Available online at: www.mbai.org.in doi: 10.6024/jmbai.2014.56.1.01750s-17

Checklist of Chondrichthyans in Indian waters

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Received: 23 Jun 2014, Accepted: 30 Jun 2014, Published: 15 Oct 2014

Original Article

Abstract

Conservation, management and sustainable utilisation of biological resources depend on the accurate identification of exploited taxa, which emphasises the need for systematic taxonomic research. Chondrichthyans (sharks, rays, skates and chimaeras) are considered to be one of the most vulnerable exploited marine resources, however, the basic taxonomic study of these groups in Indian waters needs improvement to achieve better management for their sustainable exploitation. We discuss issues concerning chondrichthyan taxonomic research in India and provide an extended, updated checklist of chondrichthyans listed/reported from Indian waters, together with comments on their occurrence.

Keywords: *Chondrichthyans, checklist, taxonomy, status, India, diversity, management, conservation.*

Introduction

India has many different climatic, ecological and bio-geographical zones, and diverse faunal and floral groups in its ecosystems. Conservation and management of this diversity is important to maintain the equilibrium of ecosystems and for their potential human usage. Conservation, management and sustainable utilisation depend on the quantitative and qualitative assessment of biodiversity, taxonomic identity and understanding the taxa of concern (Narendran, 2001; Agnarsson and Kuntner, 2007; Prathapan *et al.*, 2009).

Large amounts of research funding and effort have been invested to provide an inventory of the biodiversity of India. However, our current taxonomic and systematic knowledge on certain groups are inadequate, scattered and mostly unorganised (Narendran, 2001; Hariharan and Balaji, 2002; Kumaran, 2002; Aravind *et al.*, 2004; Das *et al.*, 2006; James, 2010; Vishwanath and Linthoingambi, 2010; Wafar *et al.*, 2011). Understanding the fauna and its diversity in specific habitats/ecosystems/regions of the country, with their distribution patterns and phylogeography, is an important baseline for future studies and for the formulation of conservation and management plans.

Chondrichthyans include all cartilaginous fish species commonly called sharks, rays, skates and chimaeras. They are widely distributed in all the world's oceans, but are most diverse in the tropical and subtropical Indo-Pacific Ocean (Bonfil, 2002). Chondrichthyans are one of the most vulnerable groups due to their biological characteristics. Global concern over these apex predators is increasing as

high exploitation rates are decreasing their stocks (Smith *et al.*, 1998; Baum *et al.*, 2003; Garcia *et al.*, 2008; Dulvy *et al.*, 2014). Documenting chondrichthyans in specific regions and understanding their taxonomy and diversity in particular ecosystems are very important for conservation and management of these decreasing resources.

Chondrichthyan research is limited in India despite its rich diversity, long history and huge fishery. An impediment to chondrichthyan research in India is a lack of comprehensive taxonomic studies/revisions and conclusive checklists. This paper presents an extended, updated checklist of chondrichthyans reported from Indian waters, together with comments on their taxonomic status and validity of occurrence.

Material and methods

The chondrichthyan checklist presented in this paper is based on a review of available publications, monographs and catalogues on their diversity, taxonomy, life history (biology, food and feeding, stock assessments), ecology and fishery; along with reports of exploratory surveys from Indian seas. Chondrichthyans identified from field and exploratory surveys conducted during 2008-2013 by the authors and information shared by colleagues are also included in the list. Validity status and occurrence from the region was confirmed and evaluated following recent publications and Eschmeyer (2014). The IUCN assessment category (IUCN, 2013) for each species is also listed.

Results

Diversity and taxonomic status of Indian chondrichthyans

Chondrichthyans found in Indian waters have been catalogued by several researchers, but an exhaustive inventory remains elusive. Day (1889) reported 69 species, Misra (1952) reported 52, Misra (1969) reported 114 species and Talwar and Kacker (1984) reported 76 species. Raje *et al.* (2002) listed 110 elasmobranch species, Venkataraman *et al.* (2003) prepared a field identification handbook on sharks containing 72 species, and Raje *et al.* (2007) listed 84 elasmobranchs from the commercial fishery. These publications during different periods have therefore recorded between 52 and 114 species occurring in the Indian seas.

This study provides a checklist of 227 chondrichthyan species (from 11 orders and 41 families) recorded/listed from Indian seas (Table 1). In this combined list, 27 species (12%) have questionable status with regard to their occurrence because their distributional range does not fall within Indian seas as per recent studies. For example, the yellow spotted catshark *Scyliorhinus capensis* (Smith, 1838) is known only from the southeast Atlantic Ocean and off South Africa in the Indian Ocean (Compagno, 1984) but is listed as occurring in India (Gunther, 1870; Day, 1878). A further 41 species (18%) listed from India need confirmation. These may have distributional ranges including India or parts of Indian seas, but require taxonomic reports for confirmation. Excluding species with uncertain status and several undescribed common species, the valid species from Indian waters total 155. This includes more than 40 additional species over those reported by previous workers (Raje *et al.*, 2007), but we believe the list is still incomplete.

Chondrichthyan species diversity in Indian seas is higher than that reported in many other tropical Indian Ocean countries or regions such as the Arabian Gulf (43 sharks) (Moore *et al.*, 2012), Sri Lanka (92 elasmobranchs) (Moron *et al.*, 1998; De Silva, 2006), Maldives (51 elasmobranchs) (Anderson and Hafiz, 2002) and Thailand (145 elasmobranchs) (Vidthayanon, 2002). However, a higher number (137-207 species) have been reported from Indonesia (White *et al.*, 2006; Fahmi, 2010).

