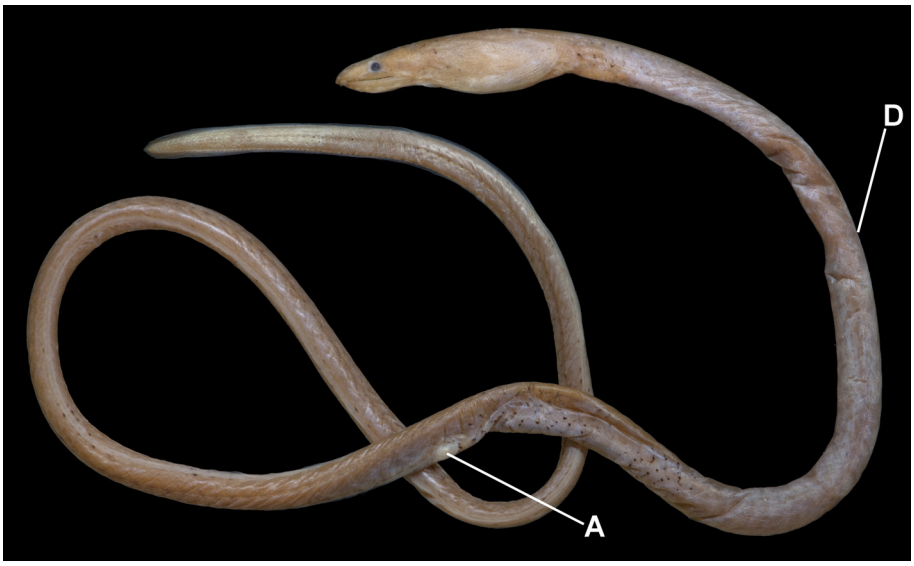

FIGURE 1. Holotype of *Neenchelys andamanensis* sp. nov., PMBC 25065, 336 mm TL, Andaman Sea. *A* position of anus, *D* origin of dorsal fin.

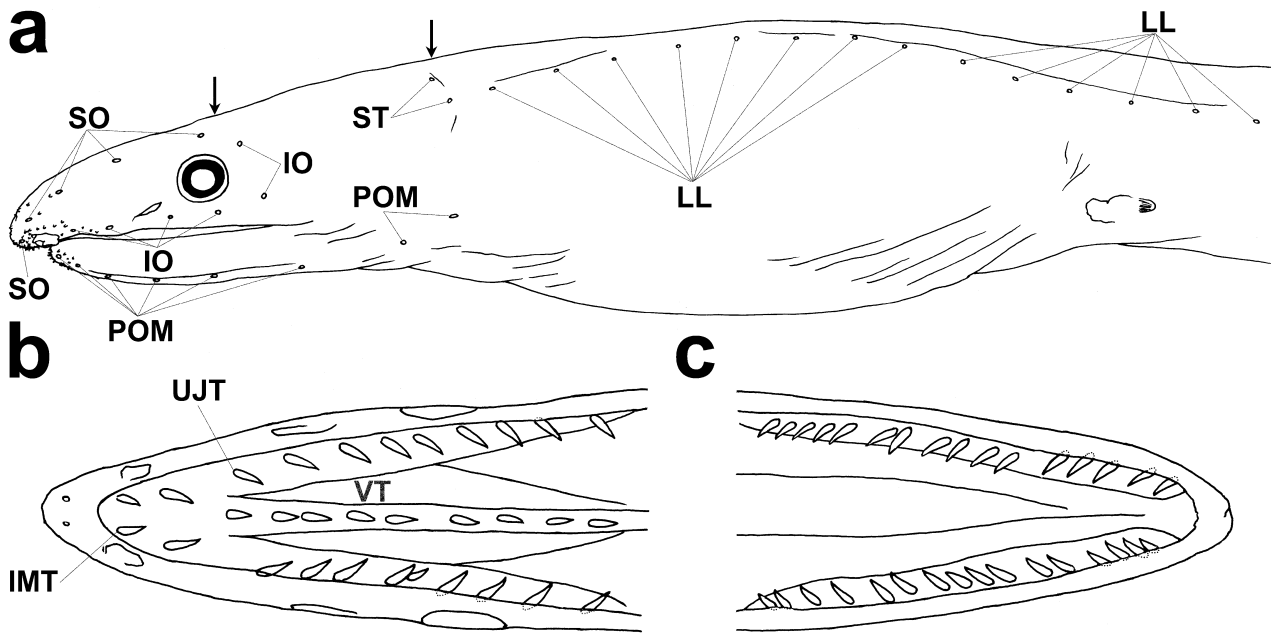

FIGURE 2. Lateral view of head (**a**), dentition of upper jaw and palatal area (**b**), and lower jaw (**c**) of *Neenchelys andamanensis* sp. nov., holotype, PMBC 25065. *IMT* intermaxillary teeth, *IO* infraorbital pores, *LL* lateral-line pores, *POM* preoperculomandibular pores, *SO* supraorbital pores, *ST* supratemporal pores, *UJT* upper-jaw teeth, *VT* vomerine teeth. *Arrows* indicate interorbital and median supratemporal pores.

