Annotated **Bibliography** of Elasmobranch Research in India

Part 1: 1837-2020

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Foreword

Elasmobranchs (sharks, rays and skates) are fishery resources that are highly valued globally, which, however, are rendered vulnerable to excessive fishing due to their biological characters and life histories. As a result, there has been a drastic decline in populations of many elasmobranch species worldwide, making them the focus of massive conservation programs across several nations.

India has a rich diversity of elasmobranchs with over 160 species being recorded from its waters. Elasmobranchs form part of commercial fisheries in India and the country is seen as a major elasmobranch fishing nation with an average annual production of 54,767 tonnes of elasmobranchs. Though elasmobranch production appears high, it forms only 1-2% of India's total marine production, as these resources are landed mostly as by-catch of other fisheries, and are seldom targeted in exclusive fisheries. The landed elasmobranchs are utilized within the country and are exported as well; the domestic consumption and preference for these resources show a wide variation across the country depending on cultural practices and perceived health benefits. Shark finning has hardly been practised in India; most of the elasmobranchs are landed whole and utilized completely.

Elasmobranch research in India has a long and rich history and is currently being actively carried forward by several organizations with ICAR-CMFRI being a major leader. Research in the country is focussed on elasmobranch taxonomy, diversity, fisheries, biology and stock assessment. However, many of the early research works are not easily accessible to researchers and there is no common repository for documents on elasmobranch research carried out in India during the last 7 or 8 decades.

To close this lacuna, ICAR-CMFRI has brought out this annotated bibliography on elasmobranchs of India. It is a compilation of research titles with annotations of the contents which the team could trace out. Almost all the articles included (in full wherever available or in abstract form) have been compiled in electronic form for easy access.

I congratulate the Demersal Fisheries Division of ICAR-CMFRI for the effort they have taken in carrying out this task. I am confident that this bibliography will be very useful for researchers and stakeholders in the country and elsewhere who are keen to study about elasmobranchs of India.

A. Gopalakrishnan

Director, ICAR-CMFRI

Preface

The study of elasmobranchs, encompassing sharks, rays, skates, and chimaeras, is a vital component of marine biodiversity research due to their ecological importance as apex predators and their unique biological characteristics. In India, with its extensive coastline, rich marine ecosystems, and diverse fish fauna, elasmobranchs play a significant role in both the marine food web and the livelihoods of coastal communities. However, despite their importance, much of the research on these species has remained scattered across various journals, reports, and publications, often making it difficult for researchers, conservationists, and policymakers to access relevant information in one place. This annotated bibliography seeks to bridge existing knowledge gaps by systematically compiling a comprehensive review of elasmobranch research in Indian waters, covering studies conducted over the past century focusing primarily on taxonomy, species diversity, fisheries, biology, and stock assessments. By consolidating these works into a single resource, this bibliography not only preserves the legacy of past research but also provides an essential reference for advancing current scientific investigations.

Through detailed annotations, this volume organizes the wealth of existing knowledge into a user-friendly electronic format, thereby enhancing accessibility to historical and current studies. This publication marks the first volume in a series, covering the period from 1837 to 2020, with a subsequent volume currently in progress. The current compilation includes the annotated bibliography of the full text or abstracts of research articles, as accessible to our team. We recognize, however, that some relevant articles may have eluded our search due to limited access or oversight. Therefore, we invite contributions from the broader research community to help enrich future editions. If you possess knowledge of missing works or have access to articles beyond our reach, we welcome your submissions at the provided email address (sharkbibliography@gmail.com). Your contributions will be acknowledged in the next volume, allowing us to collectively build a more comprehensive repository of elasmobranch research in India.

ICAR-CMFRI has made significant strides in advancing elasmobranch research over the last decade, gaining international recognition and fostering collaborations with global organizations like FAO, IUCN, and CITES, as well as with partner countries including Australia, Sri Lanka, and Oman. This compilation reflects the institute's commitment to advancing marine science and underscores the need for continued collaboration in the study of these fascinating and ecologically vital species. We hope that this annotated bibliography serves as a valuable resource and a catalyst for future research, ultimately contributing to the conservation and sustainable management of elasmobranchs in India's waters.

Authors

Contents

A

Abdurahiman, K. P., Nayak, T. H., Zacharia, P. U. & Mohamed, K. S. (2010). Trophic organisation and predator - prey interactions among commercially exploited demersal finfishes in the coastal waters of the southeastern Arabian Sea. *Estuarine, Coastal and Shelf Science*, 87(4), 601 - 610. https://doi.org/10.1016/j.ecss.2010.03.002

The authors present the trophic interactions in the commercially exploited demersal finfishes in the southeastern Arabian Sea off India. They use cluster analysis of predator feeding similarities and ontogenic diet shifts within each predator to identify four major trophic guilds and several sub-guilds. Among the species studied are the giant guitarfish *Rhynchobatus djiddensis* and the blacktip shark *Carcharhinus limbatus*. The results of their study indicate that *R. djiddensis* belongs to "Guild 2", the largest guild, which comprises shrimp feeders, while *C. limbatus* belongs to "Guild 4" which comprises piscivores. They report that large *R. djiddensis* are "true *Acetes* feeders" while medium forms are "shrimp and *Acetes* feeders". They report that teleost fish formed the most important diet in all size groups of *C. limbatus*, with a tendency for increasing piscivory with size/age.

Aiyar, R. G. (1942). Observations on the protective envelopes of some viviparous elasmobranch fishes of Madras Coast. *Proceedings of the 29th Indian Science Congress (Baroda)*, Pt. 3 Abstracts: 157.
Reprint not obtained

Aiyar, R. G. (1943). Sharks and shark-liver oil. *Current Science*, 12(3), 77 - 78.

The author reviews the growing scope for the shark-liver oil industry in India against the backdrop of the world war which caused a slump in the supply of cod-liver oil. He suggests the promotion of the trade through the judicious harvest of the commonly available sharks such as *Scoliodon, Carcharinus, Hemigaleus, Sphyrna, Carcharius, Galeocerdo and Cestracion* and other elasmobranchs such as *Pristis, Rhyncobatus, Rhinobatus, Dasybatus* and *Trygon*. However, he suggests a precautionary approach, considering the biological vulnerability of these viviparous fishes and advocates the release of pre-term or full-term young ones back to the sea if obtained live during the capture of the mother. The author hints at a collaborative approach towards promoting the shark-liver oil industry where the biologist, biochemist and fishery expert can play an equal part in establishing the required database and background information concerning the resources for managed and sustainable exploitation levels.

Aiyar, R. G. & Mahadevan, G. (1939). On a collection of elasmobranch embryos obtained from the Madras Coast. *Proceedings of the 26th Indian Science Congress (Lahore)*, Pt. 3 Abstracts: 134.
Reprint not obtained

Aiyar, R. G. & Nalini, K. P. (1938). Observations on the reproductive system, egg-case and breeding habits of *Chiloscyllium griseum* M & H. *Proceedings of the Indian Acadamy of Science*, 7b (5), 252 - 269.

The authors present a very detailed account of the complete life-history of *Chiloscyllium griseum* from Madras, with explicit descriptions of the reproductive system and the egg-case. They describe a single ovary with a common oviducal opening, well-developed nidamental glands and a breeding period which probably commences in January and extends over several months. They suggest that the eggs are probably liberated in pairs; the two eggs of every pair escaping in quick succession. They estimate the time taken for the development of the egg into a full-grown embryo before it is liberated to be as short as 2 1/2 to 3 months, unlike the very much longer periods taken in colder regions by allied forms. This document is probably one of the earliest descriptions of the reproductive biology of an elasmobranch from the Indian coast.

Ajeeshkumar, K. K., Vishnu, K. V., Kumari, K. R. R., Navaneethan, R., Asha, K. K., Ganesan, B., Niladri, S. C., Anandan, R. & Suseela, M. (2015). Biochemical composition and heavy metal content of selected marine fish from the Gulf of Mannar, India. *Fishery Technology*, 52(3), 164 - 169.

The authors discuss the biochemical composition of five marine fish from the Gulf of Mannar (Tamil Nadu, India), including two elasmobranchs - the grey bamboo shark *Chiloscyllium griseum* and the pale-edged stingray *Dasyatis zugei*. The protein content was 20.97% and 20.12% in *C. griseum* and *D. zugei* respectively. Lipid content was maximum (3.56%) in *C. griseum* and minimum (1%) in *D. zugei*. The predominant fatty acids recorded in all the species were docosahexaenoic acid (DHA), arachidonic acid (AA) and palmitic acid. The authors present the different levels of essential amino acids, minerals and heavy metals in the tissues of these fishes.

Akhilesh, K. V. (2014). *Fishery and biology of deep-sea chondrichthyans off the south-west coast of India.* Ph D Thesis, Cochin University of Science and Technology. Dyuthi Digital Repository, Cochin University of Science and Technology. http://dyuthi.cusat.ac.in/purl/4951

This is a comprehensive study on the fishery and biology of deep-sea chondrichthyans from India's south-west coast during the years 2008 to 2011. The author has studied the status of deep-sea chondrichthyans in the fishery and found that the landings show a declining trend at Cochin. He provides a detailed taxonomic account of 24 species and records the diversity of chondrichthyans in Indian waters with a comprehensive checklist of 159 species. New records include *Deania profundorum*, *Hexanchus griseus* and *Zameus squamulosus* (new to Indian waters), *Pseudocarcharias kamoharai* (new to the west coast of India) and *Halaelurus quagga* (recorded after a long period). The author also describes in detail, the diet, feeding biology and reproductive biology of 3 species - *Echinorhinus brucus*, *Eridacnis radcliffei* and *Bythaelurus hispidus*. He also provides a detailed account of the population dynamics and stock status of *E. brucus*. Stressing on the need for further studies on deep-sea chondrichthyans, The author suggests the implementation of different measures for better monitoring, conservation and management of elasmobranchs in India, including deep-sea fauna.

Akhilesh, K. V. & Ganga, U. (2013). Note on the targeted fishery for deep-sea oil sharks at Cochin Fisheries Harbour. *Marine Fisheries Information Service (T&E Series)*, 218, 22 - 23.

The authors discuss a targeted fishery for deep-sea gulper sharks *Centrophorus* spp. and their commercial utilization at Cochin Fisheries Harbour (CFH). They document the diversity of deep-sea chondrichthyans in the deep-sea shrimp trawl bycatch landed at CFH, which were also used for oil extraction. They report that on 10 December 2013 two multi-gear steel vessels with longlines operated off Munambam at 300-400 m depth, and landed 350 kg of gulper sharks, mostly *C. atromarginatus*, and 28 tonnes of the bramble shark *Echinorhinus brucus*, and suggest that although the market driven significant increase in the deep-sea chondrichthyans landings at Cochin especially during 2002-09 had slackened, the biological traits of deep-sea chondrichthyans warrants the need for both, a precautionary approach in targeted elasmobranch fishery and regular monitoring of trawl bycatch.

Akhilesh, K. V., Bineesh, K. K., Ganga, U. & Pillai, N. G. K. (2013a). Report of velvet dogfish, *Zameus squamulosus* (Günther, 1877) (Somniosidae: Squaliformes) from Indian waters. *Indian Journal of Fisheries*, 60(3), 127 - 129.

In this short communication, the authors record the occurrence of the velvet dogfish shark, *Zameus squamulosus* in Indian waters for the first time, from three specimens collected from the bycatch of the deep-sea shrimp trawl landings at Cochin Fisheries Harbour during December 2008, caught

at 350-450 m depths off the southwestern coast of India. This report extends the known distribution range of *Z. squamulosus* to the northern Indian Ocean.

Akhilesh, K. V., Bineesh, K. K., Ganga, U. & Pillai, N. G. K. (2013b). Report of crocodile shark *Pseudocarcharias kamoharai* (Pseudocarchariidae) from deep waters off the southwest coast of India. *Marine Biodiversity Records,* 6,1 - 3.https://doi.org/10.1017/S1755267213000778

The authors report the crocodile shark, *Pseudocarcharias kamoharai* from the Arabian Sea off southwest coast of India, indicating a wider distribution than previously known since earlier reports from the Indian Ocean are few and patchy and do not include the southeastern limits of the Arabian Sea. They present a detailed description with morphometric measurements of a single female specimen collected from Cochin Fisheries Harbour, from the bycatch of a deep-water shrimp trawler operated off Cochin at depths of 300 - 500 m.

Akhilesh, K. V., Bineesh, K. K., White, W. T. & Pillai, N. G. K. (2012). Aspects of the biology of the pygmy ribbontail catshark *Eridacnis radcliffei* Smith (Proscylliidae: Carcharhiniformes) from off the southwest coast of India. *Journal of Fish Biology*, 81(3), 1138 - 1144. https://doi.org/10.1111/j.1095-8649.2012.03379.x

In this brief article, the authors document some aspects of the biology of the pygmy ribbontail catshark *Eridacnis radcliffei* from 549 individuals collected from by-catch of commercial deep-sea shrimp trawl fishery along the southwest coast of India. They report an overall sex ratio of 1.3:1, with the length range of females and males being 106-257 mm and 107-235 mm (total length). The authors present the estimated length-mass relationship for both the sexes. They report aplacental vivipary with females having one functional ovary (right) and two functional uteri. They estimate the length at first maturity to be 183 and 170 mm in females and males respectively, and the size at birth to be between 105 and 128 mm. Their observations on the diet indicate the species to be primarily a crustacean feeder, which is in contrast to an earlier study that reported the species to feed mostly on fishes.

Akhilesh, K. V., Purushottama, G. B., Thakurdas, & Kizhakudan, S. J. (2017). Biological observations on the broadfin shark *Lamiopsis temminckii* (Carcharhiniformes: Carcharhinidae). *Journal of Fish Biology*, 91(6), 1721 - 1729. https://doi.org/10.1111/jfb.13474.

The authors provide biological information on the broadfin shark *Lamiopsis temminckii*, which is rarely encountered and has been classified as "Endangered" in the IUCN Red List. The information provided pertains to 214 specimens (109 females and 105 males) collected from commercial landings by dolnetters, gill netters and demersal trawlers that operated in the northern Arabian Sea along Maharashtra coast during 2013-2016. They present the size at maturity (in terms of total length) of females and males as 1430 and 1368 mm respectively, with a litter size of 2-8 and size at birth 418-650 mm. The length range of the sampled specimens was 418-1782 mm. They report a dietary preference for crustaceans, followed by bony fishes and cephalopods. The endangered status of the shark and the paucity of knowledge on its life history traits make this article a significant one.

Akhilesh, K. V., Bineesh, K. K., Mishra, S. S., Ganga, U. & Pillai, N. G. K. (2014). Notes on the Indian swell shark, *Cephaloscyllium silasi* (Scyliorhinidae: Carcharhiniformes) from deep waters off the west coast of India. *Marine Biodiversity Records*, 7(25), 1 - 5. https://doi.org/10.1017/S1755267214000141

The authors discuss the deepwater swellshark *Cephaloscyllium silasi* caught from Kollam, southwest coast of India. For a long period after the original description by Talwar (1974) the validity status of *C. silasi* was under question; this

report fills the knowledge gap. The authors also present the first report of the egg case of *C. silasi*, and provide detailed morphological data of the three female specimens collected.

Akhilesh, K. V., Bineesh, K. K., Shanis, C. P. R., Human, B. A. & Ganga, U. (2011). Rediscovery and description of the quagga shark, *Halaelurus quagga* (Alcock, 1899) (Chondrichthyes: Scyliorhinidae) from the southwest coast of India. *Zootaxa*, 2781(1), 40 - 48. https://doi.org/10.11646/zootaxa.2781.1.3

This article adds to our existing knowledge of one of the poorest known scyliorhinid (Carcharhiniformes) sharks of the world, the quagga shark *Halaelurus quagga* (Alcock, 1899,) described from a single specimen collected from the Arabian Sea coast of India (off Malabar). The authors record this species more than 100 years after its first description; the report itself is only the third of this species, globally. They redescribe this species based on the study of four specimens (two male and two female) collected from demersal trawl bycatch landed at Cochin Fisheries Harbour and Sakthikulangara Fisheries Harbour.

Akhilesh, K. V., Manjebrayakath, H., Bineesh, K. K., Shanis, C. P. R. & Ganga, U. (2010). New distributional records of deep-sea sharks from Indian waters. *Journal of the Marine Biological Association of India*, 52(1), 29 - 34.

In this article the authors document, for the first time, the occurrence of three new deepwater sharks in Indian waters, i.e *Hexanchus griseus* (Hexanchidae), *Deania profundorum* (Centrophoridae) and pygmy false catshark (undescribed) (Pseudotriakidae). Thay also present taxonomic details of smooth lanternshark, *Etmopterus pusillus* (Etmopteridae) and leafscale gulper shark, *Centrophorus squamosus* (Centrophoridae) caught by hooks & line and landed at Cochin Fisheries Harbour, Kerala, thereby confirming the occurrence of these two species off the southwest coast of India.

Akhilesh, K. V., Manjebrayakath, H., Ganga, U., Bineesh, K. K. & Shanis, C. P. R. (2008). Morphometric characteristics of the pelagic stingray *Pteroplatytrygon violacea* (Bonaparte, 1832) caught off Cochin, southwest coast of India. *Journal of the Marine Biological Association of India*, 50(2), 235 - 237.

The authors describe the morphometric characteristics of the pelagic stingray *Pteroplatytrygon violacea* (Bonaparte, 1832) for the first time from Indian waters. The study is based on a male stingray measuring 102 cm total length, 47 cm disc width and 2.5 kg weight, caught off Cochin in August 2008. They report consistency in morphometric characteristics of this specimen with that reported from the North Sea.

Akhilesh, K. V., Manjebrayakath, H., Ganga, U., Pillai, N. G. K. & Sebastine, M. (2009). Morphometric characteristics of deepwater stingray *Plesiobatis daviesi* (Wallace, 1967) collected from the Andaman Sea. *Journal of the Marine Biological Association of India*, 51(1), 246 - 249.

The authors document the morphometric characteristics of two deepwater stingrays *Plesiobatis daviesi* collected off Diglipur and off Mayabandar in the northeastern Andaman Sea during a deep-sea fishery resource exploration survey on FORV Sagar Sampada in the Andaman Sea. They report that the morphometric characteristics of the two specimens match with the representative described from South African waters with slight variations in certain characteristics; however, most of the variations were within described limits. They report semi-digested teleosts and shrimps as the food items in the guts of the two specimens.

Akhilesh, K. V., White, W. T., Bineesh, K. K., Ganga, U. & Pillai, N. G. K. (2013). Biological observations on the bristly catshark *Bythaelurus hispidus* from deep waters off the southwest coast of India. *Journal of Fish Biology*, 82(5), 1582 - 1591. https://doi.org/10.1111/jfb.12087

Through this study, the authors attempt to provide information on the biological characteristics of the bristly catshark *Bythaelurus hispidus* landed as bycatch of deep-sea shrimp trawl operations at 200-500 m depth off the southwest coast of India during September 2010 to February 2011. They studied one hundred and sixty-two individuals comprising 99 females and 63 males in the length range of 120-366 mm and 135-311 mm respectively. Size-at-maturity (L_{50}) for females and males was estimated at 252 and 235 mm LT, respectively. The authors report that the reproductive mode of *B. hispidus* is aplacental viviparity, which is the rarest reproductive mode within the Scyliorhinidae and is considered the most advanced of three reproductive modes occurring within this family. Dietary analysis of stomach contents revealed *B. hispidus* feeds on a variety of prey, primarily fishes. This study provides new biological information on *B. hispidus* which has been listed as 'Data Deficient' by the IUCN Red List due to the paucity of information on population sizes or trends and biological data.

Akhilesh, K. V., Bineesh, K. K., Gopalakrishnan, A., Jena, J. K., Basheer, V. S. & Pillai, N. G. K. (2014). Checklist of Chondrichthyans in Indian waters. *Journal of the Marine Biological Association of India*, 56(1), 109 - 120. https://doi.org/10.6024/jmbai.2014.56.1.01750s-17

The authors update the existing species checklist of chondrichthyan resources in Indian waters and offer comments on their occurrence. They emphasise the need for detailed chondrichthyan taxonomic research for better management of these vulnerable resources in Indian waters. 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 the field and exploratory surveys conducted during 2008-2013 by the authors, and information shared by colleagues. The IUCN Assessment Category for each species is also listed. The authors designate the total number of Indian chondrichthyan species (excluding species with uncertain status) as 155.

Akhilesh, K. V., White, W. T., Bineesh, K. K., Purushottama, G. B., Singh, V. V. & Zacharia, P. U. (2016). Redescription of the rare and endangered broadfin shark *Lamiopsis temminckii* (Müller & Henle, 1839) (Carcharhiniformes: Carcharhinidae) from the northeastern Arabian Sea. *Zootaxa*, 4175(2), 155 - 166. https://doi.org/10.11646/zootaxa.4175.2.3

The authors redescribe the broadfin shark *Lamiopsis temminckii* as a prelude to collecting detailed data on this species, which was earlier believed to have been the only one under the genus *Lamiopsis* but has now been confirmed to be one among two - *Lamiopsis tephrodes* of the Western Central Pacific, and *L. temminckii* of the Indo-West Pacific. The redescription has been done from seven specimens, measuring 418-1782 mm in total length, collected between 2013 and 2016 from the fishery in the eastern Arabian Sea along the Maharashtra coast of India. The authors provide a clear and detailed account of the descriptive characters and proportional dimensions of different body parts as percentages of total length. The syntypes designated as lectotype and paralectotypes for the study were a dried and stuffed juvenile male of 1057 mm total length, from India (BMNH 1851.8.16) and a juvenile male of 975 mm total length, from India (ZMB 4475). They also provide the Genbank Accession numbers for the mitochondrial partial COI barcodes generated for the species. They conclude with a key to distinguish *L. temminckii* from *L. tephrodes*, noting that differences in dentition and size and position of the dorsal fins are prominent differentiating characters.

Akhilesh, K. V., Bineesh, K. K., White, W. T., Shanis, C. P. R., Manjebrayakath, H., Ganga, U. & Pillai, N. G. K. (2013). Catch composition, reproductive biology and diet of the bramble shark *Echinorhinus brucus* (Squaliformes: Echinorhinidae) from the

southeastern Arabian Sea. *Journal of Fish Biology*, 83(5), 112 - 127.https://doi.org/10.1111/jfb.12201

The authors of this article present a detailed account of catch composition, reproductive biology and dietary pattern of the bramble shark *Echinorhinus brucus* (Squaliformes: Echinorhinidae) caught from the Southeastern Arabian Sea. Their observations are based on the study of 5318 individuals caught as bycatch in deep water bottom set longlines gillnets and shrimp trawls operated at depths of 200 - 1200 m off southwest coast of India between January 2008 and December 2011. They subjected a total of 431 individuals to biological investigation and estimated size at maturity (LT_{50}) for females and males as 189 and 187 cm LT, respectively, size at birth between 42 and 46 cm LT with a litter size of 10 to 36. They describe the dietary pattern of *E. brucus* as diverse, with crustaceans, teleosts, cephalopods and elasmobranchs as principal components in decreasing order of relative dominance. This study provides the first exhaustive insight on important biological traits of *E. brucus*, and also suggests that the species is subject to considerable fishing pressure in this region.

Akhilesh, K. V., Ganga, U., Pillai, N. G. K., Vivekanandan, E., Bineesh, K. K., Shanis, C. P. R. & Manjebrayakath, H. (2011). Deep-sea fishing for chondrichthyan resources and sustainability concerns - A case study from southwest coast of India. *Indian Journal of Geo-Marine Sciences*, 40(3), 347 - 355. http://nopr.niscair.res.in/handle/123456789/12424.

The authors present the change in species composition of chondrichthyan landings following changes in fishing patterns and extension of grounds to deeper waters since the year 2000. They compare the trends reported during the 1980s and 1990s with the composition of chondrichthyan landings at Cochin Fisheries Harbour (CFH) during 2008-09 as a case study. They report the predominance of several off-shore and deep-sea species of chondrichthyans like *Alopias superciliosus*, *Carcharhinus limbatus, Echinorhinus brucus, Galeocerdo cuvier*, *Centrophorus* spp. and *Neoharriotta pinnata* with an equal reduction in the landings of more common coastal species like *Sphyrna lewini*, *Carcharhinus sorrah* and other *Carcharhinus* spp. They also note the landing of several species like *Hexanchus griseus*, *Deania profundorum*, *Zameus squamulosus* and *Eridacnis radcliffei*, which had hitherto not been reported from Indian waters. Describing the fishing fleet, the authors note that the fishermen who venture into multiday distant water fishing for sharks are mostly from the fishing village of Thoothoor and nearby villages in Kanyakumari district of Tamil Nadu. They observe that the fishing is demand-based, citing the example of targeted fishing for gulper sharks. They record 45 shark species belonging to 20 families in the shark landings at CFH during 2008-09, while records from the 1980s show 13 species of sharks in the landings at CFH, which increased to 30 species in 2000-02. They also provide an account of the processing and utilization pattern of the landed sharks. The information provided in this article is very useful and significant as it outlines the major shift in shark fishing patterns and landings across several decades.

Akhilesh, K. V., Shanis, C. P. R., White, W. T., Manjebrayakath, H., Bineesh, K. K., Ganga, U., Abdussamad, E. M., Gopalakrishnan, A. & Pillai, N. G. K. (2012). Landings of whale sharks *Rhincodon typus* Smith, 1828 in Indian waters since protection in (2001) through the Indian Wildlife (Protection) Act, (1972). *Environmental Biology of Fishes*, 94(3), 1 - 10.https://doi.org/10.1007/s10641-012-0063-9

The authors provide a detailed insight into the landing of the whale shark *Rhincodon typus* after its inclusion in the Indian Wildlife (Protection) Act, 1972 in May 2001. They report that most of the whale sharks were caught as incidental bycatch in commercial fishing operations. Between 2001 and 2011 only 79 cases of whale shark landing were recorded. During this period, the smallest whale shark recorded measured 94 cm in total length (TL) while the largest measured 13.7 m. Only seven juveniles of <3 m TL were recorded. The authors

observe that the protection of the whale shark has reduced its landings considerably, with only incidental catches and strandings being recorded. They recommend that although the protection status of whale sharks in India is generally well understood by fishers, there is still a need for further education regarding the current national legislation and vulnerability of the species.

Alcock, A. (1894). *Illustrations of the zoology of the Royal Indian Marine Survey Steamer Investigator. Part II.* Office of the Superintendent of Government Printing, Calcutta.

This is a compilation of illustrations of fishes collected during cruises of the survey ship "Investigator". Explanation of the plates includes the name of the species illustrated and reference to the magazine in which the details have been published. The illustrated species are *Raja mamillidens, Paracentroscyllium ornatum* and *Scyllium hispidum* (Figs. 1-3, Part II, Plate VIII).

Alcock, A. (1898). A note on the deep-sea fishes, with descriptions of some new genera and species, including another probably viviparous Ophidioid. *Annals and Magazine of Natural History*, 7(2), 136 - 156.

The author describes fishes dredged from a depth of 100-1800 fathoms in Indian waters after 1896 by the Royal Indian marine survey ship "Investigator". Among the species described are three elasmobranchs, *Centrophorus rossi* (Family: Spinacidae), *Benthobatis moresbyi* (Family: Torpedinidae) and *Raja powelli* (Family: Rajidae).

Alcock, A. (1899a). *A descriptive catalogue of the Indian deep-sea fishes in the Indian Museum. Being a revised account of the deep-sea fishes collected by the Royal Indian marine survey ship "Investigator".* The trustees of the Indian Museum, Calcutta.

The author presents detailed descriptions of fishes dredged by the R.I.M.S. "Investigator" from deep waters between 65^0 and 99^0 E and 5^0 and 24^0 N, spanning the southeastern Arabian Sea and the Bay of Bengal. Of the 169 species described, 9 are elasmobranchs (Chondropterygii) - *Centrophorus rossi, Centroscyllium ornatum* (Family: Spinacidae), *Scyllium canescens, Scyllium hispidum* and *Scyllium quagga* (Family Scyllidae), *Benthobatis moresbyi* (Family: Torpedinidae), *Raja johannis-davisi, Raja mamillidens, Raja powelli* (Family: Rajidae). Of these, *Raja johannis-davisi* and *Scyllium quagga* are new reports from the region.

Alcock, A. (1899b). *Illustrations of the zoology of the Royal Indian Marine Survey Steamer Investigator. Part V.* Office of the Superintendent of Government Printing, Calcutta.

This is a compilation of illustrations of fishes collected during cruises of the survey ship "Investigator". Explanation of the plates includes the name of the species illustrated and reference to the magazine in which the details have been published. The illustrated species are *Centrophorus rossi* and *Raja powelli* (Figs 3-4, Part V, Plate XXVI).

Alcock, A. (1900). *Illustrations of the zoology of the Royal Indian Marine Survey Steamer Investigator. Part VI.* Office of the Superintendent of Government Printing, Calcutta.

This is a compilation of illustrations of fishes collected during cruises of the survey ship "Investigator". Explanation of the plates includes the name of the species illustrated and reference to the magazine in which the details have been published. The illustrated species is *Centroscyllium ornatum* (Fig. 1a-b, Part VI, Plate XXXV).

Alcock, A. W. (1889). On the Bathybial Fishes of the Bay of Bengal and neighbouring waters, obtained during the seasons - Natural History Notes from H.M. Indian Marine Survey Steamer "Investigator." *Annals and Magazine of Natural History*, 6(IV), 376 - 399.

In this description of the bathybial fishes of the Bay of Bengal Region (including the Bay of Bengal, Gulf of Mannar and Andaman Sea), The author describes two elasmobranchs - *Paracentroscyllum ornatum* (Family Sinacidae; Order Selachoidei) and *Raja mamillidens* (Family Rajidae; Order Batoidei), from three specimens (two males and one female) of *P. ornatum* obtained from 405-285 fathoms depth in the Bay of Bengal and one female specimen of *R. mamillidens* obtained at 597 fathoms depth in the Gulf of Mannar during surveys by the Indian Marine Survey Steamer "Investigator".

Alcock, A. W. (1890). Observations on the gestation of some sharks and rays. *Journal of the Asiatic Society of Bengal*, *LIX*, SF5.51-56.

The author describes the state of the foetus within pregnant sharks and rays caught during exploratory surveys in the Bay of Bengal and Andaman Sea. The species studied include three sharks - *Carcharias melanopterus, Zygaena blochii* and *Carcharias dussumieri*, and two rays - *Trygon bleekeri* and *Myliobatis nieuhofii*. The author's descriptions are brief but exact. He reports the spongy nature of the uterine walls in *C. melanopterus* and *Z. blochii*, in contrast to the thick and compact muscular coating in *T. bleekeri*, indicating greater parturient effort in the latter. The uteri in the five feet long *C. melanopterus* is described as being divided longitudinally into three compartments with each compartment housing a young one about 12 inches long and in the hammerhead shark of almost equal length, though the layout of the uteri is similar, the author reports five foetuses, each, of about 15 inches length. The author describes the uteri of a 7½ feet long *C. dussumieri* as similar in layout to that of *C. melanopterus*, but housing five foetuses each, about two feet long. These foetuses were live and the author documents that they swam vigorously for about an hour in a tub of seawater before they succumbed to haemorrhage due to rupture of the placental cord. The author does not mention the disc dimensions of *T. bleekeri,* except that it was very large, but records the presence of a single male foetus with a disc 11¾ inches long and 10¾ inches broad. The *M. nieuhofii* specimen had a disc length of seventeen inches and breadth of 28 inches. It was not pregnant but The author records the presence of large ova in the left ovary. The author notes the structure of the uterine papillae in this ray and suggests that the whole intra-uterine mucous membrane forms a superficial gland which probably functions as a milk gland for nourishing the developing embryo.

Alcock, A. W. (1892a). On utero-gestation in *Trygon bleekeri*. *Annals and Magazine of Natural History*. Pl. 19, 6(9), 417 - 427.

In this article, the author discusses different modes of uterine development in elasmobranchs, with emphasis on the development of uterine glands which secrete "uterine milk" for the nourishment of the developing embryo, exemplified through his observations in a pregnant female *Trygon bleekeri*, measuring 3 feet in disc width, caught from the mouth of the Godavari estuary. The author gives detailed descriptions of the uterus, oviducts, uterine villi, glands of the uterine villi (or trophonemata) and the single male foetus within the terminal portion of the left oviduct. The author concludes that there is a single uterus in *Trygon bleekeri*, which in a pregnant female, will hold a single naked foetus unattached structurally to the mother, deriving its nourishment from a viscid, turbid or milky, richly albuminous secretion from the uterine trophonemata.

Alcock, A. W. (1892b). Some observations on the embryonic history of *Pteroplatea micrura*. Natural history notes from H.M. Indian Marine Survey Steamer "Investigator". *Annals and Magazine of Natural History*, 6(X), II, No.4., 1 - 8.

The author describes the early embryo, its gill filaments and uterine trophonemata of the stingray *Pteroplatea micrura*, from a single female in an early stage of pregnancy, obtained from the Godavari Delta. He notes the remarkably Selachoid appearance of the early embryo. He observes that

most of the gill filaments, when straightened out, is nearly twice the length of the embryo and the sum of the lengths of all the gill filaments put together measure nearly one-third of the whole volume of the embryo. He also notes that while the gill filaments do not have any contact with the uterine wall, they are in close relation with the yolk, and envelopes it completely on all sides, indicating their role in absorbing nutrient yolk. From transverse sections of the uterine trophonemata, the author concludes that the secreting glands of the nursing filaments are similiar to the alveoli of milk glands in mammals; the secreting glands are seen as two opposing rows of bulb-shaped glands with funnel-shaped mouths, separated by a vascular space. Based on the pectoral fins and gill slits of the early embryo of *Pteroplatea micrura*, the author suggests a line of descent for the species, passing through a *Rhina*-like form and a Myliobatoid form. The author concludes the article with a surmise on the origin of aplacental viviparity in elasmobranchs.

Ambarish, G. P., Kingsley, H. J. & Akhilesh, K. V. (2017). Frequent landing of bull sharks at Vizhinjam. *Marine Fisheries Information Services (T&E Series)*, 233, 23 - 24.

The authors report the unusual landing of bull shark *Carcharhinus leucas* at Vizhinjam, Kerala, during February-Marh 2018, by motorized plywood boats operating hooks and lines, and, in some cases, bottom-set gill nets targeting rays. They record 16 sharks measuring 110-359 mm in total length and weighing 90-330 kg, and note that only 3 sharks were immature. They also report that the sharks were auctioned at prices of ₹ 40,000-90,000/- each.

Ambarish, G. P., Kingsly, H. J. & Zacharia, P. U. (2017). Report on the rare quagga cat shark landed. *Marine Fisheries Information Services (T&E Series)*, 233, 28 - 29.

The authors report the landing of a single male specimen of the quagga shark *Halaelurus quagga* at Muttom, Tamil Nadu on 5 June 2017. They present detailed morphometrics of the specimen which measured 298 mm in total length. It was part of the bycatch of a demersal trawl operated off Muttom at 150-200 m depth.