The taxonomic problems with regard to Carcharhiniformes, Squaliformes and Myliobatiformes are yet to be resolved, which could lead to a greater known diversity in Indian seas. e.g., of the 24 squaliform shark species listed from India, 54% have uncertain status. The deep-sea chondrichthyans of India form a mostly overlooked group. Many species belonging to the same genera look alike and are possibly widely distributed. Genetic and specific morphological data are needed to the clarify taxonomic status of deep-sea chondrichthyans from Indian waters.

Many descriptions of chondrichthyans from Indian waters by earlier ichthyologists have been synonymised or are considered invalid at present (Table 2). But, several such species have been recently revalidated by advanced studies with wider geographic sampling (Marshal *et al.*, 2009; Ebert *et al.*, 2010; White *et al.*, 2010a,b,c), which suggests many additional species could be revalidated through studies in the future.

Not all the species listed currently as being from India are available in collections, which increases the difficulty in resolving taxonomic issues. While the checklist was supposed to give the reference collection numbers (see Compagno *et al.*, 2005; Ebert *et al.*, 2013), the absence of Indian specimens and appropriate cataloguing hindered this effort. Clearly, national museums and reference collections should strive to have specimens of all the Indian species in custody.

The confusion and inconsistency in species identification due to the usage of invalid/misapplied names, complex taxonomic

histories and presence of several undescribed species in commercial fisheries, are impediments in resolving species listings. In turn, this results in poor reporting on catch, exports and management at a species level. There is also significant confusion persisting for similar-looking species occurring in Indian seas, which need to be critically studied and compared through collaborative studies.

Conservation status of Indian chondrichthyans

Excluding the species with uncertain status (questionable and those which need confirmation), the total number of Indian chondrichthyan species are 155, of which 3% are listed as Critically Endangered (CR), 5% are Endangered (EN), 26% are Vulnerable (VU), 21% are Near Threatened (NT), 8% are of Least Concern (LC), 27% are Data Deficient (DD) and 10% are Not Evaluated (NE) (Table 1, Fig. 1).

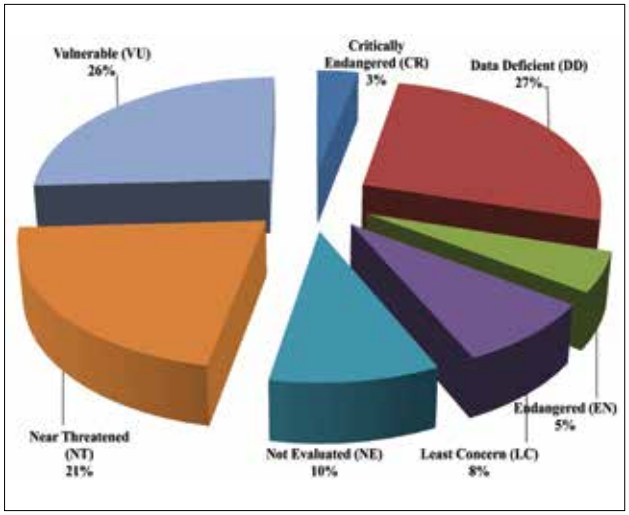

Fig 1. Conservation status of Indian chondrichthyans.

In 1999, the FAO developed a framework for the conservation of sharks, which recommended all States to prepare management policies and develop a National Plan of Action (NPOA) to identify information gaps, issues and priorities for the conservation and management of sharks. Despite several international commitments, there has been little action to better understand, manage and protect elasmobranch species in India other than the Indian Wildlife (Protection) Act, 1972. At present India does not have a National Plan of Action for the conservation and management of sharks, but the preparation of plans for regional management is underway. In 2013, shark finning was prohibited by the Ministry of Environment and Forests, Government of India.

The Indian Wildlife (Protection) Act, 1972 lists 10 elamsobranchs in Schedule I part 2(A) in MoEF, 2001, which have to be identified accurately in the field to ensure their protection. But the absence of *Carcharhinus hemiodon* (Müller and Henle, 1839), *Glyphis glyphis* (Müller and Henle, 1839) and *Glyphis gangeticus* (Müller and Henle, 1839) in recent collections questions the availability of these species, the possibility of their extinction, or them being mis-identified (see Compagno *et al*., 2003; Compagno, 2007; Compagno *et al*., 2009). Another species listed in IWPA, 1972 is *Himantura fluviatilis* (Hamilton, 1822), which is considered as a junior synonym of *Pastinachus sephen* (Forsskål, 1775) (Eschmeyer, 2014). Recently *P. sephen* was considered as a complex with new species described and resolved (Last *et al*., 2005, 2010 a,b), of which at least two are available in India. The National Biodiversity Action Plan (NBAP, 2008) has stated that the "implementation of Biological Diversity Act and National Environmental Policy 2006 would be difficult without having adequate number of trained taxonomists". Resolving taxonomic ambiguities is, thus, the first step towards evolving a comprehensive conservation plan for chondrichthyans from Indian waters.

Discussion

This century has been called the century of extinctions (Dubois, 2003, 2010). Over-exploitation and habitat degradation/ alteration are major concerns causing biodiversity declines and extinction of species. There is an urgent need for cataloguing biodiversity before several species become extinct without humans even knowing of their existence. Proper identification of species is necessary for cataloguing and monitoring biodiversity (Vecchione and Collette, 1996), with taxonomic accuracy in reports, publications and datasets being crucial, because these form the foundation of management and policy (Kholia and Jenkins, 2011).

