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Marine snakes of Indian coasts: historical resume, systematic checklist, toxinology, status, and identification key

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Abstract: We compile an up-to-date checklist of 26 species of marine snakes known from the Indian coastlines. We furnish information on the original orthography, authorship, date of publication, current binominal representation, synonymy and chresonymy lists for each recognized taxon. In addition, we provide details of name-bearing types, repository and type locality (both original and subsequent restrictions where applicable) of the prevailing nomen for all recognized species. We summarise the history of research on Indian marine snakes from Linnaeus to the present day, including taxonomic and regional treatises, and highlight the taxonomic flux. We also provide a revised key for this group to facilitate easier identification and support effective conservation.

Keywords: Achrochrodide, annotated checklist, Homalopsidae, Hydophiinae, India, literature review, synonymy.

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The authors are part of the Coastal and Marine Biodiversity Conservation Network (CoMBINe) Database team involved in updating Species checklists and documenting recorded Species information in Indian waters. This updated checklist is part of the ongoing initiative to list out and update marine biodiversity of India.

Author Contribution: SRG and VDS conceived the study, with inputs from RP and RR. TN, CRS, KRA were involved in literature survey. SRG led the writing with inputs from TN and VDS. All authors eqaually participated in refining the manuscript, addressing editorial comments and approving the final text.

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INTRODUCTION

Snakes which live completely or occasionally in marine and estuarine environments comprise about 90% of living marine reptile species (Wallach et al. 2014; Uetz & Hosek 2017). Marine snakes are mainly found in warm tropical and subtropical coastal waters (Dunson 1975; Tu 1988; Heatwole 1999; Rasmussen et al. 2011; Wallach et al. 2014), and are broadly classified as brackish water snakes, sea kraits and true sea snakes. Occasionally sea snakes venture into tidal river creeks far from the tide line, and similarly brackish water snakes can swim into the sea (Rasmussen et al. 2011; Murphy 2012). Brackish water snakes comprise of wart snakes (Acrochordidae) and mangrove water snakes (some species belonging to family Homalopsidae), which are either non-venomous (Acrochordidae) or mildly venomous (Homalopsidae) and have a cylindrical tapering tail (Whitaker & Captain 2004; Murphy 2007; Alfaro et al. 2008). The true sea snakes (Elapidae: Hydrophiinae) are all venomous with front fangs, and are distinguished by their laterally compressed paddle-like or oar-shaped tail (Heatwole 1999). Two tribes, Hydrophiini (true sea snakes) and Laticaudini (sea kraits) which are also highly venomous and have paddle-shaped tail (Heatwole et al. 2012, 2016; Sanders et al. 2012), are present. Marine snakes live in a variety of habitats like mangrove swamps, coral reefs and lagoons, mud flats and estuaries (Voris & Murphy 2012). Water salinity has been reported to greatly influence the distribution of marine snakes globally (Gasperetti 1988; Brischoux et al. 2012).

As a group of thoroughly aquatic and stenohaline taxa, true sea snakes (Hydrophiinae) have several special adaptations (Brischoux & Shine 2011). Like all reptiles these snakes undergo pulmonary respiration and have an elongated cylindrical lung on the left side of their body for adequate gas exchange. They have nostril valves that regulate air entering the lung so that they can remain under water for 0.5 to 2 hours during a dive. True sea snakes have specialized head-heart distance and lung morphology (Lillywhite et al. 2012b), and like most marine snakes they have a salt-excretion gland under their tongue sheath (Dunson & Dunson 1973). Sea snakes have a paddle-shaped tail for efficient swimming (Aubert & Shine 2008) and specialized visual systems to facilitate underwater habitat selection, foraging and mating (Hart et al. 2012). Sea kraits are known to possess a unique skin that is partially permeable to water exchange (Dunson & Robinson 1976; Lillywhite et al. 2009). A recent study on true sea snakes has revealed the existence of unique sense organs on the scales called sensilla which are sensitive to light variations in the environment (Zimmermann & Heatwole 1990; Crowe-Riddell et al. 2016). True sea snakes have also been reported to be influenced by water loss and dehydration even at mid-sea (Lillywhite et al. 2008, 2012a, 2014, 2015).

True sea snakes shed their skins more frequently (every 2–6 weeks) than land snakes (3–4 months), mainly to remove fouling marine organisms like algae, barnacles and bryozoans (Mays & Nickerson 1968; Key et al. 1995). They are mainly ovoviviparous except for the egg-laying sea kraits (Shetty & Shine 2002). They usually copulate for a long duration lasting up to over 3 hours on the water surface (Heatwole 1999; Chanhome et al. 2011). The reproduction period ranges from 4–11 months and most species reproduce annually (Rasmussen 1989, 1992, 1994; Shine 1988, 2005). Juvenile sea snakes swim up to the water surface to breathe immediately after birth. In many species, juveniles are brightly banded while the adults are unpatterned (Heatwole 1999). Unlike snakes of the tribe Hydrophinii, which are typically adapted to warm coastal waters (Heatwole & Cogger 1993), the sea kraits (genus *Laticauda* Laurenti, 1768) are semi-aquatic and can move well on land, as they often do for thermoregulation, oviposition, skin shedding, prey digestion and assimilation (Heatwole & Guinea 1993; Shine & Shetty 2001).

In India, snakes have religious (Vogel 1926), medical (Whitaker & Andrews 1995) and socio-economic significance (Whitaker 1978). Scientific studies of Indian snakes by the academic community started in the late 18th Century (Vijayaraghavan 2005), and currently a total of 26 marine snake species are recognized (Whitaker & Captain 2004; Adimallaiah 2014): one species of file snake, five species of brackish water snakes and 20 species of venomous sea snakes, including two species of sea kraits (Aengals et al. 2018; Adimallaiah 2014). The file snake is restricted mainly to mangrove areas and occasionally ventures into the sea along India's west coast, the Bengal coast and the Bay Islands' coasts (Whitaker & Captain 2004). The remaining snakes are homalopsids, a family of rear-fanged aquatic snakes comprising of smooth water snakes, mud snakes and mangrove snakes. Of the five species of the homalopsid brackish water snakes, only one (*Cerberus rynchops*) is widespread and common, whereas the other four (*Cantoria violacea*, *Dieurostus dussumierii*, *Fordonia leucobalia* & *Gerarda prevostiana*) are rather rare or range-restricted (Whitaker & Captain 2004; Chandramouli et al. 2012; Kumar et al. 2012; Adimallaiah 2014). The following section presents an in-depth description of Indian marine snakes.

HISTORY OF RESEARCH ON INDIAN MARINE SNAKES

In the 18th Century Linnaeus described a few species of Indian marine snakes, including *Coluber laticaudatus* (now *Laticauda laticaudata* (Linnaeus, 1758)) and *Anguis platura* (now *Hydrophis platurus* (Linnaeus, 1766)). Later the Scottish naturalist Patrick Russell described a few more species using vernacular names that were later given scientifical names by others, including Bokadam: *Cerberus rynchops* (Schneider, 1799); Kerril patti: *Hydrophis nigrocinctus* Daudin, 1803; Shootur sun and / or Kalla Shootur sun: *Hydrophis obscurus* Daudin, 1803; Chittul: *Hydrophis cyanocinctus* Daudin, 1803; Hoogli pattee and /or Valakadyen: *Hydrophis schistosus* Daudin, 1803; Shiddil: *Hydrophis jerdoni* (Gray, 1849) and Kadel Nagam: *Microcephalophis gracilis* (Shaw, 1802) (Russell 1796, 1801). In the same century Schneider (1779) described *Hydrus granulatus* (now *Acrochordus granulatus* (Schneider, 1799)), *Hydrus rynchops* (now *Cerberus rynchops* (Schneider, 1799), *Hydrus Colubrinus* (now *Laticauda colubrina* (Schneider, 1799)) and *Hydrus fasciatus* (now *Hydrophis fasciatus* (Schneider, 1799)).

