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Sea snakes (Serpentes: subfamilies Hydrophiinae and Laticaudinae) in Vietnam: a comprehensive checklist and an updated identification key

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Abstract

Sea snakes (Elapidae, subfamilies Hydrophiinae and Laticaudinae) reach a very high species richness in Southeast Asia, but most countries in the region still lack comprehensive and up-to-date identification tools for these snakes. We present an updated checklist of sea snakes in Vietnam. We also provide diagnostic characters for all species and a new complete identification key, chiefly based on easy-to-use external characters. The checklist and key cover the 25 species documented from Vietnam, as well as three likely future additions to its sea snake fauna. By surveying incoming fishing vessels between Nha Trang and the mouth of Mekong River in 2000–2001, we were able to document two species new for Vietnamese waters: *Hydrophis belcheri* and *H. pachycercos*. Through these surveys we also secured four specimens of the rare endemic species *H. parviceps*, formerly known only from two specimens. A comprehensive bibliography of the literature treating sea snakes in Vietnamese waters is provided.

Identification key: bibliography, biodiversity, diagnostic characters, Vietnamese waters

Introduction

Many new species have been described from Vietnam and neighbouring countries in the last two decades, increasingly marking the area as a 'biodiversity hotspot' (e.g. Beck *et al.*, 2007). The list of new discoveries comprises truly unexpected elements such as large mammals (Giao *et al.* 1998), but also many freshwater fishes, amphibians and reptiles (e. g. Bain & Truong, 2004; Ziegler *et al.*, 2007). As of yet, the herpetological exploration of Vietnam has focussed on terrestrial and freshwater habitats, with much less emphasis on coastal and marine areas. This is despite the fact that Vietnam has a long coastline comprising many distinct habitat types and embracing 13 degrees in latitude.

Globally there are some 65 species of sea snake (aquatic elapids, in the subfamilies Hydrophiinae and Laticaudinae), found in tropical and subtropical waters of the Indian Ocean and the Pacific Ocean, from the east coast of Africa in the west to the Gulf of Panama in the east. Most species are found in the Indo-Malayan Archipelago, the China Sea, Indonesia, and the Australian region (Shuntov, 1966; Golay *et al.*, 1993; David & Ineich, 1999; Iskandar & Colijn, 2001). Indeed, Vietnam can be termed as 'a biodiversity hotspot' for sea snakes, also, with many species recorded from its waters (Nguyên *et al.*, 2009), including *Hydrophis parviceps*, which appears to be endemic (Smith, 1935; Taylor, 1963; personal observation).

Over the last 80 years the number of sea snake species recorded in Vietnam has doubled, but its waters still remain much understudied. Further addition of species can be expected, the geographical ranges of already documented species are poorly known, and previously published studies have not been comprehensively reviewed. A recent checklist of Vietnamese sea snakes (Kharin 2006) overlooked *Emydocephalus annulatus* and *Hydrophis spi-*

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ralis, two species previously reported from the country (Dotsenko, 1999), and the same publication has some shortcomings in its identification key. The latest available checklist (Nguyên *et al.*, 2009) follows Kharin (2006) and Rasmussen, A.R. (pers comm, 2006.) but adds no further species to the Vietnamese list.

An up-to-date treatise of Vietnam´s sea snakes is thus much needed from a general standpoint of taxonomic completeness, but also as a tool for biodiversity research and conservation efforts in this area of high diversity. Furthermore, sea snakes are locally numerous and conspicuous inhabitants of shallow coastal Vietnamese waters, causing cases of envenomation among fishermen and other members of the public (Dowling, 1966; Barme, 1968; Warrell, 1994), a fact calling for correct and comprehensive identification aids. Following Bourret's work on sea snakes in former Indochina (Bourret, 1934, 1936), Barme´s studies (1958, 1963, 1964, 1968) focussed mostly on the venoms of Vietnamese sea snakes. Barme reported 13 species from Vietnam and provided detailed qualitative and quantitative data on the venom of *Lapemis curtus* (as *L. hardwickii*) and *Enhydrina schistosa*. He did, however, not distinguish the different Vietnamese species in the genus *Hydrophis*.

The aims of the present paper are to address these deficiencies and needs by publishing: i) primary records secured from incoming fishing vessels in 2000–2001, ii) an updated checklist, iii) diagnostic characters for all Vietnamese species, iv) a complete identification key, also including species that are potential additions to the Vietnamese list (some species known from the Philippines, the Gulf of Thailand and Cambodia (Saint Girons, 1972; McCarthy & Warrell, 1991; David & Ineich, 1999; Murphy *et al.*, 1999; Kharin, 2009), and v) a comprehensive bibliography.

New field records

For two weeks in each of September 2000 and September 2001, we secured, identified and preserved sea snakes caught as fisheries bycatch by trawling boats and landed in the fishing harbours of Phan Thiet (10º55´N, 108º06´E) and Ham Tân (La Gi) 10º40´N, 107º45´E , ca. 200 km and 250 km southwest of Nha Trang, respectively. Although from Vietnamese waters, the specific offshore positions of the catches are unknown. Our survey of incoming fishing vessels resulted in a large number of specimens of 13 species (Table 1), adding the following two species to the fauna of Vietnam: *Hydrophis belcheri* and *H. pachycercos* (resurrected by Rasmussen *et al.*, 2007). Furthermore, four specimens of the rare species *H. parviceps*, formerly known only from two specimens (Smith, 1935; Taylor, 1963), were found close to the original type locality.

TABLE 1. Sea snakes obtained from catches landed by fishing vessels in the harbours of Phan Thiet and Ham Tan (southern Vietnam) in September 2000 and 2001.

Species	Individuals landed
Acalyptophis peronii	>50
Hydrophis atriceps	15–20
H. belcheri	10–15
H. cyanocinctus	>50
H. lamberti	15–20
H. melanocephalus	15–20
H. ornatus	>50
H. pachycercos	8
H. parviceps	4
Kerilia jerdonii	10
Kolpophis annandalei	1
Lapemis curtus	>50
Thalassophina viperina	>50

Checklist of Vietnamese sea snakes

Based on available preserved specimens and our fishing vessel survey, the following 25 species are now confirmed from Vietnamese waters: *Acalyptophis peronii, Aipysurus eydouxii, Astrotia stokesi, Emydocephalus annulatus, Enhydrina schistosa, Hydrophis atriceps, H. belcheri, H. brookii, H. caerulescens, H. cyanocinctus, H. gracilis, H. klossi, H. lamberti, H. melanocephalus, H. ornatus, H. pachycercos, H. parviceps, H. spiralis, Kerilia jerdonii, Kolpophis annandalei, Lapemis curtus, Laticauda colubrina, Pelamis platura, Thalassophina viperina* and *Thalassophis anomalus*.

Nevertheless, we have found no specimens or otherwise been able to confirm the occurrence of the following species, which are all mentioned by Bourret (1934) from Indochina waters (including Cambodia), hence not specifically from Vietnamese waters: *Hydrophis cantoris, H. inornatus, H. torquatus* and *Laticauda laticaudata. Hydrophis cantoris* is found only in the Andaman Sea. The specimen found closest to Vietnamese waters is the type from Penang (West side of Peninsular Malaysia), strongly indicating that *H. cantoris* does not occur in Vietnamese waters. The validity of *H. inornatus* is still doubtful (Rasmussen, 1989); none of the collected specimens from our fishing vessel surveys conforms with the species description, and we have not found any other evidence to support its occurrence in Vietnam. We therefore include this species neither in the checklist nor in the list of hypothetical Vietnamese sea snakes. Similarly, we have not found any documentation of *H. torquatus diadema* from Vietnamese waters, despite the fact that this taxon has been recorded in Tonle Sap in Cambodia, which is connected to the Mekong River (Ineich, 1996). Bourret (1934) stated that *H. torquatus* is only found in the waters of Vietnam´s southern coasts and included two illustrations of specimens from Phan Thiet (fig. 9 and "planche V" fig. B: #M147). Bourret reported these specimens as *H. torquatus*, but based on the same drawings we identify them as *H. ornatus*. Two years later, Bourret (1936: p.361, fig. 145.) used the same drawings to illustrate *H. torquatus* from Indochina. Smith (1926) mentioned five specimens of *H. torquatus diadema* labelled by collectors as originating from China and stored in the Zoological Museum of Berlin. We have examined these specimens and agree with Smith´s identification. However, Smith (1926) expressed doubt about the locality (the snakes were collected from trading vessels and all other records mentioned by Smith are from the Gulf of Thailand), and we can not tell whether they actually emanate from China. However, if these specimens are from China they would suggest *H. torquatus* is present in Vietnamese waters, too. Warrell (1994) mentioned *H. torquatus* from near Vung Tau in southern Vietnam (pers. comm. between Warrell and Nguyen Khoc Huong), but this claim was not substantiated by documentation of any specimens. Based on the above we can not rule out that *H. torquatus* can be found in Vietnamese waters in the near future. Consequently, we include it in the list of hypothetical Vietnamese species and we provide a description of its diagnostic characters.

We have found neither specimens nor other substantiated records of *Laticauda laticaudata* from Vietnam. However, its known distribution (Melanesia, Tonga to East and Southeast Asia including India. India) indicates that it is likely to be found in Vietnamese waters, and we therefore include it in the hypothetical list, in the key and provide a description of diagnostic characters. Based on Kharin (2009), *L. semifasciata* is also a possible new addition to the Vietnamese herpetofauna, and it is treated here in the same way as the two above-mentioned species. The hypothetical list thus includes three species: *Hydrophis torquatus, L. laticaudata* and *L. semifasciata*.

Checklist

For each species we first (in parenthesis after the scientific and author names) list all publications explicitly mentioning its occurrence in Vietnam. Most of these papers include primary data. All characteristics used in the descriptions are expressed based on scale count procedures and other methods described in the introductory text to the identification key (below).

Acalyptophis Boulenger

***Acalyptophis peronii* (Duméril):** (Kharin, 1984b; Zhao & Adler, 1993, 2006).

Diagnostic characters: The only sea snake with spines on the head: parietal and frontal scales broken up,

supra- and postoculars and adjacent scales with spines posteriorly. Scale rows around neck 18–24, rarely up to 27; scale rows around body 23–31, rarely 21 or 32; ventrals 142–222. Maxillary teeth behind fangs 5–8. **Colouration:** Body cream, grey or pale brown above, paler below, with brown/black bands, which are brighter ventrally. Sometimes has dark small bars or spots between the bands, tapering to a point on the sides. **Size:** 128 cm. **General distribution:** Gulf of Thailand, Vietnam, China, Taiwan, Hong Kong and the Australian region (Smith, 1926; David & Ineich, 1999).

Aipysurus Lacepède

***Aipysurus eydouxii* (Gray):** (Bourret, 1934, 1936; Minton, 1975; Tran & Nguyên, 1980; Kharin, 1984b; Welch, 1988; Nguyên & Hó, 1996; Dotsenko, 1999; Nguyên *et al.*, 2005; Kharin, 2006; Nguyên *et al.*, 2009).