Recent taxonomic studies on chondrichthyans around the world (e.g. in Indonesia, Taiwan and Australia) have resulted in descriptions of many new species and have increased the resolution of species complexes (Last, 2007; Last *et al*., 2008a,b; Last *et al*., 2008a, b, 2010c). This suggests that a systematic taxonomic study of this group in Indian waters, with wide regional sampling, molecular studies, and comparisons would identify a greater diversity of this group and validate many of the currently used names in India.

In recent years, several species have been added to the elasmobranch faunal lists of Indian seas (Akhilesh *et al*., 2010; Babu *et al*., 2011; Benjamin *et al*., 2012; Kizhakudan and Rajapackiam, 2013; Bineesh *et al*., 2014) due to the extension of fishing to newer and deeper grounds. According to White and Last (2012), Indian waters are poorly known for its elasmobranch fauna and more scientific exploration and investigations are needed in the region. In particular,

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examples and case studies in White and Last (2012) suggest the need for more studies with molecular support and wide geographical sampling which would validate several unrecognized species.

In recent years, the use of molecular and genetic data has allowed the discrimination of species with morphological similarity and overlapping characters. Hebert *et al*. (2003) proposed a global identification system for animals by using the mitochondrial gene, cytochrome c oxidase subunit 1 (COI) to differentiate the vast majority of animal species, including the discovery of new or cryptic species. DNA barcoding techniques (i.e., sequencing a region of mitochondrial cytochrome oxidase I gene) for rapid and accurate species identification including their life stages will be a useful tool. In India, such advanced technologies have been used on chondrichthyans by Pavan-Kumar *et al*. (2013) and Bineesh *et al*. (2014).

In this checklist, we have tried to include recent additions to chondrichthyan fauna, with recent taxonomic changes, but there still are many unrecognized species occurring in Indian seas and several others with misapplied names. Research institutes and Universities in India should form a network for cataloguing marine biodiversity, with multinational and multi-institutional collaboration where necessary, in the interests of conservation.

Acknowledgements

We thank the Director, Zoological Survey of India and S.S. Mishra (ZSI, Calcutta) for their support to Bineesh during his visit to ZSI. Thanks are also due to W. White, P. Last (CSIRO, Australia), and D. A. Ebert (PSRC, USA) for their support and comments on the manuscript. Juergen Pollerspock (Shark References, Germany) provided missing references. Simon Weigmann (University of Hamburg, Germany) shared information and publications. We also Thank Muktha Menon (CMFRI, Visakhapatnam), G. B. Purushothama (CMFRI, Mumbai), Sajna Ali and K. M. Sandhya (CIFRI, Barrckpore), G. B. Sreekanth, (ICAR Research Complex for Goa), K. K. Prajith (CIFT, Veraval), M. Hashim and Vinu Jacob (CMLRE, Kochi), R. R. Kumar and S. Venu (Pondicherry University, Andaman Islands) for sharing information.

Table 1. Checklist of chondrichthyans reported/listed from Indian waters

Order /Family	Species	Validity in India	IUCN status (Global)
CHIMAERIFORMES			
RHINOCHIMAERIDAE	*Neoharriotta pinnata* (Schnakenbeck, 1931)		DD
	Neoharriotta pumila Didier & Stehmann, 1996	Needs confirmation	DD
	Rhinochimaera atlantica Holt & Byrne, 1909	Questionable	LC
	Harriotta raleighana Goode & Bean, 1895	Questionable	LC
CHIMAERIDAE	*Chimaera monstrosa* Linnaeus, 1758	Questionable	NT
	Hydrolagus cf. *africanus* (Gilchrist, 1922)		DD
HEXANCHIFORMES			
HEXANCHIDAE	*Hexanchus griseus* (Bonnaterre, 1788)		NT
	Hexanchus nakamurai Teng, 1962	Needs confirmation	DD
	Heptranchias perlo (Bonnaterre, 1788)		NT
	Notorynchus cepedianus (Péron, 1807)	Needs confirmation	DD
ORECTOLOBIFORMES			
HEMISCYLLIIDAE	*Chiloscyllium arabicum* Gubanov, 1980		NT
	Chiloscyllium griseum Müller & Henle, 1838		NT
	Chiloscyllium indicum (Gmelin, 1789)		NT
	Chiloscyllium plagiosum (Bennett, 1830)		NT
	Chiloscyllium punctatum Müller & Henle, 1838		NT
	Chiloscyllium hasselti Bleeker, 1852	Needs confirmation	NT
	Chiloscyllium burmensis Dingerkus & DeFino, 1983	Needs confirmation	DD
STEGOSTOMATIDAE	*Stegostoma fasciatum* (Hermann, 1783)		VU
GINGLYMOSTOMATIDAE	*Nebrius ferrugineus* (Lesson, 1831)		VU
	Ginglymostoma cirratum (Bonnaterre, 1788)	Questionable	DD
RHINCODONTIDAE	*Rhincodon typus* Smith, 1828		VU