In the early 19th Century, Shaw (1802) described *Hydrus spiralis* (now *Hydrophis spiralis* (Shaw, 1802)), *Hydrus caerulescens* (now *Polyodontognathus caerulescens* Shaw, 1802), *Hydrus curtus* (now *Hydrophis curtus*) and *Hydrus gracilis* (now *Microcephalophis gracilis* (Shaw, 1802). Daudin (1803) described *Hydrophis schistosus* Daudin, 1803, *H. cyanocinctus* Daudin, 1803, *H. nigrocinctus* Daudin, 1803, *H. obscurus* Daudin, 1803 and *Anguis mamillaris* (now *Hydrophis mamillaris* (Daudin, 1803) (also see Bour 2011). Schlegel (1837) described the brackish water snakes *Homalopsis leucobalia* (now *Fordonia leucobalia* (Schlegel, 1837)). Eydoux & Gervais (1837) described *Coluber* (*Homalopsis*) *prevostianus* (now *Gerarda prevostiana* (Eydoux & Gervais, 1837)). Gray (1842, 1846, 1849) described the sea snakes *Aturia ornata* (now *Hydrophis ornatus* (Gray, 1842)), *Hydrus stokesii* (now *Hydrophis stokesii* (Gray, 1846)), *Aturia lapemoides* (now *Hydrophis lapemoides* (Gray, 1849)) and *Kerilia jerdonii* (now *Hydrophis jerdonii* (Gray, 1849)). André Marie Constant Duméril (1774–1860), Gabriel Bibron (1805–1848) and Auguste Henri André Duméril (1812–1870), zoologists associated with the Museum National d'histoire Naturelle in Paris, France also studied sea snakes. Duméril et al. (1854) described *Eurostus dussumierii* (now *Dieurostus dussumierii* Duméril, Bibron & Duméril, 1854). Later, a German-born zoologist working with the Natural History Museum, London, Albert Karl Ludwig Gotthilf Günther described two species, *Hydrophis stricticollis* Günther, 1864 and *Microcephalophis cantoris* Günther, 1864 (see Günther 1864).

By the late 19th Century no new species of Indian marine snakes were being described (see Whitaker & Captain 2004). The first regional treatise on Indian herpetology was prepared by the British physician Thomas Caverhill Jerdon (1811–1872) (see Jerdon 1854), followed by a treatise by Günther (1864). Museum-based stock-takings and catalogues were also produced, including a description of the holdings of the Indian Museum in Calcutta by William Theobald (Theobald 1868, 1876) and an expanded herpetological catalogue from the same institution by museum director William Lutley Sclater (Sclater 1891). George Albert Boulenger (1858-1937), a Belgian-British zoologist, expanded and revised his early work on Indian herpetology (Boulenger 1890) based on the collections of the London Museum (Boulenger 1896).

In the early 20th Century, Frank Wall, a British physician and herpetologist who lived in South Asia wrote extensively about Indian snakes (Campden-Main 1968, 1969). He published a descriptive list of sea snake specimens preserved in the Indian Museum, Calcutta (Wall 1906), and then what is perhaps the first monograph exclusively dealing with sea snakes (Wall 1909). Like Russell and Jerdon, Wall's experience included studies of museum specimens and a considerable amount of field observation. He worked with the holdings of the Bombay Natural History Society Museum, the British Museum, the Madras Museum and the Indian Museum in Calcutta (Wall 1906, 1909). In a more regional context, Prater (1924) recorded snake species from the Islands of Bombay and Salsette and the surrounding seas, and reported 11 species of sea snakes. Following Wall, Malcolm Arthur Smith (1875-1958) expanded and refined the sea snake monograph (1926) and also the work on Indian ophiology (1943), mainly based on collections in the London and Indian museums.

In modern times studies of Indian marine snakes have primarily consisted of regional reviews (Table 1). Gyi (1970) revised the Homalopsid snakes that also covered the Indian taxa. Ahmed (1975) studied the sea snakes of the Indian Ocean based on the collection of Zoological survey of India (ZSI), dealing with systematics, ecology and distribution of sea snakes, recognizing 29 species. McCarthy (1986) elaborated on the relationships of sea kraits, that also included Indian species. Das (2003) made an extensive overview of the systematics, taxonomy and nomenclature of Indian reptiles, listing 23 species of marine snakes including true sea snakes, sea kraits, file snakes and brackish water snakes. Whitaker

Table 1. Records of sea snakes from Indian waters from 1796 to 2004. Number in entries denote the numbers of nominal representations (i.e., synonyms) for each species as currently recognized. Abbreviations: Rus: Russell (1796-1809), Jerd: Jerdon (1854), Gthr: Günther (1864), Blgr: Boulenger (1890), Scltr: Sclater (1891), Wall: Wall (1909), Smt: Smith (1943), Ahm: Ahmed (1975), WC: Whitaker & Captain (2004), NA: not applicable. * indicates usage of vernacular names.

Species	Rus*	Jerd	Gthr	Blgr	Scltr	Wall	Smt	Ahm	WC
Acrochordus granulatus		1	1	1	1	NA	1	NA	1
Dieurostus dussumierii						NA	1	NA	1
Cerberus rynchops	1	1	1	1	1	NA	1	NA	1
Fordonia leucobalia			1	1	1	NA	1	NA	1
Gerarda prevostiana				1	1	NA	1	NA	1
Cantoria violacea			1	1	1	NA	1	NA	1
Laticauda colubrina		1		1	1	1	1	1	1
L. laticaudata			1	1	1	1	1	1	1
Hydrophis caerulescens			1	1	1	1	1	1	1
H. curtus		1	1	1	1	1	1	1	1
H. cyanocinctus	1	1	1	3	2	1	1	1	1
H. fasciatus			1	1	1	1	1	1	1
H. jerdoni	1		1	1	1	1	1	1	1
H. lapemoides			1	1	1	1	1	1	1
H. mamillaris				1		1	1	1	1
H. nigrocinctus	1	1	1	2	1	1	1	1	1
H. obscurus	2		1	3	3	2	1	1	1
H. ornatus			1	1		1	1	1	1
H. platurus		1	1	1	1	1	1	1	1
H. schistosus	2	1		2	1	1	1	1	1
H. spiralis			1	2	1	1	1	1	1
H. stokesi			1	1		1	1		1
H. stricticollis			1				1	1	1
H. viperinus				2	1	1	1	1	1
Microcephalophis cantoris			1	1	1	1	1	1	1
M. gracilis	1	1	1	1	1	1	1	1	1

& Captain (2004) published a field guide to the snakes of India that illustrated and described 157 of over 270 species of Indian snakes, including 23 species of marine snakes. They provided photographs of several marine snakes providing a useful tool for species identification by non-experts. Smith (1926) who considers *H. hardwickii* to not be part of the Indian sea snake fauna, quotes Günther's (1864) remark that though its type specimen is believed to be from India, several circumstances lead one to suppose that it is from Penang [in Malaysia]. Subsequently, *H. hardwickii* is treated as a synonym of *H. curtus* (see Gritis & Voris 1990).

More recently, several reviews on Indian taxa have appeared (Voris 1972, 2017; Rasmussen 1989, 1992, 1994, 1997; Heatwole et al. 2005, 2012, 2017; Kharin 2005; Kharin & Czeblukov 2006; Somaweera et al. 2006; Somaweera & Somaweera 2009; de Silva et al. 2011; Murphy et al. 2012; Sanders et al. 2013; Wallach et al. 2014; Ukuwela et al. 2017). Other aspects studied include marine snake ecology and conservation, and the distribution and diversity of marine snakes along the coasts of India (Murthy 1977 a,b; Lobo et al. 2005; Lobo 2006; Murthy 2007; Kannan & Rajagopalan 2008; Palot & Radhakrishnan 2010; Adimallaiah 2014). Adimallaiah (2014) reported the poorly-known mud snake *Dieurostus dussumierii* from Kochi beach in the Malabar Coast (also see Chadramouli et al. 2012; Kumar et al. 2012). In Homalopsid snakes, some poorly-known Indian species were researched (Alfaro et al. 2004; Somaweera et al. 2006; Chandramouli et al. 2012; Kumar et al. 2012; Das et al. 2013; Vyas et al. 2013; Adimallaiah 2014; Murphy & Voris 2014; Ukuwela et al. 2017). Lastly, Aengals et al.