Ambarish, G. P., Surya, S., Midhunraj, N. K., Suresh, K. K., Kishore, T. G. & Anil, M. K. (2018). Unusual landing of blue shark. *Marine Fisheries Information Services (T&E Series)*, 235, 16.

The authors report the unusual landing of 46 blue sharks, *Prionace glauc*a, weighing 3.5 tonnes, on 3 June 2017 at Thengapattanam landing centre (Kanyakumari district, Tamil Nadu) by hook & line units operated off Mumbai coast by fishermen from Thoothoor and Thengapattanam villages (Tamil Nadu). They report that the catch comprised only males in the length range of 190-285 cm TL, weighing 55-80 kg each. They also provide a profile of the elasmobranchs in the landings at the centre the same day. They note that the blue shark is categorised as 'Near Threatened' in the IUCN Red List.

Ambe, K. S. & Sohonie, K. (1957 a). A comparative study of the proteins of shark and skate and casein. I. Isolation, analysis and comparison of amino-acid make-up. *Indian Journal of Fisheries*, 4(1), 113 - 123.

The authors discuss the results of a comparative study of proteins extracted from the muscle tissue of the sharks *Scoliodon sorrakowah* and *S. palasorrah* and the skate (giant guitarfish) *Rhynchobatus djiddensis* and casein. Following a method of total protein preparation by extracting the proteins with dilute alkali and precipitating the same with acetic acid, they obtained a yield of 10 g/100 g of fresh fish muscle. They report a higher proportion of the basic amino acid fraction in the fish proteins. They also note that the amino acid profile of the fish proteins compares favourably with that of casein. This study was carried out by them to explore avenues to increase the market value and demand for fishes of relatively low edible value in the domestic market.

Ambe, K. S. & Sohonie, K. (1957 b). A comparative study of the proteins of shark and skate and casein. II. Enzymic hydrolysis of the fish proteins and casein. *Indian Journal of Fisheries*, 4(1), 124 - 129.

As part of their comparative study of elasmobranch proteins and casein, the authors studied the action of two proteolytic enzymes, pepsin and trypsin, on these proteins. They compare the determination of total digestible nitrogen when subjected to pepsin hydrolysis, the rate of hydrolysis of the proteins under the influence of trypsin and the order of liberation of amino acids when hydrolysed by trypsin.

Ambe, K. S. & Sohonie, K. (1957 c). A comparative study of the proteins of shark and skate and casein. III. Essential amino-acid content and the nutritive value. *Indian Journal of Fisheries*, 4(1), 130 - 133.

In this third part of documentation of their study, the authors present their observations on the essential amino acids in the sharks and skate proteins, estimated by standard microbiological processes. They report that the fish proteins contain a very good proportion of essential amino acids, and the calculated biological values of the two proteins are of a higher order than that of casein. Through this study, the authors suggest that the fish proteins will be of use as supplementary protein sources.

Ambily, M. N., Zacharia, P. U., Najmudeen, T. M., Ambily, L., Sunil, K. T. S., Radhakrishnan, M. & Kishor, T. G. (2018). First record of African angel shark *Squatina africana* (Chondricthyes, Squatinidae) in Indian waters, confirmed by DNA barcoding. *Journal of Ichthyology*, 58(3), 312 - 317. https://doi.org/10.1134/S0032945218030013

The authors report the landings of a single specimen of the African angel shark *Squatina africana* from Lakshadweep waters. This is the first report of this species from Indian waters, and the authors confirm the identity of the shark through morphological characters and molecular methods. This report suggests an extension in the distribution of the species, which is native to the Western Indian Ocean, from the east coast of Souh Africa to the south-west coast of India.

Aneesh Kumar, K., Paresh Khanolkar, S., Pravin, P., Meenakumari, B. & Radhakrishnan, E. (2012). First record of the pelagic thresher shark *Alopias pelagicus* (Pisces: Alopiiformes: Alopiidae) from the Lakshadweep Sea, India. *Marine Biodiversity Records*, 5, E16. https://doi.org/10.1017/S1755267211001114

The authors report the capture of a male pelagic thresher shark during longline operations in the Lakshadweep Sea by fishermen from Agatti Island on 4 April 2011. They present some morphometric measurements of the specimen which measured 275 mm in total length.

Annandale, N. (1908). A new sting ray of the genus *Trygon* from the Bay of Bengal. *Records of the Indian Museum*, 2, 393 - 394.

The author describes a species of sting ray *Trygon microps* from one large specimen of 195 cm disc breadth, collected from the shallow waters of Chittagong coast. He notes that the species was hitherto undescribed and from the pale colour, delicate skin and small eyes, he surmises that it is likely to be a deep-sea form inspite of having been collected from shallow waters.

Annandale, N. (1909). *Report on the fishes taken by the Bengal fisheries steamer "Golden crown." Part I, Batoidei.* Memoirs of the Indian Museum.2(1), 1 - 58, Pls. 1 - 5. https://doi.org/10.5962/bhl.part.29058

The author provides a detailed description of the batoid fishes taken during cruises of the "Golden Crown", mostly in the northern Bay of Bengal. He describes members of the families Pristidae (4 species and 1 variety), Rhinobatidae (5 species), Trygonidae (16 species), Torpedinidae (4 species) and Myliobatidae (5 species).

Annandale, N. (1910). *Reports on the fishes taken by the Bengal fisheries steamer Golden crown*. Indian Museum Memoirs, 3(1), 1 - 5.

The author supplements the information published in his earlier report, on the families Trygonidae and Myliobatidae, with descriptions of *Trygon uarnak, T. gerrardii, T. fluviatilis, Urogymnus asperrimus* and *Aetobatus narinari.*

Anandhakumar, C., Lavanya, V., Pradheepa, G., Tirumurugaan, K. G., Raj, G. D., Raja, A. & Balachandran, C. (2012). Expression profile of toll-like receptor 2 mRNA in selected tissues of shark (*Chiloscyllium* sp.). *Fish and Shellfish Immunology*, 33(5), 1174 - 1182. https://doi.org/10.1016/j.fsi.2012.09.007

The authors demonstrate the expression of toll-like receptors (TLR), which are components of the immune system, in the tissues of bamboo shark *Chiloscyllium* spp. sharks. They report successful amplification of a 270 bp amplicon using a degenerate primer design strategy that corresponded to the Toll/IL-1 receptor (TIR) domain of TLR2. Through BLAST analysis they were able to obtain a maximum nucleotide identity of 87% and 76% with the TLR2 of higher mammals and teleost fishes respectively. They found that phylogenetically there is a closer clustering of the shark TIR sequence with those from human, cattle, goat, sheep and chicken than with other fish species. Basal expression levels of the TLR2-TIR mRNA are significantly higher in kidneys followed by fins, spleen and intestinal spiral valve (ISV). They also found that in-vivo exposure of sharks to peptidoglycan (TLR 2 ligand) resulted in 9 folds higher expression of TLR2-TIR mRNA in gills followed by 5 folds in the fins, which further increased to 12 fold in skin followed by epigonal, kidneys and ISV when inoculated with a TLR ligand pool. The study thus supports the presence of the TLRs in sharks and also proves their induction upon exposure to specific ligands.

Anandhakumar, C., Raj, G. D., Uma, A., Tirumurugaan, K. G., Raja, A. & Kumanan, K. (2012). Mating behaviour and breeding of the grey bamboo shark, *Chiloscyllium griseum* Müller and Henle, 1838 in captivity. *Indian Journal of Fisheries*, 59(3), 149 - 152.

In this brief but interesting note the authors report mating and breeding of the grey bamboo shark *Chiloscyllium griseum* in captivity. This is a first report from India on shark reproduction in captive conditions. The authors observed mating activity in sharks maintained in marine aquarium for studies on innate immunity. They describe male and female behaviour during the process of courtship and mating, with explicit photographs. They report that egg cases were laid by the female after about a month and a total of 22 eggs were laid within 3 months after mating. They provide descriptions of hatching of the young sharks.

Appukuttan, K. K. (1978). Studies on the developmental stage of hammer head shark *Sphyrna* (*Eusphyrna*) *blochii* from the Gulf of mannar. *Indian Journal of Fisheries*, 25(1&2), 41 - 52.

The author presents a detailed account of the various stages of intra-uterine embryos, placentation and associated aspects of gestation in the hammerhead shark *Sphyrna (Eusphyrna) blochii* from the study of four female specimens collected from the Gulf of Mannar. The author observes the placentation in this species to be intermediate between *S. sorrakowah* (most advanced type) and *Carcharinus dussumieri* (most primitive type). He suggests July-August as the mating season for this species in the Gulf of Mannar, and March-April as the peak parturition period, indicating a gestation period of about one year. At the time of this study, biological studies on sharks from Indian coasts were meager. This article is thus a valuable contribution that added to the Indian knowledge base on sharks, particularly reproductive biology.

Appukuttan, K. K. & Nair, K. P. (1988). Shark resource of India, with notes on biology of a few species. In M. M. Joseph (Ed.), *Proceedings of the First Asian Fisheries Forum*, Asian Fisheries Society Indian branch., pp. 173 - 183...

The authors discuss the status of shark landings in India during the years 1983-84 and 1984-85 with state-wise production statistics. Sharks formed 55% of the total elasmobranch landings and accounted for 39019 t in 1983-84. They report that about one-third of the shark landings was accounted for by the west coast of the country. The authors also provide an account of the biology, including feeding and breeding habits, intra-uterine embryos and growth characteristics of 20 species that contribute significantly to the fishery.

Aravindakshan, M. (1976). Killer sharks in Indian sea. *Science Reporter*, 13, 366 - 367.

The author presents a few facts regarding shark attacks and the species to look out for in Indian waters. He refers to three isolated reports of shark attacks - in Calcutta in 1878, Bombay in 1973 and Alleppey in 1974. While in the first instance, the shark was identified as the Indian sea shark *Charcharias gangeticus*, species identification was not done in the other two cases. The author lists five sharks, *Charcharodon charcharias* (white shark), *Charcharias melanopterus*, *Charcharias gangeticus, Galaeocerda cuvier* and *Prionace glauca*, as dangerous, out of which the first and last were not known to exist in Indian waters.

Aravindakshan, M. (1981). Shark attacks in Indian seas. *Seafood Export Journal*, 13(11), 29 - 30.

The author discusses instances and facts of shark attacks in Indian waters. He identifies the tiger shark, *Galaeocerdo cuvier*, the blue shark, *Prionace glauca*, and the gangetic shark *Carcharhinus gangeticus* as the most dangerous sharks in Indian waters. He also mentions *Carcharias melanopterus*, a relative of the great white which is notorious in the waters of Australia.

Aravindakshan, M. (1988). Record catch of tiger sharks from Maharashtra coast. *Marine Fisheries Information Services (T&E Series)*, 88, 20.

The author discusses the schooling habit of tiger sharks. He reports the catch of tiger sharks through hook and line fishing using cut pieces of catfishes as bait along Maharashtra coast.

Arumugam, G. (2002). On a giant devil ray *Manta birostris* (Walbaum) landed at Tuticorin fishing harbour. *Marine Fisheries Information Services (T&E Series)*, 171, 9.

The author reports landing of a giant male devil ray *Manta birostr*is (Walbaum) locally called, 'Kombu thirukkai', caught by trawlnet at 50 m depth off Tuticorin on 24 March 2001. He reports total length as 331 cm and the disc width as 576 cm, with the total weight being 1850 kgs. He also mentions the existence of a special and organised harpoon fishery for devil rays in Androth and Kalpeni islands of the union territory of Lakshadweep.

Arumugam, G. & Balasubramaniam, T. S. (2003). Whale shark *Rhincodon typus* (Smith) landed at Tuticorin, Gulf of Mannar, *Marine Fisheries Information Services (T&E Series)*, 175, 14.

The authors report the landing of a whale shark measuring 4.45 m and weighing approximately 1.5 t at Thirespuram in Tuticorin on 23 August 2002, after being entangled in a net operated for tuna and allied species. They provide morphometric measurements of the animal which was auctioned for ₹1150/-.

Arumugam, G. & Balasubramanian, T. S. (2006). *Manta birostris* landed at Tuticorin. *Marine Fisheries Information Services (T&E Series)*, 188, 20.

The authors document the landing of a large-sized female *Manta birostris* caught by "singivalai", a type of bottom set gill net, from a depth of 40 m off north landing centre of Tuticorin on 31 March

2006. The animal measured 370 cm in total length, 620 cm in breadth and 1550 kg in weight.

Arumugam, G. & Balasubramanian, T. S. (2007). Value added products from rays at Tuticorin. *Marine Fisheries Information Services (T&E Series)*, 191, 23.

The authors discuss utilisation of rays and their byproducts at Tuticorin. They estimate the annual average catch of rays by trawlers, hook and line, bottom set gillnet and drift gillnet as 1334 t state that almost all the body parts like skin, head, gill rakers, liver, tail and stomach contents of the rays are processed and converted as value-added products which find diversified markets.

Arumugam, G., Balasubramanian, T. S. & Chellappa, M. (2004). Whaleshark, *Rhincodon typus (Smith)* landed at Tuticorin, Gulf of Mannar. *Marine Fisheries Information Services (T&E Series)*, 180, 14 - 15.

The authors document the landing of a male whale shark *Rhincodon typus* measuring 4.78 m in total length and weighing about 1.7 t, caught by a trawler operated at a depth of 70 m and 28 km away from the shore at Tuticorin on 30 July 2003. They provide morphometric measurements of the shark.

Arumugam, G., Balasubramanian, T. S. & Rajapackiam, S. (1990). On the occurrence of chimaeroid egg capsule off Tuticorin, Gulf of Mannar. *Indian Journal of Fisheries*, 37(2), 167 - 168.

In this brief report, the authors document the occurrence of two chimaeroid egg capsules in deep sea trawl catch from a depth of 250-400 m off Tuticorin on 18 January 1990 and discuss the morphometric characters of the egg cases.

Ashok Kumar, K., Ravishankar, C. N., Badonia, R. & Solanki, K. K. (1996). Processing and marketing of whale shark (*Rhiniodon typus*) in Veraval, Gujarat. *Seafood Export Journal*, 27(11), 9.

The authors present a brief account of the processing and trade of whale shark in Veraval. They discuss the methods followed for processing its meat and note that a major problem encountered is the low quality of the processed meat due to microbial spoilage during the long time between capture and towing ashore and also due to poor handling practices. They also discuss the value of the by-products and mention the scope for processed fin rays, while the liver oil is often of a low quality due to the crude methods practised for extracting it.

Ayyangar, S. R. (1922). Notes on the fauna and fishing industries of the Laccadive Islands. Report No. 2of 1922. *Madras Fisheries Bulletin*, *XV*, 45 - 69.

The author presents a detailed account of a cruise to the Laccadive Islands in September 1920 from Mangalore. He documents the fishing practices, fishery resources and other fauna they come across during the cruise. The author records the capture of a big bat ray *Dicerobatus* sp. at Amini Island, measuring 15 feet across the disc and 11 feet in total length. The author estimates the weight of the ray to be bout 560 lb, and notes that the stomach was empty. He also records the occurrence of two species of sucker fish within the mouth of the ray. The author also records a big *Stegostoma*, washed ashore in Kalpeni in mid-December. He notes that the shark was "*thrown away by fishermen as people say they are not eaten*".

B

Babu, C., Ramachandran, S. & Varghese, B. C. (2011). On a new record of sixgill stingray *Hexatrygon bickelli* Heemstra and Smith, 1980 from south-west coast of India. *Indian Journal of Fisheries*, 58(2), 137 - 139.

The authors report the occurrence of the sixgill stingray *Hexatrygon bickelli* based on a single specimen caught at a depth of 508 m off the south-west coast of India. This is the first record of the species from Indian waters. They present a detailed description of the specimen, a male measuring 43.1 cm in disc width, with morphometric measurements. Interestingly, they report that the specimen had seven and not six gill slits on the right side, which is probably an aberration since all earlier records of the species note the presence of six gill slits on either side.

Baby, K. G. (2009). An unusual landing of whale shark *Rhincodon typus* along Blangad beach, Kerala. *Marine Fisheries Information Service (T&E Series)*, 199, 15.

The author reports the incidental capture of a whale shark measuring 515 cm in length and weighing about 500 kg, in a motorized drift net operated at a depth of 30 m off Blangad landing center in Thrissur district, Kerala on 3 March 2008.

Baby, K. G. (2010). A large ray *Mobula diabolus* landed at Ponnani, Kerala. *Marine Fisheries Information Service (T&E Series)*, 206, 18.

The author reports the landing of a large ray *Mobula diabolus* weighing 900 kg, at Ponnani on 23 June 2009. The whale was caught in a drift gill net operated at a depth of 34 m. The author presents some of the morphometric measurements of the ray.

Baby, K. G. (2012). Heavy landing of *Mobula* sp. at Neendakara, Kollam, Kerala. *Marine Fisheries Information Service (T&E Series)*, 212, 20.

The author documents the landing of 36 mobulid rays at Neendakara Fisheries Harbour on 12 June 2012, caught by multiday hooks and lines at a depth of about 450 m from the Goa coast. The total weight of the landings was 3400 kg and the rays were sold @ ₹ 80/kg.

Bal, D. V. & Banerji, S. K.(1951). Survey of the sea fisheries of India. *Proceedings of Indo-Pacific Fisheries Council,* 2, 1 - 6.

The authors present a brief account of sampling design and techniques used for estimating marine fish landings at some centres along the Indian coast. In Appendix II detailing the zone-wise catch composition of major fish groups, they record that sharks formed 5% of the catch along Andhra coast, from Visakhapatnam to Masulipatnam and 15% along the Malabar and South Kanara coast, north of Ponnani to Mangalore, while rays formed 15% of the catch along Coromandel coast, south of Cuddalore up to Devipattanam.

Bal, D. V. & Ghanekar, D. S. (1956). The enzymes of some elasmobranchs from Bombay. IV. Lipases of *Scoliodon sorrakowah* and *Rhynchobatus djiddensis*. *Proceedings of the Indian Academy of Sciences,* B, 44(5), 247 - 256.

The authors study the distribution and activity of lipases in different organs of the shark *Scoliodon sorrakowah* and the guitarfish *Rhynchobatus djiddensis*, using titrimetric methods. They conclude that in both species, lipolytic activity is maximum in the pancreas, minimum in the spleen and kidneys, intermediate in the liver and absent in muscle and brain.

Balakrishnan, K. P. (1963). On a chimaeroid eggcapsule from the Arabian Sea. *Journal of the Zoological Society of India*, 14(2), 137 - 140.

The author describes a chimaeroid egg capsule, tentatively assigned to *Harriota pinnata*.

Balakrishnan, S., Dhaneesh, K. V., Srinivasan, M., Sampathkumar, P. & Balasubramanian, T. (2012). Recurrence of scalloped hammerhead *Sphyrna lewini* from Indian coastal waters. *Marine Biodiversity Records, Marine Biological Association of the United Kingdom*, 5, 79. https://doi.org/10.1017/S1755267212000607

The authors report the catch of a single specimen of the scalloped hammerhead shark *Sphyrna lewini* by a long line, from coastal waters of Nagapattinam (Tamil Nadu, India). The only direct information presented by the authors is that the specimen measured 75 cm in total length and 64 cm in standard length. They then provide a review of the characteristics of the species. However, based on their catch, they infer that the scalloped hammerhead has made reappearance in that part of the coast after 35 years, which is a questionable statement.

Balakrishnan, S., Selvam, R., Sundar, K., Chittibabu, S., Ramamoorthy, U. & Kannan, C. B. N. (2015). Studies on calcification efficacy of stingray fish skin collagen for possible use as scaffold for bone regeneration. *Tissue Engineering and Regenerative Medicine*,12 (2), 98 - 106. https://doi.org/10.1007/s13770-014-0075-y

The authors made an effort to filter collagen from stingray fish skin that was naturally calcified for the purpose. Glutaraldehyde and gambier were used to stabilise soluble collagen collected from the skin of stingray fish. The calcification of stingray skin (SRS) collagen was higher than that of rat tail tendon (RTT) collagen with both cross-linking agents, according to the findings. They discovered that Glutaraldehyde cross linked SRS collagen shrank faster and was more resistant to bacterial collagenase breakdown than gambier treated collagen. According to the findings, glutaraldehyde stabilised SRS collagen could be an excellent candidate for building scaffolds for hard tissue regeneration.

Balasubramaniam, T. S., Rajapackiam, S. & Arumugam, G. (1992). An account on the disposal of deep-sea sharks and skates at Tuticorin. *Marine Fisheries Information Service (T&E Series)*, 116, 10 - 12.

The authors give a vivid account of the market channel and marketing of sharks and skates landed in Tuticorin during January to May 1990. They report that the catch consisted of 6 species of sharks i.e., *Carcharhinus sorrah* (spot tail shark), *Carcharhinus longimanus* (oceanic white tip shark), *Carcharhinus brevipinna*, (spinner shark), *Carcharhinus limbatus* (black tip shark), *Carcharhinus melanopterus* (black tip reef shark) and *Sphyrna lewini* (scallopped hammer head shark) and one species of skate, *Rhina ancylostoma*. Approximately 6.9 tonnes of sharks were auctioned for ₹ 97,242/- during the five-month period. The liver was utilized for extracting oil and the fins were dried for export; the flesh was salted and sent to Kerala. The authors also give a species-wise account of the price realised every month during the period of the study.

Balasubramaniam, T. S., Rajapackiam, S., Kasim, H. M. & Ameer Hamsa, K. M. S. (1993a). On the egg cases of zebra shark (*Stegostoma fasciatum*) caught off Tuticorin Gulf of Mannar. *Marine Fisheries Information Service (T&E Series)*, 121, 11.

The authors report the landing of two zebra sharks measuring 157 and 165 cm in total length and weighing 30 and 34.5 kg respectively, at Tuticorin. They also describe in detail the characteristics of six egg cases found inside one of the sharks.

Balasubramaniam, T. S., Rajapackiam, S., Kasim, H. M. & Ameer Hamsa, K. M. S. (1993b). On the landing of bramble shark (*Echinorhinus brucus*) at Tuticorin. *Marine Fisheries Information Service (T&E Series)*, 121, 13.

The authors report the landing of eighteen bramble sharks by deepsea trawlers at Tuticorin during May 1991. There were 8 males and 10 females; males ranged from 190 to 295 cm in total length and 40 to 140 kg weight while the females ranged from 205 to 298 cm in total length and 60 to 150 kg in weight. The authors also report that one female shark 272 cm long had about 40 developed embryos. This report thus gives an estimate of the relatively high fecundity of the bramble shark, while existing literature documents the number of young ones per litter as ranging between 15 and 24.

Balasubramanyan, R. (1964). On the use of different natural baits for sea fishing in India, *Fishery Technology,* 1(1), 41 - 47.

The author discusses the different natural baits used for marine fishing in India. He notes that the major groups targeted by the fishermen on either coast include perches, carangids, sciaenids, scombroids and elasmobranchs, with long lines and hand lines being the major gears used for elasmobranchs. He lists the major baits used for the capture of sharks, rays and skates as fishes (including small rays and skates), beef, squid, big crabs, turtle flesh and dolphin meat. He lists the major species of elasmobranchs targeted as *Carcharias acutus, C. limbatus, C. melanopterus, Galeocerdo articus, Zygaena tudis, Z. blochii, Trygon sephen, T. uarnak, Aetobatus narinari, Dicerobatus* sp. and *Rhynchobatus ancylostomus*. He comments that sharks have been found to bite off hooks irrespective of the type of bait used, and even in the absence of baits. However, beef flesh, rays, skates and fishes were the common baits used for shark fishing. This article is a very interesting one as it describes the type of fishing methods, live baits and species composition of the catches at the time (although considerable revisions in the taxonomy of elasmobranchs have taken place since then).

Barnes, A., Sutaria, D., Harry, A. & Jabado, R. W. (2018). Demographics and length and weight relationships of commercially important sharks along the north-western coast of India. *Marine and Freshwater Ecosystems*, 28(6), 1374 - 1383. https://doi.org/10.1002/aqc.2940

The authors present biological information on four shark species that occur in the commercial fish landings at Porbander, Gujarat - the milk shark *Rhizoprionodon acutus*, the grey sharpnose shark *Rhizoprionodon oligolinx*, the spadenose shark *Scoliodon laticaudus*, and the bigeye smoothhound shark *Iago omanensis*. They also discuss the seasonal variation in the availability of mature adults and neonates in the landings. The data presented in this paper updates the available earlier information on these shark species and will be of use in quantitative population assessments of these species.

Batcha, H. (1990). On a shoal of Javanese cow-nose ray from Palk Bay. *Marine Fisheries Information Service (T&E Series)*, 104, 10.

The author reports fishing of a shoal of Javanese cow-nose ray *Rhinoptera javanica* in the Palk Bay by shrimp trawlers on 16 December 1989. He documents that disc width and weight ranged from 100 to 165 cm and 16 to 57 kg respectively. He also records that the gut contents of the rays consisted of crushed pieces of gastropod shells, partly digested fishes such as sciaenids and gobids, and crustaceans like crabs, Squilla, *Penaeus semisulcatus* and *Alpheus* spp.

Batcha, H. & Reddy, P. S. (2007). First report on the philopatric migration of bull shark, *Carcharhinus leucas* in the Pulicat lagoon. *Marine Fisheries Information Service (T&E Series)*, 191, 30.

The authors observe philopatric migration, a unique migratory behaviour of pregnant bull sharks *Carcharhinus leucas* for parturition. They report the capture of four such pregnant bull sharks by a modified gillnet, made of cotton twine from Pulicat lagoon during 2005-06. They record the size range of the adult bull sharks and the sharklings as 300-350 cm total length and 300-335 kg weight and 620-840 mm total length and 3.5-4.1 kg weight, respectively.

Behera, P. R., Bar, S., Jayasankar, R., Muktha, M., Ghosh, S. & Edward, L. (2013). Occurrence of near threatened tiger shark, *Galeocerdo cuvier* (Peron & Lesueur, 1822) from Puri coast, Odisha. Marine Fisheries Information Service Technical & Extension Series, 217. p. 19.

In this brief note, the authors report the landing of a tiger shark measuring 105 cm in total length and weighing approximately 10 kg, at Pentakota

landing centre in Odisha on 20 March 2013. They note that the shark was incidentally caught in hook and line operated from a traditional fishing craft between 40-70 m depth.

Benjamin, D., Rozario, J. V., Jose, D., Kurup, B. M. & Harikrishnan, M. (2012). Morphometeric characteristics of the Ornate eagle ray *Aetomylaeus vespertilio* (Bleeker, 1852) caught off Cochin, southwest coast of India. *International Journal of Environmental Sciences*, 3(1), 685 - 688. https://doi.org/10.6088/ijes.2012030131066

In this brief article, the authors describe some morphometric characteristics of the ornate eagle ray *Aetomylaeus vespertilio* from a single male specimen collected from tuna by-catch landing by a gillnetter at Cochin Fisheries Harbour in April 2011. The specimen, a male measuring 180 cm in total length and 195 cm in disc width, weighed 4.4 kg.

Bennet, S. P., Arumugam, G. & Balasubramanian, T. S. (1990). Tagged tiger shark (*Galeocerda cuvieri*) landed at Tuticorin. *Marine Fisheries Information Service (T&E Series)*, 104, 14 - 15.

The authors report the landing of a female tiger shark on 24 August 1989, caught by a mechanised boat operating hooks and lines 40 km from the shore, southeast of Tuticorin, at 26 fathoms depth. They document that the shark was landed with a tag in the form of a girdle around the nape just behind the 5th gill opening, piercing through the muscle at the base of right pectoral fin. The tag measured 1045 mm in circumference and 10 mm in width and was made of plastic, with coded markings imprinted to a length of 33 mm of the tag from one end. The authors have provided a pictorial depiction of the coded markings on the tag. However, they do not mention anything about the source or origin of the tag. They also provide morphometric measurements of the shark.

Bensam, P. (1964). On a freak embryo of the grey shark *Carcharinus limbatus* Müller and Henle. *Journal of the Marine Biological Association of India*, 7(1), 206 - 208.

The author discusses an abnormal embryo observed in a pregnant grey shark *Carcharhinus limbatus* that he observed at Cannanore landing centre on 12 February 1961. He found 5 normal embryos along with the freak embryo inside the same mother shark. He reports that the features that distinguished the freak embryo from the normal ones were 4 branchial slits instead of 5, shortened and stumpy caudal fin, highly curved pectoral fins, flap-like ear-shaped anal fin fused with caudal fin, dorsal fin folded to the right side at its base and an inverted comma-shaped structure on the left side of the caudal region. The author has not reported on the scientific cause of the abnormal characters, but conjectures that the freak embryo might have developed from an egg which was fertilized after the others and that the older sister foetuses might have exerted pressure on the post-cephalic region of the developing embryo, resulting in its malformation.

Bhargava, A. K., Somvanshi, V. S. & Varghese, S. (2002). Pelagic sharks by-catch in the tuna longline fishery of the Indian EEZ. In N. G. K. Pillai, N. G. Menon, P. P. Pillai, & U. Ganga (Eds.), *Management of Scombroid Fisheries* (pp. 165 - 176).

The authors provide a detailed account of the pelagic and oceanic shark resources of the Indian EEZ from the tuna longline bycatch obtained during surveys for oceanic tuna resources. They list about 14 species of sharks which together formed 52, 50 and 45% respectively of the total catch from the southeast, Andaman and northeast sectors of the EEZ, and 49 and 32% respectively from the northwest and equatorial sectors. They report relatively higher hooking rates from the southwest, southeast and Andaman & Nicobar sectors. This study emphasises the possible commercial longline fishery for sharks in the oceanic part of the Indian EEZ. The results have been presented sector-wise with details of the location of the fishing grounds, which makes this article particularly useful in relating shark species

to possible areas of exploitation in the EEZ. They ratify their findings from a comparison of the catch by industrial longliners - chartered foreign vessels and Indian owned joint venture/leased vessels.

Bhatkal, G. (1994). Landing of whale sharks. *CMFRI Newsletter*, 63, 8.

The author reports the landing of two whale sharks measuring 2.5 m and 3 m in total length, caught by purse seines operated at 40 m and 24 m depth on 22 February and 3 March 1994 respectively at Bhatkal and Ganguli in Karnataka.

Bhimachar, B. S. & Venkataraman, G. (1952). A preliminary study of the fish populations along the Malabar Coast. *Proceedings of the National Institute of Sciences of India*, 18(6), 627 - 655.

This is an exhaustive account of the composition of the inshore fish population of the Malabar coast studied from the weekly fish collection during April 1949 to March 1950, from the sea near West Hill (Calicut) using boat seines and gillnets. The authors present a very detailed account of the different predominant fish groups and their variability with the season and environmental conditions. Among the fish groups, the authors mention the family Carcharhinidae, and three species of sharks - *Scoliodon sorrakowah, S. palasorrah and S. walbeehmi*. Although sharks did not rank high in predominance, the authors mention that among the sharks, *S. sorrakowah* was prominent with the collections including 188 specimens obtained at wide intervals. However, they obtained specimens continuously during the first quarter of 1950. They also mention that all these sharks taken from the inshore waters were of juvenile size ranges, with the size range of *S. sorrakowah* being 11 - 30 cm.

Bineesh, K. K., Gopalakrishnan, A., Jena, J. K., Akhilesh, K. V., Basheer, V. S. & Pillai, N. G. K. (2013). Sharks and rays in Indian commercial fisheries: need for revision of taxonomy. In E. Vivekanandan, Maeve Nightingale, & N.M. Ishwar (Eds.), *Ecosystem approaches to the management and conservation of the fisheries and marine biodiversity in the Asia Region* (pp. 143 - 145).

In this paper, the authors attempt to highlight the confusion and inconsistencies in species identification of elasmobranchs in Indian waters. They carried out barcoding of 105 species of chondrichthyans from 56 genera, 34 families, 10 orders from two subclasses, the Holocephali (Rhinochimaeridae and Chimaeridae, two species) and the Elasmobranchii (sharks and rays, 103 species) for a 655bp region of COI from 484 specimens. They also used the partial sequence of 16S rRNA along with COI genes in certain families such as Rajidae, Scyliorhinidae and Centrophoridae that showed considerable morphological similarity and overlapping characters among species. Through this study, the authors confirm the existence of 150 species of elasmobranchs and record the presence of eleven species, new to Indian waters, which require formal species descriptions. They also demonstrate that sequencing a ~650 bp region of mtDNACOI permits discrimination of 100% of 105 species of chondrichthyans. They suggest taxonomic revision of families such as Triakidae, Centrophoridae, Torpedinidae, Dasyatidae, Rajidae, Rhynchobatidae and Rhinidae with wide regional sampling, comparisons and collaborations using conventional and molecular techniques. They also advocate the conduct of IUCN regional status assessment workshops to validate the Arabian Sea and Bay of Bengal species, which are presently classified under Data Deficient and Not Evaluated categories.

Bineesh, K. K., Akhilesh, K. V., Sajeela, K. A., Abdussamad, E. M., Gopalakrishnan, A., Basheer, V. S. & Jena, J. K. (2014). DNA barcoding confirms the occurrence of rare elasmobranchs in the Arabian Sea of Indian EEZ. *Middle-East Journal of Research*, 19 (9), 1266 - 1271.https://doi.org/10.3109/19401736.2015.1137900

The authors, based on DNA barcoding, confirm the occurrence of rare elasmobranch species such as

Rhynchobatus australiae Whitley, 1939, *Dasyatis microps* Annandale (1908), *Himantura granulata* (Macleay, 1883), *Aetomylaeus vespertilio* (Bleeker, 1852) in the Arabian Sea off the south-west coast of India. They were able to match 640 bp COI sequence fragments with specific sequences available on the Barcode of Life (BOLD) System Database. This is a very useful study which documents extension in the known range of distribution of these rare species.

Bineesh, K. K., Gopalakrishnan, A., Akhilesh, K. V., Sajeela, K. A., Abdussamad, E. M., Pillai, N. G. K., Basheer, V. S., Jena, J. K. & Ward, R. D. (2016). DNA barcoding reveals species composition of sharks and rays in the Indian commercial fishery. *Mitochondrial DNA Part A*,28, 4, 458 - 472. http://dx.doi.org/10.3109/19401736.2015.1137900

Through this study, the authors developed DNA barcodes/reference sequences for 111 chondrichthyan species collected from 11 landing locations along the east and west coasts of India. The sample size per species ranged from 2 to 13 with an average of 5.1. Representatives from 60 genera, 34 families, 10 orders, and two subclasses (Holocephali and Elasmobranchii) were barcoded. They compared all sequences with those in the NCBI GenBank and BOLD databases to verify initial identifications. Forty of the 111 species had not been previously barcoded. A complete list of species, DNA barcoded, with major collection locations and GenBank accessions has been provided in the paper. This study is a valuable contribution as it documents the chondrichthyan diversity in the Indian commercial fishery, including bycatch landings.

Blyth, E. (1847). Zoological Department Report. *Journal of Asiatic Society of Bengal*, 16, 725 - 726.