LAMNIFORMES			
ODONTASPIDIDAE	*Carcharias taurus* Rafinesque, 1810		VU
	Odontaspis ferox (Risso, 1810).		VU
	Odontaspis noronhai (Maul 1955)		DD
ALOPIIDAE	*Alopias pelagicus* Nakamura, 1935		VU
	Alopias superciliosus (Lowe, 1841)		VU
	Alopias vulpinus (Bonnaterre, 1788)		VU
LAMNIDAE	*Carcharodon carcharias* (Linnaeus,1758)	Questionable	VU
	Isurus oxyrinchus Rafinesque, 1810		VU
	Isurus paucus Guitart Manday, 1966		VU
PSEUDOCARCHARIIDAE	*Pseudocarcharias kamoharai* (Matsubara, 1936)		NT
CARCHARHINIFORMES			
SCYLIORHINIDAE	*Apristurus indicus* (Brauer, 1906)	Questionable	DD
	Apristurus investigatoris (Misra, 1962)		DD
	Apristurus microps (Gilchrist, 1922)	Questionable	LC
	Apristurus saldanha (Barnard, 1925)	Questionable	LC
	Apristurus canutus Springer & Heemstra, 1979	Questionable	DD
	Atelomycterus marmoratus (Anonymous [Bennett], 1830)	Need additional reports	NT
	Cephaloscyllium silasi (Talwar, 1974)		DD
	Cephaloscyllium sufflans (Regan, 1921)	Questionable	LC
	Halaelurus buergeri (Müller & Henle, 1838)	Questionable	DD
	Halaelurus natalensis (Regan, 1904)	Questionable	DD
	Halaelurus quagga (Alcock, 1899)		DD
	Halaelurus boesemani Springer & D'Aubrey, 1972	Needs confirmation	DD
	Bythaelurus lutarius (Springer & D'Aubrey, 1972)	Needs confirmation	DD
	Bythaelurus hispidus (Alcock, 1891)		DD
	Holohalaelurus punctatus (Gilchrist, 1914)	Needs confirmation	EN
	Scyliorhinus capensis (Müller & Henle, 1838)	Questionable	NT
PROSCYLLIIDAE	*Eridacnis radcliffei* Smith, 1913		LC
	Eridacnis sinuans (Smith, 1957)	Questionable	LC
	Proscyllium magnificum Last & Vongpanich, 2004		NE
PSEUDOTRIAKIDAE	*Planonasus* sp. (Sensu Akhilesh *et al.*, 2010)		NE
TRIAKIDAE	*Iago omanensis* (Norman, 1939)		LC
	Iago sp. A [*Sensu* Compagno *et al.*, 2005]		NE
	Mustelus mangalorensis Cubelio, Remya & Kurup, 2011	Holotype possibly lost	NE
	Mustelus mosis Hemprich & Ehrenberg, 1899		DD
HEMIGALEIDAE	*Chaenogaleus macrostoma* (Bleeker, 1852)		VU
	Hemigaleus microstoma Bleeker, 1852		VU
	Paragaleus randalli Compagno, Krupp & Carpenter, 1996		NT
	Hemipristis elongata (Klunzinger, 1871)		VU
CARCHARHINIDAE	*Carcharhinus altimus* (Springer, 1950)		DD
	Carcharhinus amblyrhynchoides (Whitley, 1934)		NT
	Carcharhinus amblyrhynchos (Bleeker,1865)		NT
	Carcharhinus albimarginatus (Ruppel,1837)		NT
	Carcharhinus amboinensis (Müller & Henle, 1839)		DD
	Carcharhinus brevipinna (Müller & Henle, 1839)		NT

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	Carcharhinus dussumieri (Müller & Henle, 1839)		NT
	Carcharhinus falciformis (Müller & Henle, 1839)		NT
	Carcharhinus hemiodon (Müller & Henle, 1839)		CR
	Carcharhinus leucas (Müller & Henle, 1839)		NT
	Carcharhinus limbatus (Müller & Henle, 1839)		NT
	Carcharhinus longimanus (Poey, 1861)		VU
	Carcharhinus macloti (Müller & Henle, 1839)		NT
	Carcharhinus melanopterus (Quoy & Gaimard, 1824)		NT
	Carcharhinus obscurus (Lesueur,1818)		VU
	Carcharhinus sealei (Pietschmann, 1913)	Needs confirmation	NT
	Carcharhinus sorrah (Müller & Henle, 1839)		NT
	Galeocerdo cuvier (Péron & Lesueur, 1822)		NT
	Glyphis gangeticus (Müller & Henle, 1839)		CR
	Glyphis glyphis (Müller & Henle, 1839)	Needs confirmation	EN
	Lamiopsis temminckii (Müller & Henle, 1839)		EN
	Lamiopsis tephrodes (Fowler, 1905)	Needs confirmation	NE
	Loxodon macrorhinus Müller & Henle, 1839		LC
	Negaprion acutidens (Rüppell, 1837)		VU
	Prionace glauca (Linnaeus, 1758)		NT
	Rhizoprionodon acutus (Rüppell, 1837)		LC
	Rhizoprionodon oligolinx Springer, 1964		LC
	Scoliodon laticaudus Müller & Henle, 1838		NT
	Triaenodon obesus (Rüppell, 1837)		NT
SPHYRNIDAE	*Eusphyra blochii* (Cuvier, 1817).		NT
	Sphyrna lewini (Griffith & Smith, 1834)		EN
	Sphyrna mokarran (Rüppell, 1837)		EN
	Sphyrna zygaena (Linnaeus, 1758)		VU
	Sphyrna tudes (Valenciennes, 1822)	Questionable	VU
SQUALIDAE	*Squalus blainville* (Risso, 1827)	Needs confirmation	DD
	Squalus acanthias Linnaeus, 1758	Needs confirmation	VU
	Squalus megalops (Macleay, 1881)	Needs confirmation	DD
	Squalus mitsukurii Jordan & Snyder, 1903	Needs confirmation	DD
	Squalus cf. *lalannei* Baranes, 2003		DD
CENTROPHORIDAE	*Centrophorus moluccensis* Bleeker, 1860	Needs confirmation	DD
	Centrophorus uyato Rafinesque, 1810	Needs confirmation	NE
	Centrophorus cf. *granulosus* (Bloch & Schneider, 1801)		VU
	Centrophorus lusitanicus (Bocage & Capello, 1864)	Needs confirmation	VU
	Centrophorus squamosus (Bonnaterre, 1788)		VU
	Centrophorus atromarginatus Garman, 1913		DD
	Centrophorus cf. *zeehaani* White, Ebert & Compagno, 2008		NE
	Deania profundorum (Smith & Radcliffe, 1912)		LC
ETMOPTERIDAE	*Centroscyllium ornatum* (Alcock, 1889)		DD
	Centroscyllium fabricii (Reinhardt, 1825)	Needs confirmation	LC
	Etmopterus granulosus (Günther, 1880)	Needs confirmation	LC
	Etmopterus pusillus (Lowe, 1839)		LC
	Etmopterus spinax (Linnaeus, 1758)	Needs confirmation	LC

