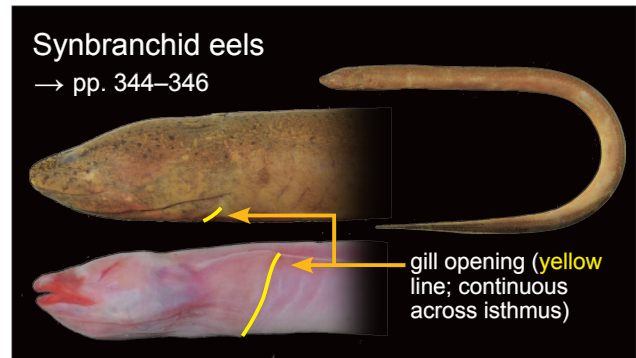
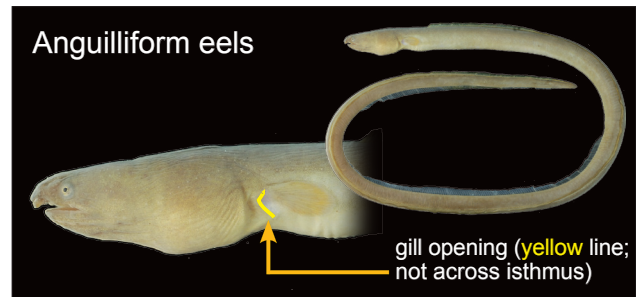


ANGUILLIFORMES – eels

Several groups of eels and/or eel-like fishes are found in the Mekong, such as anguilliform eels (pp. 46–51), swamp eels (synbranchids, pp. 344–346), earthworm eels (chaudhuriids, p. 347), spiny eels (mastacembelids, pp. 348–351), and eel gobies (a part of gobiids, pp. 482–485). These fishes have a flexible, markedly elongated snake- or worm-like body; scales on the body are absent or, if present, usually minute, thin and easily overlooked. Of these eels/eel-like fishes found in the Mekong, the anguilliform eels are strikingly similar to the synbranchid eels in general appearance, and they merely differs externally by having a pair of gill openings usually not continuous at the ventral surface (vs. gill openings merging into a single slit across the isthmus; see right figures). Despite their great similarities, the anguilliform eels are not closely related to the synbranchid eels (see also introduction of the elopiform fishes, pp. 52–53).

The anguilliform eels are marine-oriented fishes; although several species are known to enter brackish and/or freshwater areas, they spawn eggs in the marine waters. This is also true of all Mekong species shown here. Many of the Mekong species are known from the lower reaches or brackish estuaries, except for one, *Anguilla marmorata*, which goes up to Laos.



Anguilla marmorata Quoy & Gaimard, 1824

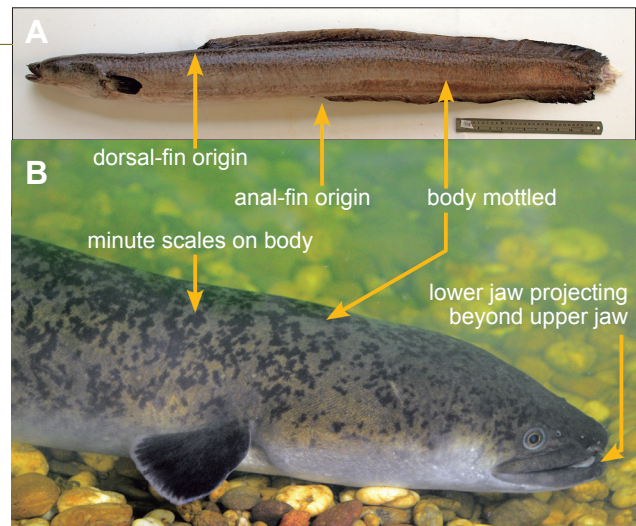
Family: Anguillidae (FC: 074)

Size: 90 cm SL (Kottelat, 2001a: 26).

Distribution: Mekong Basin in Laos, Thailand, Cambodia, and Vietnam; Indo-Pacific.

Notes: A catadromous species, usually found in freshwater rivers and streams, and brackish estuaries; it is also found in small upland streams above large water falls.