Diagnostic characters: Maxillary bone extending forward beyond palatine. Large ventrals, each being at least three times as broad as the adjacent body scales. Scale rows around neck 15–17; scale rows around body 17; 124–155 ventrals, slightly notched on posterior border. Maxillary teeth behind fangs 7–12 and very small. **Colouration:** Body brownish or olive green above, paler below, with yellow or pale brown irregular bands, which may expand laterally and break up ventrally. Scales within bands usually with dark margins. **Size:** 110 cm. **General distribution**: West Malaysia, Gulf of Thailand, Vietnam, Indonesia and Australian region (David & Ineich, 1999). **Remarks:** The only species in the genus *Aipysurus* found outside the Australian region.

Astrotia Fischer

***Astrotia stokesii* (Gray):** (Kharin, 1984b; Zhao & Adler, 1993, 2006; Nguyên *et al.*, 2009).

Diagnostic characters: Ventrals divided into pairs of foliform scales, except on throat. Body stout, covered with strongly imbricate scales. Scale rows around neck 37–47; scale rows around body 46–63; ventrals 226–286. Maxillary teeth behind fangs 6–7. **Colouration:** Highly variable; body ranging from brown to more creamy-white above, pale brown or whitish below. Sometimes has 24–36 dark or black bands above, each tapering to a point laterally. Some specimens have spots in between the bands, laterally as well as ventrally. **Size:** 179 cm. **General distribution**: Indo-Malayan Archipelago, South China Sea, Philippines, Indonesia and tropical waters of Australia (David & Ineich, 1999). **Remarks:** The most massive sea snake, along with *Aipysurus laevis* from the Australian region.

Emydocephalus Krefft

***Emydocephalus annulatus* Krefft:** (Dotsenko, 1999; Rasmussen & Ineich, 2010).

Diagnostic characters: Three supralabials, the second very long. Large ventrals, each three or more times as broad as the adjacent body scales. Scale rows around neck 15; scale rows around body 17, rarely 15; ventrals 125–146. Only rudimentary maxillary teeth behind fangs. **Colouration:** Highly variable, body ranging from uniform black or brown to yellow, with or without bands. **Size:** 103 cm. **General distribution**: Vietnam, Philippines and the Australian region (David & Ineich, 1999; Dotsenko, 1999; Alcala *et al.*, 2000; Rasmussen & Ineich, 2010). **Remarks:** Feeds only on fish eggs (McCarthy, 1987).

Enhydrina Gray

***Enhydrina schistosa* (Daudin):** (Smith, 1920; Bourret, 1934, 1936; Shuntov, 1962; Pickwell, 1972; Minton, 1975; Harding & Welch, 1980; Tran & Nguyên, 1980; Kharin, 1984b; Gasperetti, 1988; Welch, 1988; Golay *et al.*, 1993; Tran & Nguyên, 1995; Nguyên & Hó, 1996; Nguyên *et al.*, 2005; Kharin, 2006; Nguyên *et al.*, 2009).

Diagnostic characters: Mental narrow, elongated and hidden in a groove. Scale rows around neck 40–55; scale rows around body 49–66; ventrals small but distinct, sometimes missing in the most anterior part of body, 239–322. Maxillary teeth behind fangs 3–4. **Colouration:** Body grey or bluish-grey above, whitish-grey below,

with dark or black bands, which usually disappear with age. **Size:** 140 cm. **General distribution**: Arabian Gulf, India, Sri Lanka, Indo-Malayan Archipelago, South China Sea, Indonesia and the Australian region (David & Ineich, 1999). **Remarks:** Aggressive and highly venomous.

Hydrophis Latreille

Remarks: The genus *Hydrophis* is diverse and includes 36 species (Rasmussen & Ineich, 2000; Rasmussen *et al.*, 2001; Rasmussen *et al.*, 2007), 13 of which have been found in Vietnamese waters.

***Hydrophis atriceps* Günther:** (Smith, 1926; Bourret, 1934, 1936; Shuntov, 1962; Pickwell, 1972; Harding & Welch, 1980; Tran & Nguyên, 1980; Kharin, 1984b; Tran & Nguyên, 1995; Nguyên & Hó, 1996; Kharin, 2006; Nguyên *et al.*, 2009).

Diagnostic characters: Head small. Body slender anteriorly and long. More than 31 scale rows around mid-tail. Scale rows around neck 25–30; scale rows around body 39–49; ventrals 320–455. Maxillary teeth behind fangs 5–6. **Colouration**: Anterior part of body dark or black with pale yellowish oval spots on the sides or spots merging into bands. Posterior part of the body greyish white above, whitish below, with dark bands that may extend down the sides to form complete bands. Head dark or black. **Size:** 120 cm. **General distribution:** Singapore, Gulf of Thailand, South China Sea, Philippines, Indonesia and Arafura Sea (Smith, 1926; David & Ineich, 1999). **Remarks:** *H. atriceps* has been regarded as a subspecies of *H. fasciatus*; now most authors recognise *H. atriceps* as a valid species (Cogger *et al.*, 1983), thus excluding the allopatric *H. fasciatus*.

***Hydrophis belcheri* (Gray):** (Rasmussen *et al.*, 2007).

Diagnostic characters: Normally only one supralabial (the fourth) bordering the eye, but rarely two (third and fourth or fourth and fifth). Scale rows around neck 24–27; scale rows around body 32–37; ventrals 278–313. Maxillary teeth behind fangs 7–8, rarely 6 or 9. **Colouration:** Body yellow or greyish above, yellow-whitish below, with 52–70 dark or black bands. Head dark with flecks of olive or yellowish markings on prefrontal and around eye. **Size:** 94 cm. **General distribution**: Gulf of Thailand, Vietnam, Indonesia and New Guinea (McCarthy & Warrell, 1991; David & Ineich, 1999; Rasmussen *et al.*, 2007; Nguyên *et al.*, 2009).

***Hydrophis brookii* Günther**: (Smith, 1926; Bourret, 1934, 1936; Minton, 1975; Harding & Welch, 1980; Tran & Nguyên, 1980; Kharin, 1984b; Welch, 1988; Golay *et al.*, 1993; Tran & Nguyên, 1995; Nguyên & Hó, 1996; Dotsenko, 1999; Nguyên *et al.*, 2005; Kharin, 2006; Nguyên *et al.*, 2009).

Diagnostic characters: Head small, body long and slender anteriorly. Scale rows around neck 25–31; scale rows around body 37–45; ventrals 328–414. Maxillary teeth behind fangs 4–5. **Colouration:** Body bluish white with 60 to 80 dark or black bands. Anteriorly these completely encircle the body, but posteriorly they narrow on the sides and may be incomplete below. Head blackish, with a yellow horseshoe mark on the upper side. **Size:** 104 cm. **General distribution**: Indo-Malayan Archipelago, South China Sea and North Coast of Borneo and Java (David & Ineich, 1999).

***Hydrophis caerulescens* (Shaw)**: (Smith, 1926; Bourret, 1934, 1936; Kharin, 1984b; Tran & Nguyên, 1995; Nguyên & Hó, 1996; Kharin, 2004a; Nguyên *et al.*, 2005; Kharin, 2006; Nguyên *et al.*, 2009).

Diagnostic characters: The only sea snake with more than 13 maxillary teeth (i.e. 14–18) behind the poison fangs. Scale rows around neck 31–43; scale rows around body 38–54; ventrals 253–334. **Colouration:** Body bluish-grey above, greyish below, with 40–60 dark or black bands, which are broader than the interspaces between them. With age the bands become indistinct and the body almost uniformly greyish blue. **Size:** 82 cm. **General distribution**: Pakistan, India, Andaman Sea, Indo-Malayan Archipelago, South China Sea, Indonesia, Arafura Sea and Gulf of Carpentaria (Australia) (David & Ineich, 1999).

***Hydrophis cyanocinctus* Daudin**: (Smith, 1926; Bourret, 1934, 1936; Shuntov, 1962; Pickwell, 1972; Harding & Welch, 1980; Tran & Nguyên, 1980; Kharin, 1984b; Golay *et al.*, 1993; Tran & Nguyên, 1995; Nguyên & Hó, 1996; Dotsenko, 1999; Nguyên *et al.*, 2005; Kharin, 2006; Nguyên *et al.*, 2009).

Diagnostic characters: Scale rows around neck 27–35, rarely 25; scale rows around body 37–47; ventrals 279–390. Maxillary teeth behind fangs 5–8. **Colouration:** Very variable, especially the bands. Body pale yellow green or greyish above, whitish below. Dark bluish or black bands, which may be: a) encircling the body and broadest above, b) encircling the body and of rather uniform width, or c) broadest above and narrowing out to disappear laterally. On the posterior part of the body the bands are dorsally always broader than the interspaces between them. With age the banding pattern fades. **Size:** 275 cm. **General distribution**: From the Arabian Gulf in the west to Japan in the east (David & Ineich, 1999) **Remarks:** One of the largest species of sea snake, approaching 3 m.

***Hydrophis gracilis* (Shaw):** (Smith, 1926; Bourret, 1934, 1936; Shuntov, 1962; Harding & Welch, 1980; Tran & Nguyên, 1980; Kharin, 1984b; Golay *et al.*, 1993; Tran & Nguyên, 1995; Nguyên & Hó, 1996; Dotsenko, 1999; Nguyên *et al.*, 2005; Kharin, 2006; Nguyên *et al.*, 2009).

Diagnostic characters: Ventrals entire anteriorly, more or less completely divided by a longitudinal furrow posteriorly. Head small. Body slender anteriorly. Scale rows around neck 17–23; scale rows around body 30–43; ventrals 215–350. Maxillary teeth behind fangs 5–6. **Colouration:** Anterior part of body black, with whitish lateral patches (formed by dark bands merging dorsally) or complete pale transverse bands. Posterior part of the body with more unbroken alternating black and whitish bands. With age the bands disappear and the body becomes uniformly greyish. **Size:** 122 cm. **General distribution**: From Arabian Gulf to South China Sea and Indonesia, Arafura Sea to Gulf of Papua (New Guinea) (David & Ineich, 1999). Smith (1926) defined two subspecies with *H. g. microcephalus* occurring in the middle of the range of the typical form (Natuna and Java Seas).

***Hydrophis klossi* Boulenger**: (Kharin, 2004b, 2006).

Diagnostic characters: Head small. Body slender anteriorly. Scale rows around neck 22–25, rarely 27; scale rows around body 30–37, rarely 39; ventrals 360–415. Maxillary teeth behind fangs 5–6. **Colouration:** Body greyish yellow with 50–75 dark or black bands, which are broader than their interspaces dorsally. Head greyish black, sometimes with an indistinct pale horseshoe-shaped mark above. **Size:** 142 cm. **General distribution**: Straits of Malacca, the Gulf of Thailand, Cambodia and southern Vietnam (David & Ineich, 1999; Kharin, 2004b).