	Etmopterus baxteri Garrick, 1957	Needs confirmation	LC
	Etmopterus lucifer Jordan & Snyder, 1902	Needs confirmation	LC
SOMNIOSIDAE	*Centroselachus crepidater* (Bocage & Capello, 1864)		LC
	Zameus squamulosus (Günther, 1877)		DD
ECHINORHINIDAE	*Echinorhinus brucus* (Bonnaterre, 1788)		DD
	Echinorhinus cookei Pietschmann, 1928	Questionable	NT
PRISTIFORMES			
PRISTIDAE	*Anoxypristis cuspidata* (Latham, 1794)		EN
	Pristis microdon Latham, 1794		CR
	Pristis pectinata Latham, 1794	Needs confirmation	CR
	Pristis pristis (Linnaeus, 1758)		CR
	Pristis zijsron Bleeker, 1851		CR
SQUATINIFORMES			
SQUATINIDAE	*Squatina squatina* (Linnaeus, 1758)	Questionable	CR
	Squatina africana Regan, 1908	Needs confirmation	DD
TORPEDINIFORMES			
TORPEDINIDAE	*Torpedo panthera* Olfers, 1831	Needs confirmation	DD
	Torpedo fuscomaculata Peters, 1855	Needs confirmation	DD
	Torpedo sinuspersici Olfers, 1831	Needs confirmation	DD
	Torpedo marmorata Risso, 1810		DD
	Torpedo zugmayeri Engelhardt, 1912		NE
NARCINIDAE	*Benthobatis moresbyi* Alcock, 1898		DD
	Narcine brunnea Annandale, 1909		NE
	Narcine lingula Richardson, 1840		DD
	Narcine prodorsalis Bessednov, 1966	Needs confirmation	DD
	Narcine timlei (Bloch & Schneider, 1801).		DD
	Narcine cf *oculifera* Carvalho, Compagno & Mee, 2002		DD
	Narcine maculata (Shaw, 1804)		DD
NARKIDAE	*Heteronarce prabhui* Talwar, 1981		DD
	Narke dipterygia (Bloch & Schneider, 1801)		DD
RAJIFORMES			
RHINIDAE	*Rhina ancylostoma* Bloch & Schneider, 1801		VU
RHYNCHOBATIDAE	*Rhynchobatus laevis* (Bloch & Schneider, 1801)		VU
	Rhynchobatus australiae Whitley, 1939		VU
	Rhynchobatus djiddensis (Forsskål 1775)		VU
	Rhynchobatus palpebratus Compagno & Last, 2008		NE
RHINOBATIDAE	*Glaucostegus granulatus* (Cuvier, 1829)		VU
	Glaucostegus halavi (Forsskål, 1775)		DD
	Glaucostegus obtusus (Müller & Henle, 1841)		VU
	Glaucostegus thouin (Anonymous, 1798)		VU
	Glaucostegus typus (Anonymous [Bennett] 1830).		VU
	Rhinobatos annandalei Norman, 1926		DD
	Rhinobatos annulatus (Müller & Henle, 1841)	Needs confirmation	LC
	Rhinobatos holcorhynchus Norman, 1922	Needs confirmation	DD
	Rhinobatos lionotus Norman, 1926		DD
	Rhinobatos punctifer Compagno & Randall, 1987		DD