Anguilla, the only genus in the family Anguillidae, differs from the other eels of the Mekong by having projecting lower jaw and minute scales on the body. Two species, viz., *A. marmorata* and *A. bicolor*, are known from this region. *Anguilla marmorata* differs from *A. bicolor* (below) by having mottled body and much longer dorsal fin, which extends anteriorly well beyond a vertical line through the anus.



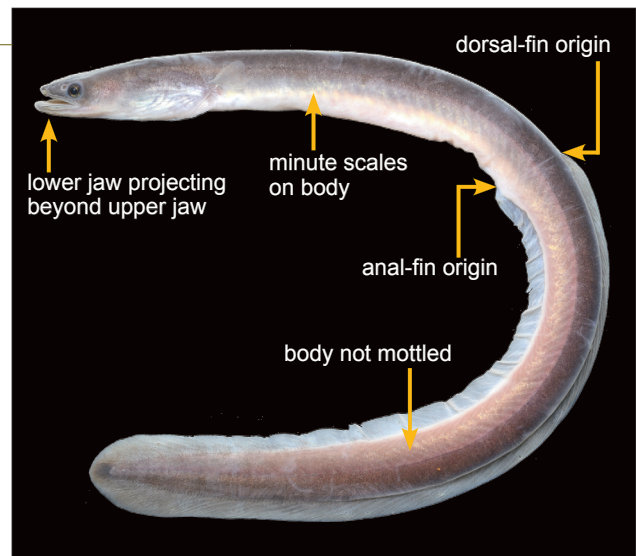
Anguilla bicolor McClelland, 1844

Family: Anguillidae (FC: 074)

Size: 100 cm TL (Kottelat *et al.*, 1993: 7).

Distribution: ?Mekong Basin in Cambodia, Vietnam, and China (Yunnan); Indo-West Pacific.

Notes: A catadromous species, usually found in brackish estuaries and adjacent freshwater areas. Some researchers have recorded *Anguilla bicolor* from the Mekong (e.g., Kottelat, 1989a; Rainboth, 1996b; Vidthayanon, 2008, as *A. bicolor pacificus*; Rainboth *et al.*, 2012), although Roberts in Roberts & Warren (1994: 108) noted, "I have not yet seen any specimens or photos of Mekong *Anguilla* that could be identified as *Anguilla bicolor*." During our field surveys in 2007–2013, we could not confirm any specimens of *A. bicolor* from the Mekong. A recent record of a specimen of *A. bicolor* from the Mekong in Yunnan (Chen *et al.*, 2010a) needs re-confirmation regarding its origin.



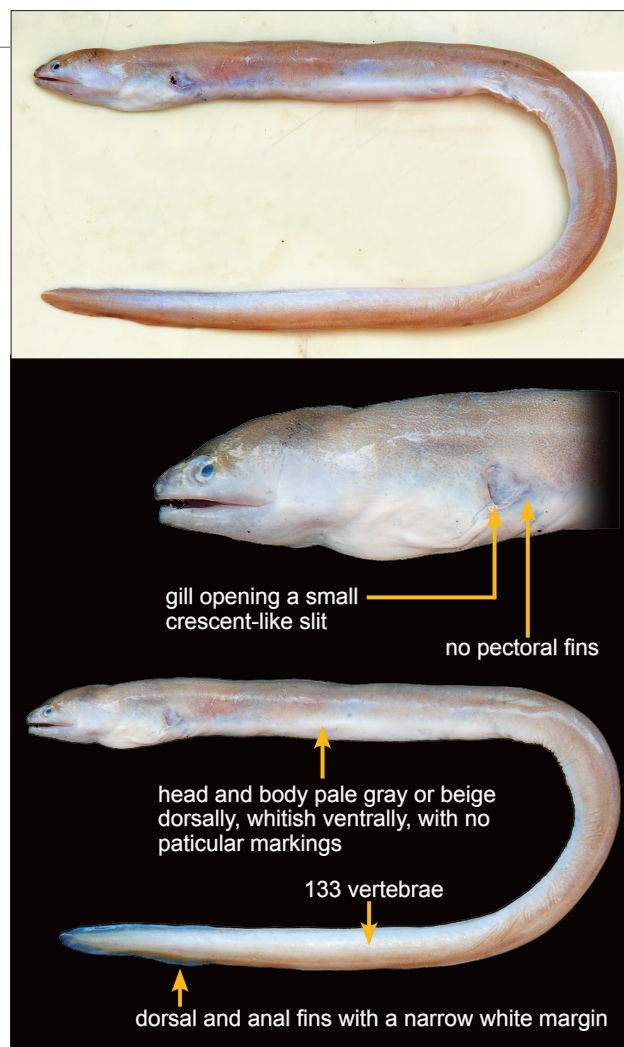
A) UNMF uncatagued (caudal part heavily damaged, photo: CG); B) aquarium fish, collected from the Mekong in Ubon Ratchathani (photo: KS)