***Hydrophis lamberti* Smith**: (Kharin, 2006; Rasmussen *et al.*, 2007; Nguyên *et al.*, 2009).

Diagnostic characters: Scale rows around neck 37–45; scale rows around body 45–56; ventrals 258–306. Maxillary teeth behind fangs 9–12. **Colouration:** Body whitish or pale grey above, paler below. Large rounded dorsal bands anteriorly, posteriorly gradually becoming narrower and separated by broader interspaces. Bands broader above, narrow and faintly coloured laterally. **Size:** 122 cm. **General distribution**: Singapore, Gulf of Thailand, Vietnam and Philippines (Rasmussen, 1989; David & Ineich, 1999). **Remarks:** Has been included in *H. ornatus* by some authors (e. g. Smith, 1926), but is very distinct in its colour pattern.

***Hydrophis melanocephalus* Gray**: (Kharin, 2006; Rasmussen *et al.*, 2007; Nguyên *et al.*, 2009).

Diagnostic characters: Head small, body slender anteriorly. Scale rows around neck 23–27; scale rows around body 33–41; ventrals 289–358. Maxillary teeth behind fangs 6–8. **Colouration:** Body greyish yellow above, yellowish or white below, with 40–55 black bands, about as broad as their interspaces, usually broadest above and below. Head blackish, sometimes with yellow spots. **Size:** 123 cm. **General distribution**: Vietnam, China, Taiwan, Japan, and Philippines (David & Ineich, 1999; Kharin, 2006). **Remarks:** Has been confused with *H. coggeri* in the Australian region (Kharin, 1984a).

***Hydrophis ornatus* (Gray):** (Smith, 1926; Bourret, 1934, 1936; Shuntov, 1962; Pickwell, 1972; Harding & Welch, 1980; Tran & Nguyên, 1980; Kharin, 1984b; Gasperetti, 1988; Golay *et al.*, 1993; Tran & Nguyên, 1995; Nguyên & Hó, 1996; Dotsenko, 1999; Nguyên *et al.*, 2005; Kharin, 2006; Rasmussen *et al.*, 2007; Nguyên *et al.*, 2009).

Diagnostic characters: Scale rows around neck 34–41; scale rows around body 42–54; ventrals 235–294. Maxillary teeth behind fangs 9–13. **Colouration:** Body pale grey above, whitish below. Broad dark greyish bands, interspaces narrow and almost equidistant anteriorly. Head olive-green or greyish above. **Size:** 115 cm. **General distribution**: From the Arabian Gulf in the west to Japan, Philippines, Indonesia and New Caledonia (Rasmussen, 1989; Ineich & Rasmussen, 1997; David & Ineich, 1999), and the Australian region (*H. ornatus ocellatus*) (Smith, 1926).

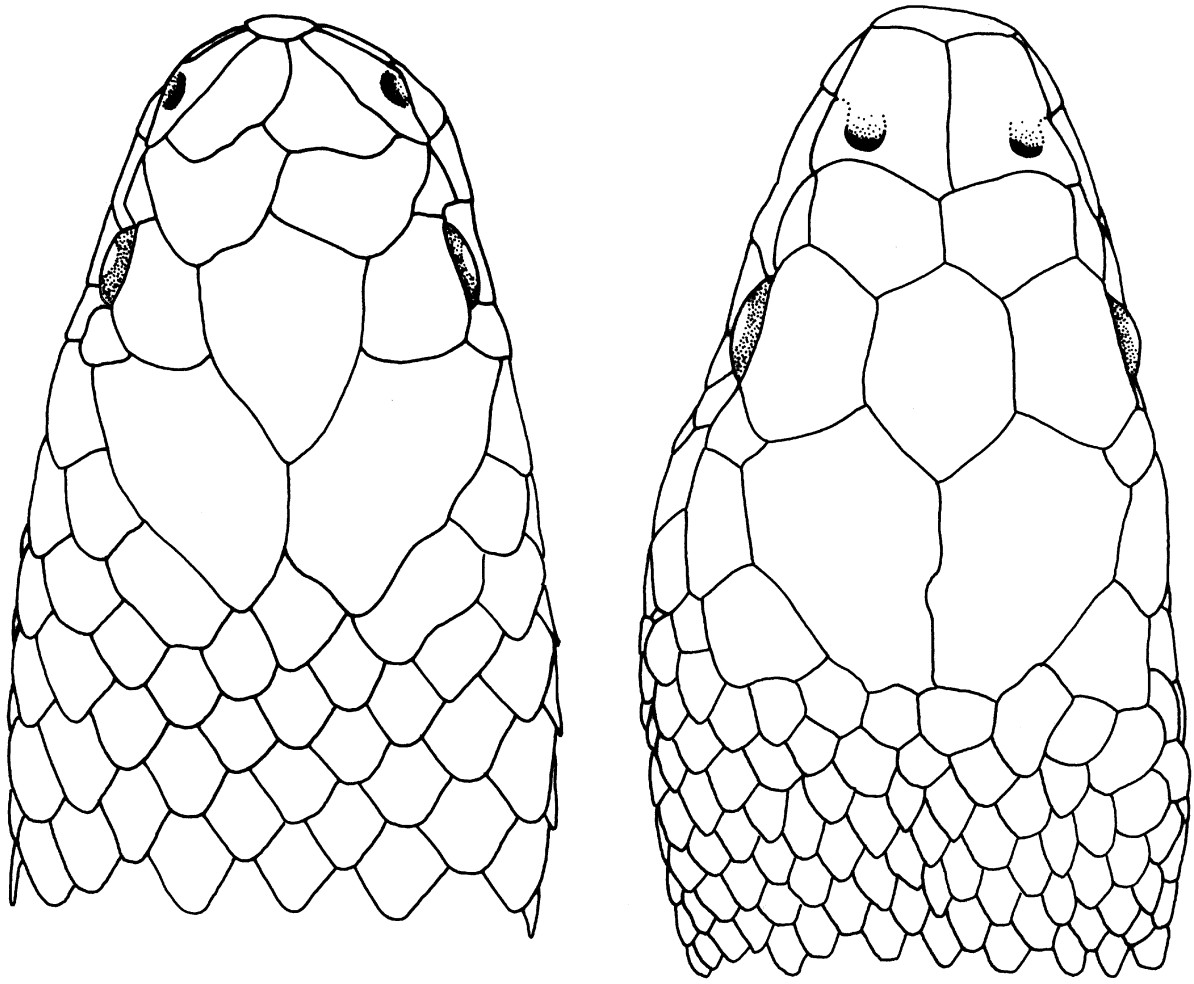

FIGURE 1. Head of *Laticauda laticaudata* (left) and *Hydrophis ornatus* (right), showing presence and absence of internasals, respectively (drawing M. Andersen).

***Hydrophis pachycercos* Fischer**: (Rasmussen *et al.*, 2007).

Diagnostic characters: Scale rows around neck 26–31; scale rows around body 39–45; ventrals 247–297. Maxillary teeth behind fangs 7–8. **Colouration:** Body pale yellow above, white below, with pale brown transverse bands fading on the upper part of the flanks. Head white below, black/dark above with pale supralabials and a pale ring around the eyes. **Size:** 111 cm. **General distribution**: South China Sea (one specimen at the Natural History Museum, London, collected in "E. Ind. Archipelago")(Rasmussen *et al.*, 2007). **Remarks:** Recently resurrected from *H. belcheri* (Rasmussen *et al.*, 2007).

***Hydrophis parviceps* Smith**: (Smith, 1935; Taylor, 1963; Kharin, 1984b; Nguyên & Hó, 1996; Nguyên *et al.*, 2005; Kharin, 2006; Rasmussen *et al.*, 2007; Nguyên *et al.*, 2009).

Diagnostic characters: Head small, body slender anteriorly. Scale rows around neck 19–21; scale rows around body 31–34; ventrals 329–348. Maxillary teeth behind fangs 6–7. **Colouration:** Body olivaceous above, greyish below, with 65–70 blackish bands. Head black with no or only a few faint paler marks. **Size:** 125 cm. **General distribution**: Southern Vietnam (Smith, 1935; Taylor, 1963) **Remarks:** Only two specimens known previously; one caught in 1929 and one in 1960, both from the coast of southern Vietnam (Smith, 1935; Taylor, 1963). Four additional specimens were collected during the fishing vessel survey in 2001 SW of Ham Tan. The species is endemic to Vietnam.

***Hydrophis spiralis* (Shaw)**: (Dotsenko, 1999).

Diagnostic characters: Scale rows around neck 25–31; scale rows around body 33–38; ventrals 295–362. Maxillary teeth behind fangs 6–7. **Colouration:** Body yellow above, pale yellow below, with black bands. Inter-

spaces broader than bands, at least posteriorly. Head yellow/dark above, paler below. **Size:** 275 cm. **General distribution:** From the Arabian Gulf in the west to Vietnam in the east, Indonesia and New Caledonia (Ineich & Rasmussen, 1997; David & Ineich, 1999; Dotsenko, 1999).

***Hydrophis torquatus diadema* Günther**: (Bourret, 1934; Warrell, 1994; Ineich, 1996; Nguyên & Hó, 1996; Nguyên *et al.*, 2005; Nguyên *et al.*, 2009). Despite mentioned by many authors the species is not yet confirmed from Vietnamese waters.

Diagnostic characters: Scale rows around neck 29–37; scale rows around body 35–49; ventrals 230–340. Maxillary teeth behind fangs 8–10. **Colouration:** Body grey or whitish above, yellow or whitish below, with black bands, which are often incomplete below. Bands fade and disappear with age, leaving the back more or less uniform grey. Head black with a yellowish band across the snout and along sides. **Size:** 104 cm. **General distribution**: Straits of Malacca, Borneo, Gulf of Thailand, Tonle Sap lake in Cambodia, and possibly China (Smith, 1926; Ineich, 1996; David & Ineich, 1999) **Remarks:** Three subspecies are defined, each with a very limited range (Smith, 1926). The one found closest to Vietnamese waters is *H. torquatus diadema* (Smith, 1926; Ineich, 1996).

Kerilia Gray

***Kerilia jerdonii* Gray**: (Bourret, 1934, 1936; Harding & Welch, 1980; Tran & Nguyên, 1980; Kharin, 1984b; Tran & Nguyên, 1995; Nguyên & Hó, 1996; Nguyên *et al.*, 2005; Kharin, 2006; Nguyên *et al.*, 2009).

Diagnostic characters: Easily recognized by the yellowish colour and the low scale row counts around neck and body. Maxillary bone extending forward beyond the palatine and fangs followed without any interspace by 7–9 teeth. Scale rows around neck 15–17; scale rows around body 19–23; ventrals 200–278. **Colouration:** Body yellow above, yellowish or white below, with black bands wider above and fading laterally. In some specimens the dark bands encircle the body. **Size:** 105 cm. **General distribution:** India, Sri Lanka, Andaman Sea, Strait of Malacca, Singapore, Gulf of Thailand, South China Sea, Taiwan and Borneo (David & Ineich, 1999). **Remarks:** Two subspecies are recognised (Smith, 1926): *K. jerdoni jerdoni* is found in India, Sri Lanka, Andaman Sea, and from Strait of Malacca to Singapore; *K. j. siamensis* is found from East Malaysia, Gulf of Thailand to China and Taiwan. (Smith, 1926; Rasmussen & Andersen, 1990).