Body elongate, extremely slender, trunk subcylindrical but gradually compressed posteriorly, strongly compressed at tip of tail (Fig. 1); head small; tail long, preanal length clearly shorter than tail. Snout long, deep and horizontally wide, tip of snout relatively acute, its length about 2.6 times eye diameter; small papillae distributed on tips of snout and lower jaw (Fig. 2a); mouth inferior, distance from tip of snout to tip of lower jaw slightly

shorter than eye diameter; no prominent groove on ventral side of snout; anterior nostril tubular, short, its length half of eye diameter, with elongate flap on posterior margin of rim (Fig. 3); posterior nostril as elongate slit, entirely open posteriorly, located above upper lip on anteroventral side of eye; eye small, covered by a transparent skin, located at midpoint of upper jaw; mouth large, rictus of mouth much behind a vertical through posterior margin of eye; a weak ridge on upper and lower lips; all teeth conical, pointed, and slightly recurved posteriorly; jaws and vomerine teeth uniserial (Fig. 2b, c); intermaxillary teeth arranged in a trapezoid; interorbital region slightly convex, without a median groove; gill opening constricted, one-third of eye diameter, located ventrolaterally, just anterior to base of pectoral fin; arrangement of cephalic sensory pores as follows (Fig. 2a): one + four supraorbital, four + two infraorbital, six + two preoperculomandibular, and two supratemporal; lateralline almost completed, posteriorly reaching to 1/2 head length before caudal-fin base; pores small but conspicuous, 11 anterior to pectoral-fin insertion, 36 anterior to dorsal-fin origin, 78 anterior to anus, and total 187. Dorsal and anal fins somewhat low, both fins confluent with caudal fin; origin of dorsal fin located anterior to mid-trunk; tip of caudal fin rounded, extremely short; pectoral fins minute, inconspicuous, their length shorter than eye diameter and their base less than half of gill opening.

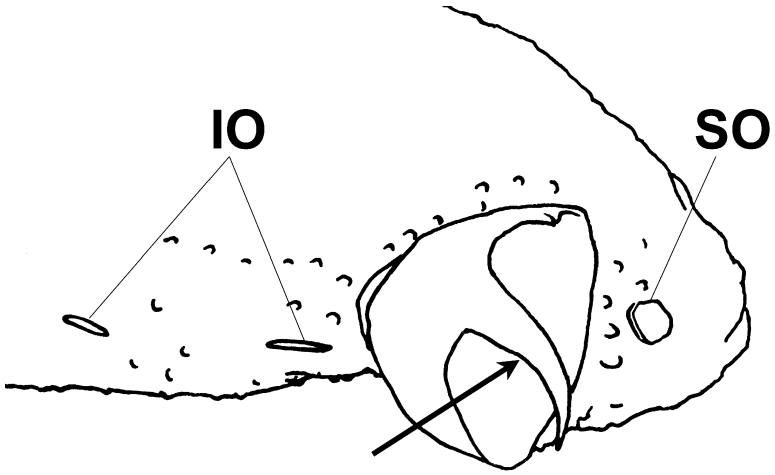

FIGURE 3. Lateral view of anterior nostril of *Neenchelys andamanensis* sp. nov., holotype. PMBC 25065 (right side). *IO* infraorbital pore, *SO* supraorbital pore. *Arrow* indicates an elongate flap.

Color of fixed and preserved in 10 % formalin. Head and body uniformly brown (Fig. 1), with scattered dark spots mainly distributed along dorsal midline, lateral line, and anal-fin base; sensory pores on head relatively pale. Dorsal and anal fins pale brown, but darker posteriorly (posteriormost tail region about 1/3 head length); caudal fin dark brown and pectoral fin pale brown.

Distribution. Known from only type locality, off Phuket, southeastern Andaman Sea, eastern Indian Ocean.

Etymology. The scientific name is derived from the type locality, Andaman Sea.

Discussion

Ho *et al.* (2013) described three "new species" and recognized nine valid species in the genus *Neenchelys*. Although we agree with their content, all nomenclatural acts by them are unavailable (Tashiro *et al.* 2015). That problem was already resolved by Ho *et al.* (2015), the correct date of valid nomenclatural publication is Ho *et al.* (2015). Incidentally, Ho *et al.* (2013) also provided a key to species of the genus and redescribed six valid species. Of these, they wrote that *Neenchelys microtretus* is closely similar to *N. parvipectoralis* and there is only a minor difference between these two species in total vertebral counts (151 in the former vs. 138–148 the latter). We examined five additional specimens of *N. parvipectpralis* and found that their total vertebral count ranges 135–148. In addition, *N. microtretus* and *N. parvipectoralis* are distinguishable by their counts of mandibular pores (five vs. six or seven) and positions of their dorsal-fin origins (distance from dorsal-fin origin to a vertical through mid-anus 74% of trunk length vs. 78–85%). Therefore, we also recognize *N. microtretus* and *N. parvipectoralis* as valid species.