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	Rhinobatos variegatus Nair & Lal Mohan, 1973		DD
ZANOBATIDAE	*Zanobatus schoenleinii* (Müller & Henle, 1841)	Questionable	DD
ANACANTHOBATIDAE	*Cruriraja andamanica* (Lloyd, 1909)		DD
RAJIDAE	*Amblyraja reversa* (Lloyd, 1906)	Needs confirmation	DD
	Dipturus sp. A (Sensu Bineesh *et al.*, 2013)		NE
	Dipturus johannisdavisi (Alcock, 1899)		DD
	Dipturus crosnieri Seret, 1989	Needs confirmation	VU
	Fenestraja mamillidens (Alcock, 1889)		DD
	Leucoraja circularis (Couch, 1838)	Needs confirmation	VU
	Okamejei powelli (Alcock, 1898)		DD
	Okamejei sp. A		NE
	Raja miraletus Linnaeus, 1758	Questionable	LC
	Raja texana (Chandler, 1921)	Questionable	DD
	Rostroraja alba (Lacepède, 1803)	Questionable	EN
MYLIOBATIFORMES			
HEXATRYGONIDAE	*Hexatrygon bickelli* Heemstra & Smith, 1980		LC
PLESIOBATIDAE	*Plesiobatis daviesi* (Wallace, 1967)		LC
DASYATIDAE	*Dasyatis bennetti* (Müller & Henle, 1841)	Needs confirmation	DD
	Dasyatis centroura (Mitchill, 1815)	Questionable	LC
	Dasyatis chrysonota (Smith, 1828)	Questionable	LC
	Dasyatis lata (Garman, 1880)	Questionable	LC
	Dasyatis microps (Annandale, 1908)		DD
	Dasyatis pastinaca (Linnaeus, 1758)	Needs confirmation	DD
	Dasyatis thetidis Ogilby, 1899	Needs confirmation	DD
	Himantura alcockii (Annandale, 1909)		NE
	Himantura draco Compagno & Heemstra, 1984	Needs confirmation	NE
	Himantura uarnacoides (Bleeker, 1852)		VU
	Himantura fai Jordan & Seale, 1906		LC
	Himantura fava (Annandale, 1909)		NE
	Himantura gerrardi (Gray, 1851)		VU
	Himantura granulata (Macleay, 1883)		NT
	Himantura imbricata (Bloch & Schneider, 1801)		DD
	Himantura cf. *imbricata* (Bloch & Schneider, 1801)		NE
	Himantura jenkinsii (Annandale, 1909)		LC
	Himantura leoparda Manjaji-Matsumoto & Last, 2008		VU
	Himantura marginata (Blyth, 1860)		DD
	Himantura pastinacoides (Bleeker, 1852)		VU
	Himantura polylepis Bleeker, 1852		EN
	Himantura uarnak (Forsskål, 1775)		VU
	Himantura undulata (Bleeker, 1852)		VU
	Himantura walga (Müller & Henle, 1841)		NT
	Neotrygon kuhlii (Müller & Henle, 1841)		DD
	Pastinachus sephen (Forsskål, 1775)		DD
	Pastinachus atrus (Macleay, 1883)		NE
	Pteroplatytrygon violacea (Bonaparte, 1832)		LC
	Taeniura lymma (Forsskål, 1775)		NT

	Taeniura meyeni (Müller & Henle, 1841)		VU
	Urogymnus asperrimus (Bloch & Schneider, 1801)		VU
GYMNURIDAE	*Gymnura japonica* (Schlegel, 1850)	Needs confirmation	DD
	Gymnura cf micrura (Bloch & Schneider, 1801)		DD
	Gymnura zonura (Bleeker, 1852)		VU
	*Gymnura poecilur*a (Shaw, 1804)		NT
	Gymnura tentaculata (Müller & Henle, 1841)	Needs confirmation	DD
MYLIOBATIDAE	*Aetobatus flagellum* (Bloch & Schneider, 1801)		EN
	Aetobatus ocellatus (Kuhl, 1823)		NE
	Aetobatus narinari (Euphrasen, 1790)	Questionable	NT
	Aetomylaeus vespertilio (Bleeker, 1851)		EN
	Aetomylaeus nichofii (Bloch & Schneider, 1801)		VU
	Aetomylaeus maculatus (Gray, 1834)		EN
	Aetomylaeus milvus (Müller & Henle, 1841)		NE
	Myliobatis aquila (Linnaeus, 1758)	Questionable	DD
MOBULIDAE	*Manta alfredi* (Kreft, 1868)		VU
	Manta birostris (Walbaum, 1792)		VU
	Mobula mobular (Bonnaterre, 1788)	Needs confirmation	EN
	Mobula japanica (Muller & Henle, 1841)		NT
	Mobula diabolus (Shaw,1804)		NE
	Mobula thurstoni (Lloyd, 1908)		NT
	Mobula eregoodootenkee (Bleeker, 1859)		NT
	Mobula kuhlii (Müller & Henle, 1841)		DD
	Mobula tarapacana (Philippi, 1892)		DD
RHINOPTERIDAE			
	Rhinoptera javanica Müller & Henle, 1841		VU
	Rhinoptera jayakari Boulenger, 1895		NE
	Rhinoptera sewelli Misra, 1947		NE
	Rhinoptera brasiliensis (Müller,1836)	Questionable	EN

Table 2. List of chondrichthyans described from India and their present status

Species described from India	Type area	Present status/valid as
Aetobatis indica Swainson, 1839	Vizagapatanam, India	Synonym of *Aetobatus ocellatus* Kuhl, 1923
Aetoplatea tentaculata Müller & Henle,1841	?Indian Seas	Valid as *Gymnura tentaculata* (Müller & Henle, 1841)
Bengalichthys impennis Annandale,1909	Balasore Bay, Orissa coast, India	Synonym of *Narke dipterygia* (Bloch & Schneider, 1801)
Benthobatis moresbyi Alcock, 1898	Laccadive Sea, India	Valid as *Benthobatis moresbyi* Alcock, 1898
Carcharias (*Hypoprion*) *hemiodon* Muller & Henle,1839	Puduchery, India	Valid as *Carcharhinus hemiodon* (Müller & Henle, 1839)
Carcharias (Physodon) muelleri Müller & Henle, 1839	Bengal, ? India	Synonym of *Scoliodon laticaudus* Müller & Henle, 1838
Carcharias (Prionodon) bleekeri Duméril,1865	Puducherry, India	Synonym of *Carcharhinus sorrah* (Müller & Henle, 1839)
Carcharias (Prionodon) dussumieri Muller & Henle,1839	Puduchery, India	Valid as *Carcharhinus dussumieri* (Müller & Henle, 1839)
Carcharias (Prionodon) palasorra Bleeker, 1853	Pala sorrah of Russell (1803)	Possible synonym of *Scoliodon laticaudus* Müller & Henle, 1838
Carcharias (Prionodon) temminckii Muller & Henle,1839	India	Valid as *Lamiopsis temminckii* (Müller & Henle, 1839)
Carcharias malabaricus Day, 1873	Cochin, Calicut, India	Synonym of *Carcharhinus dussumieri* (Müller & Henle, 1839)
Carcharias sorrah kowa Bleeker, 1853	Vizagapatam, India	Synonym of *Rhizoprionodon acutus* (Rüppell, 1837)