(2018) worked on an updated checklist of Indian reptiles, featuring a total of 26 marine snakes.

This summary shows that there has been a considerable amount of work published documenting Indian marine snakes since the 18th Century. Taxonomic inconsistency is evident, with different authors having described the same species using different names or synonyms. Major works from 1796 to 2004 are listed in Table 1, followed by a synopsis for each species mainly sourced from Smith (1943), Golay et al. (1993), Somawera & Somaweera (2009), Wallach et al. (2014) and Uetz & Hosek (2017). An updated chreso-synonymy (sensu Smith & Smith 1973; Dubois 2000), information of type specimen(s), type locality and other pertinent data have also been updated to current taxonomy.

SPECIES SYNOPSIS

Acrochordidae Bonaparte, 1831

File Snake *Acrochordus granulatus* (Schneider, 1799)

Hydrus granulatus Schneider, 1799 (sic)

Anguis granulatus acrochordus Schneider, 1801

Acrochordus fasciatus Shaw, 1802

Pelamis granulatus — Daudin, 1803 (sic, for *Pelamis granulata*)

Chersydrus [fasciatus] — Cuvier, 1817

Chersydrus granulatus — Merrem, 1820

Acrochordus fasciatus — Raffles, 1822

Hydrus granulatus — Raffles, 1822

Acrochordus granulatus — Cantor, 1847

Chersydrus annulatus Gray, 1849

Chersydrus granulatus luzonensis Loverdige, 1938

Type locality: "Madras, India" (fide Sang et al. 2009).

Type specimen: unknown or lost (fide Sang et al. 2009; Wallach et al. 2014).

Homalopsidae Jan, 1863

Dussumier's Mud Snake *Dieurostus dussumierii* (Duméril, Bibron & Duméril, 1854)

Eurostus dussumierii Duméril, Bibron & Duméril, 1854

Hypsirhina dussumieri — Jan, 1863 (nomen incorrectum)

Dieurostus dussumieri —Berg, 1901

Hypsirhina malabarica Werner, 1913

Enhydris dussumieri — Smith, 1943

Enhydris dussumieri — Murphy, 2007

Enhydris dussumieri — Kumar & Captain, 2011 (nomen incorrectum)

Enhydris dussumierii — Chandramouli et al., 2012

Dieurostus dussumieri — Kumar et al., 2012 (nomen incorrectum)

Dieurostus dussumieri — Murphy & Voris, 2014

Dieurostus dussumierii — Wallach et al., 2014

Type locality: Malabar Coast, India / 'Bengal'.

Type specimen: Lectotype, Muséum National d'Histoire Naturelle, Paris, France, MNHN 3751 (after Wallach et al. 2014; *contra* Kumar et al. 2012).

Type species: *Eurostus dussumierii* Duméril, Bibron & Duméril, 1854 is the type species of the genus *Dieurostus* Berg, 1901.

Dog-faced Water Snake *Cerberus rynchops* (Schneider, 1799)

Hydrus rynchops Schneider, 1799

Boa moluroides Schneider, 1801

Hydrus cinereus Shaw, 1802

Coluber cerberus Daudin, 1803

Hurria bilineata Daudin, 1803

Python rhynchops — Merrem, 1820

Homalopsis cerberus — Fitzinger, 1826

Homalopsis molurus H. Boie, 1826

Coluber decipiens Oppel in Boie, 1826

Homalopsis rhynchops — Boie, 1827

Cerberus cerberus — Cuvier, 1829

Homalopsis rufotaeniatus Wagler, 1833

Cerberus grantii Cantor, 1836

Cerberus cinereus — Cantor, 1839

Cerebrus russellii — Fitzinger, 1843

Homalopsis rhinchops (*sic*) — Cantor, 1847; Mason, 1852

Cerberus unicolor Gray, 1849

Cerberus rhynchops — Günther, 1864

Cerberus rhynchops — Anderson, 1871

Hurria rynchops — Stejneger, 1907

Type locality: "Ganjam" (Orissa State, E India).

Type specimen: Lectotype; specimen illustrated in Russell (1796), after Wallach et al. (2014).

Type species: *Hydrus rynchops* Schneider, 1799 is the type species of the genus *Cerberus* Cuvier, 1829.

Crab-eating Water Snake *Fordonia leucobalia* (Schlegel, 1837)

Homalopsis leucobalia Schlegel, 1837

Fordonia leucobalia — Gray, 1842

Fordonia unicolor Gray, 1849

Hemiodontus leucobalia — Duméril, Bibron & Duméril, 1854

Hemiodontus chalybaeus Jan, 1863

Fordonia bicolor Theobald, 1868

Fordonia papuensis Macleay, 1877
Fordonia variabilis Macleay, 1878
Fordonia leucobalia — Smith, 1943

Type locality: Timor (Indonesia) by lectotype designation

Type specimen: Lectotype, Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands RMNH 1161 (see Wallach et al. 2014).

Type species: *Homalopsis leucobalia* Schlegel, 1837 is the type species of the genus *Fordonia* Gray, 1842.

Glossy Marsh Snake *Gerarda prevostiana* (Eydoux & Grevias, 1837)

Coluber (Homalopsis) prevostianus Eydoux & Gervais, 1837
Gerarda bicolor Gray, 1849
Campylodon prevostianum — Duméril, Bibron & Duméril, 1854
Gerarda prevostiana — Cope, 1862
Heleophis flavescens Müller, 1884 (fide Smith, 1943)
Helipophis flavescens Müller, 1884 (fide Murphy & Voris, 2014, in error)
Gerardia prevostiana — Wall, 1905

Type locality: "Manille" (= Manila in Luzon, Philippines)

Type specimens: Syntypes: Muséum national d'Histoire naturelle Paris, France, MNHN 3758 and MNHN 7593 (Wallach et al. 2014).

Remarks: Type specimen details was stated to be unknown by Das et al. (2013).

Type species: *Coluber prevostianus* Eydoux & Grevias, 1837 is the type species of the genus *Gerarda* Gray, 1849.

Mangrove Snake *Cantoria violacea* Girard, 1858

Cantoria violacea Girard, 1858
Hydrodipsas elapiformis Peters, 1859
Hemiodontus elapiformis – Jan, 1863
Cantoria elongata Günther, 1864 (nom. nov. pro *Cantoria violacea* Girard) – nomen nudum Wallach et al., 2014
Cantoria elapiformis – Günther, 1869
Cantoria dayana Stoliczka, 1870
Cantoria dayana — Anderson, 1871
Cantoria violacea — Grandison, 1978

Type locality: "Singapore".

Type specimen: Holotype; United States National Museum, Chicago, USA USNM 5523.

Type species: *Cantoria violacea* Girard, 1858 is the type species of the genus *Cantoria* Girard, 1858.

Remarks: Precise Indian records of this species are from the Andaman Islands (Ghodke & Andrews 2002).

Elapidae Boie, 1827

Common Sea Krait *Laticauda laticaudata* (Linnaeus, 1758)

Coluber laticaudatus Linnaeus, 1758 (part)
Laticauda scutata Laurenti, 1768
Platurus fasciatus Latreille, 1801
Platurus laurenti Rafinesque, 1817 (non *Platurus laurenti* Daudin, 1803)
Aspisurus laticaudatus — Gray in Grey, 1841 (nomen incorrectum) – Wallach et al. 2014
Platurus laticaudatus — Girard, 1858
Platurus fischeri Jan, 1859
Platurus fasciatus Jan, 1859
Platurus affnisi Anderson, 1871
Platurus fischeri — Anderson, 1871
Platurus muelleri Boulenger, 1896
Platurus laticaudatus — Wall, 1906
Laticauda laticaudata — Stejneger, 1907
Laticaudata laticaudata — Oshima, 1910
Laticauda laticauda — Brehm, 1913
Laticauda laticoudata — Khole, 1991

Type locality: "Indiis"; by lectotype designation (see Wallach et al. 2014).

Type specimen: Lectotype; Naturhistoriska Riksmuseet, Stockholm, Sweden NRM (NHRM Lin-87).

Type species : *Coluber laticaudatus* Linnaeus, 1758 is the type species of the genus *Laticauda* Laurenti, 1768.