Tashiro *et al.* (2015) recognized two groups in *Neenchelys*. The first group is characterized by having more than 200 total vertebrae (high-number vertebral group including *N. daedalus*, *N. nudiceps*, and *N. similis*), and the second group by having less than 200 (low-number vertebral group, *N. buitendijki*, *N. cheni*, *N. diaphora*, *N. mccoskeri*, *N. microtretus*, *N. parvipectoralis*, and *N. pelagica*). *Neenchelys andamanensis* is similar to the three species belonging to the high-number vertebral group in its total vertebral count and slender body, however, it differs from the three in having a shorter tail (60% TL vs. 70–76%), more numerous preanal vertebrae (77 vs. 59–71), and shorter pectoral fins (2.4% HL vs. 21–27%) (Tashiro *et al.* 2015; this study). The new species can be easily distinguished from the species belonging to the low-number vertebral group and the latest congeneric species, *N. gracilis*, by its higher numerous total vertebral counts (221 vs. 135–186 in the low-number vertebral group and 200 in *N. gracilis*) (Ho *et al.* 2013; Ho & Loh 2015; this study). Although *N. andamanensis* resembles *N. mccoskeri* in some proportional characters, i.e., smaller head (6.4–7.7% TL), somewhat longer tail (57–63% TL), lower depth (1.5–3.2% TL at gill opening), and shorter pectoral fin (1.5–4.3% HL) than that of the other congeners, new species is distinguishable from the latter by its more numerous total vertebrae (221 vs. 172–184), position of its dorsal-fin origin (horizontal distance from the origin to a vertical through mid-anus 65% of trunk length vs. 46–59%) and the width of its interorbital region (4.5% HL vs. 8.2–16%) (Hibino *et al.* 2012; Ho *et al.* 2013).

As stated above, Tashiro *et al.* (2015) defined two morphological groups within *Neenchelys*. After the study, two new species were described in this volume (*N. andamanensis* of total vertebrae 221 and *N. gracilis* of 200). The vertebral count of *N. andamanensis* is included in the high-number vertebral group, but *N. gracilis* is out of the range of the definition by Tashiro *et al.* (2015). Although the gap of these two groups should be modified because of that, we do not change the gap in the present study because there are still only very few materials of *N. gracilis*, moreover, *N. daedalus* and *N. nudiceps*.

Comparative materials. *Neenchelys buitendijki*: ZMA 102.171, lectotype, 210 mm TL, Moluccas, Indonesia; ZMA.PISC. 112.614, paralectotype, 132 mm TL, Moluccas, Indonesia; NMMB-P 13649, 239 mm TL, Matang, Malaysia. *Neenchelys cheni*: NMMB-P3019 (formerly THUP 3234), lectotype, 335 mm TL, Tungkang, Taiwan; NMMB-P 1534 (formerly THUP 3328), paralectotype, 356 mm TL, Tungkang, Taiwan; NSMT-P 69185, 358 mm TL, NhaTrang, Vietnam. *Neenchelys daedalus*: CAS 50708, paratype, cleared and stained, 272 mm TL, Astrolabe Bay, Madang, Papua New Guinea. *Neenchelys nudiceps*: MZB 22725 (formerly HUMZ 194698), holotype, 782 mm TL, off Sumatra, Indonesia, eastern Indian Ocean. *Neenchelys mccoskeri*: NMMB-P 15557, holotype, 512 mm TL, Tungkang, Taiwan; ASIZP 70422, paratype, 324 mm TL, Tashi, Taiwan; NSMT-P 50182, 108562, 108563, 108565, 108567–108571, paratypes, nine specimens, 298–400 mm TL, Suruga Bay, Shizuoka, Japan. *Neenchelys parvipectoralis*: FRLM 46844, 176 mm TL, Tungkang, Taiwan; KAUM–I. 44993, 44995, 44996, three specimens, 175–232 mm TL, Tashi, Taiwan; NMMB-P 13505, 289 mm TL, Tungkang, Taiwan. *Neenchelys pelagica*: NMMB-P 15556, holotype, 388 mm TL, Tungkang, Taiwan. *Neenchelys similis* (from off Kumano Basin, Mie, Japan): FRLM 38980, paratype, 756 mm TL; FRLM 42319, paratype, 714 mm TL; FRLM 45513, 826 mm TL.

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