Non-Mekong specimen, taken at an aquarium shop in Japan (photo: KS)

Gymnothorax* sp.*Family:** Muraenidae (FC: 079)**Size:** 38.8 cm TL (Rainboth *et al.*, 2012, pl. 8, fig. 154, as *Gymnothorax* sp. 2).**Distribution:** Mekong Basin in Vietnam; Gulf of Thailand.

Notes: A relatively small-sized species of moray, found in coastal marine waters and in brackish estuaries. It is presumed to be an undescribed species (K. Hatooka, pers. comm.). Both of 2 unidentified species of *Gymnothorax* of Rainboth *et al.* (2012: 58, pl. 8, figs 153 and 154) appear to be conspecific with this fish. The photographed specimen shown here was collected from a fish market at Sóc Trăng, Vietnam; the photograph below shows various small eels (being dried), including *Gymnothorax* sp. (present species), some ophichthids (e.g., *Pisodonophis boro*), and *Ophisternon bengalense* (a synbranchid), at Bến Tre, Vietnam.

Eels of the Muraenidae, commonly known as morays, have a small rounded gill opening and no pectoral fins. Many of the muraenids are confined to marine waters, but some can enter brackish estuaries and the adjacent freshwater areas. At least 2 species, *Gymnothorax pseudothyrsoides* and *Gymnothorax* sp. (shown here), are known from the Mekong Delta (Rainboth *et al.*, 2012; Tran *et al.*, 2013), as well as some other species with doubtful identification. Note that the photographed specimens of a muraenid *Strophidon sathete* of Vidthayanon (2008: 29, fig. 21) and that of Rainboth *et al.* (2012, pl. 8, fig. 157) are actually *Ophichthus lithinus* (an ophichthid) and the other unnamed species of *Gymnothorax*, known from the Gulf of Thailand (T. Hibino, pers. comm.), respectively; the latter is currently being investigated by T. Hibino and his collaborators.



CTU-P 4851 (photo: LXT)

Various kinds of estuarine eels, including at least 18 individuals of *Gymnothorax* sp. (yellow arrows), being dried (Bến Tre, Vietnam, photo: KS)

Moringuidae, indet. gen. & sp.

Family: Moringuidae (FC: 076)

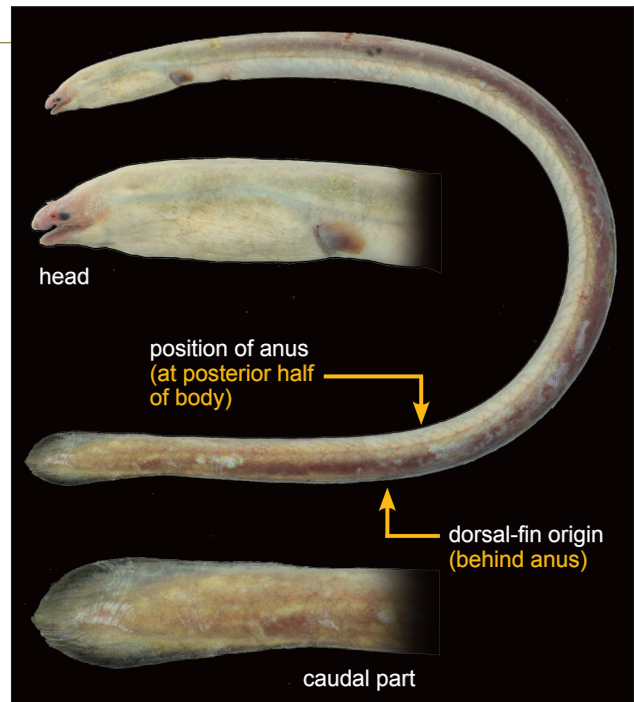
Size: 39.8 cm TL (CTU-P 1498).