In this report, the author acknowledges the donation of specimens to the collections of the Zoological Department, including a specimen of zebra shark, *Stegostoma*. He identifies the species as *S. carinatum*. He provides a vivid description of the shark which was 4 feet long, brown in colour with spots and ridges on the body.

Blyth, E. (1860). The cartilaginous fishes of lower Bengal. *Journal of Asiatic Society of Bengal*,29(1), 35 - 45.

The author enumerates the sharks, rays and skates collected from the fish markets in Calcutta, and presumably indicative of the populations inhabiting the Gangetic delta. The species list includes *Stegostoma fasciatum, Squalus (Scoliodon) laticaudus, Squalus (Carcharinus) milberti, Squalus (Carcharinus) gangeticus, Squalus (Carcharinus) temmincki, Squalus (Carcharinus) melanopterus, Sphyrnias blochii, Galeocerdo tigrinus, Pristis antiquorum, Pristis pectinatus, Rhinobatus granulatus, Rhinobatus obtusus, Dasyatis micrura, Aetobatis flagellum, Trygon marginatus, T. atrocissimus, T imbricatus, T. walga, T. bleekeri, T. ellioti, T. russellii, T. variegatus, T. uarnak*and *T. crozierii.* The author provides descriptions of the examined specimens and gives a detailed account of the *Trygon* species complex.

Biswas, S., Mishra, S. S., Das, N. P. I., Nayak, L., Selvanayagam, M. & Satpathy, K. K. (2012). First record of eleven reef inhabiting fishes from Tamil Nadu coast of India, Bay of Bengal. *Proceedings of the Zoological Society*, 65(2), 105 - 13. http://dx.doi.org/10.1007/s12595-012-0042-3

The authors describe eleven reef-associated fishes from the Tamil Nadu coast, including the stingray, *Himantura gerrardi* and the electric ray, *Torpedo sinuspersici*. The authors state that these species are new to the Tamil Nadu coast, which appears to be an erroneous observation.

Bonfil, R. (1994). Overview of world elasmobranchs fisheries. *FAO Fisheries Technical Paper No.341*. Rome.119. http://www.fao.org/docrep/003/v3210e/V3210E03.htm#ch2.2.3.3

In this description of the elasmobranch fisheries of the world, The author gives a brief account of India's

elasmobranch fisheries during the period 1977-1991. He suggests the need for careful monitoring, with a caution that with catches as high as 73,500 t in 1988, the elasmobranch fisheries in India are unlikely to sustain over long periods.

Bonfil, R. (2002). Trends and patterns in world and Asian elasmobranch fisheries. In: S. L. Fowler, T. M. Reed, & Dipper, F.A.(Eds.), *Elasmobranch biodiversity, conservation and management: Proceedings of the International Seminar and Workshop in Sabah, July 1997, IUCN SSC Shark Specialist Group* (pp. 15 - 24).

In this article, The author analyses the status of elasmobranch fisheries across the globe and in the Asian region, using FAO statistics for the period 1947-2001. He indicates India as a major elasmobranch fishing nation, accounting for about 20% of the shark and ray catches by the Asian and South-east Asian countries. He raises concern over the steep increase in elasmobranch catches in India, and also highlights the difficulty in proper assessment as most of the catch is reported as "elasmobranchs", without species-wise assessments.

Borrell, A., Cardona, L., Kumarran, R. P. & Aguilar, A. (2011). Trophic ecology of elasmobranchs caught off Gujarat, India, as inferred from stable isotopes. *ICES Journal of Marine Science*,68(3), 547 - 554. https://doi.org/10.1093/icesjms/fsq170

The authors use stable isotope analysis to establish the trophic level of 13 species of elasmobranchs caught from the Arabian Sea off Gujarat. This is perhaps one of the first attempts at such a study in elasmobranchs from Indian waters, and the first report of the same. The sample included six species of shark, *Carcharhinus sorrah, Rhizoprionodon acutus, Mustelus manazo, Sphyrna lewini, R. typus, and Stegostoma fasciatum,* the sawfish *Pristis pectinata,* and six batoids, *Himantura bleekeri, Aetomylaeus maculatus, Mobula diabolus, Rhina ancylostoma, Rhinobatos granulatus,* and *Rhynchobatus djiddensis*. Using the clupeiform *Ilisha melastoma* of known trophic level as a baseline, they estimated the relative trophic levels of the elasmobranchs and report that all the sharks except *R. typus* had relatively higher trophic levels (>3.8) while the batoids had lower trophic levels (<3.8); the sawfish *P. pectinata* has the highest trophic level of 4.34 (although the authors have not been able to elucidate the reasons for this). They suggest ontogenetic dietary shifts in *S. lewini* and *R. typus*, in which trophic level increases with length. They also identify *R. typus, M. diabolus* and *R. ancylostoma* as the most epipelagic species and *S. fasciatum, P. pectinata, R. granulates* and *A. maculatus* as the most inshore and benthic species. A significant observation they make based on their samples is the predominant fishing of newborns and juveniles of many species, particularly *S. lewini,* in Indian waters.

Borrell, A., Aguilar, A., Gazo, M., Kumarran, R. P. & Cardona, L. (2011). Stable isotope profiles in whale shark (*Rhincodon typus*) suggests segregation and dissimilarities in the diet depending on sex and size. *Environmental Biology of Fishes*, 92(4), 559 - 567. https://doi.org/10.1007/s10641-011-9879-y

The authors discuss sex-wise and size-wise dietary differences in the whale shark *Rhyncodon typus* from the north-eastern Arabian Sea off Gujarat, studied using stable isotope analysis. They found that the overall isotope signature was similar to that of the pelagic-neritic zooplanktivore *Ilisha melastoma*, indicating similarity in prey preference. They found a high positive correlation between the isotopes of Nitrogen (N^{15}) and Carbon (C^{13}), suggesting increasing contribution of small fish and/or larger zooplankton to the diet as the fish moves from offshore areas to coastal areas.

Bose, A. N., Dasgupta, S. K. & Srimani, B. N. (1958). Studies on fishes of Bay of Bengal II. Processing of sharkflesh. *Indian Journal of Veterinary Sciences,* 28, 163 - 169.
Reprint not obtained'

Brar, S. (1998). On a whale shark landed at Paradeep, Orrisa. *Marine Fisheries Information Service (T&E Series)*, 155, 20.

The author reports the landing of a female whale shark measuring 6.69 m in total length, at Paradeep in Orissa on 4 November 1997, caught by a trawler that operated 6 km southeast off Paradeep. He also notes that the shark was discarded due to a lack of demand for its flesh.

Burman, B. K. (1994a). On a zebra shark landed along the northeast coast of India. *Marine Fisheries Information Service (T&E Series)*, 131, 22 - 23.

The author reports the landing of a zebra shark *Stegostoma fasciatum* caught in a monofilament gill net at Raidighi fish landing centre near Contai, West Bengal, on 11 February 1994, and records a few morphometric measurements.

Burman, B. K. (1994b). Shark landing at Kakdwip in West Bengal. *Marine Fisheries Information Service (T&E Series)*, 135, 13 - 15.

The author documents the inception of hook and line fishery targeting sharks and rays in Kakdwip, West Bengal, using dolphin and eel meat as bait. He presents a lucid account of the fishing operations and the economics involved, along with a detailed break-up of the catch in each unit and the market rates for the landed elasmobranch species.

Burman, B. K. (1994c). On the landing of a tiger shark and skate at Digha, Conta, West Bengal. *Marine Fisheries Information Service (T&E Series)*, 135, 16.

The author reports the landing of a tiger shark *Galeocerdo cuvier* and a skate (sawfish) *Pristis microdon* by a baram gillnet of 17.5 cm mesh size, at Digha, near Contai, West Bengal on 23 December 1992, and presents the morphometric measurements of the tiger shark.

Burton, R. W. (1940). A visit to the Laccadive Island. *Journal of Bombay Natural History Society*, 41, 488 - 513.

The author chronicles details of a visit to the Laccadive Islands in a manner so explicit that the reader is transported with the writer. There are a few references to sharks and shark fishing in the text. He mentions the use of harpoons - 11-foot shafts- as being used for hunting porpoises, dolphins, sharks and rays (page 492). He mentions incidents when sharks were captured (page 503), the largest being a 90 lb pregnant *Carcharias* with four young ones, each measuring 22 inches in length. He also mentions the possible sighting of a whale shark as they set sail to return (page 512).

C

Cantor, T. E. (1837). Description of new species of *Zygaena. Calcutta Medical and Physical Society*, 1837, 315 - 320.

Reprint not obtained. Information accessed from - Pollerspöck, J. (2011), Bibliography database of living/fossil sharks, rays and chimaeras (Chondrichtyes: Elasmobranchii, Holocephali)

The species described in this article is *Zygaena laticeps* (Valid name: *Eusphyra blochii* (Cuvier, 1816)).

Chacko, P. I. (1944). Occurrence of a new variety of the skate, *Urogymnus asperrimus* around Krusadai Island, Gulf of Mannar. *Current Science,* 13(3), 81.

In this brief letter to the Editor, the author highlights the occurrence of a new variety of the skate *Urogymnus asperrimus* in the waters around Krusadi Island in the Gulf of Mannar. He describes the differences between the variant and *U. asperrimus* and mentions that the Director, Zoological Survey of India did not find it sufficient to create a new species for the Krusadi. However, since the author found consistency in variations in the Krusadi area, it was denoted as a new variety - *Urogymnus asperrimus* var. *krusadiensis.*

Chacko, P. I. & Mathew, M. J. (1954). A record of the whale shark (*Rhineodon typus* Smith) from the Malabar coast. *Journal of Bombay Natural History Society*, 52 (3), 623.

The authors report the entangling of two whale sharks, a male and a female, in a boat-seine net operated at 9-10 fathoms depth for catfish in the sea off Madapilly, north of Calicut on the south-west coast of India. The author reports that attempts by 80 fishermen in 10 canoes to haul both the sharks ashore failed, and the female was allowed to escape. The male shark which was landed live, measured 21.5 feet in length and weighed about 2.5 tonnes. The authors provide some information on the appearance and morphometric measurements of the shark, which they note was sold for ₹ 290/- to local merchants. The authors did not find any stomach content in the animal; they record the fishermen's observation of a shoal of pomfrets swimming in close association with the animals. This report is the first record of a whale shark from the Calicut coast and the authors also mention previous reports of whale sharks from other parts of the Indian coast.

Chakraborty, K. & Joseph, D. (2018a). Effects of antioxidative substances from seaweed on quality of refined liver oil of leafscale gulper shark, *Centrophorus squamosus* during an accelerated stability study. *Food Research International*, 103, 450 - 461. https://doi.org/10.1016/j.foodres.2017.10.018

The authors report their evaluation of the antioxidative potentials of ethyl acetate extracts from five brown seaweeds, *Sargassum wightii*, *Sargassum ilicifolium*, *Sargassum tenerrimum*, *Padina gymnospora* and *Turbinaria conoides* in improving the quality of refined liver oil of the leafscale gulper shark *Centrophorus squamosus*. They estimated the oxidative changes in the refined oil after accelerated storage by evaluating the lipid oxidation products by various in vitro assays and analyzed the differences in C20 - 22 n-3 PUFA profile before and after the study period to determine the antioxidative potentials of the seaweeds. Isochromenyl benzoate and dihydrofuranone group of compounds isolated from the EtOAc extract of *S. wightii* appeared to play a major role to prevent the oxidative degradation of the refined oil leading to rancidity. Nuclear magnetic resonance and mass spectroscopic fingerprint analysis of different groups of marker compounds responsible to cause the rancidity of the oil further signified the efficacy of *S. wightii* to arrest the development of undesirable oxidation products during storage on shelf.

Chakraborty, K. & Joseph, D. (2018b). Preparation and physicochemical attributes of refined liver oil from deep-sea dogfish. *Journal of the American Oil Chemists' Society*, 95(5), 591 - 605. https://doi.org/10.1002/aocs.12055

In this study, the authors report the efficacy of refining the crude triglycerides extracted from the liver oil of a deepsea dogfish, *Centrophorus squamosus* by incorporating stepwise procedures of degumming, neutralization, bleaching and deodorization. They monitored the physicochemical qualities and the C20 - 22 n-3 PUFA composition during the clarification process by various quantitative and qualitative methods. The progression of the stepwise clarification process was also monitored by gas chromatography-mass spectroscopy (GC-MS)-based fingerprint analyses to examine the various functional and chemical attributes of the deodorization process. The suitable degumming agent was found to be phosphoric acid, which was able to remove the hydrocarbon functions in the crude oil and also maintained the undesirable physicochemical properties below their threshold limits. Activated charcoal/Fuller's earth (1:1) could effectively reduce the colored impurities in the oil during the downstream process of refining. The authors report that the multistep refining process of CDLO significantly increases the composition of long-chain C20 - 22 n-3 PUFA without affecting the desirable physicochemical properties.

Chandran, E. T.(1980). *Handling and processing of sharks in India (Lakshadweep)* [M.Sc. Thesis, C.I.F.E., Bombay].
Thesis not obtained

Chandrasekharan, F. & Bose, S. V. C.(1973). A note on the whale shark, *Rhincodon typus* Smith netted off Manapad. *Journal of the Marine Biological Association of India*, 15 (1), 438 - 439.

This is a brief report on the capture of a male whale shark entangled in a nylon net operated 6-7 miles of Manapad, Tamil Nadu, at a depth of 20-24 m, on 2 February 1973. The authors present some morphometric measurements of the shark and note that the liver weighed 47 kg but yielded only ½ kg of poor-quality oil. The shark which was sold for ₹45/-, was exhibited for a few days at Odangudi, after which it was buried for manure.

Chandy, M. (1955). The nervous system of the Indian sting-ray *Dasyatis* Rafinesque (*Trygon cuvier*). *Journal of the Zoological Society of India,* 7(1), 1-12.
Reprint not obtained

Chaudhary, R. G., Joshi, D., Mookerjee, A., Talwar, V. & Menon, V.(2008). *Turning the tide- The campaign to save Vhali, the whaleshark in Gujarat.* Wildlife Trust of India.

In this conservation action report, the authors detail the story of participatory conservation of the whale shark in Gujarat through a Whale shark Conservation Programe of the Wildlife Trust of India in partnership with International Fund for Animal Welfare, Gujarat Forest Department, Tata Chemicals Ltd. and Gujarat Heavy Chemicals Ltd. With a dipstick survey revealing that awareness levels among adults on poaching and the protected status of the shark to be as low as 19% in Veraval, the hub of the whale shark fisheries, the Save the Whale Shark Campaign was initiated to build awareness on its protected status and illegal killings among the local fishing community in order to stop the killings and to urge the general public of Gujarat to protect it. The authors present the progress of the campaign through various phases in different parts of coastal Gujarat during 2004-2007. The effectiveness of the campaign was measured in dipstick surveys in the years 2005 and 2007, and the final survey in 2007 revealed that awareness levels on the legal status of the whale shark had reached 69% among adults in Veraval.

Chaudhuri, B. L. (1908). Descriptions of a new species of saw-fish captured off the Burma coast by the Government of Bengal's steam trawler "Golden Crown". *Records of the Indian Museum,* 2(4), 391 - 392.

The author describes a new species of sawfish, *Pristis annandalei*, from one male specimen caught near Elephant Point, Burma Coast, in July 1908. The specimen measured 8 feet, 7 inches, without the rostrum. The author provides some details of its meristics and morphometrics and outlines the traits differentiating it from *P. zysron*.

Chaudhuri, B. L. (1911). Freshwater sting-rays of the Ganges. *Journal of Asiatic Society of Bengal,* 7, 625 - 629.
Reprint not obtained

Chaudhuri, B. L. (1916). Fauna of the Chilka lake. *Fish. Part-I. Memoirs of the Indian Museum*, 5, 405 - 413.

In this part of a systematic treatise on the fauna of the Chilka Lake, The author describes ten elasmobranch species of the Sub-orders Selachii and Batoidei, of the order Palgiostomi. He describes the sharks *Physodom mulleri, Carcharhinus gangeticus* and *Carcharhinus melanopterus* of the family Carcharhinidae, the sawfish *Pristis pectinatus* of the family Pristidae, the rays *Trygon uarnak, T. pareh, T. imbricata, Hypolophus sephen* of the family Trygonidae, *Aetobatis flagellum, A. guttata* and *Aetomylaeus nichofii* of the family Myliobatidae. He gives detailed descriptions and distribution status of all the species, with morphometric details of the rays.

Chembian, A. J. (2007). New record of *Rhino chimaera atlantica* (Chimaeriformes: Rhinochimaeridae) spawning ground in the Gulf of Mannar along the southeast coast of India. *Indian Journal of Fisheries,* 54(4), 345 - 350.

The authors identify the spawning grounds of the chimaera *Rhinochimaera atlantica* in the Gulf of Mannar on the southeast coast of India, based on a collection of 89 egg capsules (one with embryo) collected in March 2007 during demersal trawl surveys at depths of 200-500 m. They describe the capsule and the embryo in detail.

Chembian, A. J. (2010). Description of spawning ground and egg capsules of the batoid *Raja miraletus* Linnaeus, 1758 in the Wadge Bank, along the south-west coast of India. *Indian Journal of Fisheries*, 57(1), 13 - 16.

The authors identify the possible spawning grounds of the skate *Raja miraletus* in the Wadge Bank on the south-west coast of India, based on a collection of egg capsules collected in May 2008 during demersal trawl surveys at depths of 45-221 m. They report 119 egg capsules, of which 117 were hatched out and therefore, empty, and two held embryos. They provide detailed descriptions of the egg capsule and the embryo and suggest the terminal period of incubation to be in May.

Chidambaram, K. (1945). Note on the food of tiger sharks (*Galeocerdo* spp.) of the Madras coasts. *Journal of Bombay Natural History Society*, 45 (2), 247.

The author discusses the food of tiger sharks, feared for their ravenous appetites and attacks on human beings. The author's description of the food items discovered in the stomachs of several specimens of two tiger shark species, *Galeocerda arcticus* and *G. rayneri*, however indicate the shark's preference for fishes. He lists a variety of fishes found in the sharks sampled from different coastal regions of the Madras Presidency - mackerel, seer, soles, silverbellies, catfish, horse mackerels, small sharks, skates and cuttlefish in the Malabar and S. Kanara coasts, catfish, ribbonfish, anchovies on the Vizagapatam coast and flying fish, hilsa, horse mackerels, silverbellies, small sharks and small sawfish in the Tanjore, Ramnad and Tinnevelly coasts. He also mentions turtles and sea-snakes, with the latter being common in the tiger sharks sampled from either coast. He ends the article with a reference to some earlier reports of interesting objects found in the stomach of *G. arcticus,* such as the head of a cow found in a female caught off Tellicherry, two biscuit tins found in a male caught off Pudimaddaka, a goat found in a male shark caught off Lawson's Bay and a bag containing 10 lb of raw rice in another male tiger shark.

Chidambaram, K. & Menon, M. D. (1946). *Investigations on the shark fishery of Madras Presidency.* Govt. Museum, Madras. [Breeding in *Galeocerdo* spp., *Carcharhinus melanopterus, Sphyrna* spp. and *Pristis* spp.]
Reprint not obtained

Chidambaram, L. (1986). Note on a whale shark *Rhincodon typus* Smith landed at Pondicherry. *Marine Fisheries Information Services (T&E Series)*, 66, 36.

The author reports the incidental capture of a juvenile male whale shark *Rhincodon typus* by the Solathandavankuppam fishermen of Pondicherry State on 30 January 1984. The author notes that the shark was entangled in a gillnet, locally called kattuvalai, of 13 cm mesh size. Some morphometric measurements of the shark are presented which indicates that it measured 497 cm in total length.

Choodamani, N. V. (1941). On the smallest Elasmobranch egg. *Proceedings of 28th Indian Science congress (Bonarus)*, Pt. 3 (Abstracts), 179.

The authors describe the processof gastrulation of the egg, blastoderm formation, enclosure of the yolk and embryos of *Scolidon sorrakowah*.

CMFRI. (1981). Whale sharks land near Mangalore. *CMFRI Newsletter*, 11, 5.

This news snippet records three instances of whale shark landings along the Karnataka coast, near Mangalore in January 1981 - three whale sharks caught off Kaup on 20 January, two landed at Malpe on 31 January, and one captured by a purse-seiner at 18 m depth off Anjadev island and landed at Karwar on 21 January. The lengths (possible total length) of the specimens are mentioned.

CMFRI. (1986). Biheaded baby shark landed. *CMFRI Newsletter*, 34, 6.

This news snippet reports that a biheaded baby shark was dissected out from a pregnant shark caught by gillnet off Miani near Porbandar. The baby shark measured 290 mm in total length and weighed 170 g. The author, however, does not make any mention of the species of the shark.

CMFRI. (1988). Whale sharks landed. *CMFRI Newsletter*, 39, 7.

This very brief note records the fishing of forty whale sharks by fishermen of Veraval during the first half of March. This is the first report of large-scale fishing of the whale shark in Indian waters. There is however no mention of the size range of the individuals caught.

CMFRI. (1993). Whale shark landings. *CMFRI Newsletter*, 60, 6.

This brief note reports the fishing of about 300 whale shark individuals during March-April 1993, indicating the demand for this shark, mainly for its fins and liver. There is however no mention of the size range of the individuals caught.

CMFRI. (1995). Whale shark landed. *CMFRI Newsletter*, 66, 6.

This is a very brief news snippet recording the capture of two whale sharks weighing 2 and 3 tonnes, respectively at Veraval during February 1995.

CMFRI. (2002). Smallest whale shark recorded. *CMFRI Newsletter*, 96, 3.

This brief note records the incidental entangling of a juvenile whale shark in gillnet laid for sardines. The shark was landed live at Vizhinjam fish landing centre and was kept alive for about 13 hours. The report claims this individual to be smallest whale shark captured till then from Indian waters; the size however is not mentioned.

CMFRI. (2005). World record sized giant bull shark caught at Chennai coast. *CMFRI Newsletter*, 107, 5.

This is a brief report on the landing of a large-sized female bull shark by a mechanized gill netter at Chennai's Fisheries Harbour in Kasimedu on 22 June 2005. The shark measured 356 cm in total length and weighed 320 kg, and was auctioned for ₹32,000/-.

CMFRI. (2007a). Diversity of deep-sea resources in the shelf break area of Indian EEZ. *CMFRI Newsletter,* 113, 3.

This is a brief report on thirteen fishing operations carried out by *FORV Sagar Sampada* during cruise 250 using the Expo model net and HSDT CV nets in four transects in the continental slope between 200 and 800 m depth of the southwest coast of India in October 2006. Seventy-four species of deep-sea resources, including fourteen elasmobranchs, have been listed in the catch. The deep-sea shark *Halaelurus lutarius* reportedly formed 10%. The other elasmobranchs recorded in the catch are - *Apristurus indicus, Benthobates moresbyi, Cephaloscyllium sufflans, Centrophorus lucitanicus, Centroscyllium fabrici, Centroscymnus crepidater, Chimaera sp., Dipturus johannisdavisi, Eridachnus radclifii, Etmopterus pussilis, Neoharriota pinnata, Raja circularis,* and *Raja miraletus.*

CMFRI. (2007b). Rare specimen of roundel skate landed at Pamban, Gulf of Mannar. *CMFRI Newsletter*, 115, 4.

This brief report highlights the landing of a roundel skate, *Raja texana*, caught by a trawler at Pambantherkuvadi on the Gulf of Mannar coast in July 2007. The skate weighed 760 g.

CMFRI. (2008a). Whale shark landed at Visakhapatnam fishing harbour. *CMFRI Newsletter*, 118, 8.

This brief report documents the landing of a whale shark 401 cm FL at Visakhapatnam Fishing Harbor on 24th June 2008. The shark was entangled in a large-mesh gillnet locally known as 'panduvala'.

CMFRI. (2008b). *Stegostoma fasciata* - a rare shark landed at Puthiyappa Harbour. *CMFRI Newsletter*, 118, 8.

This news snippet reports the landing of a 3 ft long *Stegostoma fasciata* at Puthiyappa Fisheries Harbour on 6th June 2008.

CMFRI. (2008c). Landing of female bull shark and Napoleon wrasse fish at Tuticorin. *CMFRI Newsletter*, 119, 8 - 9.

This note reports the landing of a female bull shark *Carcharhinus leucas* at Tuticorin Fisheries Harbour. The shark which measured 311 cm in total length and weighed 320 kg, had been caught in trawl operations at a depth of 50 m.

CMFRI. (2008d). DFO Kannur registered a criminal case against the fishermen of Malabar Region for catching whale sharks and selling of its meat. *CMFRI Newsletter*, 119, 16-17.

This news snippet reports the first instance of a criminal offence case being registered by the District Forest Officer, Kannur (Kerala) against fishermen for catching a whale shark and selling its meat. The case was registered under the Indian Wildlife (Protection) Act, 1972. The whale shark, measuring 12 m in length and weighing 2500 kg, was entangled in a gillnet operated about 30 nautical miles from the shore on 22 September 2008.

CMFRI. (2008e). New records from Indian waters. *CMFRI Newsletter*, 119, 9.

This is a brief report on three fishes recorded for the first time from Indian waters, two of which are sharks - the arrowhead dogfish *Daenia profundorum* and the bluntnose sixgill shark *Hexanchus griseus.* Both the species, previously known from South Africa and the western Indian Ocean, were found in the landings by hook and line fishing fleet that operated from Cochin Fisheries Harbour.

CMFRI. (2009). Heavy landings of the giant-sized lesser devil ray *Mobula diabolus* by gillnets at Chennai. *CMFRI Newsletter*, 120, 13.

This is a brief report on the heavy landing of the lesser devil ray *Mobula diabolus* at Chennai Fisheries Harbour by gillnets operated at a depth of 80-100 m off Nagapattinam during January-March 2009. The size range of the rays was 230-320 cm DW and 250-450 kg weight. The report also mentions the landing of the devil ray *Manta birostris.*

CMFRI. (2013). Large tooth sawfish landed at Malpe Harbour, Karnataka. *CMFRI Newsletter*, 137, 15.

The author reports the landing of a large tooth sawfish *Pristis microdon*, caught accidentally in a trawl net, at Malpe landing centre in Karnataka. The fish weighed about 800 kg. This report is of much significance since the species has been included in Schedule II of the Indian Wildlife (Protection) Act, 1972 since 2001.

Compagno, L. J. V. & Talwar, P. K. (1985a). Generic relationship and status of the scyliorhinid shark, *Scyliorhinus (Halaelurus) silasi* Talwar, 1974

(Chondrichthyes: Selachii, Scyliorhinidae). *Bulletin of the Zoological Survey of India,* 7 (1), 37 - 39.

The authors discuss the taxonomic status and generic relationship of the scyliorhinid shark, *Scyliorhinus silasi* Talwar. They re-examined the type material (four specimens collected off Quilon, Kerala, from 300 m depth) held in the repository of the Zoological Survey of India, with the holotype of *Scyllium quagga* Alcock, 1899, the two species being neither conspecific nor congeneric. The species has been assigned to the genus *Cephaloscyllium*. They state that within the genus, *C. silasi* is a very distinct species, separable from all other species by the combination of its simple colour pattern, with a few broad dark saddle markings and no small spots, wedge-shaped head in dorso-ventral view, anterior nasal flaps broad, not attenuated, and teaching mouth, claspers very long and slender, and apparent small size, males maturing at 360 mm.

Compagno, L. J. V. & Talwar, P. K. (1985b). On the occurrence of the narrowheaded sevengill shark, *Heptranchias perlo* (Bonnaterre, 1788) (Chondrichthyes: Hexanchidae) in Indian waters. *Bulletin of Zoological Survey of India,* 7(2&3), 169 - 171.

The authors record the occurrence of the narrow-headed sevengill shark *Heptranchias perlo* for the first time from Indian waters, based on a re-examination of eight type specimens collected from 300 m depth off Quilon in Kerala, India. The specimens, all free-living and immature, close to the size at birth of the species, include 6 males, 275-293 mm in total length, and 2 females, 304-330 mm in total length. The authors present the diagnostic characters of the specimens for field identification, with an illustration of an Indian female specimen. They note that the only other shark in Indian waters with a single dorsal fin and seven pairs of gill-openings is the broadnosed sevengill shark *Notorynchus cepedianus* (Peron, 1807) (= *Heptranchias indicus*) described by Day (1878). However, the preference of cold to warm temperate waters and the absence of an additional record of *N. cepedianus* since Day's account suggest that the species may not occur off India, confirming the identification of the eight type specimens as *Heptranchias perlo.*

Cubelio, S. S., Ramya, R. & Kurup, B. M. (2011). A new species of *Mustelus* (Family: Triakidae) from Indian EEZ. *Indian Journal of Geo-Marine Sciences,* 40(1), 28 - 31.

The authors report a new species of the genus *Mustelus*, based on a single specimen collected on 8 January 2009 from the catch of a commercial trawler operated at a depth of 200 m in the Arabian Sea off Mangalore on the south-west coast of India. They present a detailed description with morphometric measures of the new shark named as *Mustelus mangalorensis* nov. sp., after the type locality in which it was found. They report that the species shows a close similarity with *M. henlei* and *M. mosis,* but differs in many morphometric characters like preoral snout, upper labial furrow, interdorsal space, length of pelvic fin anterior margin and anal fin height.

D

Dash, S. S., Bharadiya S. A. & Gohel, J. (2013). Occurrence of pelagic thresher shark, *Alopias pelagicus* Nakamura, 1935 from Porbandar, Gujarat. *Marine Fisheries Information Service (T&E Series)*, 218, 5 - 7.

The authors describe in detail the capture of a single male *Alopias pelagicus* (pelagic thresher shark) measuring 160 cm in length and weighing 7.178 kg by a multiday gill netter in Veraval fishing harbour on 28 November 2013. Apart from investigating the maturity stage, gut content, and upper and lower teeth pattern, they also present morphometric and meristic features of the specimen.

Dash, S. S., Bharadiya S. A., Kamalia K. R. & Zala, M. S. (2013). On the egg case of Arabian carpet shark, *Chiloscyllium arabicum* from Gujarat. *Marine Fisheries Information Service (T&E Series)*, 218, 14 - 15.

The authors describe the occurrence of the egg case in a female *Chiloscyllium arabicum* measuring 52.5 cm (TL) and weighing 405 g, which was obtained from a trawl landing at Mangrol on 18 April 2013. They also provide detailed morphometric measurements of both the specimen and the egg case.

Day, F. (1873a). On some new fishes of India. *Journal of the Linnean Society of London, Zoology*, 11, 524 - 530.

In this report, the author presents the description of some new fishes of India based on enquiries at Madras and along the western coast or the contiguous Coimbatore district. He describes the shark *Carcharias melanopterus* from 3 specimens - one specimen, 15 inches in length, taken at Palliport, near Cochin, and two more, each 16 inches in length, taken at Calicut on the Malabar coast. He notes that among the large sharks of Malabar, *C. melanopterus*, is the most common, while on the Madras coast it is comparatively rare, and its liver is largely used in the preparation of fish-oil.

Day, F. (1873b). *Report on the freshwater fish and fisheries of India and Burma.* Office of the Superintendent of Government Printing: Calcutta, India.

In this report, the author presents the result of investigations made since 1867, into whether wasteful destruction of the fresh-water fisheries is or is not occurring in India and Burma, based on personal investigations and the result of enquiries made by European and Native civil officers in India and Burma. He presents a detailed account of different aspects of the existing fishery and needs for regulation and management, followed by a description of the freshwater fishes - what they consist of, definitions of sub-classes, orders, genera and species. Under cartilaginous fishes, he details the characteristics of sub-class Chondropterygii, order Plagiostomata, sub-order Selachoidei (sharks) with family Carcharhidae (*Carcharias gangeticus*) and sub-order Batoidei (rays), with families Pristidae (*Pristis cuspidatus*), and Trygonidae (*Trygon sephen, Trygon uarnak*).

Day, F. (1878). *The Fishes of India; being a natural history of the fishes known to inhabit the seas and fresh waters of India, Burma, and Ceylon.* Bernard Quaritch, London.

The author presents detailed descriptions of the fishes inhabiting the freshwater and marine habitats of India, Burma and Ceylon including the following elasmobranchs - *Aetobatis narinari, Astrapedi pterygia, Carcharias acutidens, Carcharias acutus, Carcharias bleekeri, Carcharias dussumieri, Carcharias ellioti, Carcharias gangeticus, Carcharias hemiodon, Carcharias laticaudus, Carcharias limbatus, Carcharias macloti, Carcharias melanopterus, Carcharias menisorrah, Carcharias mulleri, Carcharias sorrah, Carcharias temminckii, Carcharias tricuspidatus, Carcharias walbeehmii, Ceratopteraeh renbergii, Chiloscyllium indicum, Dicerobatis eregoodoo, Dicerobatus kuhlii, Galeocerdo rayneri, Galeocerdo tigrinus, Ginglymostoma mülleri, Hemigaleus balfouri, Lamna spallanzanii, Mustelus manazo, Myliobatis maculata, Myliobatis nieuhofii, Narcine timlei, Notidanus indicus, Platyrhina schönleinii, Pristis cuspidatus, Pristis perrotteti, Pristis zysron, Pteroplatea micrura, Rhinobatus granulatus, Rhinobatus halavi, Rhinobatus thouini, Rhinoptera adspersa, Rhinoptera javanica, Rhynchobatus ancylostomus, Rhynchobatus djeddensis, Scyllium capense, Scyllium marmoratum, Stegostoma tigrinum, Taeniura melanospilos, Triaenodon obtusus, Trygon bennettii, Trygon bleekeri, Trygon imbricata, Trygon kuhlii, Trygon marginatus, Trygon sephen, Trygon uarnak, Trygon walga, Trygon zugei, Urogymnus asperrimus, Zygaena blochii, Zygaena malleus, Zygaena tudes* The author states that *Carcharias ellioti, Carcharias tricuspidatus, Hemigaleus balfouri, Triaenodon obtusus* are described for the first time.

Day, F. (1889). Fishes - Volume I. In W. T. Blanford. (Eds.), *The Fauna of British India, including Ceylon and Burma (*pp.1 - 63). The authority of the secretary of state for India in council, Taylor and Francis, London.