Yellow-lipped Sea Krait *Laticauda colubrina* (Schneider, 1799)

Hydrus colubrinus Schneider, 1799
Coluber laticaudatus Linnaeus, 1758 (part)
Platurus colubrinus — Wagler, 1830
Coluber platycaudatus Oken, 1836 (nomen substitutum)
Hydrophis colubrina — Schlegel, 1837
Hydrus colubrinus — Begbie, 1846
Laticauda scutata (non Laurenti, 1768) Cantor, 1847
Platurus fasciatus var. *colubrina* — Fischer, 1856
Platurus laticaudatus var. B. — Günther, 1858 (part)
Platurus colubrinus — Fischer, 1884
Platurus colubrinus — Boulenger, 1896 (part)
Laticauda colubrina — Stejneger, 1907
Laticauda celubrina — Deraniyagala, 1977 (nomen incorrectum)

Type locality: "East Indian Ocean" (Bauer 1998)

Type specimen: Holotype; Zoologische Museum, Berlin, Germany, ZMB 9078

Malacca Sea Snake *Hydrophis caerulescens* (Shaw, 1802)

Hydrus caerulescens Shaw, 1802 (sic)
Polyodontus annulatus Lesson, 1834
Hydrophis caerulescens — Gray, 1842
Hydrophis hybrida Schlegel, 1844
? *Hydrophis colubrinus* Jerdon, 1854
Hydrophis protervus Jan, 1859
Hydrophis wertmani Jan, 1859
Hydrophis frontalis Jan, 1863
Hydrophis polydonta Jan, 1863
Hydrophis polyodontus Jan, 1872 in Jan & Sordelli, 1870-1881
Hydrophis caerulescens thai Smith, 1920
Polyodontognathus caerulescens — Wall, 1921
Hydrophis coerulescens — Bouquet, 1964 (nomen incorrectum)
Hyhdrophis caerulscens — Deraniyagala, 1977 (nomen incorrrectum)
Hydrophis coerelescens — Lin, 1975 (nomen incorrectum)
Aturia caerulescens — Welch, 1994
Hydrophis caerulescens — Sanders et al., 2013
Polyodontognathus caerulescens — Wallach et al., 2014

Type specimen: Holotype; The Natural History Museum London, UK, BMNH 1946.1.3.90, from "East-Indian" (= Indian Ocean).

Type locality: Indian Ocean (as East-Indian); however, label on type cites type locality as "Indian Ocean: Vizagapatam" (see Smith 1926).

Short Sea Snake *Hydrophis curtus* (Shaw, 1802)

Hydrus curtus Shaw, 1802
Hydrophis flaviventris Siebold, 1827
Hydrophis pelamidoides Schlegel, 1837
Lapemis curtus — Gray, 1842
Lapemis loreatus Gray, 1843
Hydrus pelamoides Hallowel, 1845 (nomen emendatum)
Hydrophis pelamiodes Duméril, 1853 (nomen incorrectum)
Hydrophis pelamidoides — Duméril, Bibron & Duméril, 1854
Hijdrophis pelamidioides Bleeker, 1856 (nomen emendatum)
Hydrophis (*Pelamis*) *pelamidoides* var. *annulata* Fischer, 1856
Hydrophis (*Pelamis*) *pelamidoides* — Fischer, 1856
Hydrophis problematicus Jan, 1859
Hydrophis propinquus Jan, 1859
Hydrophis abbreviatus Jan, 1863
Hydrophis brevis Jan, 1863
Hydrophis loreata — Günther, 1864
Hydrophis fayreriana Anderson, 1871
Hydrophis fayeri Fayer, 1871 (nomen emendatum)
Hydrophis pelamidoides unimaculatus Peters *in* Martens, 1876
Hydrophis pelamoides Hilgendorf, 1876 (in error)
Hydrophis hardwickei — Boettger, 1888 (emendation)
Hydrophis abreviatus — Casto de Elera, 1895 (nomen incorrectum)
Enhydris curtus — Werner, 1895
Hydrophis pelmoides — Khan, 1982 (nomen incorrectum)
Hydrophis abbreviataus — Culotta & Pickwell, 1993 (nomen incorrectum)
Hydrophis curtus — Sanders et al., 2013
Lapemis curtus — Wallach et al., 2014

Type specimen: Holotype; The Natural History Museum London, UK, BMNH 1946.1.17.59.

Type locality: "East-India", none stated more precisely.

Annulated Sea Snake *Hydrophis cyanocinctus* Daudin, 1803

Hydrophis cyanocinctus Daudin, 1803
Leioselasma striata Lacépède, 1804
Hydrophis chittul Rafinesque-Schmaltz, 1817
Hydrophis striata — Schlegel, 1837
Hydrophis sublaevis Gray, 1842 (in part)
Hydrophis subannulata Gray, 1849
Hydrophis aspera Gray, 1849
? Hydrophis striatus — Duméril, Bibron & Duméril, 1854
Hydrophis striata — Fischer, 1856
Hydrophis westermani Jan, 1859
Hydrophis westermanni — Jan, 1863 (emendation)
Hydrophis trachyceps Theobald, 1868
Hydrophis crassicollis Anderson, 1871
Hydrophis tuberculatus Anderson, 1871
Hydrophis dayanus Stoliczka, 1872
Hydrophis tenuicollis Peters, 1872
Hydrophis asperrimus Murray, 1886
Hydrophis taprobanica Haly, 1887
Hydrophis phipsoni Murray, 1887
Hydrophis cyanocincta — Boulenger, 1887
Distira cyanocincta — Werner, 1895
Distira cyanocincta — Boulenger, 1896
Distira saravacensis Boulenger, 1900
Distira sarawacensis — Shelford, 1901 (nomen

emendatum)

Hydrophis cyanocyneta — Anonymous, 1902 (nomen incorrectum)

Distira longissima Rosén, 1905

Distina cyanocincta — Aiyar, 1906 (nomen incorrectum)

Disteira cyanocincta — Stejneger, 1907

Distra cyanocincta — Castellani & Chalmers, 1913 (nomen incorrectum)

Leioselasma [sic] *cyanocincta* — Wall, 1921

Leioselasma cyanocincta — Prater, 1924

Hydrophis cyanocinctus — Smith, 1943

Hydrophis asperriums — Meyers, 1947 (nomen incorrectum)

Hydrophys cyanocinctus — Anthony, 1955 (nomen incorrectum)

Disteira saravaciensis — Culotta & Pickwell, 1993 (nomen incorrectum)

Hydrophis asperiums — Culotta & Pickwell, 1993 (nomen incorrectum)

Hydrophis cyanocinctus — Sanders et al., 2013

Leioselasma cyanocincta — Wallach et al., 2014

Type specimen: Holotype; The Natural History Museum, London, UK, BMNH 1946.1.9.23 (see Wallach et al. 2014).

Type locality: "Coromandel" Coast of eastern peninsular India, precisely the Sunderban in Bengal.

Remarks: Type material was misreported to be lost by Sang et al. (2009). The nomen *Hydrophis dayanus* Stoliczka, 1872 has varying been considered as a synonym of *H. cyanocinctus* Daudin, 1803 and *H. lapemoides* (Gray, 1849) (see Das et al. 1998).

Banded Sea Snake *Hydrophis fasciatus* (Schneider, 1799)

Hydrus fasciatus Schneider, 1799 (sic)

Hydrophis laticauda Latreille in Sonnini & Latreille, 1801

Anguis xiphura Hermann, 1804

Hydrophis lanceolatus Oken, 1817

Hydrus chlorus Merrem, 1820

Disteira fasciata — Fitzinger, 1826

Hydrus chloris Gray in Griffith & Pidgeon, 1831 (nomen emendatum)

Pelamis Lindsayi Gray in Griffith & Pidgeon, 1831

Hydrophis gracilis (not of Shaw 1802) Schlegel, 1837 (part)

Aturia Lindsayi — Gray, 1842

Colubrinus hydrus Duméril, Bibron & Duméril, 1854

Hydrophis fasciatus — Duméril, Bibron & Duméril, 1854

Hydrophis chloris Günther 1864 (non *H. cloris* Daudin, 1803)

Hydrophis Lindsayi — Anderson, 1871

Hydrophis fasciatus — Peters, 1872

Hydrophis leptodira Boulenger, 1896

Hydrophis fasciatus — Boulenger, 1896

Hydrophis rhombifer Boulenger, 1900

Hydrophis lindsays — Mocquard, 1904 (nomen incorrectum)

Disteira fasciata — Stejneger, 1907 (part)

Hydrophis lindsaya — Wall, 1921 (nomen incorrectum)

Micromastophis fasciatus — Prater, 1924

Aturia fasciata — Wall, 1921

Hydrophis fasciatus — Smith, 1943

Hydrophis fasciatus faciatus — Lin, 1975 (nomen incorrectum)

Pelamis fasciataus — Culotta & Pickwel, 1993 (nomen incorrectum)

Type specimens: Lectotype; Zoologisches Museum Berlin, Germany, ZMB 2836.