Distribution: Mekong estuary in Vietnam.

Notes: It is known only by a single specimen, collected from the tidal canal in Bến Tre, Vietnam.

Eels of the family Moringuidae resemble some ophichthids in general appearance, but they have a caudal fin (vs. most ophichthids which lack a caudal fin) and lack numerous overlapping branchiostegal rays (Smith, 1999); see also "Notes" of *Neenchelys parvipectoralis*, below. Two genera, viz., *Moringua* and *Neoconger*, are known in the family (Smith, 1989, 1999).

The specimen from the Mekong resembles *Neoconger* by its short body (for moringuids) and slightly projecting snout, however the other characteristics (positions of anus and dorsal/anal-fin origin and counts of vertebrae and fin rays) match with *Moringua* (rather than *Neoconger*). This specimen also has 130 vertebrae, 110 dorsal-fin rays, 119 anal-fin rays, and no lateral-line pores; the body depth at anus is 3.5% of TL. A poorly-known species *Moringua floresiana*, described by Weber & de Beaufort (1916) from the Flores Islands, is possibly identical to this species, although this nominal species was questionably assigned as a junior synonym of *M. raitaborua* by Kottelat (2013c). This species can be easily distinguished from all other anguilliform eels of the Mekong by the positions of anus and origin of the dorsal fin (see right figure).



CTU-P 1498 (photo: KS)

Neenchelys parvipectoralis Chu, Wu & Jin, 1981

Family: Ophichthyidae (FC: 081)

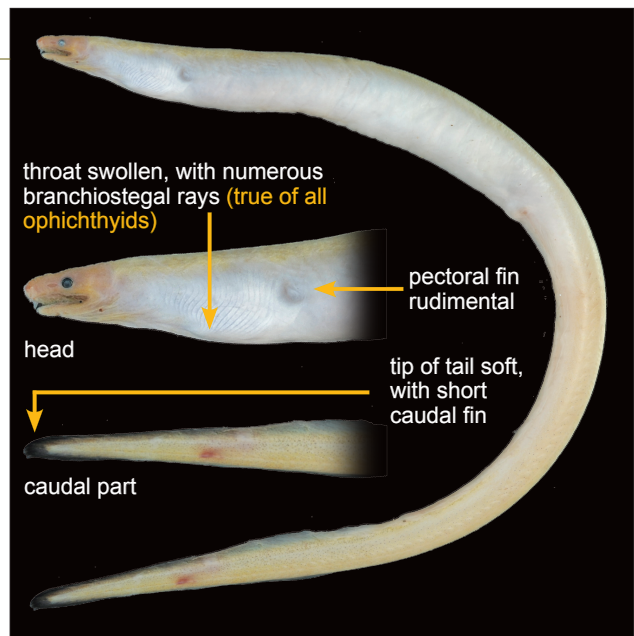
Size: 32.8 cm TL (Ho *et al.*, 2013: 12).

Distribution: Mekong estuary in Vietnam; China, Taiwan, and central Vietnam (off Nha Trang).

Notes: A relatively small-sized worm eel, found in coastal marine waters (to 300 m depth). The photographed specimen shown here was collected from brackish estuary of Cung Hâu River (a tributary of the Mekong) in Trà Vinh Province of Vietnam, together with an additional specimen.