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Carcharias sorrakowah Cuvier, 1829	on Sorra Kowah of Russell (1803)	Possibly synonym of *Scoliodon laticaudus* Müller & Henle, 1838
Carcharias watu Sarangdhar & Setna, 1946	India	Synonym of *Carcharhinus hemiodon* (Müller & Henle, 1839)
Centrophorus rossi Alcock, 1898	Off Travancore coast, India	Synonym of *Centroscymnus crepidater* (Bocage & Capello, 1864)
Cephaloptera kuhlii Muller & Henle,1841	India	Valid as *Mobula kuhlii* (Müller & Henle, 1841).
Ceratoptera orissa Lloyd, 1908	Puri, Orissa coast, Bay of Bengal	Possible synonym of *Manta birostris* (Walbaum, 1792)
Cestracion leeuwenii Day, 1865	Malabar coast, India	Synonym of *Sphyrna lewini* (Griffith & Smith, 1834).
Dicerobatis eregoodoo Cantor, 1849	Type locality includes Coromandel, India	Synonym of *Mobula eregoodootenkee* (Bleeker, 1859)
Dicerobatis thurstoni Lloyd, 1908	India	Valid as *Mobula thurstoni* (Lloyd, 1908)
Galeocerdo tigrinus Muller & Henle, 1839	Puduchery, India	Synonym of *Galeocerdo cuvier* (Péron & Lesueur, 1822)
Ginglymostoma muelleri Günther, 1870	India	Synonym of *Nebrius ferrugineus* (Lesson, 1831)
Hemigaleus balfouri Day,1878	Coromandel coast, India	Synonym of *Chaenogaleus macrostoma* (Bleeker, 1852)
Hemipristis pingali Setna, 1946	India, Mumbai	Synonym of *Hemipristis elongata* (Klunzinger, 1871)
Mustelus mangalorensis Cubelio, Remya & Kurup, 2011	Mangalore	Uncertain/holotype couldn't be located
Myliobatis eeltenkee Rüppell, 1837	Type locality includes Vizagapatanam, India	Synonym of *Aetobatus ocellatus* (Kuhl,1823)
Myliobatis nieuhofi var. *cornifera* Annandale, 1909	Balasore, Orissa	Uncertain
Narcine brunnea Annandale, 1909	Bay of Bengal, Hoogli	Valid as *Narcine brunnea* Annandale, 1909
Narcine indica Henle, 1834	Tharangambadi, India	Synonym of *Narcine timlei* (Bloch & Schneider, 1801)
Narcine microphthalma Dumeril, 1852	Malabar coast, India	Synonym of *Narcine timlei* (Bloch & Schneider, 1801)
Pentanchus (Parapristurus) investigatoris Misra, 1962	Andaman Sea	Valid as *Apristurus investigatoris* (Misra, 1962)
Proscyllium alcocki Misra,1950	Andaman Sea	Synonym of *Eridacnis radcliffei* Smith, 1913
Raja fluviatilis Hamilton, 1822	Ganges	Synonym of *Pastinachus sephen* (Forsskål, 1775)
Raja asperrima Bloch & Schneider, 1801	Mumbai, India	Valid as *Urogymnus asperrimus* (Bloch & Schneider, 1801)
Raja bicolor Shaw, 1804	Indian Seas	Uncertain as *Narcine bicolor* (Shaw, 1804)
Raja diabolus marinus Bloch & Schneider, 1801	India	Synonym of *Manta birostris* (Walbaum, 1792)
Raja flagellum Bloch & Schneider, 1801	Coromandel	Valid as *Aetobatus flagellum* (Bloch & Schneider, 1801)
Raja fluviatilis Hamilton, 1822	Ganges, India	Synonym of *Pastinachus sephen* (Forsskål, 1775)
Raja guttata Shaw, 1804	Based on Russell (1803)	Synonym of *Aetobatus ocellatus* (Kuhl, 1823)
Raja imbricata Bloch & Schneider, 1801	Tarangambadi, India	Valid as *Himantura imbricata* (Bloch & Schneider, 1801)
Raja johannisdavisi Alcock, 1899	off Travancore, India	Valid as *Dipturus johannisdavisi* (Alcock, 1899)
Raja poecilura Shaw, 1804	Vizagapatam, India, (on Russell, 1803)	Valid as *Gymnura poecilura* (Shaw, 1804)
Raja sancur Hamilton, 1822	Ganges, India	Synonym of *Pastinachus sephen* (Forsskål, 1775)
Raja timlei Bloch & Schneider, 1801	Tarangambadi, India	Valid as *Narcine timlei* (Bloch & Schneider, 1801)
Raja dipterygia Bloch & Schneider, 1801	Tharangambadi, India	Valid as *Narke dipterygia* (Bloch & Schneider, 1801)
Rhina ancylostomus Bloch & Schneider, 1801	Coromandel coast, India	Valid as *Rhina ancylostoma* Bloch & Schneider, 1801
Rhinobatos variegates Nair & Lal Mohan, 1973	Gulf of Mannaar	Valid as *Rhinobatos variegatus* Nair & Lal Mohan, 1973
Rhinobatus (Rhinobatus) tuberculatus Bleeker, 1853	Suttiwarah of Russell (1803)	Uncertain
Rhinobatus (Rhinobatus) obtusus Müller & Henle, 1841	Pondicherry, Malabar, India	Valid as *Rhinobatos obtusus* Müller & Henle, 1841
Rhinobatus annandalei Norman, 1926	Mouth of the Hooghli, India	Valid as *Rhinobatos annandalei* Norman, 1926
Rhinobatus armatus Gray, 1834	India	Synonym of *Glaucostegus typus* (Anonymous [Bennett], 1830)
Rhinobatus laevis Bloch & Schneider, 1801	India	Valid as *Rhynchobatus laevis* (Bloch & Schneider, 1801)
Rhinobatus lionotus Norman, 1926	Mouth of the Hooghli, India	Valid as *Rhinobatos lionotus* Norman, 1926
Rhinoptera sewelli Misra 1946	Calicut, India	Valid as *Rhinoptera sewelli* Misra, 1946
Rhinoptera adspersa Müller & Henle, 1841	India	Synonym of *Rhinoptera javanica* Müller & Henle, 1841
Rhynchobatus laevis Müller & Henle, 1841	Mumbai and Malabar, India	Synonym of *Rhynchobatus djiddensis* (Forsskål, 1775)