Type locality: None given. Smith (1926, 96) stated that the type of *Hydrophis fasciatus* was labelled "East Indies."

Type species: *Hydrus fasciatus* Schneider, 1799 is the type species of the genus *Hydrophis* Latreille *in* Sonnini & Latreille, 1801.

Jerdon's Sea Snake *Hydrophis jerdonii* (Gray, 1849)

Eryx shiddil Wagler, 1825 (nomen ineditum)

Hydrus shiddil Boie, 1827 (nomen nudum)

Kerilia jerdonii Gray, 1849 (sic)

Hydrus cantori Jerdon, 1854

Hydrophis jerdonii — Anderson, 1871

Distira jerdonii Boulenger, 1896

Hydrophis jerdonii — Boulenger, 1912

Kerilia jerdonii — Wall, 1921

Kerilia jerdoni siamensis Smith, 1926

Hydrophis jerdone — Culotta & Pickwell, 1993 (nomen incorrectum)

Hydrophis jerdonii — Sanders et al., 2013

Type specimen: Holotype; The Natural History Museum London, UK, BMNH 1946.1.10.11.

Type locality: Madras, India.

Type species: *Kerilia jerdoni* Gray, 1849 is the type species of the genus *Kerilia* Gray, 1849. The validity of the subspecies has been questioned before (see Rasmussen & Anderson 1990).

Persian Gulf Sea Snake *Hydrophis lapemoides* (Gray, 1849)

Aturia lapemoides Gray, 1849
Hydrophis lapemoides — Günther, 1864
Hydrophis holdsworthii Günther, 1872
Hydrophis stewartii Anderson, 1872
Distira lapemioides — Boulenger, 1890 (nomen emendatum)
Distira lapemoides — Werner, 1895
Distira lapemoides — Wall, 1909
Lioselasma [sic] *lapemidoides* [sic] — Wall, 1921
Distira lapimoides — Phisalix, 1922 (nomen incorrectum)
Disteira lapemoides — Werner, 1924
Hydrophis lapemoides — Smith, 1926
Lioselasma lapemoides — Culotta and Pickwell, 1993
Chitulia lapemoides — Kharin, 2005
Hydrophis lapemoides — Sanders et al., 2013

Type specimen: Lectotype; The Natural History Museum London, UK, BMNH 1946.1.7.2 (after Wallach et al. 2014).

Type locality: Ceylon, now Sri Lanka.

Bombay Gulf Sea Snake *Hydrophis mamillaris* (Daudin, 1803)

Anguis mamillaris Daudin, 1803
Hydrophis tesselatus — Murray, 1886
Hydrophis mammillaris — Wall, 1906 (nomen emendatum)
Lioselasma mamillaris — Wall, 1921 (*sic*)
Leioselasma mamillaris — Smith, 1926
Hydrophis mamillaris — Smith, 1943
Aturia mamillaris — Welch, 1994
Hydrophis mamillaris — Das, 1996
Hydrophis mammillaris [sic] — Khan, 2002 (incorrect spelling)
Chitulia mamillaris — Kharin, 2005
Hydrophis mamillaris — Sanders et al., 2013 (by implication)
Chitulia (Dolichodira) mamillaris — Kharin, 2012
Chitulia mamillaris — Wallach et al., 2014

Type specimen: Neotype; The Natural History Museum London, UK, BMNH 1861.12.30.38 (Wallach et al. 2014).

Type locality: “Vizagapatam” (=Vishakhapatnam), in northeastern Andhra Pradesh, India.

Black-banded Sea Snake *Hydrophis nigrocinctus* Daudin, 1803

Hydrophis nigrocinctus Daudin, 1803
Hydrophis nigro-cinctus — Duméril, Bibron & Duméril, 1854
Hydrophis nigrocincta — Fischer, 1856
Hydrophis nigro-cincta — Viaud-Grant-Marias, 1880 (nomen illegitimum)
Hydrophis nigrocyneta — Anonymous, 1902 (nomen incorrectum)
Melanomystax nigrocinctus — Wall, 1921
Hydrophis nigrocinctus — Smith, 1943
Disteira walli Kharin, 1989
Disteira nigrocincta — Welch, 1994
Disteira nigrocinctus — Rasmussen, 1997
Disteira nigrocincta — Wallach et al., 2014

Type specimen: Holotype; The Natural History Museum London, UK, BMNH 1946.1.10.13, depicted in Russell, 1801, p. 7, pl. 6.

Type locality: salted waters of a river near Calcutta, Sundarban, West Bengal, India.

Estuarine Sea Snake *Hydrophis obscurus* Daudin, 1803

Hydrophis obscura Daudin, 1803
Hydrophis cloris Daudin, 1803
Hydrophis shooter Rafinesque-Schmaltz, 1817
Pelamis chloris — Merrem, 1820 (nomen emendatum)
Leioselasma obscura — Fitzinger, 1827
Hydrophis subcinctus Gray, 1842
Hydrophis coronata Günther, 1864
Hydrophis latifasciata Günther, 1864
Hydrophis subcincta — Günther, 1864
Hydrophis coronata — Anderson, 1871
Porrecticollis obscurus — Wall, 1921
Hydrophis obscurus — Smith, 1943
Porreticollis obscurus — Culotta & Pickwell, 1993 (nomen incorrectum)

Type specimen: Holotype; The Natural History Museum London, UK, BMNH 1946.1.9.27 (specimen depicted in Russell, 1801, pl. 8).

Type locality: Sandbarbans, now Sunderban, West Bengal, India.

Cochin Banded Sea Snake *Hydrophis ornatus* (Gray, 1842)

Aturia ornata Gray, 1842
Hydrophis laevis Lütken, 1863 (nomen praeoccupatum)
Hydrophis ellioti Günther, 1864
Hydrophis ornata — Günther, 1864
Hydrophis godeffroyi Peters, 1879
Hydrophis ellioti — Boulenger, 1887
Distira andamanica Annandale, 1905

Distira mjobergi Lönnberg & Andersson, 1913

Distira godeflovi — Phisalix, 1922 (nomen incorrectum)

Disteira ornata — Taylor, 1922

Hydrophis inornatus — Smith, 1926

Distira ornata godeffroi — Takahashi, 1935 (nomen incorrectum)

Hydrophis ornatus — Smith, 1943

Hydrophis ornatus maresinensis Mittleman, 1947

Hydrophis ornata godeffrayi — Wang & Wang, 1956 (nomen incorrectum)

Hydrophis maresianus Kelmmer, 1963 (nomen emendatum)

Hydrophis ernata— Deraniyagala, 1974 (nomen incorrectum)

Hydrophis oranatus — Tamiya & Puffer, 1974 (nomen incorrectum)

Hydrophis elliotti — Culotta & Pickwell, 1993 (nomen incorrectum)

Chitulia ornata — Wallach et al., 2014

Type specimen: Holotype; The Natural History Museum London, UK, BMNH 1946.1.23.72.

Type locality: none given; later restricted to Indian Ocean by Günther (1864).