Family Ophichthidae comprises 2 subfamilies, viz., Myrophinae and Ophichthinae (Smith & McCosker, 1999; Nelson, 2006). Of these, the ophichthine eels are easily distinguished from the other eels by their hard, pointed and finless tip of the tail (as shown in *Ophichthus* and *Pisodonophis* in the next page), and they are commonly known as "snake eels". At least 7 species of the ophichthine eels, including 5 species of *Ophichthus* (*O. lithinus*, *O. lumbricoides*, *O. maccllelandi*, *O. rutidodermatoides*, and *O. rutidoderma*) and 2 species of *Pisodonophis* (*P. boro* and *P. cancrivorus*), were hitherto recorded from the Mekong (Rainboth *et al.*, 2012); 3 such species are shown in the next page. Note that the photographed specimen of a muraenid *Strophidon sathete* of Vidthayanon (2008: 28, fig. 21) is actually *Ophichthus lithinus* (Rainboth *et al.*, 2012, pl. 9, figs. 178; T. Hibino, pers. comm.). The ophichthids of the other subfamily Myrophinae, the worm eels, have a distinct caudal fin, as in *Neenchelys* shown here. Like the ophichthines, the myrophines can be distinguished from the non-ophichthid eels by their numerous, overlapping branchiostegal rays (can be seen externally in the ventral view).

Neenchelys can be distinguished from the other myrophine genera by having the characteristic of the following combination: long, conical and acutely pointed head and posterior noster-



CTU-P 1163 (photo: KS)

ril above the upper lip (McCosker, 1982; Smith & McCosker, 1999). *Neenchelys* comprises 9 species (Hibino *et al.*, 2012; Ho *et al.*, 2013). Of these, *N. parvipectoralis* resembles *N. mccoskeri* (known from Japan and Taiwan) and *N. microtretus* (Red Sea) in having a very small pectoral fin (shorter than snout), but differs in having 138–148 total vertebrae (vs. 172–184 and 151 in *N. mccoskeri* and *N. microtretus*, respectively) (Ho *et al.*, 2013).

Initial identification of our Mekong specimens was made by H.-S. Ho (Academia Sinica, Taipei) (see Ho *et al.*, 2013: 12). This species, *N. parvipectoralis*, is the only species of the genus from the Mekong Basin. Rainboth *et al.* (2012: 58) listed the congener *N. buitendijki* in their book of fishes of the "Greater Mekong Ecosystem" (a term meaning the entire region directly affected by the Mekong), but it was based on the record by Fourmanoir & Nhung (1965) from Nha Trang, central Vietnam; identification of Fourmanoir & Nhung's specimen(s) needs confirmation, since Ho *et al.* (2013) recorded *N. buitendijki* from India, Indonesia and Malaysia in their review of *Neenchelys*.

Ophichthus rutidoderma (Bleeker, 1852)

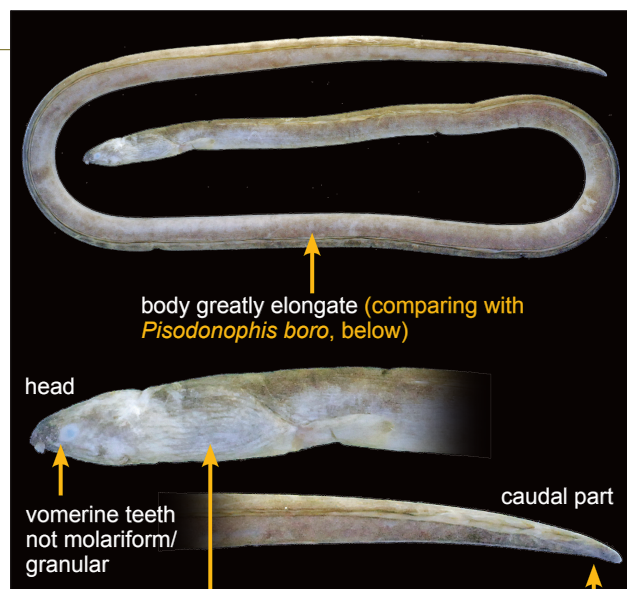
Family: Ophichthyidae (FC: 081)

Size: 95 cm TL (Rainboth, 1996b: 58).

Distribution: Mekong Basin in Cambodia and Vietnam; Indo-West Pacific.