This is an abridgement of the authors, 'Fishes of India' published in 1878 and includes several additions and alterations. The species described are *Aetobatis narinari, Alopias vulpes, Astrape dipterygia, Carcharias acutidens, Carcharias acutus, Carcharias bleekeri, Carcharias dussumieri, Carcharias ellioti, Carcharias gangeticus, Carcharias hemiodon, Carcharias laticaudus, Carcharias limbatus, Carcharias macloti, Carcharias melanopterus, Carcharias menisorrah, Carcharias mülleri, Carcharias murrayi, Carcharias sorrah, Carcharias temminckii, Carcharias walbeehmi, Chiloscyllium indicum, Dicerobatis eregoodoo, Dicerobatis kuhlii, Galeocerdo rayneri, Galeocerdo tigrinus, Ginglymostoma concolor, Hemigaleus balfouri, Lamna spallanzanii, Mustelus manazo, Myliobatis maculata, Myliobatis nieuhofi, Narcine timlei, Notidanus indicus, Odontaspis tricuspidatus, Platyrhina schoenleinii, Pristis cuspidatus, Pristis pectinatus, Pristis perrotteti, Pristis zysron, Pteroplatea micrura, Rhinobatus columnae, Rhinobatus granulatus, Rhinobatus halavi, Rhinobatus thouini, Rhinodon typicus, Rhinoptera adspersa, Rhinoptera javanica, Rhynchobatus ancylostomus, Rhynchobatus djeddensis, Scyllium capense, Scyllium marmoratum, Stegostoma tigrinum, Taeniura melanospilos, Triaenodon obtusus, Trygon bennetti, Trygon bleekeri, Trygon imbricata, Trygon kuhlii, Trygon marginatus, Trygon sephen, Trygon uarnak, Trygon walga, Urogymnus asperrimus, Zygaena blochii, Zygaena malleus, Zygaena mokarran* and *Zygaena tudes.* The synonymy is not included in this book; however, under each species the author has given a reference to the original specific description and the page in the book 'Fishes of India' (1878) where full details are given.

Day, F. (1887). *Zygaena dissimilis*, Murray. *Annals and Magazine of Natural History, including Zoology, Botany and Geology*, Fifth Series, 20, 389.

In a brief letter to the magazine, the author clarifies that the hammer-headed shark *Zygaena dissimilis* described by Murray of the Kurrachee Museum as a new species, was in fact, *Zygaena mokarran*, described by Rupell in 1835. He further states that he had not come across the species in India. He also clarifies that the species *Lamna guentheri* described by the same author from the same locality has been described by him as *Carcharhias tricuspidatus.*

Deepu, A. V., Joseph, G. & Kurup, B. M. (2010). Redescription of smooth lanternshark, *Etmopterus pusillus* (Lowe, 1839) from the EEZ of India. *Fishery Technology,* 47(2), 189 - 194.

The authors redescribe the smooth lanternshark *Etmopterus pusillus* from Indian waters based on a female specimen obtained from the western Indian Ocean at $11^{0}59'$ N Lat. and $74^{0}18'$ E Long., from a depth of 770 m. They present a detailed description with morphometric measurements and compare the measurements with those recorded for the type specimen and closely related *E. unicolor* from New Zealand and Japan.

Deshmukh, R. A. (1979a). On a new cestode *Flapocephalus trygonis* gen. et sp. nov. (Cestoda: Lecanicephalidae) from *Trygon sephen* from west coast of India. *Rivista di Parassitologia*, 40, 261 - 265.

The author describes a new cestode parasite *Flapocephalus trygonis* obtained from the stingray *Trygon sephen* from the west coast of India.

Deshmukh, R. A. (1979b). On three new species of *Uncibilocularis* Southwell, 1925 (Cestoda: Onchobothriidae) from marine fishes with a key to the species of the genus. *Proceedings of the National Academy of Sciences, India* 49 (B), 227 - 236.

The author describes 3 new cestode parasites of the genus Uncibilocularis - *U. shindei, U. somnathii and U. thapari* from 3 species of rays - *Pteroplatea micrura*, *Trygon sephen* and *Trygon zugei.*

Deshmukh, R. A. (1979c). On a new cestode *Yorkeria southwelli* (Cestoda: Onchobothriidae) from a marine fish. *Current Science*, 48(6), 271 - 272.

In this letter to the Editor, the author reports a new cestode parasite *Yorkeria southwelli* obtained from the spiral valve of the shark *Ginglymostoma concolor* from Ratnagiri coast, with a detailed description of the cestode.

Deshmukh, R. A. (1980). On a new cestode *Spinocephalum rhinobatii* gen. et sp. nov. (Cestoda: Lecanicephalidae) from a marine fish from west coast of India. *Rivista di Parassitologia*, 41, 27 - 32.

The author describes a cestode parasite *Spinocephalum rhinobatii* from the guitarfish *Rhinobatus granulatus* from the west coast of India.

Deshmukh, R. A. & Shinde, G. B. (1975). On a new cestode *Marsupiobothrium karbarii* (Cestoda: Tetraphyllidea) from a marine fish from west coast of India. *Journal of Indian Bioscientific Association*, 1, 140 - 143.

The author describes a new cestode parasite *Marsupiobothrium karbarii* obtained from the guitarfish *Rhynchobatus djeddensis.*

Deshmukh, R. A. & Shinde, G. B. (1979). Three new species of *Tetragon ocephalum* Shipley and Hornell, 1905 (Cestoda: Tetragonocephalidae) from marine fishes of west coast of India. *Bioresearch*, 3, 19 - 23.

The authors describe 3 species of cestode parasites, *Tetragonocephalum alii, Tetragon ocephalumraoi* and *Tetragono cephalum sephensis* from the stingrays, *Trygon sephen* and *Trygon zugei.*

Deshmukh, R. A. & Shinde, G. B. (1980). *Spinibiloculus ratnagiriensis* gen. n., sp. n. (Cestoda, Onchobothriidae) from a marine fish *Ginglymostoma concolor* of the west coast of India. *Acta Parasitologica Polonica*, 27, 431 - 435.

The authors describe a cestode parasite *Spinibiloculus ratnagiriensis* obtained from the spiral valve of the nurse shark *Ginglymostoma concolor* from Ratnagiri on the west coast of India.

Deshmukh, R. A., Shinde, G. B. & Jadhav, B. V. (1983). On a new species of the genus *Platybothrium* Linton, 1890 (Cestoda: Onchobothriidae) from a marine fish at Veraval, West Coast of India. *Marathwada University Journal of Science*, 22, 105 - 108.

The authors describe a cestode parasite *Platybothrium veravalensis* from the shark *Carcharias acutus* from Veraval, Gujarat.

Deshmukh, R. K., Jadhav, B. V. & Shinde, G. B. (1982). Five new species of the genus *Polypocephalus* Braun, 1878. (Cestoda: Lecanicephalidea) India. *Marathwada University Journal of Science*, 21, 79 - 86.

The authors describe 5 new species of cestode parasites of the genus *Polypocephalus,* from the shark *Carcharias laticaudus* and the rays *Dicerobatis eregoodoo* and *Trygon sephen.*

Deshpande, S. D., Rao, S. V. S. R. & Sivan, T. M. (1970). On the results of preliminary fishing trials with shark long lines in Veraval waters. *Fishery Technology*, 7(2), 150 - 157.

The authors discuss the results of experimental fishing operations with shark longlines in the sea off Veraval in Gujarat, conducted to assess their efficiency in capturing sharks and to assimilate information on the diversity of shark resources and the available resources of sharks to be used for planning future gear investigations. They deployed 5525 hooks using different fresh fishes as bait and caught 242 sharks weighing 8629 kg. The catch comprised of *Carcharias* sp., *Galeocerdo* sp. and *Zygaena* sp., in order of

dominance, with the first forming 68% of the total catch in numbers and 55% in weight. The authors give a detailed description of the fishing ground, the mode of operation and the baits used. They note that although there was bait preference in certain species, *Chirocentrus dorab* proved to be the cheapest and most effective bait in the capture of all the three varieties of sharks.

Devanesan, D. W. & Chidambaram, K.(1948). *The common fishes of Madras Presidency*, Government press, Madras.
Reprint not obtained

Devanesen, D. W. & Chidambaram, K. (1953). *The common food-fishes of the Madras State.* Dept. of Industries and Commerce, Madras. The Superintendent Government Press, Madras.

In this report, the authors have made a pioneering effort to compile a comprehensive account of the common food fishes of Madras for the first time. Although officers of the Madras Fisheries Service have periodically documented various aspects such as distinguishing characteristics, biology, habits, habitats, and capture methods of these food fishes in individual reports, this compilation serves as the first collected and consolidated account. Part 1 of the report focuses on cartilaginous food fishes, including sharks, hammerheads, sawfishes, plough-fishes, and rays. It provides detailed descriptions of their distinguishing features, colouration, biology, capture techniques, and economic significance. The section highlights the species commonly encountered in catches, such as *Carcharinus gangeticus, C. melanopterus, C. limbatus, C. temminckii, Galeocerdo articus, Sphyrna* spp., *Pristis* spp, R*hynchobatus djeddensis* (plough-fish), and *Dasyatis sephen*. Additionally, the report presents an analysis of the Vitamin A content in the liver oils of these elasmobranch species, with a notable case of a 7-foot male *Carcharinus gangeticus*, whose liver oil exhibited a Vitamin A potency of 98,000 IU, the highest recorded at that time.

Devadoss, P. (1977). *Studies on the elasmobranchs of Porto Novo coast (south India).* Ph.D. Thesis. Centre of Advanced Study in Marine Biology, Annamalai University, Tamil Nadu, India.

In this exhaustive study, the author presents a systematic survey of the elasmobranch fauna of Porto Novo off the southeast coast of India, with detailed information on their fishery potential in the area, taxonomy and key for identification of the families Stegostomatidiae, Rhiniodontidae, Alopiidae, Lamnidae, Triakidae, Hemigaleidae, Sphyrnidae, Carcharhinidae, Pristidae, Rhinidae, Rhynchobatidae, Rhinobatidae, Narkidae, Narcinidae, Dasyatidae, Gymnuridae, Myliobatidae and Mobulidae, with descriptions of major species available in the region. He gives a detailed account of the breeding biology of *Sphyrna blochii, S. lewini, Scoliodon laticaudus, Rhizoprionodon acutus, Carcharhinus limbatus, C. sorrah, Rhinobatus granulatus, R. obtusus, Narcine brunnea, N. timlei, Narke dipterygia, Dasyatis imbricatus, D. zugei, D. sephen, D. jenkinsii, Gymnura poecilura, Aetomylus nichofii* and *Aetobatus narinari*. He also presents the proximate composition of seven sharks (*C. limbatus*, *C. sorrah*, *S. laticaudus*, *S. blochii*, *Rhiniodon typus* and *Isurus glaucus*) and seven batoids (*R. granulatus, R. obtusus, D. imbricatus, D. sephen, D. jenkinsii, D. uarnak* and *A. narinari*) and urea content in ten species (*C. limbatus*, *C. sorrah*, *S. laticaudus*, *S. blochii, S. lewini, R. granulatus, D. imbricatus, D. zugei, D. jenkinsii* and *A. narinari*). In the final section, he presents his observations on deformities in some elasmobranchs.

Devadoss, P. (1978a). On the food of rays, *Dasyatis uarnak* (Forskal), *D. alcockii* (Annandale) and *D. sephen* (Forskal). *Indian Journal of Fisheries*, 25, 9-13.

In this article, the author documents the feeding habits of three stingrays, *Dasyatis uarnak, D.* alcockii and *D. sephen* based on 68, 36 and 24 specimens respectively, collected from the commercial fish landings at Porto Novo from December 1972 to October 1974. He notes that while all the three species are carnivores, feeding chiefly on fishes, crustaceans, molluscs and

polychaetes, *D. uarnak* fed voraciously on both pelagic and benthic organisms, with a strong preference for fishes but *D. alcocki* and *D. sephen* showed a preference for benthic invertebrates.

Devadoss, P. (1978b). Maturation and breeding habit of *Dasyatis* (*Amphotistius*) *imbricatus* at Porto Novo. *Indian Journal of Fisheries*, 25, 29 - 34.

In this article, the author describes the reproductive characteristics of *Dasyatis imbricatus* from specimens collected from commercial fish landings at Porto Novo and Cuddalore Port between November 1972 and October 1974. He describes in detail the reproductive organs of the female ray, the breeding season, size at maturity and ponderal index, and estimates the maturity size of females as 170-179 mm, confirmed by the ponderal index, and of males as 160-169 mm, judged by the relationship between body length and clasper length. The author notes that in this species only the left ovary and uterus are functional, and the ova are ready for ovulation even before parturition of the embryo from the uterus. He records the breeding season along this coast as extending from December to July.

Devadoss, P. (1978c). A preliminary study on the batoid fishery of Cuddalore with a note on the biology. *Indian Journal of Fisheries*, 25 (1&2), 180 - 187.

The author reports the commercial exploitation of skates and rays in bottom-set gillnet fishery off Cuddalore coast for the period 1973-1974. He records 12 species that contribute to the batoid fishery, with the common species being *Rhyncobatus djiddensis*, *Rhinobatos granulatus*, *Himantura uarnak, Himantura bleekeri*, *Dasyatis sephen*, *Aetomylaeus nichofii*, *Aetobatus flagellum*. The author gives a brief description of the common species with relevant information such as maximum length, seasonality of occurrence, diet, the occurrence of mature specimens and embryos, and utilisation pattern. Monthly catch estimates are also given for the period March 1973-December 1974. The author notes the season of occurrence of sawfishes to be July-September.

Devadoss, P. (1979). Observation on the maturity, breeding and development of *Scoliodon laticaudus* (Muller & Henle) of Calicut coast. *Journal of the Marine Biological Association of India*, 21 (1&2) 103 - 110.

In this article, the author documents in good detail the maturity and breeding characteristics of the spadenose shark *Scoliodon laticaudus* along the Calicut coast in south-west India. Size at maturity, estimated to be 30.1-35.0 cm for males and 35.1-40.0 cm for females, are corroborated through the ponderal index and by relating the percentage of liver weight to body weight. The author observes that both right and left ovaries are functional and each uterus is divided into several compartments to house individual embryos which number as many as ten in each uterus, and which develop early contact with the mother through the yolk sac placenta.

Devadoss, P. (1982). On the embryonic stage of the mottled ray *Aetomylus maculatus*, with a note on the breeding season. *Indian Journal of Fisheries*, 29, 253 - 255.

The author describes the intra-uterine embryonic developmental stages of the mottled ray *Aetomylaeus maculatus* from eight embryos in advanced stages of development retrieved from adult females landed at Devanampattinam landing centre in Cuddalore during April-May 1976. The author notes that only the left ovary and uterus was found functional in the adult females. He describes the appearance of the embryos and presents the mean morphometric measurements of the eight embryos, expressed as a percentage of disc width.

Devadoss, P. (1983). On some specimens of abnormal elasmobranchs. *Matsya*, 9&10, 486 - 488.

This is a brief note in which the author documents three instances of abnormalities recorded in elasmobranchs from Porto Novo coast. He discusses the occurrence of monozygotic twins of *Scoliodon laticaudus*, conjoint from the pectoral region to the cloaca, a malformed stingray, *Dasyatis imbricata* with pectoral fins separated from the head and a deformed numbfish, *Narke dipterygia* with a deep scar on the dorsal side of the disc.

Devadoss, P. (1984a). Further observations on the biology of the sting ray *Dasyatis imbricatus* (Schneider) at Porto Novo. *Matsya*, 9&10, 129 - 134.

The author presents the length and weight relationship, size at maturity and food and feeding habits of *Dasyatis imbricatus* from Porto Novo coast. He notes that growth is not strictly isometric and the exponent is greater than 3 for females. He correlates the percentage of liver weight of total body weight to average body weight and TL for determining the size at first maturity. His observation on the diet of the species indicates the bottom-feeding nature of this ray with crustacean forms constituting 64.8% followed by polychaetes and other benthic invertebrates and young fish.

Devadoss, P. (1984b). Nutritive value of sharks, skates and rays from Porto Novo coast. *Indian Journal of Fisheries*, 31 (1), 156 - 161.

The author discusses the nutritive value of different elasmobranchs caught off Porto Nova on the southeast coast of India. Studying seven species of sharks, two species of skates and five species of rays, he reports seasonal differences in the proximate composition between and within species, with lipid being the most variable component. The author reports an inverse relationship between water and lipid content in the tissue. He also reports an ontogenetic increase in protein and fat content. He notes that females in pregnant stages have extremely thin and dark livers with low oil content. The author classifies the different species studied into one of the five categories that have been recognised in elasmobranchs based on their oil-protein ratio.

Devadoss, P. (1984c). On the incidental fishery of skates and rays off Calicut. *Indian Journal of Fisheries*, 31 (2), 285 - 292.

The author discusses the fishery of skates and rays from the Arabian Sea off Calicut. He reports that the total incidental landing of skates and rays by trawl net, drift net and hooks-and-lines during 1977-80 was 70.9 t, forming 10% of the total elasmobranch landings at Calicut, with trawlers accounting for 95%. He presents the species composition and seasonal abundance of different species, noting that the most common species constituting the fishery were the skate *Rhynchobatus djeddensis*, the stingrays, *Dasyatis uarnak, D. jenkinsii* and *D. sephen*, the spotted eagle-ray, *Aetobatus narinari*, the cow-nose ray, *Rhinoptera javanica* and the devil ray, *Mobula diabolus* while saw-fishes and other rays like *D. imbricatus, D. zugei, Aetomylus maculatus* and *A. nichofii,* were rarely caught.

Devadoss, P. (1986). Studies on the catshark *Chiloscyllium griseum* from Indian waters. *Journal of the Marine Biological Association of India,* 28 (1&2), 192 - 198.

The author describes the catshark *Chiloscyllium griseum* from samples collected from Vellayil fish landing centre and the market at Calicut, on the south-west coast of India. He compares the proportional morphometric lengths in juveniles and adults to understand the growth pattern and reports reduction in measures of the characters of the head region, accelerated growth of the caudal and trunk regions, lengthening of pectoral and pelvic fins and slackening in the growth of dorsal fins and lower caudal lobe. He describes a common length-weight relationship for males and females, $W = 0.00001453 \times L^{2.7314}$. From the stomach content analysis of 43 samples, he reports the dominance of teleost fishes in the diet, followed by crustaceans and molluscs. He

estimates the size at maturity of males at 520 mm and females at 530 mm.

Devadoss, P. (1987). A brief description of the cat shark *Chiloscyllium griseum* (Muller and Heale) from Indian waters with some biological notes. *Indian Journal of Fisheries*, 34(3), 343 - 347.

The author describes the catshark *Chiloscyllium griseum,* from samples collected from the Indian coast. He estimates a common length-weight relationship for the sexes, with slope "b" = 2.7314 and also indicates the growth patterns of different body parts in relation to total length of the shark. The shark is a piscivore, maturing at 520 mm (males) and 530 mm (females), with an external mode of development in egg cases laid outside.

Devadoss, P. (1988a). Observation on the breeding and development of some sharks. *Indian Journal of Fisheries*, 30 (1&2), 121 - 131.

The author discusses the size at maturity, developmental stages and breeding seasons of five sharks *Sphyrna blochii, S. lewini, Rhizoprionodon acutus, Carcharhinus limbatus and C. sorrah* from the Porto Novo coast in southeast India. He gives a detailed description of the embryos and estimates of the size at maturity of these species, all of which have developed a placental system for nourishing their developing embryos.

Devadoss, P. (1988b). A new record of fantail ray *Taeniura melanospila* (Bleeker, 1853). *Journal of the Marine Biological Association of India,* 30 (1&2), 217 - 218.

The author reports the landing of four specimens of the fantail ray *Taeniura melanospila* (now Taeniura meyeni) at Madras - a female of 95 mm disc width (DW) landed by a mechanised trawler on 24 April 1986, a male of 1330 DW landed by hook & line on 23 March 1987 and a male and a female measuring 1080 and 1800 mm DW respectively landed by a trawler on 16 April 1987. The author describes the species and presents the major morphometric measurements of the four specimens. This is the first authentic record of the species from the Indian coast.

Devadoss, P. (1989). Observations on the length-weight relationship and food and feeding habit of spadenose shark *Scoliodon laticaudus* (Muller &Henle). *Indian Journal of Fisheries*, 36 (2), 169 - 174.

The author describes the food and feeding and length-weight relationship of the spadenose shark *Scoliodon laticaudus*. He notes a shift in dietary preference between two monsoon seasons - prawns are the dominant prey during the premonsoon while fishes are dominant during the postmonsoon season. He presents the length-weight relationship for males and females as $W= 0.000006795\ L^{2.8905}$ and $W = 0.000004904\ L^{2.9574}$ respectively.

Devadoss, P. (1996). Shark fishing in India. *Proceedings of the Seminar on Fisheries - A Multibillion Dollar Industry*, Madras, 7 - 11.

The author presents a brief review of shark fishing in India and gives the state-wise and region-wise shark landings during 1985-1993. He notes that while shark fishing was done by traditional methods in the early sixties, there was a tremendous improvement in the catches due to mechanisation of the fishing industry and availability of shore-based infrastructure from the 1970s. He also discusses marketing trends and presents the quantum and value of shark and guitarfish exports during 1981-1993.

Devadoss, P. (1998a) Growth and population parameters of the spadenose shark, *Scoliodon laticaudus* from Calicut coast. *Indian Journal of Fisheries*, 45 (1). 29 - 34.

In this article, the author summarises the growth and population characteristics of the

spadenose shark *Scoliodon laticaudus* from Calicut coast in south-west India, based on 7896 shark specimens comprising 3418 males and 4478 females, collected from trawl landings at Vellayil in Calicut during 1977-1981. He reports an overall male-female sex ratio of 1:1.31, with the females predominating in the length group between 551 and 600 mm. The von Bertalanffy growth parameters L_∞, K and t_0 were estimated to be 715 mm, 0.358 y^{-1}, and 0.590 y for females and 676 mm, 0.4046 y^{-1} and 0.590 y for males respectively. The size at maturity of females and males was estimated to be 375 mm and 350 mm respectively and size at birth, 140 mm. With an estimated natural mortality of 0.72 and average fishing mortality of 0.73, The author estimated the total stock of *S. laticaudus* off Calicut as 38.835 t, with a standing crop of 14.684 t.

Devadoss, P. (1998b). Observations on the breeding and development in some batoid fishes. *Indian Journal of Fisheries*, 45 (3), 271 - 283.

The author describes the breeding season, functionality of ovaries, gestation, embryos and embryonic development in the guitarfish *Rhinobatus granulatus*, the electric rays *Narcine brunnea, N. timlei,* the stingrays *Dasyatis zugei, D. sephen, D. jenkinsii,* the butterfly ray *Gymnura poecilura* and the eagle rays *Aetomylus nichofii* and *Aetobatus narinari.* He notes that both right and left ovaries are functional along with the uteri in *R. granulatus* whereas in the *Narcine* spp. and *Dasyatis* spp. only the left ovary and uterus are functional. The author discusses each species in detail and this study provides strong baseline information on the breeding and development of guitarfishes and rays in Indian waters.

Devadoss, P. & Batcha, H. (1995). Some observations on the rare bow-mouth guitarfish *Rhina ancylostoma. Marine Fisheries Information Service (T&E Series)*, 138, 10 - 11.

The authors report the landing of a rare female bow-mouth guitarfish *Rhina ancylostoma*, called kalulluvai in Tamil, measuring 2,360 mm in total length, larger than the earlier recorded specimen of 205 cm collected from the Madras coast. They present the morphometric measurements of the specimen and also the total length and sex of nine embryos that were present in the uteri of this shark - five in the right uterus and four in the left. They note that 8 of the embryos were males and the length of the embryos ranged between 268 and 310 mm. The food of the guitarfish was predominantly crustacean. They also mention recording 7-9 fully mature and yolked ova in other females, and refer to length-weight relationship and condition factors estimated for the species. However, it is not clear whether their collection included several specimens or not. They do not give details either of the gear or ground of capture of the large-sized female reported.

Devadoss, P. & Batcha, H. (1997). Sex change in hound shark, along Madras coast. *Marine Fisheries Information Service (T&E Series)*, 146, 9 - 10.

The authors discuss incidences of sex change noted in specimens of the hound shark *Iago omanensis* collected from trawl landings at Madras fisheries harbour. They examined more than sixty specimens in the size range of 295-745 mm and found several male hound sharks carrying embryos in uteri. They describe the reproductive organs of “true males”, “true females” and a third group called ‘functional females” which appear externally as males with claspers, but are fully functional females with uteri, ovaries and embryos. They report that the length of the clasper is 10-13% of the total length in true males while in functional females it is 6-8%. Discussing instances of hermaphroditism in other elasmobranchs reported by other workers, the authors conclude that the presence of undeveloped claspers in functional females is difficult to explain and suggest that histological studies on reproductive tissues of juveniles may help in understanding whether sex reversal takes place with advancing age, as in the case of serranid fishes.

Devadoss, P. & Chandrasekhar, S. (1991). A Note on the rare snaggle tooth shark, *Hemipristis elongatus. Marine Fisheries Information Service (T&E Series)*, 114, 36.

In this brief note, the authors present some details of the snaggle-tooth shark *Hemipristis elongatus* based on fourteen specimens collected from gillnet catches off Madras coast for one year from June 1990 to May 1991. The authors present details of the date of capture, total size, sex and maturity stage of each shark. The size of the sharks ranged from 130 to 220 cm in total length. They found two pregnant female sharks which had 5 and 6 embryos and they present details of the lengths of the embryos, their sex and lengths of the umbilical cords. The authors also note that only three sharks had food contents in the stomachs - one had a small shark *Scoliodon laticaudus*, one had two rays *Dasyatis imbricata* and the third had semi-digested teleost fishes. The average size of the embryos was 48.3 cm.

Devadoss, P. & Natarajan, R. (1977). On a smooth hammerhead shark, *Sphyrna zygaena* (Linnaeus, 1758) new to Indian waters*. Current Science*, 46 (5), 166 - 167.

The authors report the capture of a mature female smooth hammerhead shark *Sphyrna zygaena* in hook & line operation by a mechanised vessel at a depth of 80-90 m off Porto Novo in Tamil Nadu on 6 October 1975. They present some morphometric measurements of the shark which measured 214 cm in total length. This is the first report of the species from Indian waters.

Devadoss, P., Kuthalingam, M. D. K. & Thiagarajan, R. (1987). The present status and future prospects of elasmobranch fishery in India. *CMFRI Bulletin National Symposium on Research and Development in Marine Fisheries Sessions I & II (1987)*, 44 (1), 188 - 199.

The authors discuss the trend and status of elasmobranch fishery in India based on landings during the 25-years, 1961-1985*.* They report that elasmobranch landings fluctuated between 29,401 t (1967) and 69,844 t (1983) with an annual average of around 50,159 t. They list the major species contributing to the fishery as *Carcharhinus sorrah, C. limbatus, C. dussumieri, C. melanopterus, C. macloti, Galeocerdo cuvier, Hemipristis elongatus, Scoliodon laticaudus, Loxodon macroliinus, Rhizoprionodon acutus, R. oligolinx, Isurus oxyrhincus, Sphyrna blochii, S. lewini, S. mokarran, Rhynchobatus djeddensis, Rhinobatus granulatus, Rhina ancylostoma, Dasyatis sephen, D. uarnak, D. imbricatus, D. marginatus, D alcockii, Aetobatus narinari, Aetomylus nichofii, A. maculatus, Rhinoptera javanica, Gymnura poecilura* and *Mobula diabolus.* They also mention that whale shark, catsharks, sawfish and electric rays appeared occasionally in the fishery. They compare the trends in production along east and west coasts and also detail state-wise and group-wise landings. They also estimate the MSY and optimum effort based on catch and effort data at major landing centres. In addition, they provide brief descriptions of the general biological characteristics of some of the major species.

Devadoss, P., Gnanamuttu, J. C., Srinivasarengan, S. & Subramani, S. (1989). On the landing of a large sawfish at Madras. *Marine Fisheries Information Service (T&E Series)*, 98, 13.

The authors report the landing of the rare female sawfish *Pristis microdon* at Kasimedu fish landing centre of Madras city on 24 March 1988. The sawfish weighed about 1.5 tonnes and measured 705 cm in total length, which is greater than the earlier maximum size of 457.5 cm recorded by Day off the Orissa coast of India in 1878. The authors mention that the fish was caught in a trawl net operated at a depth of 40-50 m at a distance of about 100 km from the coast of Madras. They also present some morphometric measurements as a percentage of total length.

Devadoss, P., Nammalwar, P. V., Srinivasan & Srinivasarengan, S. (1989). Instances of landing of whale shark *Rhineodon typus* in Indian coastal water. *Marine Fisheries Information Services (T&E Series)*, 102, 18 - 20.

The authors report incidental catches of whale shark *Rhineodon typus* at different places along the southern coast of India - two female sharks at Madras on 6 March 1987 and 14 May 1989, one male shark at Injambakkam near Madras on 11 February 1989, one female shark at Quilon on 22 April 1975, two males at Porto Novo on 20 and 21 September 1974, one female shark at Porto Novo on 21 May 1975 and one shark (sex not mentioned) at Cuddalore on 9 January 1987. They give detailed morphometric measurements of the sharks landed at all the centres except Cuddalore. They mention the low demand and market value for this shark and interestingly, conclude that owing to "the low quantity and poor nutritional value of the meat and the absence of good markets it is highly unlikely that this species will be hunted like some others in the sea, and thus there is no danger of its extinction at present."

Devadoss, P., Vivekanandan, E., Raje, S. G., Mathew, G. & Chandrasekar, S. (2000). Elasmobranch resources of India. In V. N. Pillai & N. G. Menon (Eds.), *Marine Fisheries Research and Management*. CMFRI, Kochi. pp. 563 - 578

This article is a useful baseline document which encapsules the findings of research on the biology of Indian sharks and also throws light on the status of these resources. The authors discuss the biology of elasmobranchs from Indian waters based on published information on different species from various parts of the Indian coast. The information compiled includes length-weight relationship, age and growth, food and feeding and reproductive traits. They also present an account of the status of the elasmobranch fishery at that time through a comprehensive decadal analysis for the period 1950-1994. They also elaborate on the resource-wise, state-wise and gear-wise contributions to the elasmobranch fishery and discuss the increase in the value of shark fins exported from the country.

Devaraj, M. & Gulati, D. (2004). Morphometry and biology of the duskyshark, *Carcharhinus obscurus* (Lesueur), from the oceanic region off the West Coast of India. In V. S. Somvanshi (Ed.), *Large Marine Ecosystem: Exploration and exploitation for sustainable development and conservation of fish stocks*. Fishery Survey of India. pp. 100-112.

The authors document their observations on the morphometry and biology of the dusky shark, *Carcharhinus obscurus* in the west coast of India based on 42 specimens caught in tuna hook & line and longlines operated at 1600 to 2250 m depth. They found that the correlation coefficient (r) for the regression of various morphometric characteristics on total length ranged from 0.736 for the second dorsal base to 0.997 for the standard length; the length at birth ranges from 69 cm to 102 cm and the lengths at the age of 1, 10, 20 and 30 years are 102 cm, 269 cm, 341 cm and 366 cm respectively. They estimate the total life span of the shark to be about 30 years. They estimate mean length at recruitment and length at maturity to be 95 cm and 277 cm respectively.

Dhaneesh, K. V. & Zacharia, P. U. (2013). Shark finning: are Indian waters becoming a graveyard for sharks? *Journal of Indian Ocean Studies*, 21 (3), 358 - 374.

This paper reviews the status of India's shark fishery and trade and suggests measures for the conservation and management of these resources. They describe India's shark landings against the global scenario, and note that a major handicap in tracking the status is the incomplete reporting of shark landings to the authorities. They discuss the gear-wise fishery and India's position among the shark fishing nations of the world. They also discuss in detail factors leading to the overfishing of sharks and world trade in sharks and shark products, with emphasis on shark finning and utilisation of shark fins. Discussing the threats to shark populations, the authors note that late maturation, slow breeding and long gestation period make shark populations prone to depletion. They suggest promoting artificial shark fins or "Mock shark fin" made from vegetable or gelatin sources, as a substitute to reduce the demand for shark fins. They also list several conservation measures to be adopted for the sustainable management of these resources.

Dholakia, A. D.(2004). *Fisheries and Aquatic Resources of India.* Daya Publishing House, Delhi.

The author provides field identification features for seven elasmobranchs.

Dholakia, A. D. & Vasavda, G. D. (1985). *Commercial production of shark liver oil in Gujarat. Harvest and Post harvest technology of fish* (pp. 634 - 637). In Ravindran *et al.* (Eds.). Society of Fishery Technology.

The authors discuss the shark landings in Gujarat from 1965-66 to 1980-81 and the production of shark liver oil during the period. They note that the major shark genera landed in Gujarat are *Carcharhias*, *Rhyncobatus*, *Sphyrna* and *Pristis*. They present details of the shark liver oil factory set up by the Government of Gujarat in Veraval in 1964-65, with a sub-unit in Porbandar, and the process of oil production from fresh shark livers procured from Fishermen Cooperative Society and local fishermen. They present details of the oil extracted from the livers purchased and the annual yield of shark liver oil during the period. They also present the economics of production of shark liver oil during the period 1972-73 to 1981-82, and also discuss possibilities to process the residue discarded during the oil production process and thus improve the economy of shark liver oil production.

Dhulkhed, M. H., Annigeri, G. G., Nandakumar, G. & Naik, D. Y. (1984). Bumper catches of prawns, pomfrets, little tunnies, black sharks and other fishes at Karwar. *Marine Fisheries Information Services (T&E Series)*, 59, 16 - 18.

The authors discuss the landing of different fishery resources in purse-seine and hook & line catches in Karwar, and mention the landing of about 5 tonnes of the black shark *Carcharhinus melanopterus* by three hook & line units on 25 September 1982. The size of the sharks ranged from 60 to 250 cm, with most of them being males. The authors note that the fishermen realised ₹6,500/- for their catch, and the sharks were taken to Mangalore for oil extraction and curing.

Dineshbabu, A. P., Lingappa, & Muniyappa, Y. (2005). On the landing of largetooth sawfish, *Pristis microdon* at Mangalore. *Marine Fisheries Information Services (T&E Series)*, 184, 20.

The authors report an incidental landing of the largetooth sawfish, *Pristis microdon* at Mangalore Fisheries Harbour on 4 March 2005. Caught by a trawler off Mangalore at a depth of 50-60 m, the fish measured 520 cm in total length and weighed 600 kg; it was auctioned for ₹24,000. Highlighting the endangered status of the species, the authors note that it is not a targeted species along the Karnataka coast, and fishermen avoid it for fear of damage to their nets and due to the common belief, that catching a sawfish is a "bad omen".

Doiphode, P. V. (1986). On the landing of a whale shark *Rhincodon typus* Smith at Anjuna, Goa. *Marine Fisheries Information Services (T&E Series)*, 66, 29.

The author reports the landing of a female whale shark, 570 cm long and weighing 2.2 tonnes, caught in a nylon gill net operated by fishermen off Anjuna, Goa at a depth of 27 m. He presents some morphometric measurements of the specimen and mentions that the liver, which weighed 20 kg, yielded 20 l of quality oil and 5 l of poor quality, mixed oil.

Dutta, A. K. & Roy, T. (1977). Sharks and rays of Sunderbans of India. Zoological Survey of India, Newsletter (3)75 - 77.
Reprint not obtained

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Fofandi, M., Zala, M. S. & Koya, M. (2013). Observations on selected biological aspects of the spadenose shark *Scoliodon laticaudus* (Müller & Henle, 1838), landed along Saurashtra coast. *Indian Journal of Fisheries*, 60(1), 51 - 54.