Black and Yellow Sea Snake *Hydrophis platurus* (Linnaeus, 1766)

Anguis platura Linné, 1766

Anguis platuros — Gmelin, 1789 (nomen incorrectum)

Hydrus bicolor Schneider, 1799

Pelamis bicolor — Schneider, 1799

Pelamis platuros [sic] Daudin, 1803

Pelamis bicolor — Daudin, 1803

Natrix dorsalis Rafinesque-Schmaltz, 1817

Ophinectes lutens Rafinesque-Schmaltz, 1817

Pelamis schneideri Rafinesque-Schmaltz, 1817 (nomen substitutum)

Hydrophis pelamis Schlegel, 1837 (nomen substitutum)

Pelamis ornata Gray, 1842 (non *Aturia ornata* Gray, 1842)

Pelamis bicolor var. *maculata* Duméril, Bibron & Duméril, 1854 (nomen nudum)

Pelamis bicolor var. *variegata* Duméril, Bibron & Duméril, 1854

Pelamis bicolor var. *sinuata* Duméril, Bibron & Duméril, 1854

Hydrophis (Pelamis) bicolor var. *alternans* Fischer, 1855

Hydrophis (Pelamis) bicolor var. *sinuata* — Fischer, 1855

Pelamijs bicolor — Bleeker, 1856 (nomen emendatum)

Hydrophis (Pelamis) bicolor var. *alternans* Fischer, 1856 (nomen substitutum pro *P. variegata*).

Hydrophis (Pelamis) bicolor — Fischer, 1856

Hydrophis (Pelamis) bicolor var. *sinuata* — Fischer, 1856

Hydrophis bicolor chinensis Jan, 1859

Pelamis tricolor Bennett, 1862

Pelamides platurus — Blyth, 1863 (nomen incorrectum)

Hydrophis bicolor maculata Jan, 1863 (nomen nudum)

Hydrophis bicolor maculata Jan, 1872 in Jan & Sordelli, 1870-1881

Pelamis platurus — Stoliczka, 1872

Hydrus platurus — Boulenger, 1896

Hydrus platyurus — Lydekker, 1901 (nomen incorrectum)

Hydrus platurus linnaeus — Castellani & Chalmers, 1910 (nomen incorrectum)

Pelamydrus platurus — Stejneger, 1910

Hydrus platurus pallidus Wall, 1921

Hydrus platurus subobscurus Wall, 1921

Pelamydrus platalus — Nagai, 1928 (nomen incorrectum)

Pelamas platurus — Deam, 1938 (nomen incorrectum)

Pelamiris platurus — Daniel, 1949 (nomen incorrectum)

Pelamis platura brunnea Deraniyagala, 1955

Pelamis platura fasciata Deraniyagala, 1955

Pelamis platura leucostriata Deraniyagala, 1955

Pelamis platura neuricatenata Deraniyagala, 1955

Pelamis platura neurileucura Deraniyagala, 1955

Pelamis platura tricolor Deraniyagala, 1955

Pelamis platyura — Deraniyagala, 1977 (nomen incorrectum)

Palemis platurus — Felger & Moser, 1985 (nomen incorrectum)

Pelamydrus platarus — Culotta & Pickwell, 1993 (nomen incorrectum)

Hydrophis platurus — Sanders et al., 2013

Type specimen(s): Cabinet of Natural Wonders of F. Ziervogel, pharmacist to the Royal Court in Stockholm, fide E. Thorsell (in litt.) ; but stated to be in Department of Vertebrate Zoology, Stockholm, Stockholm, Sweden, NHR fide Wall (1921) (see Wallach et al. 2014).

Type locality: Unknown, erroneously cited as Suriname (Wallach et al. 2014)

Remarks: Holotype was stated to be unknown by Sang et al. (2009).

Type species: *Hydrus bicolor* Schneider, 1799 is the type species of the genus *Pelamis* Daudin, 1803.

Hook-nosed Sea Snake *Hydrophis schistosus* Daudin, 1803

Hydrophis schistosus Daudin, 1803

Enhydris valakadin Rafinesque-Schmaltz, 1817

Hydrophis cianura Rafinesque-Schmaltz, 1817

Hydrophis hoglin Rafinesque-Schmaltz, 1817

Hydrus valakadjen — Boie in Schlegel, 1826 (nomen incorrectum)

Hydrophis flaviventris Siebold, 1827

Hydrus valakadyn — Boie, 1827 (nomen incorrectum)

Disteira russelii Fitzinger, 1827 (based on Russell 1801)

Polyodontes annulatus Lesson, 1832 in Bélanger, 1831-1834

Hydrophis schistosa (not of Daudin, 1803) Schlegel, 1837

Hydrophis bengalensis Gray, 1842

Hydrophis subfasciata Gray, 1842

Enhydrina valakadyen — Gray, 1849 (nomen emendatum)

Thalassophis werneri Schmidt, 1852

Thalassophis werneria Duméril, Bibron & Duméril, 1854 (nomen emendatum)

Hydrophis schistosus — Duméril & Bibron & Duméril, 1854

Hydrophis schistosa — Fischer, 1856

Enhydrina schistosa — Stoliczka, 1870

Enhydrina valakadyen — Stoliczka, 1870

Enhydrina valacadyen — Anderson, 1872 (nomen incorrectum)

Hydrophis fasciatus (not of Schneider, 1799) — Jan, 1872

Hydrophis schistosus — Jan, 1872

Entrydrina bangaensis — Phipson, 1887 (nomen incorrectum)

Enhydrina valakadien — Boulenger, 1890 (nomen emendatum)

Enhydrina vikadien — Boettger, 1892 (nomen incorrectum)

Enhydrina schistosa — Van Denburgh, 1895

Enhydrina velakadien — Flower, 1899 (nomen incorrectum)

Enhydrina valacadjen — Kathariner, 1900 (nomen incorrectum)

Enhydrina schistoza — Codoceo, 1956 (nomen incorrectum)

Enhydrina schitosa — Bouquet, 1964 (nomen incorrectum)

Enhydrena schistose — Chippaux & Goyffon, 1983 (nomen incorrectum)

Enhydria schistose — Murthy, 1986 (nomen incorrectum)

Enhydrina valacadien — Culotta & Pickwell, 1993 (nomen incorrectum)

Disteira schistosa — McDowell, 1972

Hydrophis schistosus — Sanders et al., 2013

Type specimen: Holotype; The Natural History Museum London, UK, BMNH 1946.1.10.7.

Type locality: Tranquebar (now Tarangampadi), Tamil Nadu, India.

Type species: *Hydrophis schistosus* Daudin, 1803 is the type species of the genus *Enhydrina* Gray, 1849.

Yellow Sea Snake *Hydrophis spiralis* (Shaw, 1802)

Hydrus spiralis Shaw, 1802

Hydrus brugmannii Boie in Schlegel, 1826 (nomen nudum)

Hydrophis brugmansii Boie, 1827 (nomen emendatum)

Hydrophis melanurus Wagler, 1828

Hydrophis sublaevis Gray, 1842 (in part)

Hydrophis spiralis — Duméril, Bibron & Duméril, 1854

Hydrophis rappi Jan, 1863 (nomen nudum)

Hydrophis robusta Günther, 1864

Hydrophis robsustus — Theobald, 1868

Hydrophis rappii Jan, 1872 in Jan & Sordelli, 1870-1881

Hydrophis temporalis Blanford, 1881

Hydrophis bishopii Murray, 1884

Hydrophis aurifasciata Murray, 1886

Hydrophis melanocinctus Wall, 1906

Hydrophis brugmansii — Boulenger, 1912

Distira brugmansi — Stone, 1913

Lioselasma [sic] *spiralis* — Wall, 1921

Distira spiralis typica Raj, 1926

Hydrophis spiralis — Smith, 1943

Leioselasma spiralis — Prater, 1924

Hydrophis rapii — Culotta & Pickwell, 1993 (nomen incorrectum)

Leiocephalus spiralis — Das, 1996

Leioselasma spiralis — Wallach et al., 2014

Type specimen: Holotype; The Natural History Museum London, UK, BMNH 1946.1.6.94.

Type locality: Indian Ocean.

Remarks: Perhaps the largest of true sea snakes, at

least among those found in Indian waters (Wall 1909; Smith 1926, 1943; Whitaker & Captain 2004).