Scoliodon ceylonensis Sarangdhar & Setna, 1946	Mumbai, India	Synonym of *Loxodon macrorhinus* Müller & Henle, 1839
Scoliodon laticaudus Müller & Henle, 1838	India	Valid as *Scoliodon laticaudus* Müller & Henle, 1838
Scyliorhinus (Halealurus) silasi Talwar, 1974	Off Kollam, Arabian Sea	Valid as *Cephaloscyllium silasi* (Talwar, 1974)
Scyllium hispidum Alcock, 1891	Andaman Sea	Valid as *Bythaelurus hispidus* (Alcock, 1891)
Scyllium maculatum Gray, 1830	?India	Synonym of *Atelomycterus marmoratus* (Anonymous [Bennett], 1830)
Scyllium quagga Alcock, 1899	Laccadive Sea, India	Valid as *Halaelurus quagga* (Alcock, 1899)
Squalus caudatus Gronow, 1834	Indian Seas	Synonym of *Chiloscyllium indicum* (Gmelin, 1789)
Squalus palasorrah Cuvier, 1829	Vizagapatam and Madras, India	Uncertain as *Scoliodon palasorrah* (Cuvier, 1829)
Squalus semisagittatus Shaw, 1804	Based on Russell (1803)	Uncertain
Squalus zebra Shaw, 1804	Indian Seas	Synonym of *Stegostoma fasciatum* (Hermann, 1783)
Stegostoma carinatum Blyth, 1847	India	Synonym of *Stegostoma fasciatum* (Hermann, 1783)
Trygon alcockii Annandale 1909	Puri, Orissa Coast. India	Uncertain as *Himantura alcockii* (Annandale, 1909) or a possible synonym of *Himantura gerrardi* (Gray, 1851)
Trygon atrocissimus Blyth, 1860	India	Uncertain
Trygon bleekeri Blyth, 1860	Calcutta, India	Synonym of *Himantura uarnacoides* (Bleeker, 1852)
Trygon chindrakee Cuvier, 1853	Based on Russell (1803)	Uncertain
Trygon crozieri Blyth, 1860	?Arakan coast, India	Synonym of *Dasyatis zugei* (Müller & Henle, 1841)
Trygon ellioti Blyth, 1860	Calcutta fish market, India	Synonym of *Himantura uarnak* (Gmelin, 1789)
Trygon favus Annandale, 1909	off Orissa, Bay of Bengal	Questionably valid as *Himantura fava* (Annandale, 1909)
Trygon gerrardi Gray, 1851	India	Valid as *Himantura gerrardi* (Gray, 1851)
Trygon jenkinsii Annandale,1909	off Ganjam	Valid as *Himantura jenkinsii* (Annandale, 1909)
Trygon marginatus Blyth, 1860	Calcutta fish market, India	Valid as *Himantura marginata* (Blyth, 1860)
Trygon nuda Günther,1870	Indian Seas	Uncertain
Trygon russellii Gray, 1834	India	Questionably the same as (juvenile of) *Himantura leoparda* Manjaji, 2004
Trygon variegatus M'Clelland, 1841	Calcutta, India	Synonym of *Himantura uarnak* (Gmelin, 1789)
Trygon walga Müller & Henle, 1841	Ganges, India	Valid as *Himantura walga* (Müller & Henle, 1841)
Urogymnus asperrimus var. *krusadiensis* Chacko, 1944	Gulf of Mannar	Possible synonym of *Urogymnus asperrimus* (Bloch & Schneider, 1801)
Urogymnus laevior Annandale, 1909	Malpe	Uncertain
Zygaena indica van Hasselt, 1823	Vizagapatam, India	Synonym of *Sphyrna lewini* (Griffith & Smith, 1834)
Zygaena laticeps Cantor, 1837	Bay of Bengal	Synonym of *Eusphyra blochii* (Cuvier, 1816)

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