Notes: A large-sized snake eel with a hard and pointed caudal tip, found in brackish estuaries and the adjacent freshwater areas. The photographed specimen shown here was collected by "Dai", a large-scale fisheries using bag nets, in the Tonle Sap River, Cambodia.

This eel resembles the estuarine eels of the genus *Pisodonophis* (below), but can be separated by having a more elongated body and non-molariform/granular vomerine teeth (vs. molariform or granular in *Pisodonophis*). In addition to this species, Rainboth (1996b: 58) noted "at least three additional species of this genus are recorded from Vietnam and may also occur in the Cambodian Mekong." However, he did not give any names of the species of *Ophichthus* other than *O. rutidoderma*.



IFRED-P 4840 (photo: PT)

Pisodonophis boro (Hamilton, 1822)

Family: Ophichthyidae (FC: 081)

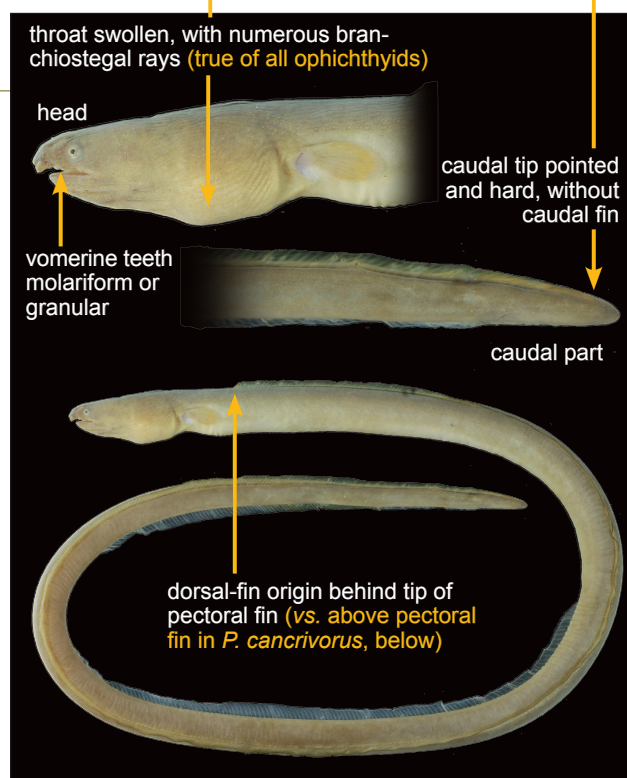
Size: 100 cm TL (Rainboth, 1996b: 58).

Distribution: Mekong Basin in Vietnam; Indo-West Pacific.

Notes: A large-sized snake eel with hard and pointed caudal tip, commonly found in brackish estuaries and adjacent freshwater areas.

Pisodonophis resembles *Ophichthus* (above) in general appearance and in particular the hard and pointed caudal tip, but it is distinguishable by having molariform or granular vomerine teeth (vs. non-molariform/granular in *Ophichthus*). At least 2 species of *Pisodonophis* were recorded from the Mekong, and, in this region, *P. boro* is more common than *P. cancrivorus* (below). *Pisodonophis boro* is readily distinguished from *P. cancrivorus* by having more elongate body (see photos) and the dorsal-fin origin behind the tip of the pectoral fin (vs. origin above the pectoral fin in *P. cancrivorus*).

Rainboth (1996) suggested possible occurrences of *Pisodonophis boro* and *P. cancrivorus* from the Cambodian Mekong. During our surveys in the Indochinese Mekong in 2007–2013, we collected these 2 species from the estuarine areas of only Vietnam.