Kolpophis Smith

***Kolpophis annandalei* (Laidlaw):** (Smith, 1926; Bourret, 1934, 1936; Minton, 1975; Harding & Welch, 1980; Tran & Nguyên, 1980; Kharin, 1984b; Welch, 1988; Das, 1993; Golay *et al.*, 1993; Tran & Nguyên, 1995; Nguyên & Hó, 1996; Dotsenko, 1999; Nguyên *et al.*, 2005; Kharin, 2006; Rasmussen *et al.*, 2007; Nguyên *et al.*, 2009).

Diagnostic characters: Head shields irregularly divided. Head large, body stout, covered with small irregular scales. Has very high scale row counts around neck (62–82) and body (74–93). Ventrals 320–368. Maxillary teeth behind fangs 6–7. **Colouration:** Body yellowish with pale grey bands above, much broader than their interspaces, narrowing on sides. With age the colour becomes pale grey above, whitish below and the bands disappear. **Size:** 91 cm. **General distribution:** Singapore, Gulf of Thailand, South China Sea, Borneo and Java (Das, 1993; David & Ineich, 1999).

Lapemis Gray

***Lapemis curtus* (Shaw):** (Smith, 1926; Bourret, 1934, 1936; Shuntov, 1962; Pickwell, 1972; Tu, 1974; Harding & Welch, 1980; Tran & Nguyên, 1980; Kharin, 1984b; Golay *et al.*, 1993; Tran & Nguyên, 1995; Nguyên & Hó, 1996; Dotsenko, 1999; Nguyên *et al.*, 2005; Kharin, 2006; Rasmussen *et al.*, 2007; Nguyên *et al.*, 2009).

Diagnostic characters: Scales in the lowermost three or four lateral rows are larger than the others. Scale rows around neck 23–35; scale rows around body 25–43. Ventrals small, 114–230, usually distinct anteriorly, very small or absent posteriorly. Maxillary teeth behind fangs 3–6. **Colouration:** Body greenish or yellowish above, whitish

below, with dark greenish to black bands, which sometimes fuse longitudinally dorsally, narrowing laterally. However, in some specimens bands meet below, encircling the body. **Size:** 110 cm. **General distribution**: From Arabian Gulf to Japan, Philippines, Indonesia, and Australian region (David & Ineich, 1999; Rasmussen & Ineich, 2000). **Remarks:** One of the most frequently caught sea snakes by trawling boats in Asia. *Lapemis hardwickii* is a synonym of *L. curtus* (Gritis & Voris, 1990)

Laticauda Laurenti

***Laticauda colubrina* (Schneider):** (McCarthy, 1986; Heatwole *et al.*, 2005; Kharin, 2006)**.**

Diagnostic characters: Head shields large, nasals separated by internasals, upper lips yellow. Scale rows around neck 21–23; scale rows around body 21–25; ventrals 213–245. **Colouration:** Body bluish-grey above, yellow or whitish below, with black bands of more or less uniform width throughout. Head black except snout, upper lips and a stripe extending back above the eye to the temporal region, which are all yellow. **Size:** 142 cm. **General distribution:** Indo-Malayan Archipelago, South China Sea, Philippines, Indonesia, Australian region east to Fiji and Vanuatu (David & Ineich, 1999; Heatwole *et al.*, 2005; Cogger & Heatwole, 2006).

***Laticauda laticaudata* (Linnaeus):** not yet found in Vietnamese waters.

Diagnostic characters Head shields large, nasals separated by internasals, upper lips dark. Scale rows around neck 19; scale rows around body 19; ventrals 225–243. **Colouration:** Body bluish-grey above, yellow or whitish below, with black bands. Head with a pale horseshoe-shaped mark above, which may or may not curve down behind eye. **Size:** 110 cm. **General distribution**: Andaman Sea, Indo-Malayan Archipelago, Gulf of Thailand, South China Sea, Philippines, Indonesia and Australian region (Smith, 1926; McCarthy, 1986; Zhao & Adler, 1993; David & Ineich, 1999; Heatwole *et al.*, 2005).

***Laticauda semifasciata* (Reinwardt *in* Schlegel):** not yet found in Vietnamese waters (Kharin, 2009).

Diagnostic characters Head shields large, nasals separated by internasals, upper lips dark. Scale rows around neck 21–23; scale rows around body 21–23; ventrals 195–210 . **Colouration:** Body bluish-grey green above, yellowish below, with black bands. Head dark brown with a yellow curved mark above, connecting posteriorly with yellow band at back of head. With age, become brownish and markings less apparent (Smith, 1926). **Size:** 135 cm. **General distribution**: Philippines, China, Taiwan, Japan and Russia (Smith, 1926; Zhao & Adler, 1993; David & Ineich, 1999; Kharin, 2009).

Pelamis Daudin

***Pelamis platura* (Linnaeus):** (Smith, 1926; Bourret, 1934, 1936; Shuntov, 1962; Pickwell, 1972; Harding & Welch, 1980; Kharin, 1984b; Golay *et al.*, 1993; Tran & Nguyên, 1995; Nguyên & Hó, 1996; Dotsenko, 1999; Nguyên *et al.*, 2005; Kharin, 2006; Nguyên *et al.*, 2009).

Diagnostic characters: Scale rows around body 49–67; ventrals 264–406 or broken up and similar to adjacent scales. Maxillary teeth behind fangs 7–11. **Colouration:** Unique among sea snakes but great variation body black above, yellow below. These colours meet distinctly laterally, but the exact level varies. Posteriorly (mostly on tail) the black and yellow colours are broken up to form spots or even irregular hour-glass-shaped transverse bands. **Size:** 88 cm. **General distribution**: The Indian Ocean and the Pacific (Ineich, 1988; David & Ineich, 1999; Kharin, 2007). **Remarks:** *Pelamis platura* is the most widely distributed species of all snakes and it is pelagic (Hecht *et al.*, 1974).

Thalassophina Smith

***Thalassophina viperina* (Schmidt):** (Smith, 1926; Bourret, 1934, 1936; Shuntov, 1962; Harding & Welch, 1980; Tran & Nguyên, 1980; Kharin, 1984b; Golay *et al.*, 1993; Tran & Nguyên, 1995; Nguyên & Hó, 1996; Dotsenko, 1999; Nguyên *et al.*, 2005; Kharin, 2006; Nguyên *et al.*, 2009).

Diagnostic characters: Easy to identify by its ventrals, which are broad anteriorly and narrow posteriorly. Scale rows around neck 27–34; scale rows around body 37–50; ventrals 226–274. Maxillary teeth behind fangs 5. **Colouration:** Body grey above, white below, with or without bands. **Size:** 95 cm. **General distribution**: From the Arabian Gulf to South China Sea, Borneo and Java (David & Ineich, 1999).

Thalassophis Schmidt

***Thalassophis anomalus* Schmidt**: (Kharin, 1984b, 2006).

Diagnostic characters: A pair of elongated shields separate the nasals, rostral divided into four or five scales. Head shields with thickened edges. Scale rows around neck 27–30; scale rows around body 31–35; ventrals 210–256. Maxillary teeth behind fangs 5. **Colouration:** Greyish above. Whitish below with dark bands, which taper to a point laterally or continue as narrow bands ventrally to encircle the body. **Size:** 81 cm. **General distribution:** Singapore, Gulf of Thailand, Vietnam, East Sumatra, Borneo and Moluccas (David & Ineich, 1999).

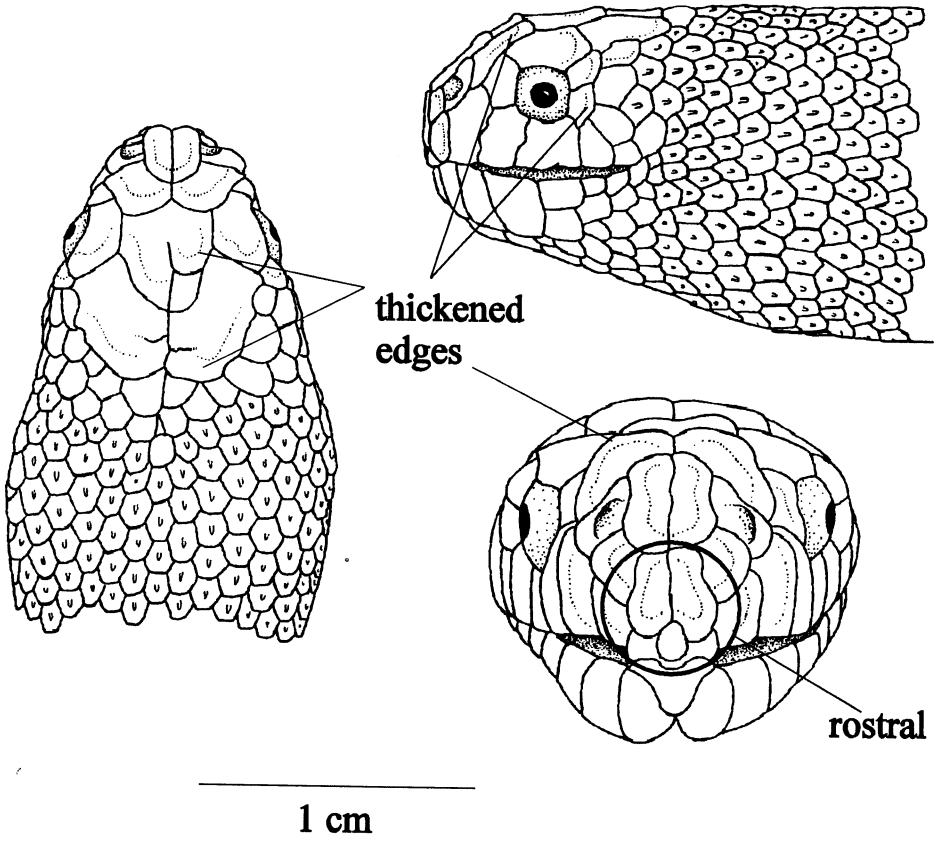

FIGURE 2. Head of *Thalassophis anomalus*, showing thickened edges of larger head shields and a rostral broken up into four or five scales (drawing M. Andersen).