The authors describe the length-weight relationship (LWR) and dietary pattern of the spadenose shark. The study is based on 439 samples, 201 males and 238 females, collected from trawlnet and gillnet landings during April 2009 to March 2010. They describe the LWRs in logarithmic form, with slopes of 2.8174 and 2.9263 for males and females respectively, and 2.9465 for the sexes pooled since they could not observe any significant statistical difference between the two LWRs. They report varying feeding intensity based on distension of the stomach, with the highest frequency of empty stomachs in October and lowest in January. They confirm the carnivorous, non-cannibalistic feeding nature of the shark and report the major prey items in the diet of *S. laticaudus* to be comprised of *Coilia dussumieri*, *Trypauchen vagina*, *Harpadon nehereus*, *Lepturacanthus savala*, *Thryssa* spp., *Cynoglossus* spp., *Loligo* spp., *Solenocera* spp., *Sardinella* spp., sciaenids, *Sepia* spp., *Squilla* spp., *Acetes indicus*, *Metapenaeus monoceros*, *Metapenaeopsis stridulans* and *Parapenaeopsis stylifera*. They observed the highest IRI percentage for shrimps (46.36%) and fishes (40.15%).

Fowler. (1928). Further notes and descriptions of Bombay shore fishes. *Journal of Bombay natural History Society*, 33, 100 - 103.

The author describes a collection of 175 fishes, representing 89 species, labelled as having been obtained from Bombay, most with an additional label of Back Bay. The descriptions include the sharks *Stegostoma tigrinum*, *Chiloscyllium griseum* (Family Orectolobidae), *Sphyrna blochii* (Family Sphyrnidae), the sawfish *Pristis cuspidatus* (Family Pristiae), the torpedo ray *Torpedo sinuspersici* (Family Torpedinidae), the stingrays *Dasyatis uarnak*, *D. imbricatus*, *D. sephen*, *D. zugei* (Family Dasyatiidae), *Pteroplatea poeciloura* and *Aetomylaeus milvus* (Family Myliobatidae).

G

Ganapathy, A. (1986). On the landing of *Rhincodon typus* Smith along Adirampatinam coast, Tanjore District, Tamil Nadu. *Marine Fisheries Information Services (T&E Series)*, 66, 37.

The author reports the landing of a whale shark entangled in a bottom-set gill net operated at 8 m depth in the Palk Strait off Adirampatinam. The author reports that the animal which was 900 cm long, was alive until it reached the shore. He provides a few morphometric measurements of the shark.

Ganapathy, A. (1992). Unusally heavy landing of cownoseray *Rhinoptera javanica* along the Pak Bay coast near Thondi. *Marine Fisheries Information Services (T&E Series)*, 117, 20.

In this brief report, the author reports the landing of 10 tonnes of *Rhinoptera javanic*a caught by trawl net operated along Palk Bay coast on 26 December 1991.

Gandhi, A. (1998). On the landing of a Hammerhead shark *Sphyrna zygaena* (Linnaeus) at Therkuvadi (Gulf of Mannar). *Marine Fisheries Information Services (T&E Series)*, 154, 17.

This is a brief report on the landing of a female hammerhead shark *Sphyrna zygaena* (Linnaeus) at Therkuvadi landing centre on 15 November 1997. The shark was 2.75 cm long and weighed 381 kg.

Gangadharam, T. & Vijaya Lakshmi, C. (2004). A new species *Phyllobothrium visakhapatnamensis* (Cestoda: Tetraphyllidea) from spiral valve of *Scoliodon palasorrah* (Cuvier). *Rivista di Parassitologia*, 21(65), 163 - 168.

Reprint not obtained. Information accessed from Pollerspöck, J. & Straube, N. 2020, www.shark references.com, World Wide Web electronic publication, Version 2020

The authors conducted a systematic investigation on shark cestode parasites along Andhra Pradesh's east coast. For the current study, 1116 sharks from 11 different species were evaluated. A new species of *Phyllobothrium* Van Beneden (1850) was discovered in the spiral intestine of *Scoliodon palasorrah* in this study. The new species is quite large, and it can be compared to *P. foliaturii*, *P. tumidum*, and *P. lactuca*, which are likewise pretty large and share some characteristics. The current specimens are characterised by a big scolex that comprises of bothridia proliferation but no suckers. Until now, no such proliferations have been described.

Ghate, H. V. (1984). A black coloration on the olfactory sacs of *Scoliodon* caught off Bombay. *Indian Journal of Fisheries*, 31(3), 406 - 407

The author describes blackened olfactory sacs in specimens of the shark *Scoliodon sorrakowah*, which were caught off Bombay and transported in a frozen state from Bombay markets to Pune. Histological observations of the blackened sacs showed a fine deposit of black particulate matter all over the tissue. However, the Schmorl reaction for the detection of melanin did not yield positive results, probably due to the small particle size. The author also found a few black foci within normal, white olfactory sacs. He suggests further histological studies on sharks in the fresh state to understand the basis of the pathological condition and its possible relation to water quality.

Ghosh, B. K. (1959). Some fossil fish teeth from Tertiary deposits of Mayurbhanj, India. *Journal of Paleontology*, 33(4), 675-679.

Reprint not obtained. Information accessed from Pollerspöck, J. & Straube, N. 2020, www.shark references.com, World Wide Web electronic publication, Version 2020

Nine different species of fish teeth have been identified in limestone and clay from the lower Miocene epoch. *Aetobatis arcuatus* var. *baripadensis* and *Hypolophus sylvestris* var. mohuliyi are two new varieties proposed. It is discussed how old the contained beds are.

Gladston, Y., Akhilesh, K. V., Thakurdas, C., Ravi, O. P. K., Ajina, S. M. & Shenoy, L. (2018). Length - weight relationship of selected elasmobranch species from north-eastern Arabian Sea, India. Journal of Applied Ichthyology, 34(3), 753 - 757. https://doi.org/10.1111/jai.13680

The authors describe the length-weight relationship of 12 species of elasmobranchs exploited from the Arabian Sea off Maharashtra. The described species include five sharks (*Chiloscyllium arabicum*, *Lamiopsis temminckii*, *Rhizoprionodon acutus*, *Rhizoprionodon oligolinx* and *Scoliodon laticaudus*) four rays (*Aetobatus ocellatus, Brevitrygon imbricata*, *Gymnura poecilura* and *Pateobatis bleekeri*) and three guitarfishes (*Glaucostegus granulatus, Rhinobatos annandalei* and *Rhynchobatus djiddensis*). They also report a new maximum size for two sharks, *Lamiopsis temminckii* (208 cm in female) and *Chiloscyllium arabicum* (89 cm in female) and one guitarfish, *Rhinobatos annandalei* (89 cm in female).

Gnanamuthu, C. P. (1951). New copepod parasites of sharks. *Annals and Magazine of Natural History*, (12) 4, 1236 - 1256.

Reprint not obtained. Information accessed from https://www.tandfonline.com/doi/abs/10.1080/00222935108654254

The author describes three copepod parasites obtained from the skin of twenty carcharhinid sharks caught near Rameshvaram in south India. The parasites described are *Alebionalatus*, *Pandarus longus* and *Perissopus manuelensis*.

Gopakumar, G., Ajith Kumar, T. T. & Krishnapriyan, M. (2003). Juvenile whale shark, *Rhinocodon typus* (Smith) caught at Vizhinjam. *Marine Fisheries Information Services (T&E Series)*, 175, 11.

The authors report the entanglement of a live juvenile whale shark in gillnet locally called *Chalavala*, deployed for sardine catch at Vizhinjam fish landing center on 26 December 2002. The detailed morphometric measurements of this shark are given.

Gopalan, U. K. (1962). Occurrence of a whale shark at Veraval, Gujarat State. *Journal of the Marine Biological Association of India*, 4(2), 231 - 232

The author reports the landing of a female whale shark that was entangled in a drift gill net operated at 7 fathoms depth off Veraval. It is presumed to be the first record of the species from the area. The author provides a brief description of the animal with some morphometric measurements, and observes that plant matter formed the major part of the gut contents of the shark which measured 525 cm in total length.

Gopalan, U. K. (1971). On two abnormal sharks from Gujarat. *Journal of Bombay Natural History Society*, 68(2),465 - 467.

The author briefly describes two abnormal sharks he collected from Porbandar and Veraval in Gujarat - a two-headed specimen of *Carcharias walbeehmi* and blunt-nosed albino *Eulamia dussumieri*. He notes that the heads of the 16 cm long specimen of *C. walbeehmi* obtained from the womb of a mother shark were distinct up to the fifth gill slit, and had a common placental cord, with the visceral organs except the single median intestine and the urinogenital system existing as pairs. Among the fins, the pectoral, pelvic and a blunt crippled caudal fin were common while the dorsals were paired. The author records that the 28 cm long specimen of *E. dussumieri* was an albino with only four gill slits and a deformed head in which the eyes were placed ventrally behind a blunt and spongy snout.

Gowthaman, A. M., Jawahar, P. & Venkataramani, V. K. (2014). New occurrence of big eye thresher shark *Alopias superciliosus* Lowe, 1841 in Gulf of Mannar, southeast coast of India. *Indian Journal of Geo-Marine Sciences*, 43(5), 883 - 885.

The authors report the capture of a male big eye thresher shark *Alopias superciliosus* by a surface gill net operated off Manapad, southeast coast of India on 27 July 2010. The specimen measured 295 cm in total length and the authors report that it had well-developed claspers. Some morphometric measurements of the shark are also provided.

Gudger, E. W. (1953). What ultimately terminates the life span of the whale shark *Rhineodon typus. Journal of Bombay Natural History Society*, 54(4), 879 - 884.

In an attempt to elucidate the cause of death in a whale shark, the largest among sharks, and which seemingly cannot be affected by animate predators, the author gives a brief description of the peculiar size, swimming behaviour and feeding strategies characteristic of the species. Although the whale sharks referred to in the text were not from Indian waters, the article is of a general nature and applies to the shark irrespective of its area of occurrence. The author concludes that the whale shark is likely to face a premature death only in the event of a collision with a steamer, and if this does not happen, the shark will eventually die of old age.

Gurusamy, R. & Balasubramanian, T. S. (1994). On two large specimens of devil ray *Manta birostris* (Walbaum) landed at Tuticorin. *Marine Fisheries Information Services (T&E Series)*, 127, 15.

The authors document the landing of two large female devil rays, *Manta birostris* on 29 march 1993 at Tuticorin landing centre, measuring more than 5.5 m and weighing just under 1.5 t each. The authors have also documented some morphometric measurements of the two specimens which were auctioned for ₹550/- and ₹600/- at the fish landing centre.

Gupta, C. A., Purandhara, C. & Naik, A. R. (1991). On the landing of whale shark (*Rhincodon typus*) Smith off Malpe, Dakshina Kannada coast. *Marine Fisheries Information Services (T&E Series)*, 110, 10.

The authors record the landing of a juvenile female whale shark captured at Malpe Fisheries

Harbour on 13 December 1990. They report that the shark, weighing 900 kg, was captured by a 53 feet purse-seiner off Malpe at 36 m depth.

Gupta, V. & Parmar, S. (1987). On two new species of *Balanobothrium* Hornell, 1912 from marine fishes of Deegha, West Bengal. *Indian Journal of Helminthology*, 34(2), 107 - 113.

Reprint not obtained. Information accessed from Pollerspöck, J. & Straube, N. 2020, www.shark-references.com, World Wide Web electronic publication, Version 2020

Two new species of *Balanobothrium* Hornell. 1912 from marine fishes of Bay of Bengal, Deegha, West Bengal have been described. *B. shindei* sp. nov. from *Rhynchobatus djiddensis* differs from all the known forms of the genus except *B. stegostomatis* in the absence of neck. It differs from *B. stegostomatis* in the absence of bothridial collar, broader than long proglottids, unarmed cirrus. 80-100 testes and vitellaria in 2 to 3 rows. *B. trygoni* sp. nov. from *Trygon sephen* differs from all the known forms of the genus except *B. pafvum* and *B. stegostomatis* in having spinose cirrus. The new form differs from both these forms in having granular vitellaria. A key to the species of the genus *Balanobothrium* Hornell, 1912 is given.

Gupta, V. & Parmar, S. (1988). *Echinobothrium deeghai* sp. n. from a marine fish *Trygon sephen* of West Bengal. *Proceedings of Parasitology*, 6, 78 - 81.

Reprint not obtained

H

Haldar, V. & Chakraborty, N. (2017). A novel evolutionary technique based on electrolocation principle of elephant nose fish and shark: fish electrolocation optimization. *Soft Computing*, 21(14), 3827 - 3848. DOI: 10.1007/s00500-016-2033-1

Reprint not obtained. Information accessed from Pollerspöck, J. & Straube, N. 2020, www.shark-references.com, World Wide Web electronic publication, Version 2020

The authors mathematically developed nature-inspired meta-heuristic technique named fish electrolocation optimization (FEO) based on active and passive electrolocation of fish akin to elephant nose fish and sharks, respectively. They conducted a benchmark-function comparison research between actual coded genetic algorithm, accelerated particle swarm optimization, particle swarm optimization, harmony search, and the suggested approach. In addition, a comparison study of simulated annealing and differential evolution on eggcrate function was conducted. The proposed method has also been used to solve a real-world optimization problem involving cost-based reliability enhancement in a radial distribution system. When comparing % of success, mean number of function evaluations, and standard deviation, it can be concluded that the FEO algorithm outperforms the other metaheuristic algorithms.

Hamsa, K. M. S. A, Kasim, H. M., Rajapackiam, S. & Balasubramanian, T. S. (1991). On the rare landings of the dogfish shark species from Gulf of Mannar. *Marine Fisheries Information Services (T&E Series)*, 107, 17 - 18.

The authors record their observations on a rare catch 820 kg (224 numbers) of the spiny dogfish shark *Centrophorus moluccensis* Bleeker by drift gillnets at Veeraapandianpatnam landing centre on the Gulf of Mannar coast on 17 September 1990. The authors record their observations on 121 specimens which were landed, the remaining having been discarded at sea by the fishermen due to difficulty in towing the entire catch to the shore. They give a detailed account of the sex ratio, sex-wise length range and length-weight relationship. They report the food items to be the tuna *Auxis thazard*, the fusilier *Dipterygonous leucogrammicus*, crabs, shrimps and squid. They also report that the liver was rich in oil content and the fishes were auctioned for ₹150/- per 50 numbers. The authors state that the occurrence of the dogfish shark *Centrophorus moluccensis* from the Gulf of Mannar indicates the availability of a potentially economic shark resource in deeper waters off Veerapandianpatnam.

Hanfee, F. (1997). *The trade in sharks and shark products in India: a preliminary survey.* WWF-India/ TRAFFIC-India, New Delhi.

In this report, the author presents an overview of the status of India's shark fishery and trade, with emphasis on the trade of different shark products. This is the seventh wildlife trade monitoring report of TRAFFIC-INDIA, and the first one on marine species. The report seeks to highlight the problems in the conservation of sharks in India and control of trade. The report evolves through seven chapters describing a general overview of shark fishing, trade overview, historical perspective, current fisheries status, trade in shark products, conclusions & recommendations and regulatory & management frameworks. This is the first comprehensive report on trade in sharks and shark products in India and suggests the way forward for judicious and sustainable utilisation of sharks.

Hanfee, F. (1999). Management of shark fisheries in two Indian coastal states: Tamil Nadu & Kerala. In Shotton, R. (Ed.), *Case studies of the management of elasmobranch fisheries. FAO Fisheries Technical Paper. No. 378, part 1* (pp. 316 - 338). Food and Agriculture Organization of the United Nations, Rome.

The author describes the shark fisheries of India with an emphasis on the fisheries of the two southern states of Tamil Nadu and Kerala. She reviews the status of the fisheries in the two states, with details of species composition of the shark landings, the gears used for exploitation, fleet characteristics, markets, trade and export, management policies, legal frameworks and enforcement issues.

Hausfather, Z. (2004). *India's shark trade: An analysis of Indian shark landings based on shark fin exports.* Grinnell College, Iowa.

The author discusses the status of India's shark fin landing vis-à-vis the quantum of shark fin exports. Two estimates of Indian shark fin exports, one based on projected shark fin production from the Food and Agriculture Organisation (FAO) recorded landings data and the other based on recorded Hong Kong imports from India, show that actual exports are likely many times greater than officially recorded amounts. Fins from sharks caught in Indian waters are usually dried in preparation for export and The author identifies Chennai and, to a lesser extent, Mumbai as the major centres for shark fin export with fins coming from all over the Indian coast. The wholesale prices for shark fins are ₹280-340 per kg ($7-$8.50) domestically, while end-market retail prices are often five times greater in the Hong Kong or Singapore markets. The author suggests that officially reported shark landings data understate actual shark landings.

Hegde, M. R., Padate, V. P. & Rivonker, C. U. (2014). Biological aspects and catch trends of Elasmobranchs in the inshore waters of Goa, west coast of India. *International Journal of Marine Science*, 45, 1 - 12. http://ijms.biopublisher.ca

The authors discuss the elasmobranch fishery in the nearshore waters of Goa, along the west coast of India and identify 10 species that occur in the trawl catches - *Scoliodon laticaudus, Chiloscyllium griseum, Himantura walga, Himantura gerrardi*, *Aetobatus flagellum*, *Glaucostegus granulatus*, *Rhinobatus obtusus, Neotrygon kuhlii, Pastinachus sephen* and *Himantura uarnak.* Of these, the first seven occurred in catches from all along the Goa coast while *N. kuhlii* and *P. sephen* occurred off North Goa and *H. uarnak*, off South Goa. They present details of size range and juvenile composition of each of these species in the catch and report *S. laticaudus, H. walga, A. flagellum* and *R. obtusus* were dominated by juveniles, *C. griseum* was represented equally by juveniles and adults, and the other five species were represented exclusively by juveniles. Identifying the Indian oil sardine as the major prey item of elasmobranchs along the Goa coast, they report an ontogenic shift in diet of *S. laticaudus*, with a preference for crustaceans being replaced by teleost fishes and cephalopods.

The catch trend during 1969-2004 indicated high variability with the proportion of elasmobranchs in the total annual catch ranging between 0.05 and 5.04%.

Hora, S. L. (1956). Food of the whale shark, *Rhineodon typus* (Smith): Evidence of a Jataka sculpture, 2nd century B. C. *Journal of Bombay Natural History Society*, 53, 478 - 479.

The author refers to a Jataka sculpture - *Timingila Jataka* Medallion, that he examined and comments on the diet of the whale shark based on the art depicted in it. He refers to earlier reports by McCann (1954) and Gudger (1953) and contends that the whale shark is probably not a vegetarian fish, feeding on filamentous algae, but feeds on small schooling fishes like the sardine. He also suggests that the diets ascribed to the species by the two authors are probably biased, based on the size of the specimen (s) sampled.

McCann, C. (1954). The Whale Shark Rhineodon typus (Smith). JBNHS, 52, 326-333.

Gudger, E.W. (1953). What ultimately terminates the life of the Whale Shark Rhineodon typus? JBNHS, 51, 879-884.

J

Jabado, R. W., Kyne, P. M., Nazareth, E. & Sutaria, D. N. (2018). A rare contemporary record of the Critically Endangered Ganges shark *Glyphis gangeticus*. *Journal of Fish Biology*, 92(5), 1663 - 1669. https://doi.org/10.1111/jfb.13619

The authors present the first confirmed record of *Glyphis gangeticus* from the Arabian Sea that is beyond the species' range in over a decade. The report is based on a single adult female specimen measuring 266 cm total length collected from Sassoon Docks in Mumbai, India in February 2016. They emphasise the need to determine population size and observe fisher education and awareness campaigns as it is a critically endangered species.

Jabado, R. W., Kyne, P. M., Pollom, R. A., Ebert, D. A., Simpfendorfer, C. A., Ralph, G. M., Al Dhaheri, S. S., Akhilesh K. V., Khadeeja A., Ali, M, H., Al Mamari, T. M. S., Bineesh, K. K., El Hassan, I. S., Fernando D., Grandcourt, E. M., Khan, M. M., Moore, A. B. M., Owfi, F., Robinson, D. P., Romanov, E., Soares, A., Spaet, J. L. Y., Tesfamichael, D., Valinassab, T. & Dulvy, N. K. (2018). Troubled waters: Threats and extinction risk of the sharks, rays and chimaeras of the Arabian Sea and adjacent waters. *Fish and Fisheries*, 19, 1043 - 1062.

The authors document the conservation status of important chondrichthyan fishes from the Arabian Sea and adjacent waters and report the first assessment of extinction risk for 153 species of sharks, rays and chimaeras. They report thirty endemic, seventy-eight threatened (Critically Endangered, Endangered or Vulnerable), twenty-seven Near Threatened and twenty-nine Data Deficient species. The authors observed a decline in the chondrichthyan populations and called for urgent management measures from concerted national and regional agencies to ensure the species' survival at the risk of extinction.

Jadhav, B. V. (1983). *Tylocephalum bombayensis* n. sp. (Cestoda: Lecanicephalidea) from the Indian fish *Trygon sephen*. *Rivista di Parassitologia*, 44, 193 - 195.

Reprint not obtained.

Jadhav, B. V. (1985). *Phyllobothrium trygoni* n. sp. (Cestoda: Phyllobothriidae) from *Trygon sephen*. *Rivista di Parassitologia*, 46, 181 - 183.

Reprint not obtained.

Jadhav, B. V. (1993). A new parasite from Onchobothriidae from Bombay. *Indian Journal of Helminthology*, 45 (1 - 2), 96 - 99.

Reprint not obtained.

Jadhav, B. V. & Shinde, G. B. (1979). *Balanobothrium veravalensis* n. sp. (Cestoda: Lecanicephalidae)

from a marine fish. *Indian Journal of Parasitology*, 3, 83 - 85.
Reprint not obtained.

Jadhav, B. V. & Shinde, G. B. (1981a). A new species of the genus *Tylocephalum* Linton, 1890 (Cestoda: Lecanicephalidea) from an Indian marine fish. *Indian Journal of Parasitology*, 5, 109 - 111.
Reprint not obtained.

Jadhav, B. V. & Shinde, G. B. (1981b). *Uncibilocularis veravalensis* n. sp. (Cestoda: Onchobothriidae) from an Indian marine fish. *Indian Journal of Parasitology*, 5, 113 - 115.
Reprint not obtained.

Jadhav, B. V. & Shinde, G. B. (1982). A review of the genus *Balanobothrium* Hornell, 1912 with four new species. *Helminthologia*, 19, 185 - 194.
Reprint not obtained.

Jadhav, B. V. & Shinde, G. B. (1987). *Tylocephalum aurangabadensis* sp. nov.(Cestoda: Lecanicephalidae) from a marine fish *Aetobatis narinari* from Arabian Sea. *Indian Journal of Helminthology*, 39 (2), 88 - 91.
Reprint not obtained.

Jadhav, B. V., Shinde, G. B. & Deshmukh, R. A. (1981). On a new cestode *Shindeiobothrium karbarae* gen. n. sp. n. from a marine fish. *Rivista di Parassitologia*, 42, 31 - 34.
Reprint not obtained.

Jadhav, B. V., Shinde, G. B. & Mohekar, A. D. (1984). Two new species of the genus *Pedibothrium* Linton, 1909 (Cestoda: Tetraphyllidea) from *Stegostoma tigrinum*. *Indian Journal of Parasitology*, 8, 311 - 315.
Reprint not obtained.

Jadhav, B. V., Shinde, G. B., Muralidhar, A. & Mohekar, A. D. (1989). Two new species of the genus *Uncibilocularis Southwell*, 1920 from (Cestoda: Onchobothriidae) India. *Indian Journal of Helminthology*, 41(1), 14 - 20.
Reprint not obtained.

Jadhav, B. V., Shinde, G. B. & Phad, A. N. (1984). On a new species of the genus *Uncibilocularis Southwell*, 1925 (Cestoda, Tetraphyllidea) from *Trygon sephen* at Bombay. *Helminthologia*, 21, 17 - 20.
Reprint not obtained.

Jadhav, B. V., Shinde, G. B. & Sarwade, D. V. (1986). *Polypocephalus ratnagiriensis* sp. nov. (Cestoda: Lecanicephalidae) from *Trygon zugei*, India. *Indian Journal of Helminthology*, 38 (2), 88 - 92.
Reprint not obtained.

Jadhav, B. V. & Shinde, G. E. (1981). A new species of *Oncodiscus Yamaguti*, 1934 (Cestoda: Tetraphyllidea) from India. *Proceedings of the Indian Academy of Parasitology*, 2, 26 - 27.
Reprint not obtained.

Jadhav, D. G., Chavan, B. B., Sawant, A. D. & Sundaram Sujit. (2005). Whale shark, *Rhiniodon typus* landed at Versova, Mumbai., *Marine Fisheries Information Services (T&E Series)*, 18, 18.
Reprint not obtained.

Jadhav, D. H. & Jadhav, B. V. (1993). Two new species of genus *Cephalobothrium* (Cestoda: Lecanicephalidea) at Ratnagiri (M. S.) India. *Indian Journal of Helminthology*, 45 (1 - 2), 147 - 151.
Reprint not obtained.

Jadhav, D. H. & Shinde, G. B. (1989). A new species of the genus *Polypocephalus* (Cestoda: Lecanicephalidea) at Ratnagiri, M. S., India. *Rivista di Parassitologia*, 6, 189 - 191.
Reprint not obtained.

Jadhav, D. H., Shinde, G. B. & Jadhav, B. V. (1992a). *Kowsalya bothriumsepheni* sp. nov. (Cestoda: Phyllobothrium) from marine fish *Trygonsephen* at Bombay, India. *Indian Journal of Helminthology*, 44 (1), 76 - 78.

Reprint not obtained.

Jadhav, D. H., Shinde, G. B. & Jadhav, B. V. (1992b). On a new species of the genus *Pithophorus* (Cestoda: Phyllobothriidae) at Ratnagiri. *Indian Journal of Helminthology*, 44 (2), 149 - 151.

Reprint not obtained.

Jagadis, I. & Ignatius, B. (2003). Captive breeding and rearing of grey bamboo shark, *Chiloscyllium griseum* (Müller & Henle, 1839). *Indian Journal of Fisheries*, 50 (4), 539 - 542.

The authors report their observations on the reproductive behaviour of the grey bamboo shark, *Chiloscyllium griseum*, from one female and two male sharks held in captive condition. The female shark laid 27 oval-shaped egg cases, mostly released in pairs over a period of 3 months at 2 to 9 day intervals. The release of juvenile sharks from various batches of egg cases occurred at intervals ranging from 67-85 days and the mean incubation period inside the egg case was 74 days. The length and weight at birth ranged from 107 to 118 mm and 4.5 to 5.5 g, respectively. The sex ratio of the hatched sharks was 1:0.9. The authors provide information on early growth in 12 of the 15 juvenile sharks released in captivity and note that the average monthly growth rate was 25.0 mm/8.35 g in the initial 60 days of the rearing period.

James, D. B. (1985). Note on a giant devil ray *Manta birostris* (Walbaum) caught off Madras. *Indian Journal of Fisheries*, 32(4), 492 - 494.

The author reports the capture of a female devil ray *Manta birostris* by a gillnet operated off Nochikuppam near Madras on 23 March 1981. The animal measured 4.27 m in total length and weighed 750 kg. The author presents its morphometric measurements and some details on the internal anatomy.

James, D. B., Nammalwar P. & Srinivasanranjan, S. (1986). On two juvenile whale sharks *Rhincodon typus* Smith caught at Madras. *Marine Fisheries Information Services (T&E Series)*, 66, 21.

The authors report the landing of two juvenile whale sharks, a male and a female, at Mullikuppam (Thiruvanmiyur) and Royapuram in Madras on 23 March 1980 and 2 July 1984, respectively. They present some morphometric measurements of the two specimens.

James, P. S. B. R. (1966). Notes on the biology and fishery of the butterfly ray, *Gymnura poecilura* (Shaw) from the Palk Bay and Gulf of Mannar. *Indian Journal of Fisheries*, 13 (12), 150 - 157.

The author describes the biological and ecological details of the butterfly ray, *Gymnura poecilura*, caught in the Gulf of Mannar and Palk Bay, highlighting morphological variation between the two sexes. He also describes similar variations between juveniles and adults. Morphometric details are elaborated based on 49 specimens collected in the Gulf of Mannar, including 20 intra-uterine embryos. He estimates the size at birth to be between 237 and 256 mm DW and describes the morphology of the developmental stages. The author observes that the species is mostly caught in shallow water at 30 m depth, is mostly abundant in January and May, and breeds throughout the year, with the peak period being April to October.

James, P. S. B. R. (1971). Further observations on shoals of the Javanese cownose ray *Rhinoptera javanica* Müller & Henle from the Gulf of Mannar with a note on the teeth structure in the species. *Journal of the Marine Biological Association of India*, 12 (1&2), 151 - 157.

The author reports the shoaling of Javanese cownose ray, *Rhinoptera javanica*, in the Gulf of Mannar and their capture in large numbers at several places in the region during January-February 1969. He provides measurement and sex

of 32 specimens and records the landing of about 130 rays by a shore seine at approximately 6 metres depth off the coast of Vedalai in the Gulf of Mannar. He examines 113 specimens and discusses the tooth structure of *Rhinoptera javanica*.

James, P. S. B. R. (1973). Sharks, rays and skates as a potential fishery resource of the sea around India. *Proceedings of the symposium on living resources of the seas around India, Special Publication CMFRI*, 483 - 494.

In this article, the elasmobranch resources of the Indian coast are discussed in detail by the author. He estimates the annual average elasmobranch catch from 1950 to 1967 to be 33,442 m tonnes for both the east and west coasts and discusses the existence of a potential fishery, the fleet and gear involved in the elasmobranch fishery along the west and east coasts of the country, with particular emphasis on West Bengal, Orissa, Andhra Pradesh and Madras state on the east coast and in the Andaman and Nicobar Islands. He provides a list of the species diversity of sharks, rays and skates for the Indian Seas, with bionomics of important species landed along the east coast. He suggests extending fishing operations to deeper waters off the east coast of India and the Gulf of Mannar.

James, P. S. B. R. (1980). Some observations on the ray *Himantura marginatus* (Blyth) from Gulf of Mannar. *Journal of the Marine Biological Association of India*, 22 (1&2), 161 - 164.

The author describes *Himantura marginatus* comparing morphometric characteristics of two large male specimens caught from the Gulf of Mannar in February and March 1966, with earlier records.

James, P. S. B. R. (1989). Book review - Physiology of elasmobranch fishes, edited by T J Shuttleworth (Springer-Verlag, Berlin), 1988, pp. xii + 324,685 g, Hard cover, DM 228. [ISBN 3- 540-18769-31. *Indian Journal of Marine Sciences*, 18(4), 297.

The author gives a comprehensive review of the book "Physiology of elasmobranch fishes," describing the broad contents, chapter-wise.

Jayaprakash, A. A., Pillai, N. G. K. & Elayathu, M. N. K. (2002). Drift gill net fishery for large pelagics at Cochin - A case study on by-catch of pelagic sharks. In N. G. K. Pillai, N. G. Menon, P. P. Pillai & U. Ganga (Eds.), *Management of Scombroid Fisheries* (pp. 155 - 164). CMFRI, Kochi.

In this article, the authors explain the drift gillnet fishery, highlighting the by-catch details of pelagic sharks at Kochi, India. They utilize the data on the shark fishery at Kochi from 1979 to 1999 from the drift gillnet fishery and found out that elasmobranchs constitute 4-12% in the gear and the production varied from 1,238 t in 1979 to 42 t in 1994, indicating a gradual decline in the catch. They provide the details of the exploitation of elasmobranchs by the drift gill net by pointing out the percentage composition of sharks, rays, and the rest. They also report the major pelagic sharks (*Rhizoprionodon acutus, Carcharhinus melanopterus, C. limbatus, C. macloti, C. brevipinna, R. oligolinx, Sphyrna lewini and Scoliodon laticaudus*), rays (*Mobula diabolus, Rhinoptera javanica*) and skates (*Rhynchobatus spp., Rhina ancylostoma* and rarely *Pristis* spp.) from the drift gill net. The authors also discuss the reason for the reduction in effort, catch, c/e and measures for optimum exploitation.

Joel, J. J. & Ebenezer, I. P. (1991). On a bramble shark with 52 embryos. *Marine Fisheries Information Services (T&E Series)*, 108, 15.

The authors report the capture of two female bramble sharks, *Echinorhinus brucus*, caught by hooks and line at about 100 m depth off Thoothoor, a fishing village of Kanyakumari district in October. The total length measured 262 cm and 220 cm, weight 120 and 80 kg and 52 well-developed embryos were recorded in one shark.

Joel, J. J. & Ebenezer, I. P. (1993). Long-lining, specifically for sharks practiced at Thoothoor. *Marine Fisheries Information Services (T&E Series)*, 121, 5-8.

The authors present an account of shark fishing methods, catch statistics, catch composition, biological observations, marketing and disposal methods practiced in Thoothoor in the Kanyakumari district on south Tamil Nadu coast. They report that a society called 'Meen Pidikkum Thozhllalar Sangam', functioning at Thoothoor for the welfare of the fishermen of this village, maintains records of the income of long-liners owned by its members.

Joel, J. J., Ebenezer, I. P. & Prosper, A. (1994). On a whale shark landed at Kovalam, Kanyakumari. *Marine Fisheries Information Services (T&E Series)*, 131, 22.

The authors report the landing of a whale shark at Kovalam, Kanyakumari on 13 March 1994. They provide some morphometric measurements of the 5.34 m long shark, which had been entangled in a gill net operated by a crew of six from a motorised catamaran on the surface layers of the 32 m deep waters 5 km off Kovalam. They note that the shark did not attract merchants and was buried on Kovalam beach the next day.

Jones, S. & Kumaran, M. (1980). *Fishes of the Laccadive archipelago*. The Nature Conservation and Aquatic Sciences Service, Trivandrum.

The authors brief about the different eras in the fish and fisheries research of the Laccadives. Toward the end of the nineteenth century, during the expeditions of the Royal Indian Marine Survey Ship INVESTIGATOR, the fauna of this area began to gain some attention from Alcock, who detailed the deep sea fishes caught there. The Cambridge Expedition, led by Stanley Gardiner, did not conduct a thorough study of fishes during its explorations into the fauna and geography of the Maldive and Laccadive Archipelagoes in 1899 and 1900. There are references to 71 species of fish from the Maldives in Regan's book (1903), but no data from the Laccadives. Some observations on the fish and fisheries of the islands have been made by Hornell (1910), Ayyangar (1922), Ellis (1924), Burton (1940), and Mathew and Ramachandran (1956).

Jones, S. & Sujansingani, K. H. (1954). Fish and fisheries of the Chilka Lake with statistics of fish catches for the years 1948-1950. *Indian Journal of Fisheries*, 1(1 & 2), 256 - 344.