Stoke's Sea Snake *Hydrophis stokesii* (Gray, 1846)

Hydrus stokesii Gray, 1846
Hydrus major Shaw, 1802 (part)
Hydrophis schizopholis Schmidt, 1846
Hydrus annulatus Gray, 1849
Hydrophis schizopholis — Duméril, Bibron & Duméril, 1854
Astrotia schizopholis — Fischer, 1856
Hydrophis güntheri Theobald, 1868 (nomen praeoccupatum)
Hydrophis granosa Anderson, 1871
Hydrophis guttata Murray, 1887
Disteira stokesii— Boulenger, 1896
Astrotia stokesi — Wall, 1909
Astrossii stokesii — Lowe, 1932 (nomen incorrectum)
Astrokia stokesi — Ruiter, 1958 (nomen incorrectum)
Astoria stokesi — Sawai, 1976 (nomen incorrectum)
Astroria stokesi — deSilva, 1976 (nomen incorrectum)
Astrocia stokessi — Khole, 1991 (nomen incorrectum)
Hydrophois guentheri — Cogger, 1983 (nomen corrigendum)
Hydrophis stokesii — Sanders et al., 2013
Astrotia stokesii — Wallach et al., 2014

Type specimen: Holotype; The Natural History Museum London, UK, BMNH 1946. 1. 17. 12.

Type locality: Australian Seas.

Type species: *Hydrus stokesii* Gray *in* Stokes, 1846 is the type species of the genus *Astrotia* Fischer, 1855.

Narrow-collared Sea Snake *Hydrophis stricticollis* Günther, 1864

Hydrophis stricticollis Günther, 1864
Hydrophis neglectus Wall, 1906
Distira neglecta — Wall, 1909
Aturia stricticollis — Welch, 1994
Chitulia stricticollis — Kharin, 2005
Chitulia (*Dolichodira*) *stricticollis* — Kharin, 2012
Hydrophis stricticollis — Sanders et al., 2013
Chitulia stricticollis — Wallach et al., 2014

Type specimen: Holotype; The Natural History Museum London, UK, BMNH 1946.1.6.90.

Type locality: Bay of Bengal, India.

Viperine Sea Snake *Hydrophis viperinus* (Schmidt, 1852)

Thalassophis viperina Schmidt, 1852
Diseira praescutata Duméril, 1853 (nomen nudum)
Diseira praescutata Duméril, Bibron & Duméril, 1854
Hydrophis doliata (not of Lacépède, 1804) Fischer, 1856
Hydrophis obscurus (not of Daudin, 1803) Jan, 1859 (nomen praeoccupatum)
Hydrophis nigra Anderson, 1872
Hydrophis jayakari Boulenger, 1887
Hydrophis plumbea Murray, 1887
Hydrophis viperinus — Boettger, 1888
Distira viperina — Boulenger, 1896
Disteira viperina — Stejneger, 1907
Praescutata viperina — Wall, 1921
Thalassophina viperina — Smith, 1926
Thallassophina viperina — Corkil, 1932 (nomen incorrectum)
Thalassophinae viperina — Maegraith, 1958 (nomen incorrectum)
Praescutata viperine — Sayed, 1972 (nomen incorrectum)
Paraescutata viperina — Khan, 1982 (nomen incorrectum)
Enhydrus plumbea — Culotta & Pickwell, 1993 (lapsus calami)
Thalassophina veperina — Culotta & Pickwell, 1993 (nomen incorrectum)
Hydrophis viperinus — Sanders et al., 2013
Thalassophina viperina — Wallach et al., 2014

Type specimen: Holotype; Zoologisches Museum Hamburg, Germany, ZMH 404, destroyed in World War II (see Wallach et al. 2014).

Type locality: coast of Java.

Type species: *Thalassophis viperina* Schmidt, 1852 is the type species of the genera *Praescutata* Wall, 1921 and *Thalassophina* Smith, 1926.

Remarks: Smith (1926) whilst erecting the genus *Thalassophina*, overlooked the existing senior nomen *Praescutata* Wall, 1921, a stance that he corrected later (Smith 1943). *Praescutata* Wall, 1921 is also regarded by some authorities as a nomen ineditum (see Wallach et al. 2014).

Cantor's Small-headed Sea Snake *Microcephalophis cantoris* (Günther, 1864)

Hydrophis cantoris Günther, 1864
Distira gillespiae Boulenger, 1899
Microcephalophis cantoris — Wall, 1921

Microcephalophis cantori Lin, 1975 (nomen incorrectum)

Hydrophis (Microcephalophis) cantoris — Kharin, 2004

Microcephalophis cantoris — Sanders et al., 2013; Wallach et al., 2014

Type specimen: Holotype; The Natural History Museum London, UK, BMNH 1946.1.18.30.

Type locality: Penang, Malaysia.

Common Small-headed Sea Snake *Microcephalophis gracilis* (Shaw, 1802)

Hydrus gracilis Shaw, 1802 (sic)

Disteira gracilis — Fitzinger, 1826

Microcephalophis gracilis — Lesson, 1834

Hydrus kadell-nagam Boie, 1827 (based on Russell, 1801) (nomen incorrigendum)

Hydrus garcilis — Mason, 1852 (nomen emendatum)

Thalassophis microcephala Schmidt, 1852

Hydrophis microcephalus — Duméril, Bibron & Duméril, 1854

Hydrophis gracilis — Duméril, Bibron & Duméril, 1854

Hydrophis microcephala — Fischer, 1856

Hydrophis gracilis — Fischer, 1856

Hydrophis leprogaster Duméril, 1853 (nomen nudum)

Hydrophis leprogaster Duméril & Bibron in Fischer, 1856

Hydrophis guentheri Theobald, 1868

Hydrophis guntherii — Murray, 1884 (nomen emendatum)

Distira gracilis — Wall, 1909

Hydrophis rostralis Smith, 1917

Microcephalophis gracilis gracilis Smith, 1926

Microcephaloides gracilis — Barret, 1950 (nomen incorrectum)

Distevia gracilis — Okada, 1953 (nomen incorrectum)

Microcephalus graculis — Saint-Girons, 1967 (nomen incorrectum)

Microcephalophus gracilis — Vitt, 1987 (nomen incorrectum)

Microcephalophus gracilis microcephalophis — Culotta & Pickwell, 1993 (nomen incorrectum)

Microcephalophis gracilis — Culotta & Pickwell, 1993 (nomen incorrectum)

Hydrophis (*Microcephalophis*) *gracilis* — Kharin, 2004

Microcephalophis gracilis microcephalus — Kharin, 2005

Microcephalophis gracilis — Sanders et al., 2013

Microcephalophis gracilis — Wallach et al., 2014

Type specimen: Holotype; The Natural History Museum London, UK, BMNH 1946.1.17.37.

Type locality: none given.

Type species: *Hydrus gracilis* Shaw, 1802 is the type species of genus *Microcephalophis* Lesson, 1832.

Remarks: One of the few sampled genera of true sea snakes found in Indian waters that was not nested within *Hydrophis* group taxa (Sanders et al. 2013).

THREATS AND CONSERVATION STRATEGIES

The major threat to the survival of marine snakes in India is not known precisely but their primary or direct threat is considered to be death by entangling in fishing nets when caught as bycatch by the trawlers, in fact those which survive are killed by the fishermen. The indirect threat is due to the degradation of their ecosystems like coral reef and destruction of mangrove forest habitat. Sea snakes are caught as the bycatch in trawls, and it is assessed that roughly 50% of mortality is by suffocating or being smashed by the heaviness of the catch in the trawls (Ward 2000; Wassenberg et al. 2001; Milton et al. 2009). Mass bycatch mortality of sea snake (*Hydrophis schistosus*) was reported in Goa (Padate et al. 2009). In 2015 another such instance was noted, resulting in a mass mortality in two consecutive days where around 60–80 dead sea snakes lay scattered over 20–30 meter stretch on shore. This occurred because of the operation of shore seines pulled down to the shore and the catch landed by the fishermen. Sea snakes when encountered get killed intentionally as their presence is perceived as a threat by the local community (Jamalabad 2015). Prawn trawling and boat seine nets are also among the top threats for sea snakes. In a study reported from Puducherry coast, nearly 234 *Hydrophis schistosus* were found trapped in 316 trawling nets. In 63 boat seine nets around 103 sea snakes were found entangled (Muthukumaran et al. 2015). Though some southeastern Asian countries exploit sea snakes for their meat for food and animal food purpose, in India they are not exploited for food industries, but yet many other threats doom the marine snakes in India (Das 2012; Sarker 2013; Cao et al. 2014).