Identification key

Identifying sea snakes to species level is frequently difficult; in particular the genus *Hydrophis* shows great interspecific and intraspecific variation making identification problematic when using only external characters. The key presented here allows identification to genus without the use of a microscope. The key is primarily based on examination of head shields and on counts of scale rows around neck and body. Shape and size of the head, number of ventral scales, and the position of the maxillary bone are other characters used. In order to successfully identify specimens it is important to use a combination of characters. Hence it is crucial that **all the characters** mentioned

at an identification step in the key fit with the specimen being examined. If this is not the case, the alternative "not as above" should be followed. When counting scale rows around neck and body it is important to note that the count around the neck is a minimum count and the count around the body is a maximum count (as in Smith, 1926). To be sure to find the minimum count around the neck it is necessary to count the scale rows three or four times starting one and a half head lengths behind the head, and then repeat the count starting two, two and a half, and three head lengths behind the head. When counting scale rows around the body the highest number is normally found just behind midbody, but again to be sure to find the precise maximum it is essential to make three to four counts between midbody and vent. To get the most precise scale row count, imagine a straight transverse line across the dorsal side of the body and then start from a ventral scale and count every scale this imaginary line crosses (Thomas, 1976). Ventral scales are not included in the count of scale rows. "Ground colour" refers to the colour between the darker dorsal markings/bands (if present), and is generally the same as the main colour on the ventral side. "Bands" here refers to darkish transverse markings anywhere on the body. Toward the end of the key (genus *Hydrophis*) it was necessary to include the count of maxillary teeth behind the fangs, which is done on dead specimens and requires a magnifying device. To view the maxillary teeth, use a needle to gently push the gum upwards to a level above the maxillary bone. Fixate the gum there by inserting the needle on the dorsal side of the maxillary. Sometimes it is necessary to use two needles to keep the gum in the desired position up against the roof of the mouth. Body length is measured from the snout to the tail tip and figures given here indicate the maximum size for a particular species. The nomenclature follows Rasmussen (1997) and David and Ineich (1999)

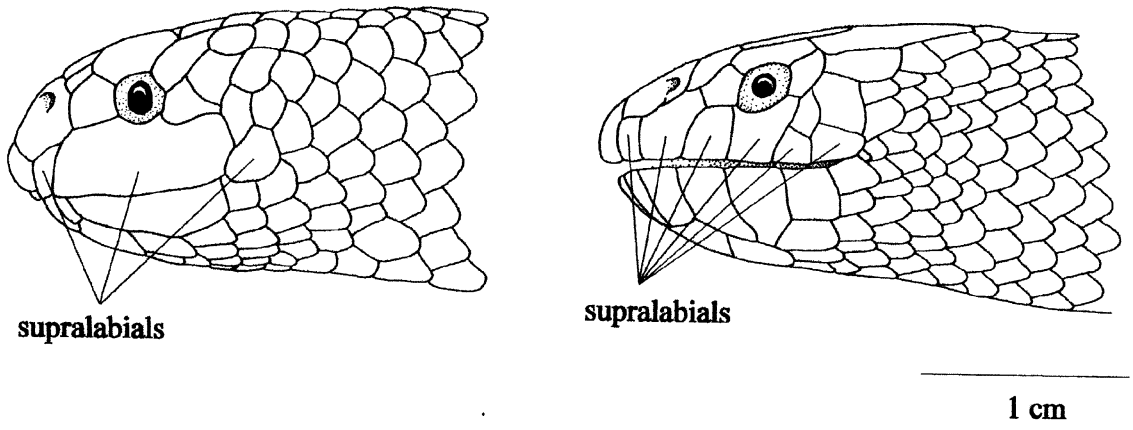

FIGURE 3. Head of *Emydocephalus annulatus* (left), showing the three supralabials, of which the second is very elongated. A standard supralabial pattern for sea snakes (right) is shown for comparison (drawing M. Andersen).

In the present key we include all 25 species confirmed from Vietnam, but also the three hypothetical species mentioned above.

1:
A: Nasals separated by internasals (Fig 1. left, but cf. *Thalassophis* in Fig. 2). Ventrals broad as in terrestrial snakes . . . . . 2. (*Laticauda*)
B: Nasals not separated by internasals (Fig. 1 right). Ventrals much smaller than in terrestrial snakes . . . . . 3.
2: (Genus *Laticauda*)
A: Upper lip yellow to white . . . . . *L. colubrina*
B: Upper lip dark brown or black, ventrals 225–250. . . . . *L. laticaudata*
C: Upper lip dark brown or black, ventrals 195–210. . . . . *L. semifasciata*
3:
A: More than 72 scale rows around midbody . . . . . *Kolpophis annandalei*
B: Less than 70 scale rows around midbody.. . . . . 4.
4:
A: Rostral broken up into 4 or 5 shields. Head shields with thickened edges (Fig. 2) . . . . . *Thalassophis anomalus*
B: Not as above.. . . . . 5.

5:
A: Three supralabials only, the second very elongated (Fig. 3 left). . . . . *Emydocephalus annulatus*
B: More than four supralabials (Fig. 3 right). . . . . 6.
6:
A: Ventrals much broader anteriorly than posteriorly (Fig. 4). . . . . *Thalassophina viperina*
B: Ventrals, if distinct, not much broader anteriorly than posteriorly . . . . . 7.

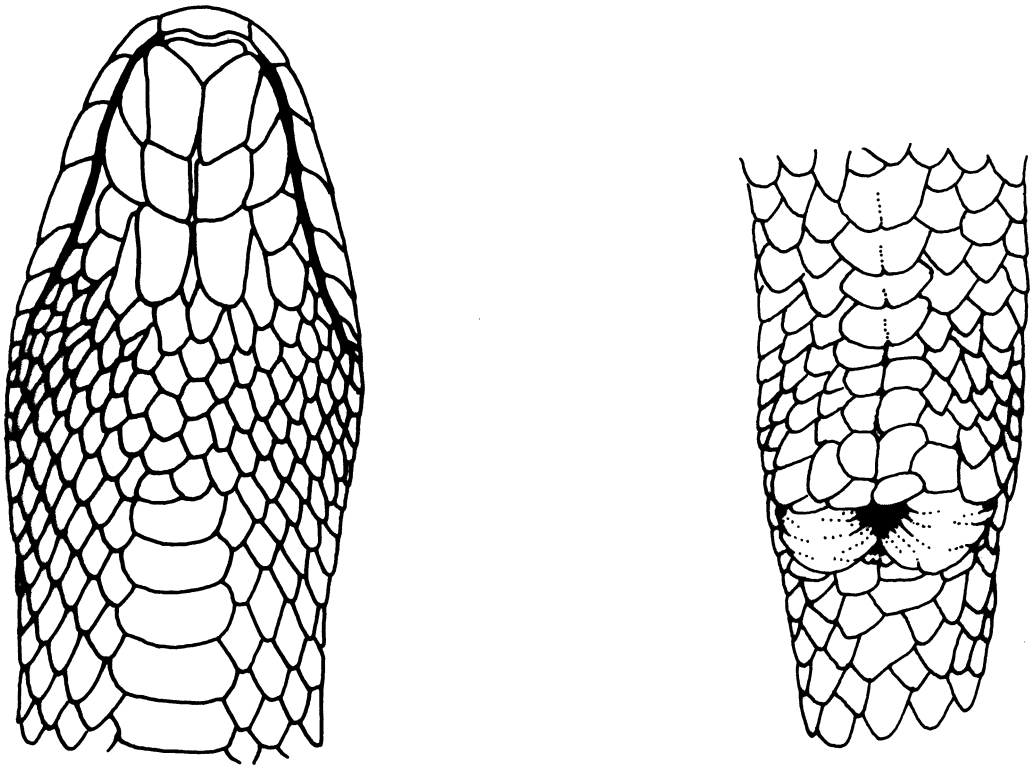

FIGURE 4. Underside views of the head (left) and the vent (right) region of *Thalassophina viperina*, showing enlarged ventrals on the anterior part of body (drawing M. Andersen).

7:
A: Elongated mental shield several times longer than broad and hidden in a groove (Fig. 5 left) . . . . . *Enhydrina schistosa*
B: Mental shield not much longer than broad (Fig. 5 right) . . . . . 8.
8:
A: Head elongated and dorsoventrally slightly flattened. Mouth opening (gape) very deep (Fig. 6). Colour normally black on dorsal side and yellow on ventral side . . . . . *Pelamis platura*
B: Not as above . . . . . 9.
9:
A: Ventrals (except on throat) divided into pairs of foliform scales (Fig. 7 left). . . . . *Astrotia stokesii*
B: Not as above . . . . . 10.
10:
A: Spines on rear edge of some of the head shields (Fig. 8) . . . . . *Acalyptophis peronii*
B: Not as above . . . . . 11.
11:
A: Ventrals very small and difficult to distinguish. Scales in the lowermost scale rows on flanks enlarged compared to dorsal scales (Fig. 9). . . . . *Lapemis curtus*
B: Not as above . . . . . 12.
12:
A: Large ventrals, each at least three times as broad as the adjacent body scales. Scale rows around body 17.. . . . . *Aipysurus eydouxii*
B: Small ventrals, each not more than twice as broad as the adjacent body scales. More than 17 scale rows around body. . . . . 13.
13:
A: Less than 24 scale rows around midbody.. . . . . *Kerilia jerdoni*
B: At least 24 scale rows around midbody . . . . . 14 (*Hydrophis*)

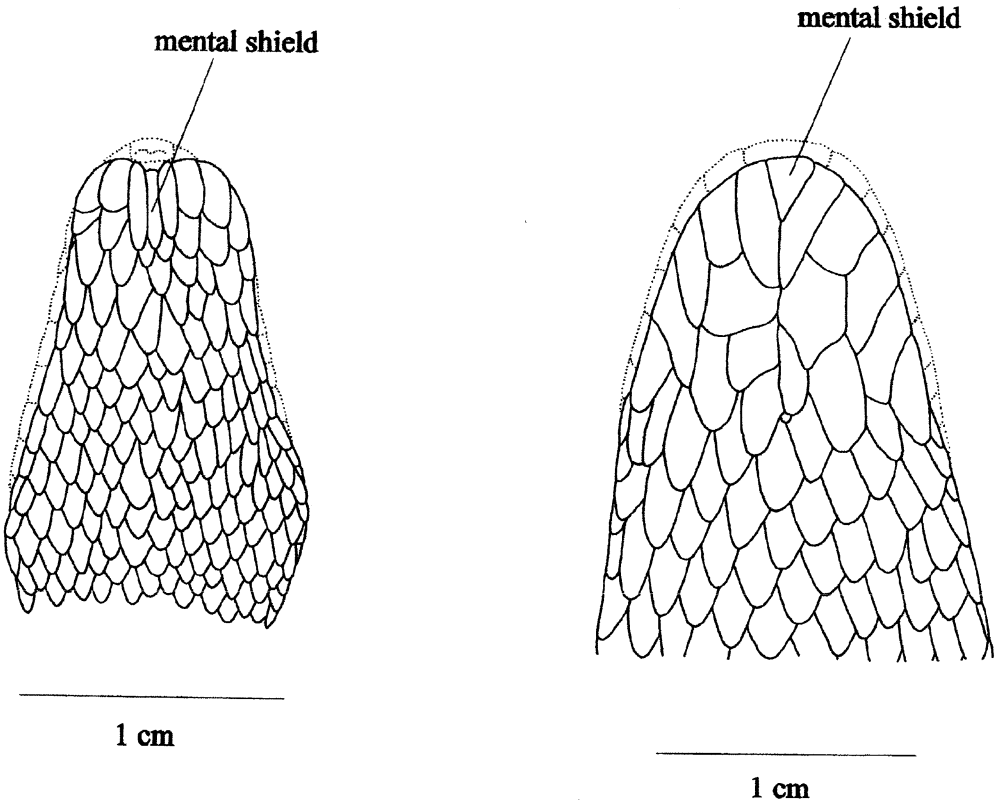

FIGURE 5. Underside view of the head of *Enhydrina schistosa* (left), showing the elongated mental shield. A standard sea snake pattern (*Hydrophis* sp.) is shown at right (drawing M. Andersen).