CTU-P 1421 (photo: KS)

Pisodonophis cancrivorus (Richardson, 1848)

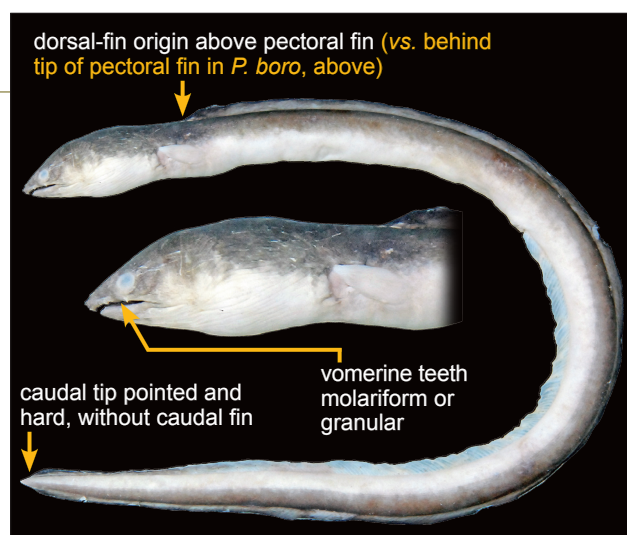
Family: Ophichthyidae (FC: 081)

Size: 75 cm TL (Rainboth, 1996b: 58).

Distribution: Mekong Basin in Vietnam; Indo-West Pacific.

Notes: A large-sized snake eel with a hard and pointed caudal tip, commonly found around the estuarine areas of the Vietnamese Mekong.

Of the 3 similar-looking species of the ophichthid eels recorded from the Mekong (viz. *Ophichthus rutidoderma*, *Pisodonophis boro* and *P. cancrivorus*, all of them are shown in this page), *P. cancrivorus* differs from the other 2 by having a non-elongated, deeper body (see photographs, right). The photographed specimen of *P. cancrivorus* in Vidthayanon (2008: 31, fig. 23) from the Mekong Delta has a markedly elongate body, and it appears to be not of this species.



CTU-P 4915 (photo: HVM)

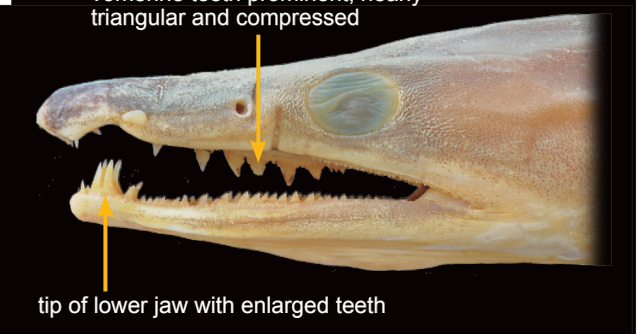
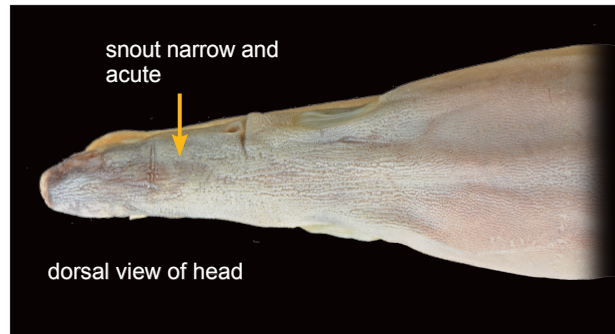
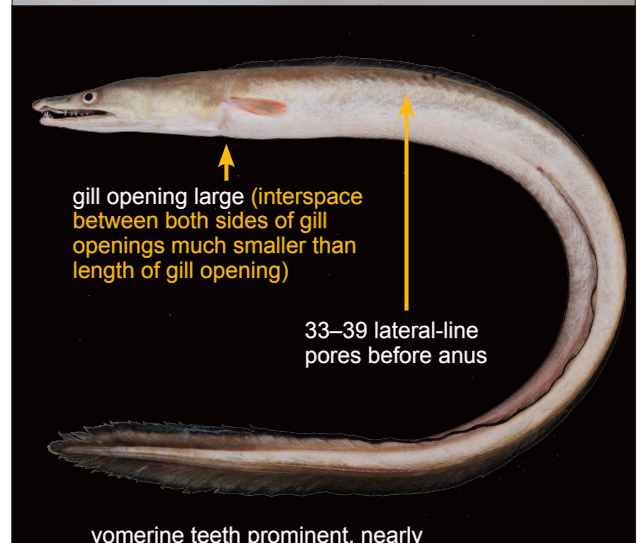


Muraenesox bagio (Hamilton, 1822)**Family:** Muraenesocidae (FC: 084)**Size:** 180 cm TL (Smith, 1999: 1676).**Distribution:** Mekong estuary in Vietnam; Indo-West Pacific.**Notes:** A large-sized species of pike congers, found in the coastal marine areas with muddy bottoms; it is commonly enters adjacent brackish estuaries.