The authors describe the diversity of fishes and fishery in the estuarine system of Chilka Lake. They provide the catch statistics for the period 1948-1950, and describe the different species in detail. Among elasmobranchs, they describe *Carcharhinus gangeticus, Carcharhinus melanopterus, Physoden mulleri (Family: Carcharhinidae), Pristis pectinatus (Family: Pristidae), Dasyatis (Amphotistius) imbricata - Trygon imbricata, Dasyatis (Himantura) uarnak - Trygon uarnak* and *Trygon pareh, Dasyatis (Pastinachus) sephen - Hypolophus sephen. (Family: Dasyatidae), Aetobatis narinari - Aetobatis flagellum, Aetobatis guttata and Aetomylceus nichofii (Family: Myliobatidae).* They confirm Chilka Lake to be potent breeding ground for *Dasyatis imbricata* and *Dasyatis sephen*. They also discuss trade and utilisation of elasmobranch catch in this area.

Josekutty, C. J., Waghmare, K. B. & Katkar, B. N. (2004). Landing of tiger shark, *Galeocerdo cuvier* at Mumbai, Maharashtra. *Marine Fisheries Information Services (T&E Series)*, 182, 14.

The authors report the landing of two tiger sharks at Sassoon Dock and New Ferry Wharf landing centers in Mumbai on 4 and 16 March 2004. They provide some morphometric measurements of the two sharks.

Joseph, D., & Chakraborty, K. (2017). Enrichment of C20-22 polyunsaturated fatty acids from refined liver oil of leafscale gulper shark, *Centrophorus*

squamosus. Journal of Aquatc Food product Technology, 26(9), 1042 - 1056. https://doi.org/10.1080/10498850.2017.1375588

The authors present methods to concentrate C20-22 n-3 PUFAs from the refined liver oil of deep-sea leafscale gulper shark *Centrophorus squamosus* without affecting their chemical properties. They treat the refined liver oil by sequential processes of winterization, urea complexation, and argentation chromatography to obtain concentrated C20-22 PUFAs, mainly 20:5n-3 and 22:6n-3. They propose that using acetonitrile as a solvent increases PUFA content while decreasing SFAs during the winterization process, that the urea complexation method removes the saturated hydrocarbon moieties from the fatty acids, and that the argentated silica chromatography method provides C20-22 n-3 PUFAs with greater than 99 percent purity.

Joshi, K. K., Balachandran, K. & Raje, S. G. (2008). Changes in the shark fishery at Cochin. *Journal of the Marine Biological Association of India*, 50 (1), 103 - 105.

In this article, the authors discuss the species diversity in elasmobranch landings at Cochin harbour during 2000-2002. The length, weight and sex ratio of the shark species are presented. They report 30 species of sharks belonging to 14 genera and 7 families. The main fishing season was March and June. A longline operation for exploiting sharks was noticed in the area between Quilon and Ratnagiri. The authors report that the considerable size of large-sized grey sharks landing inflated the catch and CPUE during the two-year study period.

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Kaikini, A. S., Rao, R. V. & Dhulkhed, M. H. (1959). A note on the whale shark *Rhincodon typus* Smith, stranded off Mangalore. *Journal of the Marine Biological Association of India*, 1(1), 92 - 93.

The authors narrate an incident of a rescue attempt by trainees of the Fishery Training Centre to save a whale shark stranded in 2-3 fathom waters off Mangalore coast on 5 March 1959, during their experimental purse seine fishing about four miles off Suratkal. Their attempt did not succeed as the exhausted whale shark died the following day.

Kakati, V. S. & Dinesh, C. K. (1995). Devil ray landed at Karwar. *Marine Fisheries Information Service (T&E Series)*, 140, 9 - 10.

The authors report the landing of a devil ray, *Manta birostris*, by a purse seiner at Karwar Fisheries Harbour on 16 September 1995. The ray, which was part of a group of 5-6 rays being pursued by dolphins, was accidentally caught in the purse seine, and being too large to be hauled onboard, was towed towards land. The authors note that the ray, measuring 5.5 m in disc width, delivered 3 young ones while being towed, and the buyer who purchased it for ₹3,600/-retrieved a fourth young one from its womb. The authors also report the landing of a young devil ray measuring 1.2 m in disc width, at Honavar Fisheries Harbour four days later, and conclude that these landings indicate the presence of a breeding ground of the species off Karwar in the 40-45 m depth zone. They also mention the landing of four young devil rays by gill nets at Binaga Bay on 4 October 1995.

Kalidasan, K., Ravi, V., Sahu, S. K., Maheshwaran, M. L. & Kandasamy, K. (2014). Antimicrobial and anticoagulant activities of the spine of stingray *Himantura imbricata*. *Journal of Coastal Life Medicine*, 2(2), 89 - 93. https://doi.org/10.12980/JCLM.2.2014APJTB-2013-0033

The authors describe the spine structure of the stingray *Himantura imbricata* by light microscopic observation and discovered that the venom apparatus consists of two spines, glandular tissue and a sheath. The spine is made of vasaodentine and is protected

by a layer of extremely hard vitrodentine. There are grooves on the ventral side that contain glandular tissue and are encased by the sheath. They also report the venom properties of *H. imbricata* spines, as well as their antibacterial activity against human pathogens and anticoagulant properties. The highest activity (14 mm) was observed against *Staphylococcus aureus*. Crude extract showed anticoagulant activity of 91.50 USP units/mg, which is comparable to standard heparin. The authors propose the use of stingray spines as an alternative to the mammalian heparin and a potential source of antimicrobial compounds.

Kamble, S. K. & Rane, U. H. (2001). On a whale shark, *Rhincodon typus* Smith, landed at Dakti Dahanu and Gungwada, Thane, Maharashtra. *Marine Fisheries Information Service (T&E Series)*, 170, 12.

The authors report the entangling of a male whale shark *Rhincodon typus* in a nylon gillnet, locally called *wagrajal*, at a depth of 40 m, and landed at Dakti Dahanu & Gungwada in Maharashtra, on 21 December 1999. They provide some morphometric measurements of the shark, which was 625 cm long and weighed 1.8 t, and note that it was purchased by a local fish merchant for ₹6000/-.

Kannan, K., Kannapiran, E. & Prabhu, N. M. (2019). Record of "near threatened" crocodile shark *Pseudocarcharias kamoharai* (Pseudocarchariidae) from Indian Exclusive Economic Zone. *Thalassas*, 35(2), 525 - 530. https://doi.org/10.1007/s41208-019-00158-y

The authors record the occurrence of the crocodile shark *Pseudocarcharias kamoharai* in the Gulf of Mannar, for the first time, from two specimens, a male and a female, landed at Tharuvaikulam landing centre by drift gillnets on 16 and 23 June 2018 respectively. They describe the systematics of the species and compare the morphometric measurements of their specimens with earlier records from Indian and New Zealand waters.

Kannan, K., Ranjith, L., Suresh Kumar, K., John James, K., Sathakathullah, S. M. & Madan, M. S. (2013). Occurrence of near threatened tiger shark, *Galeocerdo cuvier* (Peron and Lesueur, 1822) from Tuticorin coast, Tamil Nadu. *Marine Fisheries Information Service (T&E Series)*, 216, 13 - 14.

The authors report the landing of an accidentally caught female tiger shark *Galeocerdo cuvier* measuring 136 cm and weighing 13 kg, by hook and line operated at 50 m depth off the Tuticorin coast.

Kannan, K., Ranjith, L., Suresh Kumar, K., Kanthan, K. P., John James, K. & Sathakathullah, S. M. (2013). Pelagic sting ray, *Pteroplatytrygon violacea* (Boneparte, 1832) landed at Tuticorin. *Marine Fisheries Information Service (T&E Series)*, 215, 16 - 17.

The authors report the landing of a male pelagic sting ray, *Pteroplatytrygon violacea* by a gillnet operated at 100-150 m depth at Tharuvaikulam landing centre in Tuticorin on the southeast coast of India. They present the morphometric measurements of the ray, which weighed 2090 g, and compare it with earlier records from Cochin and the North Sea.

Kapoor, D., Dayal, R. & Ponniah, A. G. (2002). *Fish biodiversity of India.* National Bureau of Fish Genetic Resources Lucknow, India.

The authors present a compendium by enlisting the information on systematics, habitat and distribution of 2118 finfishes belonging to 36 orders, 55 sub-orders, 209 families and 711 genera, inhabiting different ecosystems of the Indian subcontinent. They have compiled all the available published and unpublished scattered information on the finfishes of India and made a comprehensive database for present-day requirements. It includes the most recent scientific name and classification based on Nelson's 1994 classification. A separate table of taxonomic sub-division of the fish biodiversity of India has been provided, as well as a separate list of fishes found in different aquatic conditions. They

have recorded 129 elasmobranchs under 6 orders, 26 families and 56 genera.

Kapoor, H. M. & Sahni, A. (1971). A shark tooth from Zewan Series of Guryul Ravine, Kashmir. Memoirs of the Faculty of Science, Kyoto University. *Series of Geology and Mineralogy*, 38(1), 163 - 166.

The authors describe the occurrence of a new species of shark, *Ctenacanthus ishii*, on the basis of an isolated tooth from the Zewan Series of Guryul Ravine, Kashmir. They report that the find of a shark tooth in the marine Perrnian beds of Kashmir is significant considering the rarity of fossil vertebrates in the Palaeozoics of the Himalayas. They present the systematics of the shark species with a detailed description of the tooth.

Kar, A. B., Govindaraj, K., Prasad, G. V. R. & Ramalingam, L. (2011). Bycatch in the tuna longline fishery in the Indian EEZ around Anadaman and Nicobar Islands. *Indian Ocean Tuna Commission Working Party on Ecosystems and Bycatch,* 1 - 19.

The authors discuss the composition and catch rates of bycatch in the tuna longline in the Indian EEZ around the Andaman and Nicobar Islands, and provide information on the sharks in the bycatch and on some aspects of the biology of thresher sharks. Sharks formed 38 and 54% of the total catch, by number and weight, respectively, with a hooking rate of 0.23%. They observed 17 species of sharks belonging to four families, Carcharhinidae, Lamnidae, Sphyrnidae and Alopidae, of which thresher sharks (Alopidae) were dominant. They recorded the male to female ratio for *Alopias pelagicus* as 1:0.6 and for *A. vulpinus* and *A. superciliosus* as 1:0.4. They provide information on the length-weight relationship and food and feeding of the 3 species, indicating the preference of all 3 species for squid and octopus.

Kar, S. K. (1998). On a whale shark landed and a turtle stranded at Digha, Midnapur district, West Bengal. *Marine Fisheries Information Service (T&E Series)*, 156, 21.

The author reports the landing of a 400 kg whale shark by a trawler at Digha Mohana Centre on 8 February 1998, and its subsequent sale for ₹ 2800/-.

Karbhari, J. P. (1973). A note on a giant saw fish *Pristis microdon* Lathan from the river Tapti at Surat. *Indian Journal of Fisheries*, 20(2), 677 - 678.

The author reports the landing of *Pristis microdon* from the river Tapti. The meristic and morphometric measurements of *P. microdon*, which measured 594 cm in length, weighed 800 kg, and bore 23 embryos, are included in the note.

Karbhari, J. P. (1986). On a whale shark *Rhiniodon typus* Smith landed at Cuffe Parade beach, Bombay. *Marine Fisheries Information Service (T&E Series)*, 66, 20.

The author reports the landing of a live female whale shark entangled in a nylon gillnet at Cuffe Parade beach, Bombay, on January 8, 1980. He provides morphometric measurements of the shark, which died after landing and was disposed of back into the sea.

Karbhari, J. P. & Josekutty, C. J. (1986). On the largest whale shark *Rhincodon typus* Smith landed alive at Cuffe Parade beach, Bombay. *Marine Fisheries Information Service (T&E Series)*, 66, 31 - 35.

The authors describe the landing of a live female whale shark of 12.18 m long entangled in a midwater gillnet at Cuffe Parade beach, Bombay, on November 21, 1983. They provide morphometric measurements, and a detailed description of the fish. They report that it was sold to a local fish merchant for ₹4000/- and also provide details of the processing and disposal of different body parts such as cured meat, skin, vertebrae and liver.

Karnad, D., Sutaria, D. & Jabado, R. W. (2019). Local drivers of declining shark fisheries in India. *Ambio*, 49(2), 616 - 627. https://doi.org/10.1007/s13280-019-01203-z

The authors evaluate the drivers of shark harvests in India, using a semi-structured survey carried out at two key landing sites, namely Porbandar and Malvan, in the states of Gujarat and Maharashtra, from September 2014 to September 2015 to examine the practices of shark fishers and traders, their knowledge of shark trade and policy, and perceptions of shark declines. They identify domestic consumer demand, especially for small-bodied and juvenile sharks, as the main driver for shark fishing in India, rather than global shark fin trade. They recommend improving education and awareness about sharks amongst fishers and traders, instituting locally relevant, temporal closures of fisheries, bringing local fish markets under the ambit of species protection enforcement, and focusing scientific and policy attention on key threatened species populations to ensure fishey management and sustainability of shark resources.

Karthikeyan, R., Babu, N. K. C. & Mandal, A. B. (2009). Studies on the preparation of soft leathers from *Himantura* (Family Dasyatidae) stingray skins and their applications in foot and hand reflexology. *International Union of Leather Technologists & Chemists Societies*, 349.

The authors discuss two different processing technologies developed for the preparation of soft leathers from stingray skins. They present a detailed account of the two methods by which stingray skins with mineralized denticles chemically linked to the collagen fibres were converted into leather and the leather was used to prepare various products to stimulate the reflex points present in human palms and soles. They conclude that fibre splitting during pickling, and fat liquoring during tanning process, imparts good fibre separation to the crust leather resulting in soft leather and that xyalanase could be effectively used to remove the pigments adhered to the stingray skin as well as to open up the fibre structure.

Karthikeyan, R., Babu, N. K. C., Mandal, A. B. & Sehgal, P. K. (2009). Soft leathers from *Himantura* stingray skin. *Journal of the Society of Leather Technologists and Chemists*, 93, 108 - 113.

Reprint not obtained.

Karthikeyan, R., Babu, N. K. C., Mandal, A. B. & Sehgal, P. K. (2011). A new depigmentation and fiber opening method for the conversion of stingray skins into leathers. *Journal of the American Leather Chemists Association*, 106, 25 - 32.

Reprint not obtained. Information accessed from Pollerspöck, J. & Straube, N. 2020, www.shark-references.com, World Wide Web electronic publication, Version 2020

The authors attempt to produce leather from stingray skins without using the conventional lime and sulphide combination. In the current study, sodium lauryl sulphate (SLS) was used to remove pigments from the dorsal area of the skin as well as open up the rigid fibre structure. They discovered that SLS treatment opens up fibre bundles and removes proteoglycans, as evidenced by histological investigations with alcian blue, scanning electron microscope analysis, and FT-IR analysis.

Karthikeyan, R., Babu, N. K. C. & Ramesh, R. (2013). Therapeutic applications of stingray leather. *Global Journal of Bio - Science and Biotechnology*, 2(1), 287 - 289.

Reprint not obtained.

Karuppasamy, K., Jawahar, P., Kingston, S. D., Venkataramani, V. K. & Vidhya, V. (2020). Elasmobranch diversity, conservation and management along Wadge Bank, South India. *Indian Journal of Animal Research*, 54 (3), 367-372. https://doi.org/10.18805/ijar. B-3778

The authors document the elasmobranch diversity and their abundance along Wadge Bank on the south-west coast of India, based on collections made from June 2015 to May 2016 at Chinamuttom, Colachel and Vizhinjam landing centres. From 1575 specimens, they record 44

species belonging to 8 orders, 13 families and 25 genera. Among the orders, Myliobatiformes contributed 36.4% with 17 species, followed by Carcharhiniformes at 34.1% having 15 species and Rajiformes, 11.4%, with 3 species. The authors compare diversity indices for the different landing centres and suggest strengthening of fishery and resource management measures to promote conservation of elasmobranchs along the coast.

Kasim, H. M. (1991). Shark fishery of Veraval coast with special refrence to population dynamics of *Scoliodon laticaudus* (Muller and Henle) and *Rhizoprionodon acutus* (Puppel). *Journal of the Marine Biological Association of India*, 33 (192), 213 - 228.

The author discusses the shark fishery in Veraval coast during 1979-1981. He reports that the catch rate of trawl nets indicates a peak period of abundance of sharks during December-March, while the gillnet fishery indicates year-round abundance except in October and November. The author presents the sex-wise growth parameters of the two dominant species, *Scoliodon laticaudus* and *Rhizoprionodon acutus*. He estimates L_∞ 680 mm, K 1.0822/year and t_0 -0.0119 for males and L_∞ 749 mm, K 0.8818/year and t_0 -0.0123 for females of *S. laticaudus* and L_∞ 1054 mm, K 0.6457/year and t_0 -0.0526 for males and L_∞ 1065 mm, K 0.6046/year and t_0 -0.0556 for females of *R. acutus*. He indicates low fishing pressure on *S. laticaudus* population and suggests increasing fishing effort of both trawl and gillnet without further reduction in the age of first capture for sustainable exploitation.

Kasim, H. M., Ameer Hamsa, K. M. S. & Rajapackiam, S. (1996). Age, growth, mortality, yield per recruit and stock assessment of *Carcharhinus sorrah* (Valenciennes, Müller and Henle). *The Fourth Indian Fisheries Forum Proceedings*, *Kochi*, 381 - 384.

The authors discuss the fishery and population dynamics of *Carcharhinus sorrah* from the Gulf of Mannar on the southeast coast of India. They provide estimates of the growth parameters, L_∞, K and t_0 as 1459 cm, 0.3993 $year^{-1}$, 0.0704 and 1658 cm, 0.3309 y^{-1}, -0.0901 for males and females, respectively. The size at first capture is 575 mm for males and 580 mm for females. With annual average exploitation rates of 0.76 for males and 0.88 for females during1991-1993, the authors indicate that the species is under heavy fishing pressure and recommend increasing the mesh size of drift gill nets or reducing effort input in the region.

Kasim, H. M., Balasubramanian, T. S., Ameer Hamsa, K. M. S. & Rajapackiam S. (1991). Incidence of sharks wounded by plastic bands. *Marine Fisheries Information Service (T&E Series)*, 114, 37 - 38.

The authors discuss the frequent reporting of sharks with plastic rings or belts around their necks, with injuries caused due to aberrations on the skin by the synthetic binders. They report the landing of an injured tiger shark, *Galeocerda cuvier*, which was caught by a long line with large hooks, operated by Tuticorin type mechanized plank-built boats at a depth of 30 m and landed at Punnakayal landing center on 13 February 1991. They present some morphometric measurements of the landed specimen. Noting that most of the plastic bands are discards from cargo vessels, they suggest that such bands should be cut through before being discarded so that even if they fall accidentally into the sea, they would not be a potential threat to marine life.

Kasim, H. M. & Khan, M. Z. (1984). A record of an unusually large Tiger shark *Galeocerdo articus* (Faber), from off Veraval. *Indian Journal of Fisheries*, 31(3), 370 - 372.

The authors report the landing of a large specimen of the tiger shark, *Galeocerdo articus* at Veraval in October 1982. The authors present some of the morphometric measurements of the 378 cm long female shark and compare them with measurements taken from a younger specimen. They observe that younger ones are more common in the fishery.

Kasinathan, C., Muniyandi, K., Bose, M. & Gandhi, A. (2002). Observations on whale shark *Rhineodon typus* (Smith) caught at Pamban, Palk Bay and Gulf of Mannar. *Marine Fisheries Information Service (T&E Series)*, 174, 12 - 13.

The authors report the landing of two male whale sharks, one by a gillnet at Pamban light house landing centre on 20 January 2001 and another by a pair trawl net at Pamban Therkuvadi on 16 January 2002. The sharks measured 688 cm and 1068 cm, respectively, in total length and weighed 1.5 t and 3 t.

Kasinathan, C. & Ramamoorthy, N. (1995). Observation on a whale shark *Rhinodon typus* Smith caught at Athankuri along the Palk Bay coast, Tamilnadu. *Marine Fisheries Information Service (T&E Series)*, 138, 15.

This is a report on a whale shark, *Rhinodon typus*, caught in a shore-seine at Athankarai on 26 October 1992. The authors present some morphometric measurements of the shark, which measured 1022 cm in total length and weighed 5 t.

Kasinathan, C. & Sukumaran, S. (2006). On the landing of giant devil ray *Manta birostris* at Pamban Palk Bay. *Marine Fisheries Information Service (T&E Series)*, 188, 21.

This is a very brief report on the landing of two *Manta birostris* measuring 165.5 and 154 cm by bottom-set gillnets at Pamban on 9 March 2006.

Kasinathan, C., Sukumaran, S., Ramamoorthy, N. & Balachandran, K. (2006). Whale shark, *Rhincodon typus* landed at Mandapam, Gulf of Mannar. *Marine Fisheries Information Service (T&E Series)*, 187, 21.

This is a brief report on a male whale shark caught by a pair trawl operated in Gulf of Mannar and landed at Mandapam on 11 January 2006. The shark measured 8.2 m in total length and weighed about 3 tonnes.

Katkar, B. N. (1996). Turtles and whale shark landed along Ratnagiri Coast Maharashtra. *Marine Fisheries Information Service (T&E Series)*, 141, 20.

The author reports the stranding of a 20.75 m long whale shark at Madaban village on Ratnagiri coast on September 30, 1995.

Katkar, B. N. & Josekutty, C. J. (2003). Snaggletooth shark *Hemipristis elongatus* landed at Sassoon Dock, Mumbai. *Marine Fisheries Information Service (T&E Series)*, 176, 12.

The authors report the landing of the rare snaggletooth shark, *Hemipristis elongatus* at Sasson dock, Mumbai on 20 January 2003. They present some morphometric measurements of snaggletooth shark, which measured 381 cm in total length and weighed approximately 500 kg. The shark was auctioned for ₹19,000/-.

Katkar, B. N. & Kamble, S. D. (2003). Tiger shark, *Galeocerdo cuvier* landed at Sassoon Dock, Mumbai. *Marine Fisheries Information Service (T&E Series)*, 175, 13.

This paper presents morphometric details of a female pregnant tiger shark that landed at Sassoon Dock, Mumbai. The shark was caught by a gillnet at 35 m depth. The author reports the presence of 28 embryos in the uterus.

Kemparaju, S., Lingappa, Y., Muniyappa, Y. & Mahadevaswamy, H. S. (2002). On a whale shark *Rhiniodon typus* landed at Malpe, Udupi district, Karnataka. *Marine Fisheries Information Service (T&E Series)*, 171, 9.

The authors report the accidental capture of whale shark *Rhiniodon typus* by a purse seiner at a depth of 20 m off Malpe, about 10 km from Malpe fishing harbour on 26 December 2000. The shark measured 610 cm in total length and weighed about 4 tonnes. The authors report that the liver, which weighed 200 kg, was removed for oil exraction.

Kemparaju, S., Mahadevaswamy, H. S. & Naik, Appaya, R. (1998). On a whale shark *Rhincodon typus* landed at Mangalore, Dakshina Kannada coast. *Marine Fisheries Information Service (T&E Series)*, 152, 16.

The authors report the incidental catch of a whale shark, *Rhincodon typus* by a multiday trawl boat at a depth of 30 m off Murdeshwara, about 160 km north of Mangalore on March 27, 1997.

Kewalramani, H. G. & Chhapgar, B. F. (1957). Occurrence of a rare sting ray *Taeniura melanospila* (Bleeker)] in Bombay waters. *Journal of Bombay Natural History Society*, 54(3), 770.

The authors report the occurrence of a rare stingray, *Taeniura melanospila*, for the first time in Bombay waters. They describe the species in detail and compare the specimen with the one reported from South African waters by Smith (1952).

Khan, M., Panda, S., Pattnaik, A. K., Guru, B. C., Kar, C., Subudhi, M. & Samal, R. (2011). Shark attacks on Irrawaddy dolphin in Chilika lagoon, India. *Journal of the Marine Biological Association of India*, 53(1), 27 - 34.

The authors present an analysis of the extent of shark attacks on the Irawaddy dolphin in Chilika lagoon, Odisha, on the east coast of India, based on surveys carried out during 2003 and 2009. They report that the shark species responsible for the attacks is the female bull shark, *Carcharhinus leucas*, which tends to travel inward into the outer channel of the lagoon during its late gestation period. The authors attribute overlap of habitat and prey as the main factors leading to the attacks, with >70% of the prey species identified in the stomach contents of the Irawaddy dolphin and the bull shark being common to both species. Out of 72 carcasses of dolphins examined by the authors during the study period, they found that 10 had succumbed to shark attacks.

Khan, M. F. & Nandakumaran, K. (1989). Marked 'Black tip' shark landed at Calicut. *Marine Fisheries Information Service (T&E Series)*, 95, 14 - 15.

The authors report the landing of a 200 cm long blacktip shark, *Carcharhinus limbatus* by longline at Elathur, Calicut on 12 May 1988. The shark had a blue high-density polyhthene strap girded around it just in front of the pectoral fins. The authors report the possibility of a lost tag, the origin and nature of which is not known. The morphometric measurements, strap and jaw of the shark have been deposited by the authors at the Calicut Research Centre of CMFRI. The authors also mention the landing of another blacktip shark at Elathur, six days later, but without any evidence of a tag.

Kizhakudan, S. J., Mohanraj, G., Batcha, H. & Rajapackiam, S. (2010). Ray fishery by trawlers off Chennai and some aspects of biology of the scaly whipray *Himantura imbricata* (Bloch & Schneider, 1801). *Journal of the Marine Biological Association of India*, 52 (1), 92 - 95.

The authors elaborate on the status of ray fishery along the Chennai coast during 2002-07. They detail the catch trend and estimate the annual average landing of rays by tawl nets at Chennai as 588.3 t during the period, with eleven species contributing to a major portion of the landings. Among these, *Himantura jenkinsii* dominated the catch, forming 38.6% and *H. imbricata*, 8.0%. The authors note the disc width (DW) range of *H. imbricata* in the landings as 110-229 mm and 130-289 mm for males and females, respectively, and an annual average sex ratio (M:F) of 1:1.11. They present estimates of the disc width-weight relationships for males and females as W = 0.00022DW2.676 and W = 0.00005DW2.965, respectively. They report that *H. imbricata* is a benthic carnivore which feeds mostly on small crustaceans, cephalochordates, molluscs, polychaetes and small fishes. They mention that 26.2% of the rays observed had fed on *Amphioxus*. They also mention the presence of chaetognaths and fish eggs in the diet.

Kizhakudan, S. J. & Rajapackiam, S. (2013). First report of the crocodile shark *Pseudocarcharias kamoharai* (Matsubara,1936) from Chennai, southeast coast of India. *Journal of the Marine Biological Association of India*, 55(1), 86 - 88.

The authors confirm the occurrence of the "Near Threatened" crocodile shark *Pseudocarcharias kamoharai* in the waters off Chennai, on the southeast coast of India, based on a single adult male specimen measuring 91 cm in total length and weighing 2.2 kg, caught in a hook and line operation by a deepsea trawler off Chennai-Puducherry coast, at a depth of 300 m. The authors describe the specimen and present its morphometric details. They mention that the specimen has been deposited at the National Biodiversity Referral Museum at CMFRI, Kochi with Accession No. GA.6.1.2.1.

Kizhakudan, S. J., Rajapackiam, S. & Rajan, S. (2007). Landing of thresher sharks at Chennai. *Marine Fisheries Information Service (T&E Series)*, 194, 20.

In this very brief report, the authors record the landing of four male and two female thresher sharks, *Alopias pelagicus* by gillnets at the fisheries harbour in Chennai on July 12, 2007. All were in the length range of 243-294 cm and weight range of 50-60 kg.

Kizhakudan, S. J., Rajapackiam, S, Yousuf, K. S. S. M. & Vasu, R. (2013). First report of the shortfin mako shark *Isurus oxyrinchus* (Rafinesque, 1810) in commercial landings at Madras Fisheries Harbour. *Marine Fisheries Information Service (T&E Series)*, 216, 19.

The authors report the landing of two shortfin mako sharks *Isurus oxyrinchus*, one male and one female, at the fisheries harbour in Chennai by a mechanished gillnetter on 19 July 2012. They present the morphometric measurements of the two sharks. This is the first record of the occurrence of this species in the waters off Chennai. The authors also report that the sharks were auctioned by the fishermen for ₹13,500/- and ₹7,700/-.

Kizhakudan, S. J., Muktha, M., Das, M., Gomathy, S. & Yousuf, K. S. S. M. (2013). First report on the occurrence of the silky shark, *Carcharhinus falciformis* (Müller & Henle, 1839) in commercial landings along the east coast of India. *Marine Fisheries Information Service (T&E Series)*, 217, 26.

The authors document the landing of a young silky shark, *Carcharhinus falciformis*, along the east coast of India - one in February 2012, two in July 2013 and one in August 2013 at Chennai and ten in August 2013 at Visakhapatnam. They report the size range as 66-83 and 75-97.2 cm total length for the sharks landed at Chennai and Vishakapatnam respectively. This is the first report of the species being landed along the east coast of India.

Kizhakudan, S. J., Zacharia, P. U., Thomas, S., Vivekanandan, E. & Muktha, M. (2015). *CMFRI Marine Fisheries Policy Series -2: Guidance on National Plan of Action for Sharks in India.* Central Marine Fisheries Research Institute, Kochi.

In this book, prepared in line with the International Plan of Action for conservation and management of sharks (IPOA-Sharks) developed by FAO, the authors present an overview of the shark fishery in India, biological reasons for the vulnerability of elasmobranchs, trade information, current management measures, knowledge gaps to be addressed and suggested an action plan for shark fishery management with a timeline for developing and implementing the NPOA. The information presented is based mostly on the results of the research work carried out by the Central Marine Fisheries Research Institute during 1961 to 2014. The authors also present a list of 160 species of elasmobranchs occuing in India's commercial fishing zones, with information on their abundance in fishery, areas of occurrence and gears of exploitation.

Kizhakudan, S. J., Akhilesh, K. V., Thomas, S., Yousuf, K. S. S. M., Sobhana, K. S., Purushottama, G. B., Muktha, M., Dash, S. S., Manojkumar, P. P., Nair, R. J., Najmudeen, T. M. & Zacharia, P. U. (2018). *Field identification of batoids - a guide to Indian species.* CMFRI Special Publication (132). ICAR - Central Marine Fisheries Research Institute, Kochi.

This is a concise, user-friendly field guide for identification of nearly 70 species of batoids, including sawfishes, guitarfishes, rays and skates found in the commercial landings along the Indian coast. The authors present, in a simple format, keys to identify batoid orders and families. Species have been described with photographs and line drawings and identifying characters have been mostly restricted to distinguishable morphological traits which can be noted in the field. Almost all the commercially important species and protected species of sawfishes, rays and guitarfishes have been included. While recent revisions in nomenclature have been followed, the earlier names have also been indicated in the species sheets.

Kizhakudan, S. J., Zacharia, P. U., Thomas, S., Najmudeen, T. M., Akhilesh, K. V., Muktha, M., Dash, S. S., Rahangdale, S., Nair, R. J., Purushottama, G. B., Mahesh, V., Ambarish, Gop P., Manojkumar, P. P., Remya, L. & Wilson, L. (2019). *Marine Fisheries Policy Series No.13; India Non-Detriment Finding (NDF) for silky shark, Carcharhinus falciformis, in the Indian Ocean.* CMFRI, Kochi.

The authors present the outcome of Non-Detriment Findings studies on the silky shark, *Carcharhinus falciformis* which was included in Appendix II of CITES in 2016, in keeping with the guidelines laid down by CITES, to enable decisions on the extent of trade regulation in a signatory nation. The NDF is "positive with conditions" to enable trade (of non-fin commodities) to continue for this species while improvements are made to existing fisheries and trade management and monitoring frameworks, and while additional research activities and management measures are adopted. The authors have indicated that this NDF, which will be valid from 2019 to 2022, will be re-evaluated to gauge progress against the recommendations given and updated with newly acquired data, before agreeing to a new NDF for 2023-2026.

Kizhakudan, S. J., Zacharia, P. U., Thomas, S., Najmudeen, T. M., Akhilesh, K. V., Muktha, M., Dash, S. S., Rahangdale, S., Nair, R. J., Purushottama, G. B., Mahesh, V., Ambarish, Gop P., Manojkumar, P. P., Remya, L. & Wilson, L. (2019). *Marine Fisheries Policy Series No.14; India Non-Detriment Finding (NDF) for thresher sharks, Alopias spp., in the Indian Ocean.* CMFRI, Kochi.

The authors present the outcome of Non-Detriment Findings studies on thresher sharks *Alopias* spp. which were included in Appendix II of CITES in 2016, in keeping with the guidelines laid down by CITES, to enable decisions on the extent of trade regulation in a signatory nation. The NDF is "positive with conditions" to enable trade (of non-fin commodities) to continue for this species while improvements are made to existing fisheries and trade management and monitoring frameworks, and while additional research activities and management measures are adopted. The authors have indicated that this NDF, which will be valid from 2019 to 2022, will be re-evaluated to gauge progress against the recommendations given and updated with newly acquired data, before agreeing to a new NDF for 2023-2026.

Koya, S. K. P., Savaria, Y. D. & Vanvi, J. D. (1993). On a giant ray *Manta birostris* landed at Bhidiya in Veraval. *Marine Fisheries Information Service (T&E Series)*, 122, 23.

The authors report the landing of a giant devil ray, *Manta birostris*, at Bhidiya in Veraval in February 1993 by a short-trip trawler that operated at 35 - 40 m depth. They record some morphometric details and note that the ray measured 4.9 m in disc width and weighed about 1350 kg.

Krishnamoorthi, B. & Jagadis, I. (1986). Biology and population dynamics of the grey dogshark, *Rhizoprionodon acutus* (Ruppell), in Madras waters. *Indian Journal of Fisheries*, 33 (4), 371 - 385.

The authors report the biology and population dynamics of the grey dogshark, *Rhizoprionodon acutus* from Madras waters. They report the ratios of 13 morphometric characters from 105 samples ranging in size from 144 to 826 mm. Their estimates of von Bertalanffy growth parameters are based on length-frequency data of 1418 specimens. The authors present the growth equation as $L_t = 1000(1-e^{-0.2(t+1.78)})$ and conclude that the species attains total lengths of 417.3, 522.9, 609.4, 680.2, 738.2, 785.6, 824.5, 856.3, 882.3 and 903.7 mm respectively at ages of 1 to 10 years. The length-weight relationship (LWR) in females and males did not differ significantly. The authors estimate the minimum size at maturity in females as 650 mm, and the number of embryos to range from 1 to 6, without bearing significant relation with the size of the adult. Based on the stock dynamics and mortality rates obtained, the authors suggest the scope for increasing the exploitation of the species along the Madras coast, but with caution.