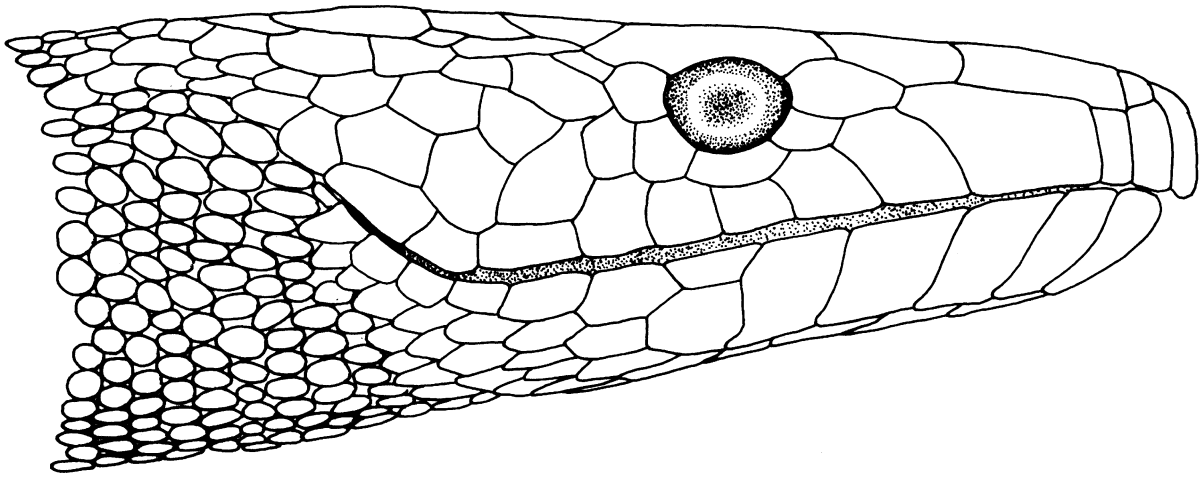

FIGURE 6. Head of *Pelamis platura*, showing the laterally flattened snout (drawing M. Andersen).

Key to the Genus *Hydrophis*

14.
A: Ventrals divided by a longitudinal furrow posteriorly (Fig. 7 right). Head small. Neck elongated and narrow. . . . . *H. gracilis*
B: Not as above . . . . . 15.
15.
A: Less than 22 scale rows around neck . . . . . .*H. parviceps*
B: At least 22 scale rows around neck . . . . . 16.

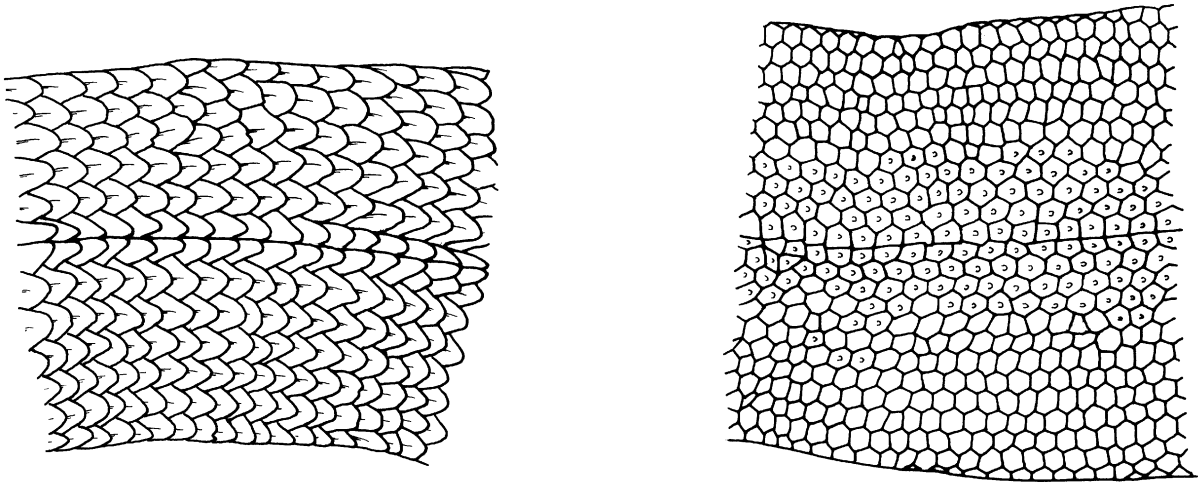

FIGURE 7. Section of body of *Astrotia stokesii* (left) and *Hydrophis gracilis* (right) in ventral views, showing the ventrals divided into pairs of foliform scales and ventrals divided by a longitudinal furrow posteriorly, respectively (drawing M. Andersen).

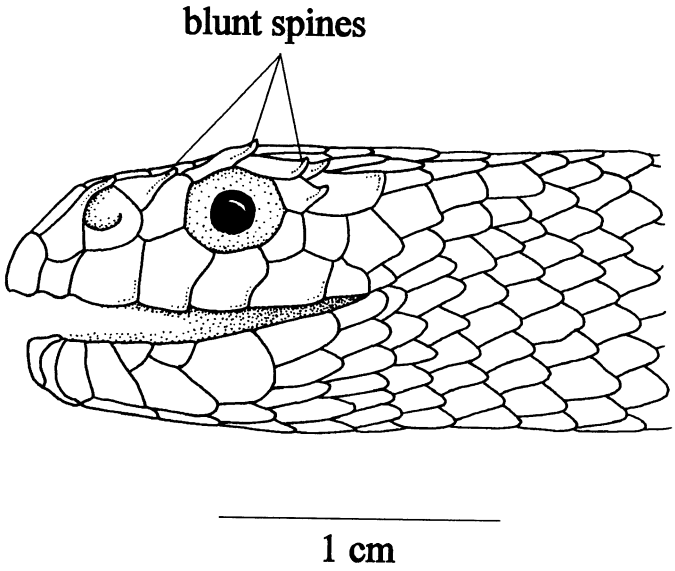

FIGURE 8. Head of *Acalyptophis peroni* showing the spines on the head shields (drawing M. Andersen).

16.
A: More than 31 scale rows around midtail. Head small and black. Neck elongated and narrow. . . . . *H. atriceps*
B: Not as above . . . . . 17.
17.
A: More than 36 scale rows around neck. Ground colour white. Body with rounded bands dorsally-anteriorly; interspaces between bands more than 2 scales wide (Fig. 10 left). . . . . *H. lamberti*
B: More than 33 scale rows around neck. Ground colour white. Body bands running parallel to each other dorsally-anteriorly; interspaces between bands less than 2 scale rows wide (Fig. 10 right) . . . . . *H. ornatus*
C: Not as above . . . . . 18.
18.
A: More than 360 ventrals. Less than 28 scale rows around neck. Head small. Neck elongated and narrow. Ground colour yellowish . . . . . *H. klossi*
B: Not as above . . . . . 19.

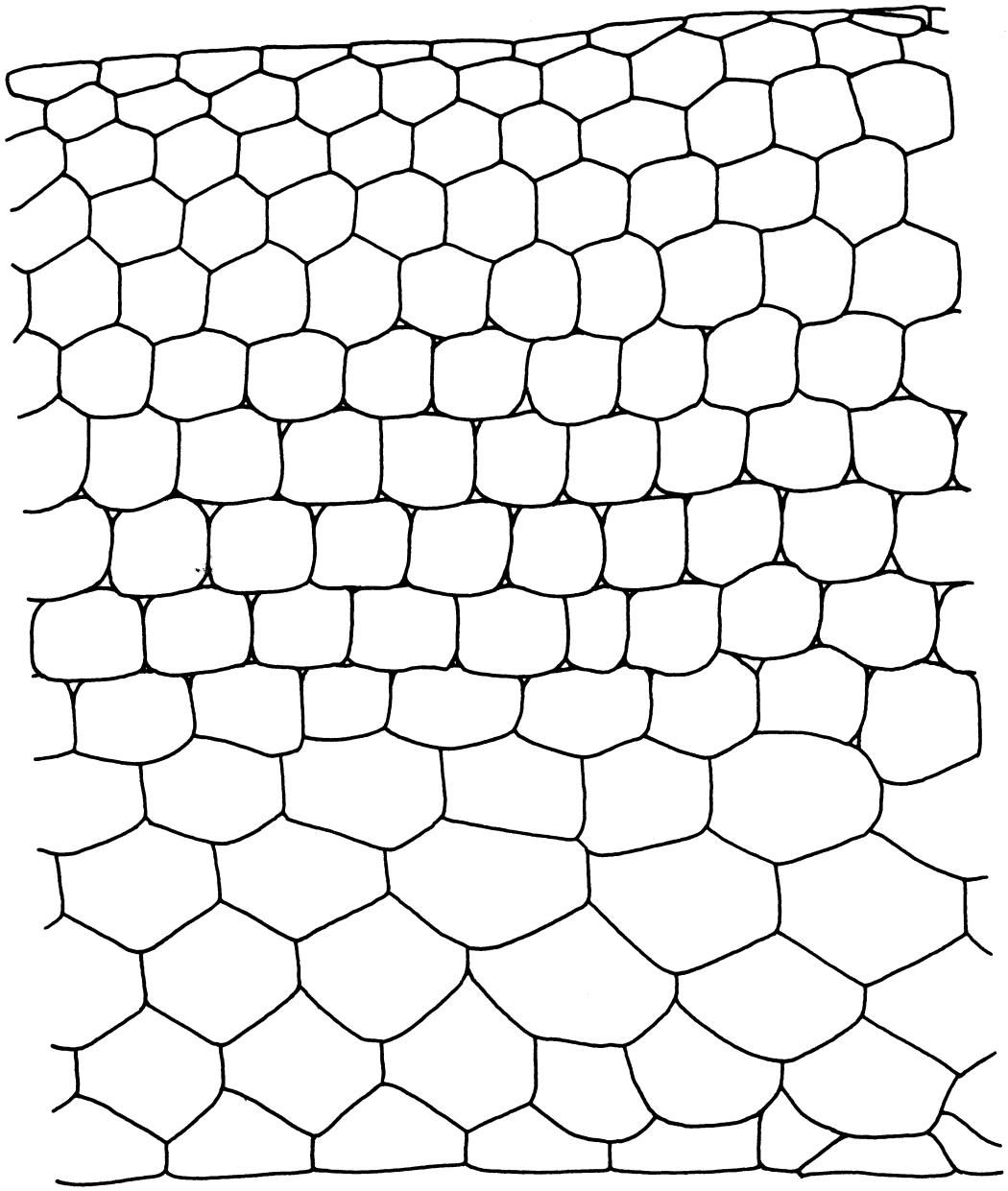

FIGURE 9. Lateral view of midbody of *Lapemis curtus*, showing the enlarged scales in the lower-most scale rows (drawing M. Andersen).