A legal management plan for the conservation of marine snake species in India is the Indian Wildlife (Protection) Act, 1972 wherein the species are protected under Schedule IV. Status of the world's sea snakes

according to IUCN category has been enumerated by Livingstone (2009) and several threatened species find place in that list. Lukoschek et al. (2013) reported on inexplicable declines in sea snake populations in Great Barrier Reef of Australia. Although marine snakes are designated as scheduled species in India to prevent exploitation, there is a need for better understanding on the impacts and vulnerability assessments of marine snakes. There is no major study on the environmental impacts and direct human threats to marine snakes are practically unknown, therefore we require a multidisciplinary effort (Elfes et al. 2013). Implementation of long-term bycatch monitoring programme to obtain baseline evidence on the abundance of the sea snake species. The most fundamental aspect of conservation effort is to analyze the areas of high biodiversity and the distribution of threatened species (Brooks et al. 2006; Hoffman et al. 2008).

BITES AND TOXINOLOGY

Bites and toxinology of sea snakes, particularly with reference to Indian scenario have been briefly reviewed by Vijayaraghavan & Ganesh (2015) and Whitaker & Martin (2015). This is sumamrised in the following: "Sea snake bites are consensually accepted as being potentially lethal to human beings and produce symptoms such as are postsynaptic neurotoxic activity, attenuated twitch blockade, degenerative changes in the central nervous system, petechiae and ecchymoses throughout the viscera, distal tubular necrosis in the kidney, lung emphysema and patchy edema, slight endocardial fibrosis, coronary sclerosis, centrilobular degeneration and necrosis in the liver, porter round-cell infiltration in the liver, and myoglobinuria". Toxinology of sea snake envenomations have been compiled by Reid (1979), Pickwell (1994) and Takasaki (1998). Ali et al. (2000) reported the bite management of an India species *Hydrophis cyanocinctus*, based on Malyan case studies. Lomonte et al. (2014) reported the envenomation and treatment of the bites of *Hydrophis platurus* based on a study from Central America. Tan et al. (2015a) reported on envenomation management in Malaysia, for one of India's widespread and fairly defensive species of sea snake – *Hydrophis schistosus*. Tan et al. (2015b, 2016) reported on cross-neutralisation by Malayan anti-cobra antivenom, of sea snake envenomations in two species – *H. schistosus* and *H. curtus*, both of which occur in India. Cases of fatality from sea snake (*Hydrophis schistosus*) bites were documented in Sri Lanka (Vithanage & Thirumavalavan 2013; Kularatne et al. 2014). The portion on snake envenomations by McGoldrick & Marx (1991) and Fenner (1998) may also be referred.

CONCLUSION

Indian marine snakes have been scientifically known and described as early as the late 18th Century, yet, there are many radical changes in their classification at species-level, genus-level and even family-level up to this day. Conflicting consensus on the taxonomy and nomenclature is far higher for this group than other snakes in India.

Many are widespread along the coast of the country, but still newer observations and records turn up. Some are so rare that they have been sporadically sighted and not adequately documented by researchers.

Many are potentially venomous and known to cause life-threatening envenomations in adult humans. As of date, specific anti-venom is unavailable for the bites and their venoms are poorly researched in India.

Some species are encountered by fishermen while entangled in the fishing gears, especially the bottom trawling nets. Often, a sharp hook-shaped pole is used to peg and throw them back into the sea. Snakes brought ashore are usually discarded on the shores or at the landing sites.

Despite being so, the biology and natural history for many species still remain obscure with no proper field observations and scientific studies.

Marine species are well-protected statutorily in most areas, both inside and outside marine protected areas (MPAs). Marine snakes often get prejudiced and killed / harmed directly by people when encountered.

India with many zoos and serpentaria has a poor history of captive stock and studies on marine snakes in such captive care facilities.

Fraught with so many paradoxes and challenges, it is hoped that this overview will stimulate further research interest and attract conservation attention towards this group of snakes.

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Image 1. Some Indian marine snakes: a - *Dieurostus dussumierii*; b - *Cerberus rynchops*; c - *Acrochordus granulatus*; d - *Laticauda colubrina*; e - *Hydrophis platurus*; f - *Hydrophis fasciatus*; g - *Hydrophis cyanocinctus*; h - *Hydrophis caerulescens*; i - *Hydrophis ornatus*; j - *Hydrophis schistosus*; k - *Hydrophis spiralis*; l - *Hydrophis curtus*.

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Key to Indian marine snakes

"*The classification of sea snakes has proved to all observers a most difficult task, in fact has given more trouble than that of any other Ophidian family*" - Wall, 1906

"*This group [i.e. sea snakes] is admittedly a difficult one, and has lead to considerable diversity of opinion among herpetologists …*" - Smith, 1926

The following key has been, to certain extent, modified from Smith (1943); however, in certain cases the arrangement has been newly devised for certain groups, based on customized set of character-states largely due to the change in generic allocation and the number of species in each group.

A. No enlarged teeth, skin very coarse and loosely attached ..... *Acrochordus granulatus*
B. Enlarged maxillary fangs at the rear of jaw; grooved
I. Nasal scales touch one another; parietals broken up; scales keeled ..... *Cerberus rynchops*
II. Nasal scales separated by internasal; parietals entire; scales usually smooth
a. Midbody scalerows 25–27, loreal present ..... *Dieurostus dussumierii*
b. Midbody scalerows 25–27, loreal absent ..... *Fordonia leucobalia*
c. Midbody scalerows 17, nasal scale smaller than internasal ..... *Gerarda prevostiana*
d. Midbody scalerows 19, nasal scale larger than internasal ..... *Cantoria violacea*
C. Enlarged maxillary fangs at the front of jaw; not grooved but hollow
I. Ventral scales very wide, extending to the full belly width ..... *Laticauda*
a. Midbody scalerows 19; prefrontals 2; no azygous extra scale ..... *L. laticaudata*
b. Midbody scalerows 21–25; prefrontals 3, often with an extra azygous scale ..... *L. colubrina*
II. Ventrals scales much reduced in width, without any median groove
i. Head scales not normal; parietals scales often broken–up ..... *Hydrophis curtus*
ii. Head scales normal, neck slightly narrower than trunk; two (or three) anterior temporals
a. Midbody scalerows 39–45; ventrals 296–330 ..... *H. nigrocinctus*
b. Midbody scalerows 37–47; ventrals 300–390 ..... *H. cyanocinctus*
c. Midbody scalerows 45–55; ventrals 374–452 ..... *H. stricticollis*
d. Midbody scalerows 33–55; ventrals 209–312 ..... *H. ornatus*
e. Midbody scalerows 43–51; ventrals 314–372 ..... *H. lapemoides*
f. Midbody scalerows 35–43; ventrals 302–390 ..... *H. mamillaris*
g. Midbody scalerows 38–54; ventrals 253–334 ..... *H. caerulescens*
h. Midbody scalerows 47–59; ventrals grooved, paired, 226–286 ..... *H. stokesii*
i. No distinct mental groove; black and yellow colouration ..... *H. platurus*
iii. Head normal; neck as wide as other parts of trunk; usually one anterior temporal
a. Midbody scalerows 19–21; snout declivous ..... *H. jerdoni*
b. Midbody scalerows 39–55; mental elongate, hidden in a groove ..... *H. schistosus*
iv. Head and neck very thin and much narrower than rest of the trunk
a. One anterior temporal; midbody scalerows 47–58 ..... *H. fasciatus*
b. two or three anterior temporals; midbody scalerows 29–37; ventrals 300–338 ..... *H. obscurus*
v. Ventral scales posteriorly with median furrow, partly or fully divided, spiny and tuberculate
a. Prefrontal not touching 3rd supralabial; ventrals 220–287..... *Microcephalophis gracilis*
b. Prefrontal touching 3rd supralabial; ventrals 404–468 ..... *M. cantoris*

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