Krishnaswamy G. T., Gururaj, P., Gupta, R., Gopal, D. R., Rajesh, P., Chidambaram, B., Kalyanasundaram, A. & Angamuthu, R. (2014). Transcriptome profiling reveals higher vertebrate orthologous of intra-cytoplasmic pattern recognition receptors in grey bamboo shark. *PLOS ONE*, 9(6), e100018. https://doi.org/10.1371/journal.pone.0100018

The authors present the results of their studies to generate the whole transcriptome of the bamboo shark, *Chilosyllium griseum*, using the Illumina HiSeq 2000 platform, from spleen and kidney. They perform a comprehensive functional annotation of the assembled transcriptome and validate the annotated data by determining the phylogenetic relationship and expression profile across different tissues by quantitative real-time PCR (qRT-PCR) for some of the annotated and identified sequences from both the organs. The identified longest transcript was 16,974 bases, which matched to the HECT domain containing E3 ubiquitin protein ligase. They report that immune and signalling pathways including cell adhesion molecules, cytokine-cytokine receptor interaction, T-cell receptor signalling pathway and chemokine signalling pathway are highly expressed in spleen, while different metabolism pathways such as amino acid metabolism, carbohydrate metabolism, lipid metabolism and xenobiotic biodegradation are highly expressed in kidney. They also predict the domain structures of some of the identified pattern recognition receptors, their phylogenetic relationships with lower and higher vertebrates and the complete downstream signalling mediators of the classical dsRNA signalling pathway. They conclude that some of the intra-cytoplasmic receptors identified in their transcriptome work showed high homology with the higher vertebrate species such as MDA5 and NOD-1 (58 to 65% nucleotide identity with *Homo sapiens*) and the genomic presence of mammalian orthologous of TLRs, NLRs and the downstream signalling mediators presents compelling evidence on the existence of the pattern recognition receptor mediate immune mechanism in this lower order vertebrate.

Kulkarni, C. V. (1948). Outsize whale-shark in Bombay waters. *Journal of Bombay Natural History Society*, 47 (4), 762.

The author reports the landing of a 22.9 ft long whale shark in Navapur fishing village about 65 miles north of Bombay. The author reports this to be the largest one landed along the Bombay coast and the second largest in India, after the landing of a 29-foot long specimen in Travancore half a century earlier. He also reports the extraction of 20 gallons of oil from the liver of the specimen.

Kulkarni, G. M., Shanbhogue, S. L. & Udupa, S. K. (1988). Length-weight relationship of *Scoliodon laticaudus* Muller and Henle and *Carcharhinus limbatus* (Muller and Henle) from Dakshina Kanada coast. *Indian Journal of Fisheries*, 35(4), 300 - 301.

The authors present the length-weight relationship in the sharks *Scoliodon laticaudus* and *Carcharhinus limbatus* landed in Mangalore, Malpe and Gangoli landing centres. They report that the relationship did not differ significantly between sexes in either of the species, and provide estimates of 'a' and 'b' as 0.0001885 and 3.07489 in *S. laticaudus* and 0.000012014 and 2.98628 in *C. limbatus.*

Kumar, K., Rana, R. S. & Singh, H. (2007). Fishes of the Khuiala Formation (Early Eocene) of the Jaisalmer Basin, Western Rajasthan, India. *Current Science*, 93(4), 553 - 559.

The authors describe a newly discovered shallow-water marine assemblage of Early Eocene fishes recorded from the lower part of the Khuiala Formation of the Jaisalmer Basin. Based on isolated teeth, they identify 14 taxa belonging to 6 elasmobranch and 5 teleost families. The elasmobranchs include *Galeorhinus* sp., *Hemiscyllium* sp., *Rhinobatos* sp., *Gymnura* sp., *Heterotorpedo* sp., *Dasyatis* sp. 1, *Dasyatis* sp. 2 and a new but probably unnamed species of the nurse shark *Ginglymostoma*. They suggest that *Hemiscyllium* is new to the sub-continent. They provide detailed descriptions and photographs of the teeth.

Kumar, A. K., Khanolkar, P. S., Pravin, P., Meenakumari, B. & Radhakrishnan, E. (2012). First record of the pelagic thresher shark *Alopias pelagicus* (Pisces: Alopiiformes: Alopiidae) from the Lakshadweep Sea, India. *Marine Biodiversity Records*, 5, E16. https://doi.org/10.1017/S1755267211001114

The authors report the capture of a male pelagic thresher shark during longline operations in the Lakshadweep Sea by fishermen from Agatti Island on 4 April 2011. They present some morphometric measurements of the specimen which measured 275 mm in total length.

Kumar, R. R., Venu, S. & Akhilesh, K. V. (2015). First report of magnificient catshark *Proscyllium magnificum* Last and Vongpanich, 2004 (Proscylliidae: Carcharhiniformes) from Bay of Bengal, Indian EEZ. *World Journal of Fisheries & Marine Science*, 7(6), 479 - 481. https://doi.org/10.5829/idosi.wjfms.2015.7.6.101184

The authors report the occurrence of the magnificient catshark, *Proscyllium magnificum* in the Indian EEZ off Andaman Islands in the Bay of Bengal. This is the second report of the species after it was first described from the Andaman Sea off Myanmar and is a new distributional record, being the first report from India. The authors present a description of the species based on two specimens collected from Junglighat landing centre in Port Blair on 4th March 2014, from the bycatch of deepsea shrimp trawl operations, carried out at 300 m depth. The specimens are availabe in the Museum in Department of Ocean Studies and Marine Biology, in Pondicherry University at Port Blair, India (PUMB 3521, 227 cm TL, Female) and National Biodiversity Referral Museum at CMFRI, Cochin, India (CMFRI GA, 1.4.2.2, 328 mm TL, Male).

Kumar, R. R., Venu, S., Bineesh, K. K. & Basheer, V. S. (2016). New biogeographic data and DNA barcodes for the Indian swellshark, *Cephaloscyllium silasi* (Talwar, 1974) (Elasmobranchii: Carcharhiniformes: Scyliorhinidae), from Andaman waters. *Acta Ichthyologica et Piscatoria*, 46 (2), 131 - 135. https://doi.org/10.3750/AIP2016.46.2.10

The authors report the occurrence of the Indian swell shark, *Cephaloscyllium silasi* from Andaman waters, confirming an extension of its known distribution range. They provide a detailed morphological description and comparison of the specimen with known material, along with molecular barcodes.

Kumar, K. R., Vennila, R., Kanchana, S., Arumugam, M. & Balasubramaniam, T. (2011). Fibrinogenolytic and anticoagulant activities in the tissue covering the stingers of marine stingrays *Dasyatis sephen* and *Aetobatis narinari*. *Journal of Thrombosis*

and Thrombolysis, 31 (4), 464 - 471. DOI: 10.1007/s11239-010-0537-6

Reprint not obtained. Information accessed from Pollerspöck, J. & Straube, N. 2020, www.shark-references.com, World Wide Web electronic publication, Version 2020

The authors make an attempt to see how the venom extracts of two marine stingray species, *Dasyatis sephen* and *Aetobatis narinari*, affected coagulation, fibrin (ogen)olytic, and proteolytic activities. The results reveal that both stingray venom extracts have fibrin (ogen)olytic, anticoagulant, and gelatinolytic activities. When the venom concentration is increased, *D. sephen* venom delays citrated plasma coagulation more than *A. narinari* venom. They also discovered that the stingray venom has fibrinogenolytic and proteolytic activity, but no thrombin-like activity, and that these activities may aid in haemorrhages, tissue necrosis, and subsequent bacterial infections at the envenomation site.

Kunjipalu, K. K. & Kuttappan, A. C. (1978). Note on an abnormal catch of devil rays *Dicerobatis eregoodoo* Day in gillnets off Veraval. *Fishing Technology*, 254 - 256.

The authors record the capture of 49 devil rays in gillnet operations on 23 February 1978 at a depth of 25 m off Veraval on the north-west coast of India. They provide details of the nets operated with catch obtained. They provide some body measurements of one male and one female specimen.

Kuthalingam M. D. K., Luther, G., Livingston, P. & Sriramchandra Murty, V. (1973). Further occurrence of the Whale shark *Rhincodon typus* Smith in the Indian coast water. *Indian Journal of Fisheries*, 20 (2), 646 - 650.

The authors report the landing of 4 whale sharks two males and two females, one each from Pamban on 15 April 1967 and Kesavanputhanthurai on 20 December 1971, and two from Vizhinjam on 23 December 1971 and 16 March 1972. The specimens measured 393, 565, 552 and 517 cm respectively in total length. They describe the specimens with some morphometric proportions and descriptions of dermal denticles. They also describe the food observed in the stomachs of the sharks landed at Kesavanputhanthurai and Vizhinjam and indicate a preference for algae as the preferred food.

L

Lakshmi, C. V. & Sarada, S. (1993). Studies on the new species *Anthobothrium loculatum* parasite from *Dasyatis* (*Himantura*) *uarnak* (Forskal). *Boletín Chileno de Parasitología*, 48 (1 - 2), 12 - 15.

Reprint not obtained.

Lazarus, S. (1985). A note on a two-headed embryo of the Javanese cow nose ray *Rhinoptera javanica* Muller and Henle. *Journal of the Marine Biological Association of India*, 27 (1&2), 184 - 191.

The author reports an abnormal embryo of the Javanese cownose ray, *Rhinoptera javanica* collected from a vendor in the Calicut fish market, and compares its morphometric measurements with those of normal embryos. The vendor had retrieved the embryo from the uterus while cutting up the adult ray. The author gives a detailed description of the embryo, which had two heads and two anal spines.

Lazarus, S., Joel, J. J., Phillipose, K. K. & Vincent, S. G. (1988). On five whale sharks landed along the Trivandrum-Kanyakumari coast. *Marine Fisheries Information Service (T&E Series)*, 88, 19 - 20.

The authors provide information on five whale sharks landed at three centres on the south-west coast of India in April 1988. They present the morphometric measurement of the first specimen which was landed by a shore seine at Panathura fish landing centre. The second, a

male, was caught at 15 m depth and 70 km along the coastal stretch and landed at St. Andrews village, also by shore seine. The authors note that the liver in both the cases was removed for extracting oil and the rest, except for the caudal fins, was towed back and discarded in the sea. The other 3 specimens, the authors report, were landed at Kottilpadu, a fishing village near Colachel and the only information about those was from a Tamil daily which reported that each specimen was 24 feet long and weighed 1,500 kg each.

Lipton, A. P. & Ramalingam, J. R. (1999). Skin of ray- A new commodity for export market. *Marine Fisheries Information Service (T&E Series)*, 127, 13.

The authors discuss the newly evolved export trade of ray skin from the Ramanathapuram coast. They provide information on the processing of the ray skin for marketing before being sent to Keelakarai for export, mainly to Nepal. The various products made using the skin of rays include chappals, wallets, belts and Hi-fashion products like ladies' bags. The authors estimate the cost of the skin to range from ₹4/- to ₹20/- depending on the size.

Lipton, A. P., Raje, S. G., Fotedar, R. S. & Ranjith S. (1987). Recovery of a ringed 'Dusky shark' *Carcharhinus obscurus. Marine Fisheries Information Service (T&E Series)*, 77, 21.

The authors report the landing of a dusky shark, *Carcharhinus obscurus* at Veraval on 28 March 1987. They provide morphometric measurements and dental formula of the shark, which measured 185 cm in total length and bore a black ring pierced through the first dorsal fin and the right pectoral fin around the girth of its body.

Lloyd, R. E. (1908a). On two new species of eagle-rays (Myliobatidae), with notes on the skull of the genus *Ceratoptera*. *Records of the Indian Museum*, 2(2), 175 - 180, Pls. 4 - 5, 10.

The author describes two Myliobatid rays - *Ceratoptera orissa* from Puri, Orissa and *Dicerobatis thurstoni*, from the collections at the Museum in Madras. The description of *C. orissa* is given in great detail with vivid notes on the morphology, skin texture, dermal denticles, cephalic horns and skull type.

Lloyd, R. E. (1908b). *Illustrations of the zoology of the Investigator. Fishes.* Pt. 9 - 10, pis. 39 - 50. Office of the Superintendent of Government Printing, Calcutta, India.
Reprint not obtained.

Lloyd, R. E. (1909). A description of the deep-sea fish caught by the R. I. M. S. ship `Investigator' since the year 1900, with supposed evidence of mutation in Malthopsis. *Memoirs of the Indian Museum*, 2(3), 139 - 180, Pls. 44 - 50.
Reprint not obtained. Information accessed from Pollerspöck, J. & Straube, N. 2020, www.shark-references.com, World Wide Web electronic publication, Version 2020

Among the deep-sea fishes described, the author describes six elasmobranchs - *Benthobatis moresbyi*, *Narcine mollis*, *Raiaanda manica*, *Raia philipi*, *Raia reversa* and *Scylliorhinus indicus*. Of these, *Raia andamanica* is a new species described.

Luther, G. (1961). On an apparently specific type of abnormality in the white spotted shovel nose skate *Rhynchobatus djiddensis* (Forsskal). *Journal of the Marine Biological Association of India*, 3(1&2), 198 - 203.

The author describes a morphological abnormality in five specimens of the white-spotted shovelnose skate, *Rhynchobatus djiddensis*, collected from different places along the Palk Bay during 1960-1961. He reports the abnormality to be related to non-development of the rostrum and disc, and compares the abnormal specimens with normal ones, with detailed morphometric measurements and pictorial representations.

M

Mainkar, K. R. (1993). On landing of a whale shark. *CMFRI Newsletter*, 59, 6.

The author reports a whale shark, *Rhiniodon typus*, landing by gillnet on 8 January at Medha, Malvan coast. The total length was measured as 13 feet and the weight recorded was about two tonnes.

Mani, P. T. (2011). Unusual landing of whale shark *Rhincodon typus* at Neendakara Fisheries Harbour, Kerala. *Marine Fisheries Information Service (T&E Series)*, 207, 39.

The author reports the landing of a juvenile female whale shark at Neendakara Fisheries Harbour in Kollam, measuring 4.15 m in total length and weighing around 450 kg, caught in hook and line operations off Chavara.

Manojkumar, P. P. (2003). An account on the smallest whale shark, *Rhincodon typus* (Smith 1828) landed at Calicut. *Marine Fisheries Information Service (T&E Series)*, 176, 9 - 10.

The author reports the accidental capture of a male whale shark embryo with yolk sac in a gill net and bringing it to shore at Vellayil in Calicut on November 15, 2001. He provides a detailed description and morphometric measurements of the embryo, which measured 94 cm in total length and weighed 3.8 kg.

Manojkumar, P. P. (2009). Rare landing of devil ray, *Manta birostris*, at Calicut. *CMFRI Newsletter*, 123, 9.

The author reports the landing of a female devil ray, *Manta birostris*, at Calicut on 18 October 2009. The ray, which was caught by a trawler operating at a depth of 80 m at Beypore, measured 342 cm in length, 594 cm in breadth and weighed 1400 kg.

Manojkumar, P. P. (2010). First record of hound shark, *Mustelus mosis* from Calicut. *CMFRI Newsletter*, 125, 18.

The author records, for the first time, the occurrence of the houndshark, *Mustelus mosis*, in the landings by multi-day trawlers operated at depths ranging between 200 and 250 m at Beypore during the last week of May 2010.

Manojkumar, P. P. (2011). First record of albinism in the blacktip reef shark *Carcharhinus melanopterus* from Malabar coast. *Marine Fisheries Information Service (T&E Series)*, 208, 36.

The author reports albinism in a single specimen of the blacktip reef shark, *Carcharhinus melanopterus*, caught by a gillnet unit operating at a depth of 40 m off Calicut in October 2010. The specimen, which measured 82 cm in total length and weighed 3.2 kg, did not exhibit differences in morphometric and meristic characteristics with normal specimens of the same species.

Manojkumar, P. P. & Pavithran, P. P. (2004). First record of snaggletooth shark, *Hemipristis elongatus* (Klunzinger, 1871) from Malabar Coast. *Marine Fisheries Information Service (T&E Series)*, 180, 13 - 14.

The authors report the unusual landing of a snaggletooth shark, *Hemipristis elongatus*, by multi-day trawlers along the Malabar coast during September 2003. They present morphometric data for the species and details of other shark species from the landings.

Manojkumar, P. P. & Pavithran, P. P. (2006). First record of thresher shark, *Alopias vulpinus*, from Malabar coast with note on its fishery and biology. *Marine Fisheries Information Service (T&E Series)*, 190, 17 - 19.

The authors report unusual landings of the thresher shark *Alopias vulpinus* for the first time along the Malabar coast in 2005. The sharks were caught by mechanised long-liners operating at depths of 120 - 150 m off the Malabar coast. The authors document the month-wise catch and effort details and some biological observations on the species.

Manojkumar, P. P., Nasser, A. K. V. & Balasubramanian, K. K. (2002). Note on a bramble shark landed at Calicut. *Marine Fisheries Information Service (T&E Series)*, 172, 8 - 9.

The authors document the landing of a male bramble shark, *Echinorhinus brucus*, measuring 144 cm in length and weighing 18.5 kg, caught by a deep-sea trawl operated at a depth of 150 m off Ponnani. The shark was landed at Beypore Harbour on 12 January 2002. They present a brief description and some morphometric measurements of the shark.

Manojkumar, P. P., Nasser, A. K. V. & Chandran, K. (2002). A rare landing of a large sawfish at Thikkodi, Calicut. *Marine Fisheries Information Service (T&E Series)*, 172, 7 - 8.

The authors report the landing of a large male sawfish, *Pristis microdon*, at Thikkodi, 30 km north of Calicut, on July 27, 2000. The specimen, measuring 592 cm in length and weighing 1200 kg, was accidentally caught in a bottomset gillnet operated at 12 m depth, about 2 km from the shore off Thikkodi. The authors present some morphometric measurements of the specimen and provide information on its disposal and the sale of different parts.

Manojkumar, P. P., Zacharia., P. U. & Pavithran, P. P. (2012). Fishery of elasmobranchs with some observations on the biology and stock assessment of *Carcharhinus limbatus* (P. Muller & Henle, 1839) exploited along Malabar coast. *Indian Journal of Fisheries*, 59(4), 35 - 41.

The authors describe the fishery of elasmobranchs along the Malabar coast of Kerala and provide information on the biology and stock status of *Carcharhinus limbatus*. They report that elasmobranchs are caught in trawls, gillnets and longlines along the Malabar coast of Kerala and land almost round the year. However, elasmobranchs account for <1% of the total landings and showed a declining trend in quantum from 2001 to 2011. They report 24 species of sharks, 8 species of rays and 2 species of skates in the catch. They present gear-wise trends in catch and catch rate of elasmobranchs as well as their species composition in the landings by trawl nets, gill nets, longlines and other gears. The length range of *C. limbatus* in the landings was 60 - 152.1 cm, with a mean size of 90.2 cm. The authors provide a single length-weight equation as $W = 0.00001486L^{2.80214}$ for both sexes pooled. The annual average exploitation ratio (E) is estimated as 0.74, which is higher than the optimum exploitation rate estimated. The authors indicate overexploitation of *C. limbatus* in the region and stress the need for management for regulating the fishery.

Marichamy, R. (1968). On a large-sized green saw fish *Pristis zijsron* Bleeker landed at Port Blair, Andamans. *Journal of the Marine Biological Association of India*, 10(2), 394.

The author reports the landing of a large-sized green sawfish, *Pristis zijsron*, on 1 June 1967 at Port Blair, Andamans. He reports the specimen's total length as 5.13 metres (20 feet 2 inches) and states that when compared to previous reports, the specimen appears to be the largest size recorded for *P. zijsron* from Andaman waters.

Marichamy, R., Kasim, H. M., Hamsa, K. M. S. A. & Rajapackiam, S. (1999). Age and growth of *Himantura bleekeri* (Blyth) and fishery for rays off Tuticorin. In M. Mohan Joseph, N. R. Menon & N. Unnikrishnan Nair (Eds.), *The Fourth Indian Fisheries Forum: Proceedings, 24-28 November, 1996, Kochi, Kerala,* pp. 397 - 399.

The authors describe the fishery for rays off Tuticorin during 1991 - 92 to 1995 - 96, with details on species composition and growth of the dominant species, *Himantura bleekeri*. They describe the month-wise average catch and effort data for rays in trawl net and bottomset gillnet and suggest a good abundance of rays in the trawling grounds off Tuticorin in all the months except March-May and November, with peaks in August-September. They also report an almost uniform abundance of the group in bottomset gillnets, with 9 and 10 species supporting the trawl net and gillnet fisheries, respectively. Based on the von Bertalanffy growth equation, they estimate sizes of 1198.9 mm and 1239.6 mm at the end of 6 years of life, respectively, for males and females.

Mathew, C. J. & Devaraj, M. (1997). The biology and population dynamics of the spadenose shark *Scoliodon laticaudus* in the coastal waters of Maharashtra State, India. *Indian Journal of Fisheries*, 44(1), 11 - 27.

The authors describe the biology and dynamics of the spadenose shark, *Scoliodon laticaudus*, from Maharashtra waters. They estimate the von Bertalanffy growth parameters as K = 0.6812, L_∞ = 74.023 cm, T_∞ = 12 years and t_0= -0.01 year, indicating a fast growth and attaining lengths of 21.8 cm, 54.5 cm and 65.5 cm in the first, second, and third year respectively. They estimate Lmax as ~66 m TL. They estimate length at birth at 14 cm with a gestation period of 4 months and average fecundity of 11 embryos per female. They record a mixed diet comprising of small-sized teleosts, prawns, squilla and molluscs, indicating *S. laticaudus* to be an active carnivore, with no evidence of cannibalism. They note that the stock is exploited at its optimum level and advise maintaining effort at the current level.

Mathew, G., Thulasidas, K. & Venugopal, K. M. (1991). On the first record of the deepsea shark *Centrophorus granulosus* (Bloch and Schneider) from Indian seas. *Marine Fisheries Information Service (T&E Series)*, 113, 22 - 23.

The authors record two different specimens of the deepsea gulper shark *Centrophorus granulosus* belonging to the family Squalidae, landed at the Cochin Fisheries Harbour on 23 February 1991.

Mohamed, K., S., Muniyappa, Y., Naik, A. R., Kemparaju, S. & Purandara, C. (1993). An unusual catch of sharks in a purse seine at Malpe, Karnataka. *Marine Fisheries Information Service (T&E Series)*, 121, 10.

The authors report the unusual catch of blacktip sharks in the size range of 59 - 114 cm, in a purse seine fishery at Malpe on the Dakshina Kannada coast in Karnataka on 10 October 1990. A single purse seine boat landed approximately 3.5 tonnes of sharks together with other pelagic fishes; the sharks were auctioned at ₹ 9/kg.

Mohanraj G., Rajapackiam, S., Mohan, S., Batcha, H. & Gomathy, S. (2009). Status of elasmobranchs fishery in Chennai, India. *Asian Fisheries Science*, 22 (2), 607 - 615.

The authors discuss the elasmobranch landings in Chennai Fisheries Harbour during the 5-year period from 2002 - 2006. They report that the annual elasmobranch landings by trawl nets varied from 489 t to 1735 t and that by mechanized gillnets, from 194 t to 519 t, with maximum total landings of the resource being 2074 t in 2002. They present trends in annual contribution of elasmobranchs to the landings by different gears, their CPUE and seasonal trends. They observe that the elasmobranch landings in India showed an increasing trend from 27.4 thousand t in 1961 to 49 thousand t in 2006, when Tamil Nadu contributed substantially with 10.8 thousand tonnes. They record 13 species of sharks, 13 species of rays and 4 species of guitarfishes, with dominant resources being *Sphyrna lewini*, *Carcharhinus sorrah* and *Carcharhinus leucas* among sharks, *Dasyatis jenkinsii* and *Mobula diabolus* among rays and *Rhynchobatus djiddensis* among guitarfishes. They describe group-wise and species-wise trends in the landings. They also provide the price

structure of elasmobranch byproducts at Chennai.

Muktha, M. (2018). *Some studies on biology and stock assessment of the longtail butterfly ray, Gymura poecilura (Shaw, 1804), off Visakhapatnam, western Bay of Bengal*. Phd Thesis. Dept. of Zoology, Andhra University, Visakhapatnam.

In this work, The author clarifies the taxonomy of *Gymnura poecilura* landed at Visakhapatnam, Andhra Pradesh. Prior to this work, butterfly rays with spine on tail were considered as *G. japonica* and those without spine as *G. poecilura*. However, this work confirms that *G. poecilura* may or may not have spine on tail and that the presence of spine cannot be taken as a diagnostic feature for the species. A male *G. poecilura* of 397 mm disc width is designated as the neotype. The author also describes the fishery of *G. poecilura* as well as growth, reproductive biology and diet of the species landed at Visakhapatnam. Based on the stock assessment carried out, the author suggests that the longtail butterfly ray stock off Visakhapatnam is currently overfished and needs to be conserved, and gives recommendations for sustainable exploitation of the species along the coast.

Muktha, M., Kumar, S. M. & Rao, M. V. H. (2011). Landing of *Alopias pelagicus* (Nakamura, 1936) at Visakhapatnam. *Marine Fisheries Information Service; Technical & Extension Series* (209), 21-22.

The authors report the landing of two pelagic thresher sharks *Alopias pelagicus*, one male and one female, at Visakhapatnam on 28 June 2011. They report that the male shark measured 940 mm and weighed 900 g andthe female measured 829 mm (caudal fin tip absent) and weighed 750 g. They present the morphometric measurements of the two specimens. Based on available information on the size at birth of the species, the authors conclude that the two specimens of pelagic thresher sharks landed at Visakhapatnam can be considered as either newborn or foetus.

Muktha, M., Akhilesh, K. V., Sukumaran, S. & Kizhakudan, S. J. (2019). New report confirming the presence of Bennett's stingray, *Hemitrygon bennettii* (Elasmobranchii: Myliobatiformes: Dasyatidae), from the western Bay of Bengal. *Acta Ichthyologica Et Piscatoria*, 49 (1), 101-108.

The authors confirm the occurrence of Bennett's stingray *Hemitrygon bennettii* in the western Bay of Bengal, from a single male specimen landed at Visakhapatnam on 28 January 2017. They present photographs and detailed description of the specimen which measured 370 mm DW. The authors also present the results of molecular analysis done by amplifying a 650 bp region of the Cytochrome C oxidase 1 from extracted DNA, which confirms the identity of the specimen. The specimen is deposited in the fish collections of the Visakhapatnam Research Centre of ICAR-Central Marine Fisheries Research Institute (CMFRI), India with accession number CMFRI V-D.1. The authors state that with the presently confirmed occurrence from the western Bay of Bengal, the known distribution of the species extends further westwards to the Indian east coast, although it is likely to be a rare species in Indian waters.

Muktha, M., Maheswarudu, G., Sreeramulu, K. & Kizhakudan, S. J. (2020). Reproductive biology and diet of the longtail butterfly ray *Gymnura poecilura* (Shaw, 1804) along western Bay of Bengal. *Journal of the Marine Biological Association of the United Kingdom*, 1-10.

In this article, the authors describe the reproductive biology and diet of the longtail butterfly ray *Gymnura poecilura* based on 630 specimens that includes 377 females and 253 males. They report sexual dimorphism in size, with the maximum size of males being only 60% of the maximum female size. They report the mean disc width (WD) of females and males as 576.7 mm (size range 190-920 mm) and 416.3 mm (size range 230-550 mm), respectively and the size at maturity (WD_{50}) to be 506.5 mm (females) and 435.9 mm (males). The mean uterine fecundity was 3.3 (range = 1 - 8). They also report year-round reproduction in the species,

with size at birth between 190 and 220 mm WD. From observations on the diet, they suggest that the species is a specialized feeder, with the Index of Relative Importance (IRI, %) being 80.9% for fishes and 18.9% for crustaceans.

Muktha, M., Akhilesh, K. V., Sukumaran, S., Jasmin, F., Jishnudev, M. A. & Kizhakudan, S. J. (2016). Re-description of the longtail butterfly ray, *Gymnura poecilura* (Shaw, 1804) (Gymnuridae: Myliobatiformes) from Bay of Bengal with a neotype designation. *Marine Biodiversity*, 1-12.

The authors re-describe *G. poecilura* from fresh materials, designate a neotype from Visakhapatnam, India (western Bay of Bengal) and report the presence of a distinct *Gymnura* species from the northern Arabian Sea with genetic support. They clarify reports of two butterfly rays, *G. japonica* and *G. micrura* from Indian waters as misidentifications and suggest that they must be excluded from the Indian elasmobranch faunal list. They present the results of molecular analysis done by amplifying a 650 bp region of the Cytochrome Coxidase 1 from DNA extracts, along with photographs and detailed description of the species and comparison of morphometric measurements of *G. poecilura* from this study with published data on *G. poecilura* and *G. japonica* from the Indo-west Pacific. A male *G. poecilura* of 397 mm disc width is designated as the neotype.

N

Nair, K. P. (1976). Age and growth of the yellow dog shark *Scoliodon laticaudus* (Muller and Henle) from Bombay waters. *Journal of the Marine Biological Association of India*, 18(3), 531 - 539.

The author presents the age and growth of the shark *Scoliodon laticaudus* based on length-frequency method from Bombay waters. He provides the details of the length attained at different ages. Sharks that are 140 mm at birth grow to be 260, 380, 470, 530, and 590 mm at the end of 1, 2, 3, 4 and 5 years respectively. Females are larger and live longer than males. The von Bertalanffy growth equation has been fitted to the observed values, with K (on an annual basis) = 0.2731, L = 755.23 mm, and to = -0.5664 years being the estimated parameters. The length-at-age thus estimated agreed fairly well with the observed values. The slow growth of *S. laticaudus* is obvious from the results and in Bombay waters, this shark can reach a maximum length of 660 mm.

Nair, K. V. & Thulasidas, K. (1984). The Bramble shark *Echinorhinus brucus* (Bonnaterres) landed at Cochin. *Marine Fisheries Information Service (T&E Series)*, 60, 15 - 17.

The authors discuss the landing of two female bramble sharks *Echinorhinus brucus* (Bonnaterre) caught from the southwest of Cochin at a depth of 120-160 meters. The species are known to occur in the upper continental slope and the deeper neritic waters of the Atlantic, Mediterranean and Indo-Pacific. These deepwater sharks were caught using hooks and lines by artisanal fishermen of Colachel from the previously underexploited deeper water fishing grounds. The authors provide a brief description of the species with diagnostic characters as *E. brucus* is extremely rare in commercial fish landings.

Nair, K. V. S., Jayaprakash, A. A. & Narayanankutty, V. A. (1986). On a juvenile whale shark *Rhincodon typus* Smith landed at Cochin. *Marine Fisheries Information Service (T&E Series)*, 66, 36.

The authors report the landing of a juvenile female whale shark weighing 1.5 t which was caught about 20 km southwest of Cochin. The authors discuss the stomach condition of the specimen and also provide the morphometric characteristics. They also mention the discarding of the carcass to the sea as there was no buyer.

Nair, R. J. & Venugopal, K. M. (2003). Targeted shark fishery in Kerala. *Marine Fisheries Information Service (T&E Series)*, 176, 8 - 9.

The authors brief the status of shark fishery in Cochin Fisheries Harbour during the last quarter of 2002. Information on species composition, gear of exploitation and landing status are provided.

Nair, R. J., Zacharia, P. U., Kumar, D. S., Kishore, T. G., Divya, N. D., Seetha, P. K. & Sobhana, K. S. (2016). Recent trends in the mobulid fishery in Indian waters. *Indian Journal of Geo-Marine Sciences*, 44(9), 1265-1283.

The authors discuss the fishery of mobulids in India during the period 2007-2012 and provide details of landings along the west and east coasts of India. They report an increase in landings along the west coast and a decrease along the east coast, with Gujarat and Tamil Nadu being the major contributors on either coast, respectively. They list seven species, viz., *Mobula diabolus, M. tarpacana, M. japanica, M. kuhlii, M. thurstoni, Manta birostris* and *M. alfredi*, in the landings at Cochin Fisheries Harbour (CFH) and provide details of size at birth of *M. alfredi, M. japanica* and *M. tarapacana* as 114 48.5 and 103 cm DW, respectively. They provide records of mobulids landed at different locations in India from 1961 to 2013 and discuss the recent trends in trade of mobulid meat and gill plates.

Nair, R. V. (1973). On the occurrence of the deepsea sting ray *Urotrygon daviesi* (w) in Indian water. *Indian Journal of Fisheries*, 20(1), 245 - 249.

The author reports the first record of the deepsea ray *Urotrygon daviesi* from Mandapam in the Gulf of Mannar, based on a female specimen measuring 534 mm in length captured on 7 February 1972 at 275 m depth during exploratory trawling. Morphometric measurements of the collected specimen are presented and also compared with the first specimen of the Indian Ocean originally described by Wallace.

Nair, R. V. & Appukuttan, K. K. (1974). Observations on the developmental stages of the smooth dogfish *Eridacnis radcliffei* Smith from Gulf of Mannar. *Indian Journal of Fisheries*, 21(1), 141 - 151.

The authors study the characteristics of the embryo and its developmental stages and reproductive mode of the smooth dogfish *Eridacnis radcliffei* (Smith) from the Gulf of Mannar. Specimens of fifteen adult females of *E. radcliffei* collected from the trawl catches at 150 fathoms off Mandapam in the Gulf of Mannar during February 1972 were subjected to the analysis. The sizes of the pregnant females, the intrauterine eggs, and embryos are detailed in the paper. The authors have observed a relationship between the female length and the size of the embryo. The study clearly shows that *E. radcliffei* exhibits ovoviviparity, an intermediate stage between oviparity and viviparity. A thin shell membrane encased the intrauterine egg, which vanished as the embryo matured inside the uterus. The embryos were seen unrestrained inside the uterus at all stages of development, with no evidence of a placental attachment.

Nair, R. V. & James, D. B. (1972). On the occurrence of stingray spines in the jaws and gills of the hammerhead shark *Sphyrna zygaena* (Linnaeus). *Journal of the Bombay Natural History Society*, 69(2), 432-434.

In this article, the authors provide information on predation of hammerhead shark, *Sphyrna zygaena* on stingrays. They report stingray spines in the jaws and gills of a 3.8 m long *S. zygaena* caught off Tuticorin at 40 fathoms depth on 22 April 1971. The spines pierced the jaws and gills, indicating that the shark chased and attacked the rays from behind. When the shark ingested the rays, the spines probably got stuck in the gills. The authors suggest that the spines are most likely from the species *Himantura alcockii* (Annandale), as it was discovered from the stomach in a partially digested condition and also due to its abundant occurrence in Tuticorin waters.

Nair, R. V., Appukuttan, K. K. & Rajapandian, M. E. (1974). On the systematics and identity of four pelagic sharks of the family Carcharhinidae from Indian region. *Indian Journal of Fisheries*, 21(1), 220 - 232.

The authors discuss the systematics and identity of four pelagic sharks of the family Carcharhinidae *viz., Scoliodon laticaudus*, *Loxodon macrorhinus, Rhizoprionodon acutus* and *R. olingolinx from the* west and southeast coasts of India. A complete description of all four species obtained from various locations along both coasts is attempted.

Nair, R. V. & Lal Mohan, R. S. (1971). On the occurrence of the spiny shark *Echinorhinus brucus* (Bonnaterre) from the east coast of India with a note on its distribution. *The Indian Journal of Animal Sciences*, 41(10), 1011 - 1014.