19.
A: More than 325 ventrals. Less than 32 scale rows around neck. Head small. Neck elongated and narrow. Ground colour whitish bluish, distinct dark transverse bands . . . . . *H. brookii*
B: Not as above . . . . . 20.

20.
A: Less than 39 scale rows around body and 25–31 scale rows around neck. Ground colour bright yellow. Distinct black transverse bands, the latter mostly 2–4 times narrower than interspaces on the posterior part of the body. . . . . *H. spiralis*
B: Not as above . . . . . 21.

21.
A: Less than 32 scale rows around neck. Light supralabials contrasting darker scales above and a light ring around eye (Fig. 11) . . . . . *H. pachycercos*
B: Not as above . . . . . 22.

22.
A: Less than 28 scale rows around neck (but usually more than 22). Head small. Neck long and narrow. . . . . *H. melanocephalus*

B: Not as above . . . . . 23.

23.

A: Less than 38 scale rows around body. Less than 32 scale rows when counted 10 ventrals anterior to vent. Seven or eight maxillary teeth behind fangs . . . . . *H. belcheri*

B: Not as above . . . . . 24.

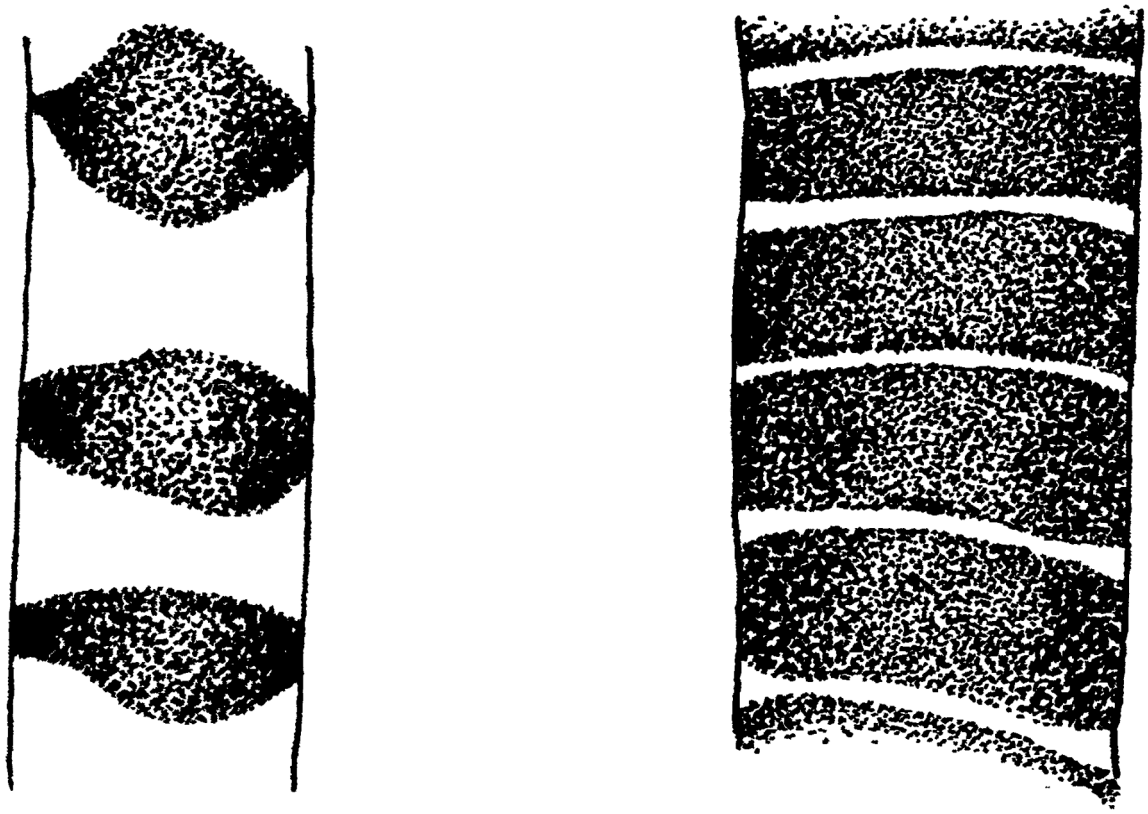

FIGURE 10. Dorsal colour pattern close to the head of *Hydrophis lamberti* (left) and *H. ornatus* (right) (drawing M. Andersen).

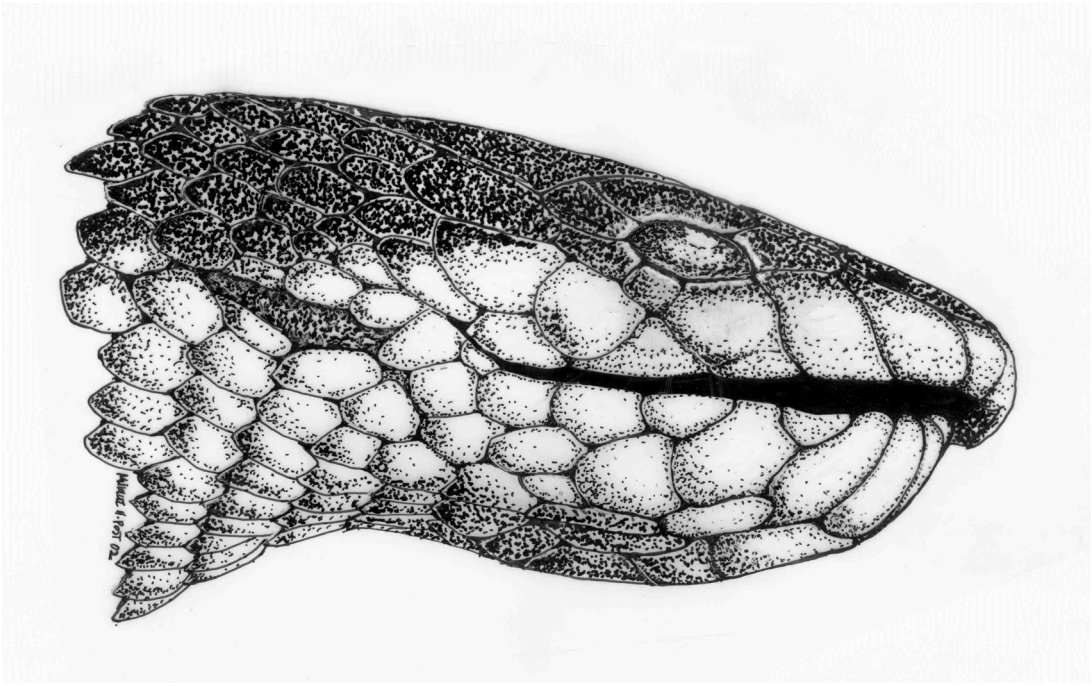

FIGURE 11. Head of *Hydrophis pachycercos* showing the pale ring around the eye and the pale supralabials (drawing M. Post Hoegh, modified by M. Andersen).

FIGURE 12. Sea snakes from Vietnam. Five pairs (rows) in left, right order from top to bottom, as follows: 1. *Acalyptophis peronii*, *Hydrophis atriceps*, 2. *H. belcheri*, *H. cyanocinctus*, 3. *H. lamberti*, *H. melanocephalus*, 4. *H. ornatus*, *H. pachycercos*, 5. *Kerilia jerdonii*, *Thalassophina viperina*.

24.
A: Head not obviously small. Less than 9 maxillary teeth behind the fangs. Ground colour light yellow. Transverse body bands bluish black with a great variation in pattern . . . . . *H. cyanocinctus*
B: Not as above . . . . . 25.
25.
A: At least 12 maxillary teeth behind the poison fangs. Ground colour bluish grey (juveniles white). Dark transverse body bands. . . . . .*H. caerulescens*
B: Head small. Eight to 10 maxillary teeth behind poison fangs. . . . . *H. torquatus diadema*

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References

Alcala, A.C., Maypa, J.P. & Russ, G.R. (2000) Distribution of the Turtle-headed sea snakes *Emydocephalus n. sp.* on coral reefs of the central Philippines. *UPV Journal for Natural Sciences*, 5, 27–32.

Bain, R.H. & Truong, N.Q. (2004) Herpetofaunal diversity of Ha Giang Province in northeastern Vietnam, with descriptions of two new species. *American Museum Novitates*, 3453, 1–42.

Barme, M. (1958) Contribution à l'étude des serpents marins venimeux hydrophiidae du Viet Nam. *Bulletin de la Société de Pathologie exotique*, 51, 258–265.

Barme, M. (1963) Venomous sea snakes of Viet-Nam and their venoms. *In:* Keegan, H.L. & MacFarlane, W.V. (Eds.) *Venomous and poisonous animals and noxious plants of the Pacific region*. Pergamon Press, Oxford, pp. 373–378.

Barme, M. (1964) Les serpents marins venimeux du Viet-Nam et leurs venins. *Cahiers du Pacifique*, 6, 192.

Barme, M. (1968) Venomous sea snakes (Hydrophiidae). *In:* Bucherl, W., Buckley, E.E. & Deulofeu, V. (Eds.) *Venemous Animals and Their Venoms.* Academic Press, New York, pp. 285–308.

Beck, J., Kitching, I.J. & Haxaire, J. (2007) The latitudinal distribution of sphingid species richness in continental Southeast Asia: What causes the biodiversity "hot spot" in northern Thailand? *Raffles Bulletin of Zoology*, 55, 179–185.

Bourret, R. (1934) Les serpents marine de l'Indochine Francaise. *Institut Océanographique de l'Indochine, Hanoi*, Note 25, 1–69.

Bourret, R. (1936) Les serpents de l'Indochine. *Catalogue systématique descriptif*, ll, 338–381.

Cogger, H.G., Cameron, E.E. & Cogger, H.M. (1983) Hydrophiidae. *In: Zoological catalogue of Australia. Amphibia and Reptilia*. Government Publishing Service, Canberra: Australia, pp. 241–256.

Cogger, H.G. & Heatwole, H. (2006) *Laticauda frontalis* (de Vis, 1905) and *Laticauda saintgironsi* n. sp. from Vanuatu and New Caledonia (Serpentes: Elapidae: Laticaudinae)—A new lineage of sea kraits? *Records of the Australian Museum*, 58, 245–256.

Das, I. (1993) Annandales seasnakes, *Kolpophis annandalei* (Laidlaw, 1901) – A new record for Borneo (Reptilia, Serpentes, Hydrophiidae) *Raffles Bulletin of Zoology*, 41, 359–361.

David, P. & Ineich, I. (1999) Les Serpents venimeux du monde: systématique et répartition. *Dumerilia(Paris)*, 3, 3–499.