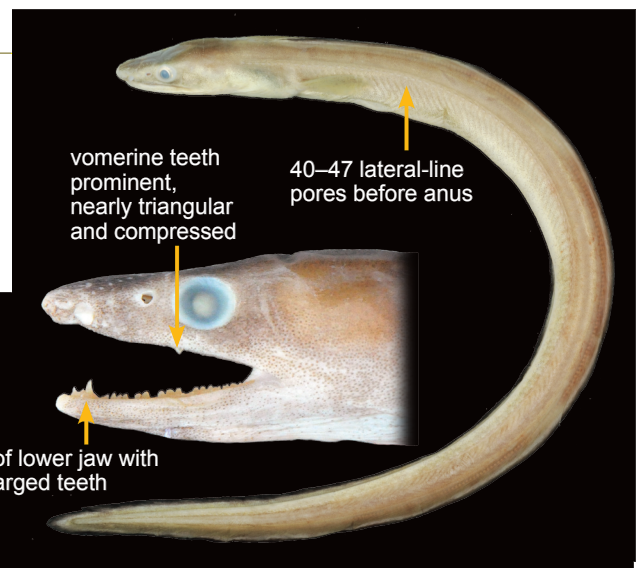
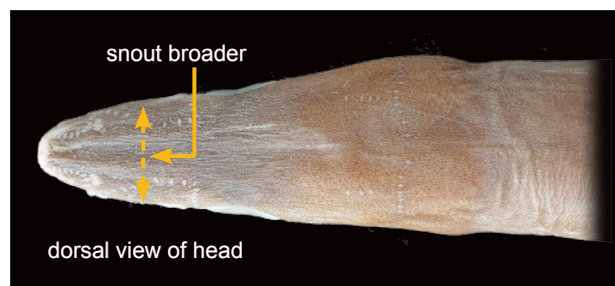
Eels of the family Muraenesocidae have a long and acute snout, large teeth on jaws, a developed pectoral fin, and a large gill opening (the interspace between the sides of gill openings is much smaller than the gill opening length). Two muraenesocid genera, *Muraenesox* and *Congresox*, have been recorded from the Mekong Delta. Superficially *Muraenesox* resembles *Congresox*, but it differs in having more slender vomerine teeth with a rounded cross-section (vs. triangular and compressed in *Muraenesox*).

Two species of *Muraenesox*, *M. bagio* and *M. cinereus*, are found in the Mekong; both are shown here. *Muraenesox bagio* is readily distinguished from the congener *M. cinereus* by having much more slender and acute snout, and only 33–39 lateral-line pores before the anus (vs. 40–47 in *M. cinereus*).

Although we have not collected any voucher specimens from the Mekong, occurrences of 2 species of *Congresox* are expected from the estuarine areas. Actually the one of them, *C. talabon*, was recorded from the Mekong Delta by Vidthayanon (2008: 28, fig. 19); he noted that the species is an "uncommon visitor of Delta." *Congresox talabon* resembles *C. talabonoides*, but it differs in having longer pectoral fin (pectoral-fin length of 3.2 in the head in *C. talabon* vs. 4.1 in the head in *C. talabonoides*) and a slightly higher count of lateral-line pores before the anus (41–42 vs. 35–40) (Smith, 1999).



CTU-P 1484 (photo: KS)

Muraenesox cinereus (Forsskal, 1775)**Family:** Muraenesocidae (FC: 084)**Size:** 80 cm TL (Smith, 1999: 1677).**Distribution:** Mekong estuary in Vietnam.**Notes:** Another species of *Muraenesox* found in the Mekong estuary. See "Notes" of the congener *M. bagio*, above.

CTU-P 1818 (photo: LXT)