Dotsenko, I.B. (1999) Snakes from Vietnam at the National Museum of Natural History of Ukrainian National Academy of Sciences stock collection. Communication 1. The sea snakes - Hydrophiidae. *Vestnik zoologii*, 33, 39–51.

Dowling, H.G. (1966) Poisonous snakes of Vietnam. *Animal Kingdom*, 69, 34–43.

Gasperetti, J. (1988) Sea snakes. *In:* Büttiker, W. & Krupp, F. (Eds.) *Fauna of Saudi Arabia*. NCWCD Riyadh, Saudi Arabia, Riyadh, pp. 169–450.

Giao, P.M., Tuoc, D., Dung, V.V., Wikramanayake, E.D., Amato, G., Arctander, P. & MacKinnon, J.R. (1998) Description of *Muntiacus truongsonensis*, a new species of muntjac (Artiodactyla: Muntiacidae) from Central Vietnam, and implications for conservation. *Animal Conservation*, 1, 61–68.

Golay, P., Smith, H.M., Broadley, D.G., Dixon, J.R., McCarthy, C., Rage, J.C., Schätti, B. & Toriba, M. (1993) *Endoglyphs and other major venomous snakes of the world. A checklist*. Herpetological Data Centre, Azemiops, Switzerland,pp.

Gritis, P.A. & Voris, H.K. (1990) Variability and significance of parietal and ventral scales in the marine snakes of the genus *Lapemis* (Serpentes: Hydrophiidae), with comments on the occurrence of spiny scales in the genus. *Fieldiana Zoology*, 56, 1–13.

Harding, K.A. & Welch, K.R.G. (1980) *Venomous snakes of the world. A checklist*. Pergamon Press, Oxford, 1–188 pp.
Heatwole, H., Busack, S. & Cogger, H.G. (2005) Geographic variation in sea kraits of the *Laticauda colubrina* complex (Serpentes: Elapidae: Hydrophiinae: Laticaudini). *Herpetological Monographs*, 19, 1–136.
Hecht, M.K., Kropach, C. & Hecht, B.M. (1974) Distribution of the Yellow-Bellied Sea Snake, *Pelamis platurus*, and Its Significance in Relation to the Fossil Record. *Herpetologica*, 30, 387–396.
Ineich, I. (1988) Le serpent marin *Pelamis platurus* (Elapidae, Hydrophiinae) : bilan des connaissances sur sa biologie et sa distribution ; situation en Polynésie orientale. *L'Année Biologique, 4ème série*, 27, 93–117.
Ineich, I. (1996) Geographic distribution. *Hydrophis torquatus diadema*. *Herpetological Review*, 27, 154.
Ineich, I. & Rasmussen, A.R. (1997) Sea snakes from New Caledonia and the Loyalty Islands (Elapidae, Laticaudinae and Hydrophiinae). *Zoosystema*, 19, 185–192.
Iskandar, D.T. & Colijn, E. (2001) *A checklist of Southeast Asian and New Guinean reptiles, part 1. Serpentes. Biodiversity Conservation Project*. Indonesian Institute of sciences, Japan International Cooperation Agency, The Ministry of Forestry & The Gibbon Foundation and Institute of Technology, Bandung, Java, Indonesia, -pp 1-195
Kharin, V.E. (1984a) A review of sea snakes of the group *Hydrophis* sensu lato (Serpentes, Hydrophiidae). 3. the genus *Leioselasma*. *Zoologicheskii Zhurnal*, 63, 1535–1546.
Kharin, V.E. (1984b) Three species of sea snakes first discovered in Vietnamese waters with a comment on a rare form *Praescutata viperina*. *Biologiya Morya. Vladivostok*, 2, 26–30.
Kharin, V.E. (2004a) On the Taxonomic Position of the Sea Snake *Hydrophis caerulescens* (Shaw, 1802) (Serpentes: Hydrophiidae). *Russian Journal of Marine Biology*, 30, 196–198.
Kharin, V.E. (2004b) Review of sea snakes of the genus *Hydrophis* sensu stricto (Serpentes: Hydrophiidae). *Russian Journal of Marine Biology*, 30, 387–394.
Kharin, V.E. (2006) An annotated checklist of sea snakes of Vietnam, with notes on a new record of the yellow-lipped sea krait, *Laticauda colubrina* (Schneider, 1799)(Laticaudidae, Hydrophiidae). *Russian Journal of Marine Biology*, 32, 223–228.
Kharin, V.E. (2007) On the second record of yellow-bellied sea snake *Pelamis platurus* (Linnaeus, 1766) from Russia. *Russian Journal of Herpetology*, 14 (1), 45-49.
Kharin, V.E. (2009) Redescription of a Russian finding of the Erabu Sea Krait *Pseudolaticauda semifasciata* (Reinwardt *in* Schlegel, 1837), with remarks about species composition of sea snakes (Serpentes: Laticaudidae, Hydrophiidae) in Russian and adjacent waters. *Russian Journal of Marine Biology*, 35, 8–14.
McCarthy, C.J. (1986) Relationships of the laticaudine sea snakes (Serpentes: Elapidae: Laticaudinae). *Bulletin of the British Museum of Natural History (Zoology)*, 50, 127–161.
McCarthy, C.J. (1987) Adaptations of sea snakes that eat fish eggs; with a note on the throat musculature of *Aipysurus eydouxii* (Gray, 1849). *Journal of Natural History*, 21, 1119–1128.
McCarthy, C.J. & Warrell, D. (1991) A collection of sea snakes from Thailand with new records of *Hydrophis belcheri* (Gray). *Bulletin of the Natural History Museum (zoology), London*, 57, 161–166.
Minton, S.A. (1975) Geographic distribution of sea snakes. *In:* Dunson, W.A. (Ed.) *The Biology of Sea Snakes*. London & tokyo Baltimore, pp. 21–31.
Murphy, J.C., Cox, M.J. & Voris, H.K. (1999) A Key to the Sea Snakes in the Gulf of Thailand. *Natural History Bulletin of the Siam Society*, 47, 95–108.
Nguyên, V.S. & Hó, T.C. (1996) *Danh luc bó sát vá éch Nhái Viét Nam* Science & Technology Publ. House, Hanoi, -Pp. 1-264
Nguyên, V.S., Hó, T.C. & Nguyên, Q.T. (2009) *Herpetofauna of Vietnam*. Edition Chimaira, Frankfurt am Main, 768 pp.
Nguyên, V.S., Hó, T.C. & Nguyên, Q.T. (2005) *A checklist of Amphibians and Reptiles of Vietnam*. Nhá Xuát Bán Nóng Nghiép, Hanoi, 1–180 pp.
Pickwell, G.V. (1972) *Sea snakes of Viet Nam and Southeast Asia. Handbook of dangerous animals for field personnel*. Undersea surveillance and ocean sciences department, Naval undersea center, San Diego, 5–25 pp.
Rasmussen, A.R. (1989) An analysis of *Hydrophis ornatus* (Gray), *H. lamberti* Smith, and *H. inornatus* (Gray) (Hydrophiidae, Serpentes) based on samples from various localities, with remarks on feeding and breeding biology of *H. ornatus*. *Amphibia-Reptilia*, 10, 397–417.
Rasmussen, A.R. (1997) Systematics of sea snakes: A critical review. *Symposium of the Zoological Society of London*, 70, 15–30.
Rasmussen, A.R. & Andersen, M. (1990) The sea snake *Kerilia jerdoni* Gray (1849): First records from Andaman Sea, Phuket Island, Thailand, with remarks on the two subspecies. *Snake*, 22, 131–133.
Rasmussen, A.R., Auliya, M. & Böhme, W. (2001) A New Species of the Sea Snake Genus *Hydrophis* (Serpentes: Elapidae) from a River in West Kalimantan (Indonesia, Borneo). *Herpetologica*, 57, 23–32.
Rasmussen, A.R., Gravlund, P., van Nguyên, C. & Chanhome, L. (2007) A resurrection of *Hydrophis pachycercos* Fischer 1855 (Serpentes: Elapidae) with a new neotype from Vietnamese waters. *Hamadryad*, 31, 288–298.
Rasmussen, A.R. & Ineich, I. (2000) Sea snakes of New Caledonia and surrounding waters (Serpentes: Elapidae): first report on the occurrence of *Lapemis curtus* and description of a new species from the genus *Hydrophis*. *Hamadryad*, 25, 91–99.
Rasmussen, A.R. & Ineich, I. (2010) Species diversity in the genus *Emydocephalus* Krefft, 1869 (Serpentes, Elapidae, Hydrophiinae): Insight from morphology and anatomy *Herpetological Review*, 41, 285–290.
Saint Girons, H. (1972) Les serpents du Cambodge. *Mémoires du Muséum national d'Histoire naturelle (France)*, Ser. A 74, 1–165.

Shuntov, V.P. (1962) Sea snakes (Hydrophiidae) of the Gulf of Tonkin (Northern Viet-Nam). *Zoologicheskii Zhurnal*, 41, 1203–1209.
Shuntov, V.P. (1966) On the distribution of sea snakes in the South China Sea and the Eastern Indian Ocean. *Zoologicheskii Zhurnal*, 45, 1882–1886.
Smith, M.A. (1920) On sea snakes from the coasts of the Malay Peninsula, Siam and Cochin-China. *Journal of the Federated Malay States Museums. Kuala Lumpur*, 10, 1–63.
Smith, M.A. (1926) *Monograph of the sea-snakes (Hydrophiidae)*. Printed by order of the Trustees of the British museum (Natural History) London, Pages i-xvii + 1-130 + 2 plates.
Smith, M.A. (1935) The sea snakes (Hydrophiidae). *Dana-Report*, 8, 1–6.
Taylor, E.H. (1963) New and Rare Oriental Serpents. *Copeia*, 1963, 429–433.
Thomas, R.A. (1976) Dorsal scale row formulae in snakes. *Copeia*, 1976, 837–841.
Tran, K. & Nguyên, Q.T. (1980) *Các loái ran dóc Viét Nam*. Science & Technology Publ. House, Hanoi,pp.
Tran, K. & Nguyên, Q.T. (1995) *Các loái ran dóc Viét Nam* Science & Technology Publ. House, Hanoi, 1–204 pp.
Tu, A.T. (1974) Sea snake investigation in the Gulf of Thailand. *Journal of Herpetology*, 8, 201–210.
Warrell, D.A. (1994) Sea snake bites in the Asia-Pacific region. *In:* Gopalakrishnakone, P. (Ed.) *Sea snake toxinology.* Singapore University Press, Singapore, pp. 1–36.
Welch, K.R.G. (1988) *Snakes of the Orient: a checklist*. Robert E. Krieger Publ. Co., Malabar, Pages i-vii + 1-183.
Zhao, E. & Adler, K. (1993) *Herpetology of China*. Society for the study of Amphibians and Reptiles. Oxford, Ohio,pp.
Ziegler, T., Hendrix, R., Thanh, V.N., Vogt, M., Forster, B. & Kien, D.N. (2007) The diversity of a snake community in a karst forest ecosystem in the central Truong Son, Vietnam, with an identification key. *Zootaxa*, 1493, 1–40.