The authors record the first report of spiny shark *Echinorhinus brucus* from the east coast of India. They provide detailed morphometric information of the collected specimen, their global distribution and the market value in India. The composition and characteristics of oil being extracted from this species are also discussed along with the economic importance.

Nair, R. V. & Lal Mohan, R. S. (1972). The deep sea spined dogfish *Centrophorus armatus* (Gilchrist) (Selachii: Squalidae) from the east coast of India, with a note on its taxonomy. *Journal of the Bombay Natural History Society*, 63(1), 193 - 199.

The authors report the extension of distribution of the deepsea spined dogfish *Centrophorus armatus* on the east coast of India along with its taxonomic details. The species was earlier recorded from the west coast of India. The authors also describe in detail, the chemical composition of muscle tissues of some common fishes and compare it with *C. armatus*. The composition and characteristics of oil being extracted from other deepsea sharks are reviewed along with the economic importance.

Nair, R. V. & Soundararajan, R. (1973). On an instance of hermaphroditism in the electric ray, *Narcine timlei* (Bloch and Schneider). *Indian Journal of Fisheries*, 20(1), 260.

The authors report the hermaphroditism observed in *Narcine timlei*, an electric ray caught by trawl off Rameshwaram on 12 November 1971. The specimen had two claspers that were partially developed besides an extrusion of yolk-like material from the cloaca. They report that only the female portion of this hermaphrodite specimen is functional and its size is within the range of its functional sex (female). In the paper, the authors also described the male and female reproductive systems.

Nair, R. V. & Lal Mohan, R. S. (1973). On a new deep sea skate, *Rhinobatos variegattus*, with notes on the deep sea sharks. *Halaelurus hispidus*, *Eridacnis radcliffei* and *Eugaleus omanensis* from the Gulf of Mannar. *Senckenbergiana biological*. pp. 71 - 80.

The authors describe deepsea elasmobranches caught in the Gulf of Mannar with diagnostic characteristics of three species of sharks such as *Eridacnis radicliffei*, *Halaelurus hispidus*, *Eugaleus omanensis* and a new species of guitarfish, *Rhinobatos variegattus. E. omanensis* is reported for the first time from Indian waters.

Nair, R. V. & Soundararajan, R. (1976). On the occurrence of the stingray *Dasyatis (Dasyatis) microps* (Annandale) on the Madras coast and in the Gulf of Mannar. *Indian Journal of Fisheries*, 23(1&2), 278 - 279.

The authors report the occurrence of *Dasyatis microps* in the Madras coast and Gulf of Mannar. A brief description of the adult species with diagnostic characters is provided, as well as observations on the male fetus acquired from a gravid female. They also provide the morphometric characteristics of *D. microps* samples collected from Rameswaram, Madras and Ervadi.

Najmudeen, T. M., Sharma, K. S. R., Aswathy J. & Zacharia, P. U. (2020). Dermal fibroma in a feral tawny nurse shark, *Nebrius ferrugineus* (Lesson, 1831). *Journal of Applied Ichthyology.* DOI: 10.1111/jai.14006 pp. 1-3.

The authors report the landing of a female tawny nurse shark *Nebrius ferrugineus* measuring 242 cm in total length and weighing 66.85 kg by a mechanised hook and line operator at Cochin Fisheries Harbour, Kerala in October 2018. They report that the shark which was caught off Gujarat coast of India, had an abnormal growth on the body which was diagnosed as a dermal fibroma, located dorsolaterally on the right side, and present histopathological details of the growth.

Najmudeen, T. M., Seetha, P. K., Radhakrishnan, M., Sunil, K. T. S., Akhildev, S., Sipson, A. & Zacharia, P. U. (2019). Note on landings of pregnant sharks in Cochin Fisheries Harbour, Kerala. *Marine. Fisheries Information Services Technical & Extension Series* 241: 27-28. ISSN ISSN 0254-380 X

The authors report incidents of the landing of a pregnant graceful shark *Carcharhinus amblyrhynchoides* and two pregnant scalloped hammerheads *Sphyrna lewini* by pelagic longlines at Cochin Fisheries Harbour in 2018. They provide details of length and weight of the mother sharks and the pups, and report litter size of 7 in *C. amblyrhynchoides* and 5 and 6 in *Sphyrna lewini.*

Najmudeen, T. M., Zacharia, P. U., Seetha, P. K., Sunil, K. T. S., Radhakrishnan, M., Akhildev, S. & Sipson, A. (2019). Length-weight relationship of three species of pelagic sharks from southeastern Arabian Sea. *Regional Studies in Marine Science,* 29: 1-4.

The authors present length-weight relationships of three species of pelagic sharks - silky shark *Carcharhinus falciformis*, graceful shark *C. amblyrhynchoides* and pelagic thresher *Alopias pelagicus*, from the analysis of 525 samples collected from the longline and gillnet fishery of southeastern Arabian Sea from January 2016 to November 2018. They estimate the values of the allometric coefficient b as 2.687 for *A. pelagicus*, 3.11 for *C. falciformis* and 2.891 for *C. amblyrhynchoides.*

Nalini, K. P. (1940). Structure and function of the nidamental gland of *Chiloscyllium griseum* (Muller and Henle). *Proceedings of the Indian Academy of Sciences* (b) XII, 5, 189 - 214.

The author describes the structure and function of the nidamental gland of *Chiloscyllium griseum* caught along the Madras coast. The work includes the description of the nidamental gland, histology and the development of the gland. The author also discusses in detail the structure and mode of formation of the egg case besides comparing the nidamental organs of a few elasmobranchs from the Madras coast.

Nammalwar, P. (1986). Report on the catch of a juvenile whale shark *Rhincodon typus* Smith at Kilakkari Gulf of Mannar. *Marine Fisheries Information Service (T&E Series)*, 66, 30.

The author reports the landing of a juvenile whale shark measuring 3.15 m and weighing around 1.5 t landed at Kilakkari, Gulf of Mannar. He notes that the shark was cut into pieces immediately and buried in the seashore.

Nammalwar, P., Livingston, P., Kasinathan, C. & Ramamoorthy, N. (1992). Instances of whale shark *Rhiniodon typus* Smith caught along the Tamil nadu coast. *Marine Fisheries Information Service (T&E Series)*, 116, 20.

The authors give details of two juvenile whale sharks landed at Kovalam near Madras and Dhanushkodi near Rameshwaram along the Tamil nadu coast. They also provide the morphometric characteristics of the samples collected.

Nasser, A. K. V. & Sumithrudu, M. S. (2004). On the landing of bowmouth guitarfish *Rhina ancylostoma*

at Visakhapatnam Harbour. *Marine Fisheries Information Service (T&E Series)*, 182, 12.

Landing of juvenile bow mouth guitarfish *Rhina ancylostoma* at Vishakhapatnam is reported. This specimen was captured by a mechanized trawler operated at a depth of 60 to 90 m and landed at Vishakhapatnam Harbour on 15 July 2004. The morphometric measurements along with a few morphological characters are given.

Neelakantan, K., Neelakantan, B. & Muthiah, C. (1993). On a two headed juvenile of the spade-nose shark *Scoliodon laticudus* Müller and Henle. *Journal of the Marine Biological Association of India*, 35(1&2), 222 - 223.

In the paper, the authors report the observation of two-headed juvenile spade-nose shark *Scoliodon laticaudus* measuring 100 mm length from Karwar in 1991 which was landed along with other demersal fishes by a trawl operating at a depth of 10-15 m. The specimen possesses two heads merged at the fifth-gill opening, and the rest of the body is fully formed, with paired first and second dorsal. Along with the description of the abnormal juvenile, the authors compare other embryonic duplicatus anterior reported in shark species elsewhere in the world. They suggest that the anomaly is caused by the fusing of two embryos during development inside the mother's uterus.

P

Padate, V. P., Rivonker, C. U., Anil, A. C., Sawant, S. S. & Venkat, K. (2017). New records of marine fishes from the coral reefs and deep waters of Gulf of Mannar, India. *Acta Ichthyologica et Piscatoria*, 47(2), 145 - 161. https://doi.org/10.3750/aiep/02108
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The authors document rare fishes which adds to the Gulf of Mannar region's existing species catalogue. In the Gulf of Mannar, 23 hauls were conducted onboard commercial single-day otter trawlers running bottom trawls at 15-100 m depths and mid-water trawls at 100-153 m depths. At Tuticorin fishing harbour, by-catch landings of commercial trawlers were also surveyed. *Hypogaleus hyugaensis* (Miyosi, 1939), an elasmobranch, was discovered during a recent study of rare fishes. The current study includes detailed descriptions of each species as well as meristic counts and morphometric measures. A key to identifying these species is also included.

Pai, M. V. & Pillai, P. K. M. (1970). Observation on a whale shark *Rhincodon typus* Smith land at Tuticorin. *Journal of the Marine Biological Association of India*, 12 (1&2), 224 - 225.

The authors report the landing of a male whale shark measuring 5.96 m in total length at Tuticorin, south Tamil Nadu coast, on 27 July 1968. The shark had been entangled in a nylon drift net operated at 18 m depth off Tiruchendur on 25 July 1968 and was towed live to "Van Tivu" island about 6 km N.N.E. of Tuticorin. However, the shark could be taken to Tuticorin only the next day, in a dead state. The authors present morphometric measures of the shark.

Pai, M. V., Nandakumar, G. & Telang, K. Y. (1983). On a whale shark *Rhineodon typus* Smith landed at Karwar, Karnataka. *Indian Journal of Fisheries*, 30(1), 157 - 160.

The authors register, for the first time, a whale shark landing at Karwar in North Kanara district. A female whale shark, *Rhineodon typus*, measuring 3.81 m in total length, was landed at Karwar in the third week of January 1981.

Pandey, D. K., Chaskar, K. & Case, G. R. (2018). Two fossil shark teeth from Lower Eocene Shales of the Khuiala Formation, Jaisalmer Basin, India. *Journal of the Palaeontological Society of India,* 63(2), 155 - 161.

Reprint not obtained. Information accessed from Pollerspöck, J. & Straube, N. 2020, www.shark-references.com, World Wide Web electronic publication, Version 2020

Two fossil shark teeth (*Galeorhinus* and *Physogaleus*) are described and illustrated from Lower Eocene layers of the Khuiala Fomiation Jaisalmer Basin. This is the first time *Physogaleus* has been found in the Jaisalmer Basin. The presence of *Galeorhinus* in the Jaisalmer Bas supports a subtropical sea environment in the Early Eocene.

Patel, S., Reddy, A. & Dolia, G. (2005). Occurrence of deep-sea sharks off Pondicherry Coast. *Journal of the Bombay Natural History Society,* 102(3), 342.
Reprint not obtained. Information accessed from Pollerspöck, J. & Straube, N. 2020, www.shark-references.com, World Wide Web electronic publication, Version 2020

Described species: *Centrophorus granulosus*, *Echinorhinus brucus*, *Neoharriotta* sp.

Paul, S. N. (1973). A note on the fossil shark tooth from Tiruchchirapalli District, Tamil Nadu, India. *Current Science*, 42(21), 753.

The author describes a fossil shark tooth collected by Dr K. V. Lakshminarayan and party from Hawa-Bibi Gypsum mines, a lower Cretaceous area in Tiruchchirapalli district of Tamil Nadu on January 29, 1970. He describes the tooth, which had a crown measuring 15.5 mm in length and 8.2 mm in width. From its overall shape, size and the absence of lateral denticles, he assigns it to the genus *Oxyrhina* Agassiz, 1838, but mentions that it did not show a resemblance to any known species of the genus.

Pavan Kumar, A., Kumar, R., Pitale, P., Shen, K. N. & Borsa, P. (2018). *Neotrygon indica* sp. nov., the Indian Ocean blue-spotted maskray (Myliobatoidei, Dasyatidae). *Comptes Rendus Biologies*, 341(2),120-130.https://doi.org/10.1016/j.crvi.2017.2018.01.004

The authors formally describe the Indian Ocean maskray as a new species, *Neotrygon indica* sp. nov., fundamentally based on the mitochondrial DNA sequences of fresh specimens from the eastern coast of India and of earlier specimens from India and Tanzania. In a tree made up of concatenated nucleotide sequences from the CO1 and cytochrome b loci, the new species established a unique haplogroup. Color/spot patterns on the dorsal side of the specimens, as well as differences in the nucleotide sequences at the CO1 and cytochrome b loci, have been recommended as diagnostic criteria for the new species.

Pavan Kumar, A., Gireesh Babu, P., Suresh Babu, P. P., Jaiswar, A. K., Prasad, K. P., Chaudhari, A., Raje, S. G., Chakraborty, S. K., Krishna, G. & Lakra, W. S. (2015). DNA barcoding of elasmobranchs from Indian coast and its reliability in delineating geographically widespread specimens. *Mitochondrial DNA,* 26(1), 92 - 100.https://doi.org/10.3109/19401736.2013.823174

The authors describe DNA barcodes developed for 18 elasmobranch species from both the east and west coasts of India, including 10 sharks from five families (Carcharhinidae, Lamnidae, Alopiidae, Hemiscyllidae, Triakidae) and eight rays from four families (Gymnuridae, Dasyatidae, Myliobatidae, Mobulidae). They estimate intra-specific genetic divergence for selected species, which have broad geographic distribution. They also recommend that more molecular markers be used in the analyses because numerous species show cryptic diversity.

Pavan Kumar, A., Gireesh-Babu, P., Suresh Babu, P. P., Jaiswar, A. K., Hari Krishna, V., Prasasd, K. P., Chaudhari, A. Raje, S. G., Chakraborty, S. K., Krishna, G, & Lakra, W. S. (2014). Molecular phylogeny of elasmobranchs inferred from mitochondrial and nuclear markers. *Molecular Biology Reports*, 41(1), 447 - 457.https://doi.org/10.1007/s11033-013-2879-6

The authors use mitochondrial and nuclear markers, such as mitochondrial cytochrome c oxidase subunit I, 12S ribosomal RNA gene, and

nuclear Internal Transcribed Spacer 2, to show the evolutionary link between elasmobranch orders. The results of their study on 30 species indicate that the combined dataset of COI and 12S rRNA resulted in a well resolved tree topology with significant bootstrap/posterior probabilities values, and it very well supports the reciprocal monophyly of sharks and batoids. They propose Heterodontiformes as a sister group to Lamniformes, Orectolobiformes, and Carcharhiniformes under Galeomorphii and the Myliobatiformes as a monophyletic group among batoids, while the Pristiformes and Rhinobatiformes as sister groups to all other batoids.

Pillai, N. K. (1968). Additions to the copepod parasites of South Indian fishes. *Parasitology*, 58(1), 9 - 36. https://doi.org/10.1017/S0031182000073388
Reprint not obtained.

Pillai, N. K. (1967). Three species of dichelesthiid copepods parasitic on South Indian sharks. *Zoologischer Anzeiger,* 179 (3 - 4), 286 - 297.
Reprint not obtained.

Pillai, P. K. M. (1972). On the landing of a whale shark *Rhincodon typus* Smith at Tuticorin. *Journal of the Marine Biological Association of India*, 14 (1), 408 - 409.

The author reports the landing of a male whale shark, *Rhincodon typus*, at Tuticorin on 16 June 1970, and the total length measured 7.45 m.

Pillai, P. P. & Honma, M. (1978). Seasonal and areal distribution of the pelagic sharks taken by the tuna longline in the Indian Ocean. *Bulletin of Far Seas Fisheries Research Laboratory*. 16, 33 - 49.

The authors describe the spatial and temporal distribution of pelagic sharks in the Indian Ocean with catch data from a Japanese longline fishery during 1972 - 1975. They indicate that shark populations are concentrated along the southern African coast from November to July, in the tropical waters off the east African coast from October to April, in the western sector of the Arabian Sea from January to July, in the eastern sector from January to July, and on the west coast of Australia nearly all year. According to the distribution of average monthly hook-rates, high concentration areas can be found off the coasts of southern and eastern Africa, the western and eastern sectors of the Arabian Sea, and off Western Australia. The authors list eleven species of sharks that are common in the longline catches from the Indian Ocean - *Carcharhinus longimanus, C. brachyurus, C. albimarginatus, C. melanopterus, Glyphis glauca, Isurus glaucus, Lamna ditropis, Galeocerdo* spp., *Sphyrna* spp., *Alopias pelagicus* and *A. profundus.*

Pillai, P. P. & Parakkal, B. (2000). *Pelagic sharks in the Indian Seas: their exploitation, trade, management and conservation.* CMFRI Special Publication.

In this book, the authors discuss the status of pelagic sharks exploited from the Indian seas, their taxonomy, species characteristics and biology, fishery along the Indian coast by artisanal and mechanised sectors, abundance in Indian seas, the trade in sharks and shark products, management and conservation. The authors provide a checklist of pelagic sharks from the Indian seas, their distribution, size and biological notes on 49 species belonging to 13 families, recorded both in the small-scale fishery and longline fishery sectors in the depth range of 50 to 70 m and in the oceanic regions, respectively.

Pillai, S. K. (1998a). A note on giant devil ray *Mobula diabolus* caught at Vizhinjam. *Marine Fisheries Information Service (T&E Series)*, 152, 14 - 15.

The author reports the landing of two female giant devil rays, *Mobula diabolus*, captured by a gillnet operated at a depth of 45 - 50 m in the inshore waters of Vizhinjam on 19 June 1995. The total length measured 442 and 450 cm across the disc, weighing 800 and 850 kg.

Pillai, S. K. (1998b). On a whale shark *Rhincodon typus* found accompanied by its young ones. *Marine Fisheries Information Service (T&E Series)*, 152, 15.

In this very brief note, The author reports the siting of a whale shark with 16 young ones on 3 March 1996 at 0800 hrs during routine observations on the long-line mussel culture, about 5 km off Adimalathurai south of Vizhinjam.

Pillai, S. K. & Badrudeen, M. (1996). Report on a whale shark *Rhincodon typus* (Smith) caught in shore-seine from the Palk Bay. *Marine Fisheries Information Service (T&E Series)*, 142, 15 - 16.

The authors report the capture of a live female whale shark on 25 July 1989 from Palk Bay in a shore-seine operated at Pirappanvalasai, near Mandapam. They provided morphometric measurements of the shark, which measured 595 cm in total length and weighed 3.5 tonnes. They also provide a list of earlier records of whale shark captures from the Palk Bay and the Gulf of Mannar from 1958 to 1992.

Pillai, S. K. & Joel, J. J. (1996). Report on juvenile of whale shark landed along the southern part of the west coast of India. *Marine Fisheries Information Service (T&E Series)*, 143, 27 - 28.

The authors report the landing of three male whale sharks, the first by gillnet at Vettukadu (Trivandrum district) on 12 December 1994, the second by gillnet at Vizhinjam (Trivandrum district) on 29 January 1995 and the third by shore seine at Mela Midalam (Kanyakumari district) on 3 March 1995. They also provide a list of earlier reports of the capture of the whale shark along the southwest coast of India from 1900 to 1994.

Pillai, S. K., & Kasinathan, C. (1985). Note on an oviparous female zebra shark *Stegostoma fasciatum* (Herman) landed at Mandapam. *Journal of the Marine Biological Association of India*, 27 (1 - 2), 195 - 197.

The authors report the landing of a 205 cm long zebra shark, *Stegostoma fasciatum*, measuring 205 cm at Mandapam on 6 November 1984. The morphometric measurements of the specimen are presented.

Pillai, S. K. & Kasinathan, C. (1988). On a large adult zebra shark landed at Pamban. *Marine Fisheries Information Service (T&E Series)*, 85, 11.

In this brief report the authors report the landing of a 207 cm long adult female zebra shark *Stegostoma fasciatum* caught by a trawler at 20 m depth off Pamban.

Pillai, S. K. & Kingston, D. (2006). Report on capture of whale shark *Rhincodon typus* (Smith) in shore seine at Pallithurai near Vizhinjam, Kerala. *Seshaiyana*, 14(2), 10 - 11.

The authors report the capture of a live female whale shark on 28 August 2005 in a shore-seine at Pallithurai, near Vizhinjam. They report that the shark, which measured 6.1 m in total length and weighed 1.7 tonnes, was cut up and buried near the seashore as it was not considered fit for human consumption and there was no demand for the flesh. They also provide a list of earlier records of whale shark captures in Vizhinjam and nearby areas from 1900 to 2002.

Pillai, V. S. & Pillai, N. K. (1976). Monogenean parasites of the marine fishes of the Kerala Coast I. *Aquatic Biology*, 1, 85 - 99.
Reprint not obtained.

Prabhakar, R. V. D., Pattnaik, P., Muktha, M., Suryanarayana, Y. V. S. & Moshe, Ch. (2020). Unusual landing of Spine tail devil ray from Andhra Pradesh. *Marine Fisheries Information Service Technical & Extension Series* No. 244, 2020, 244. pp. 34-35. ISSN ISSN 0254-380X

The authors report the unusal landings of 39

individual spine tail devil rays, *Mobula mobular* (Bonnaterre, 1788) locally called as Yenuguteku (sometimes chinnadeyyapu) at Bandaruvanipeta landing centre, Andhra Pradesh during 06.04.2017 to 10.04.2017. Craft and gear used and depth of operation are given along with the associated fish resources which landed with *M. mobular*. The morphometric measurements are also presented for the species.

Pradeep, H. D., Arun Kumar, M. & Swapnil, S. S. (2017). First Report of *Echthrogaleus denticulatus* (Smith 1874) on the Pelagic Thresher Shark (*Alopias pelagicus* Nakamura 1935) from Indian EEZ of Andaman Sea. *Sains Malaysiana*, 46(10), 1675 - 1678

The authors record for the first time the occurrence of the pandarid ectoparasite, *Echthrogaleus denticulatus* near the cloacal aperture of pelagic thresher sharks *Alopias pelagicus* from the Indian EEZ of Andaman Sea. They report that 8 out of the 15 sharks they observed were infested with a total of 36 parasite specimens, all females, and that small wounds were found in the area when the parasites were detached. The sharks were caught as bycatch by a multifilament tuna longliner during July 2015 and February 2016 voyages in Andaman and Nicobar waters.

Pradeep, H. D., Shirke, S. S., Nashad, M. & Devi, M. S. (2017). New host and geographical record of the pandarid copepod, *Pandarus cranchii* (Leach, 1819) on the pelagic thresher shark, *Alopias pelagicus* Nakamura, 1935 from Andaman Sea. *Journal of Entomology and Zoology Studies,* 834(51), 834 - 838.

The authors add a new host to the list of *Pandarus cranchii* infestations on elasmobranchs, as well as report the parasite for the first time from the Andaman and Nicobar waters of the Andaman Sea. A total of 11 *P. cranchii* specimens were recovered from the cloacal aperture and pelvic fins of a female, *Alopias pelagicus* measuring 2650 mm in length and weighed 35 kg. It was obtained as bycatch in the Andaman Sea by the multifilament tuna longline vessel MFV Blue Marlin during a voyage in July 2015. They also provided detailed reports of *P. cranchii* from various geographical sites, as well as information on the host species' diversity.

Pradeep, H. D., Shirke, S. S., Nashad, M. & Sukham, M. D. (2017). A first record of the Smallfin Gulper Shark *Centrophorus moluccensis* Bleeker, 1860 (Chondrichthyes: Squaliformes: Centrophoridae) from the Andaman & Nicobar waters, Indian EEZ. *Journal of Threatened Taxa*, 9(11), 10899 - 10903 https://doi.org/10.11609/jott.3315.9.11.10899-10903

The Smallfin Gulper Shark, *Centrophorus moluccensis* has been discovered for the first time in the Indian EEZ's Andaman and Nicobar waters. A motorised longliner landed a male specimen measuring 785 mm in total length and weighing 2.34 kg in Burmanallah, South Andaman District. A complete morphological description of the specimen is provided, as well as a comparison to earlier literature.

Pradeep, H. D., Swapnil, S. S., Ramachandran, S. & Pattnayak, S. K. (2017). Report of the crocodile shark Pseudocarcharias *kamoharai* (Matsubara, 1936) from deep waters of the Andaman Sea. *Marine Biodiversity*, 47(2), 535 - 538. https://doi.org/10.1007/s12526-016-0499-9

In this brief article, the authors describe some morphometric characteristics of the crocodile shark *Pseudocarcharias kamoharai* from a single specimen collected from multifilament tuna longline gear at a depth of 1740 m within the EEZ of India in Andaman and Nicobar waters in July 2015. The specimen, an adult female measuring 80.5 cm in total length and weighed (whole body weight) 2.0 kg.

Pradeep, H. D., Swapnil, S. S., Nashad, M., Venu, S., Ranjan, R. K., Sumitha, G., Devi, M. S. & Farejiya, M. K. (2018). First record and DNA Barcoding of Oman Cownose Ray, *Rhinoptera jayakari* Boulenger, 1895 from Andaman Sea, India.

Zoosystema, 40(4), 67 - 74.https://doi.org/10.5252/zoosystema2018v40a4

The authors utilize the mitochondrial COI molecular marker to confirm the taxonomic identity of the Oman cownose ray, *Rhinoptera jayakari*, collected from the Andaman Sea and report the occurrence as a new record from this region, thus filling the wide gap in the known distribution range of this species. The male specimen, with a disc width of 494 mm and weighing 2.9 kg, was landed by a motorized longline boat in Junglighat Fishing Harbour. They provided morphometric details of the present specimen and made comparisons with previous records.

Pradeep, S., Yousuf, K. S. S. M. & Kizhakudan, S. J. (2017). *Unusual catch of flapnose ray in ring seine. Marine Fisheries Information Service (T&E Series)*, 233, 29.

The authors document an unusual catch of 1.3 t of the flapnose ray *Rhinoptera javanica* in a ring seine operation off Parangipettai on 15 July 2017. They report that the entire catch, comprising 122 individuals in the size range of 90 - 110 cm disc width, was landed at Cuddalore and sold @₹120/- per kg to traders.

Pradeepkumar, K. C., Pavithran, P. P. & Manojkumar, P. P. (2012). Juvenile whale shark, *Rhincodon typus* stranded at Ayikkara, along the Malabar coast of Kerala. *Marine Fisheries Information Service (T&E Series)*, (211), 16 - 17.

The authors report the stranding of a 475 cm long female whale shark, *Rhincodon typus*, near Ayikkara Fisheries Harbour in the Kannur district on 25 November 2011. They provide detailed morphometric measurements of the shark.

Pramanik, P. B. & Manna, B. (2005a). *Cephalobothrium gogadevensis* new species (Cestoidea: Lecanicephalidae) from *Rhinobatus granulates* Cuv., 1829 from Bay of Bengal at Digha Coast, India. *Journal of Natural History India,* 1(2), 38 - 43.

The authors describe a new species, *Cephalobothrium gogadevensis* n. sp. from the spiral valve of *Rhinobatus granulatus* collected from Bay of Bengal, at Digha coast, India. It resembles the genus *Cephalobothrium*, which comprise the valid species *C. aetobatidis, C. variabile, C. abruptum, C. rhinobatidis, C. subhapradhi*, and *C. stagostomi* in shape, size and structure of ovary and in shape of scolex.

Pramanik, P. B. & Manna, B. (2005b). *Macrobothridium djiddensis* new species (Cestoda: Macrobothridiidae) from *Rhynchobatus djiddensis* Forsskal, 1775 from Bay of Bengal, at Digha Coast, India. *Panjab University Research Journal (Science) New Series*, 55, 197 - 200.

The authors describe a new species, *Macrobothridium djiddensis* n.sp. from the spiral intestine of *Rhynchobatus djiddensis*, captured at Digha coastal waters, Bay of Bengal. India. This species differs from the only other known species *Macrobothridium rhynchobati* in a number of ways, including the presence of 22 hooks on the rostellum, 42-46 testes per proglottid, and three to four rows of vitellaria.

Pramanik, P. B. & Manna, B. (2006a). *Callitetrarhynchus blochii* new species (Cestoidea: Lacistorhynchidae) from *Sphyrna blochii* Cuvier, 1817 from Bay of Bengal at Digha coast, India. *Journal of Natural History India*, 2(2), 10 - 15.

The authors describe *Callitetrarhynchus blochii* n. sp. from the spiral intestine of *Sphyrna blochii*, captured at Digha coastal waters, Bay of Bengal, India, differs from the only known species *C. gracilis* (Rudolphi, 1819) Pintner, 1931 by a combination of characters, including a tentacle armed with six hooks per row, an elongated v-shaped ovary and 78-85 testes.

Pramanik, P. B. & Manna, B. (2006b). *Cathetocephalus limbatus* sp. nov. (Tetraphyllidea: Cathetocephalidae)

from *Carcharhinus limbatus* (Valencinnes, 1841) at Digha coast, Bay of Bengal, West Bengal, India. *Journal of Parasitic Diseases*, 30(2), 168 - 171.

The authors describe *Cathetocphalus limbatus* sp. nov., discovered in the spiral valve of *Carcharhinus limbatus* fished off the coast of Digha in the Bay of Bengal, has been compared to the only valid species of this genus, *Calhetocephalus thatcheri*, Dailev and Overstreet, 1973. *Cathetocphalus limbatus* sp. nov. differed from the latter in possessing a four-sucker scolex, acraspedotc proglottid, genital pore position, cirrus sac structure, ovary, and shape of vitelline follicle.

Pramanik, P. B. & Manna, B. (2006c). *Nybelinia dighai* n.sp. (Cestoda: Tentaculariidae) from *Carcharias walbeehmi* Bleekar, 1878 from Bay of Bengal at Digha coast, India. *Geobios*, 33, 178 - 182.

The authors describe a new species, *Nybelinia dighai*, discovered in the spiral intestine of *Carcharias walbeehmi* in Digha, Bay of Bengal. It differs from *N. lingualis* Cuvier, 1817, *N. elongata* Shah and Bilquees, 1979. *N. anthicosum* Heinz and Daily, 1974, *N. queenslandensis* Jones and Beveridge, 1998, *N. basimegacantha* Carvajal *et al*., 1976, *Nybelinia* sp. Subhapradha, 1955, in the position of bulbs and position of velum in scolex and number of hooks per row in tentacle.

Pramanik, P. B. & Manna, B. (2006d). *Polypocephalus himanshui* n.sp. (Cestoda: Lecanicephalidae) from *Rhynchobatus djeddensis* Forsskal, 1775 from Bay of Bengal at Digha Coast, West Bengal, India. *Indian Journal of Animal Health*, 45(2), 125 - 138.

The authors describe a new species, *Polypocephalus himanshui* n. sp. (Lecanicephalidae: Cestoidea) discovered in the spiral valve of *Rhynchobatus djiddensis* Forsskal, 1775 from Bay of Bengal at Digha coast, India. It differs from *P. radiatus*, *P. vesicularis*, *P. katpurensis*, *P. pulcher*, *P. coronatum*, *P. affmis*., P. *rhinobatidis*, *P. bombayensis*, *P. alii*, *P. kharbarae*, *P. pratibhii*, *P. digholi*, *P. hanumantharaoi*, *P. thapari* in the number of tentacle. *P. lintoni, P. medusi, P. vitellaria, P. rhynchobatidis, P. singhii* differs from the present species in the structure, number of testes and arrangement of different organs. A key to identification of species in the genus is suggested.

Pramanik, P. B. & Manna, B. (2007). Six new and two known species of the Genus *Tylocephalum* Linton, 1890 (Cestoida: Lecanicephalidae) in cartilageous fishes from Bay of Bengal at Digha coastal waters, West Bengal, India. *Journal of Natural History India*, 3(2), 12 - 22.

Six new species of *Tylocephalum* Linton, 1890 are described, and two previously described species, *T. aetobatidis* Shipley & Hornell, 1906 and *T. elongatum* Subhapradha, 1955, are redescribed, all from the cartilaginous fish hosts *Dasyatis bleekeri*, *Carcharhinus limbatus*, *Aetobatus narinari*, and *Rhynchobatus djiddensis*. The shape and size of the scolex, ovary, and uterus, as well as the presence or absence of a neck and the number of testes, distinguish these six new species from each other and from the valid species of the genus. The key to identifying the species in the genus is also included.

Prasad, G. & Singh, K. (2009). New microvertebrate assemblage from the continental upper triassic rocks of peninsular India. *Journal of Vertebrate Paleontology*, 29 (Supplement to Number 3), 167A. ***Reprint not obtained. Information accessed from Pollerspöck, J. & Straube, N. 2020, www.shark-references.com, World Wide Web electronic publication, Version 2020***

Described species: *Lissodus duffini, Lonchidion estesi, Lonchidion incumbens, Parvodusti kiensis, Polyacrodus contrarius.*

Prasad, G. V. R. & Cappetta, H. (1993). Late Cretaceous Selachians from India and the age of the Deccan Traps. *Palaeontology*, 36(1), 231 - 248.

The systematics and stratigraphical relevance of batoid fish remains from Asifabad and Marepalli,

Andhra Pradesh, India, are discussed in this research. The *Raja, Rhombodus*, and *Igdabatis* taxa are represented in the selachian fauna of these locations by isolated teeth and dermal denticles. All of the dental remnants previously attributed to Dasyatis and Rhinoptera have now been recognised as Igdabatis lateral teeth. The study discovered two new species: *Raja sudhakari* sp. nov. and *Igdabatis indicus* sp. nov., which were found in Marepalli'sinfratrappean and Asifabad's intertrappean beds, respectively. The new palaeontological evidence points to a Late Cretaceous (Maastrichtian) age for peninsular India's infra- and intertrappean beds.

Prasad, G. V. R. & Sahni, A. (1987). Coastal-plain microvertebrate assemblage from the terminal Cretaceous of Asifabad, Peninsular India. *Journal of the Palaeontological Society of India*, 32, 5 - 19.

The authors describe a microvertebrate assemblage from the Infra- and Intertrappean beds of Asifabad in Andhra Pradesh, India. The assemblage, which is a mix of marine and freshwater fauna includes fossil records of six members of Class Chondrichthyes - *Orthacodus longidens* (Order Selachii; Family Orthacodontidae), described from isolated teeth, *Raja* sp. (Order Batoidea; Family Rajidae), described from many isolated teeth, *Coupatezia woutersi* (Order Batoidea; Family Dasyatidae) described from a single, complete and well-preserved tooth, *Rhombodus cf. R. laevis* (Order Batoidea; Family Dasyatidae), described from four teeth, *Rhombodus* sp. (Order Batoidea; Family Dasyatidae), described from many different types of teeth and *Igdabatis sigmodon* (Order Batoidea; Family Myliobatidae) described mainly from three teeth and several others with identical occlusal ornamentation as in *I. sigmodon* but with roots divided into two, three and four lobes and also with no divisions.

Prasad, G. V. R., Manhas, B. K. & Arratia, G. (2004). Elasmobranch and actinopterygian remains from the Jurassic and Cretaceous of India. In G. Arratia & A. Tintori (Eds.), *Mesozoic Fishes 3 - Systematics, Paleoenvironments and Biodiversity* (pp. 625 - 638). Verlag Dr. Friedrich Pfeil, Germany.

Reprint not obtained. Information accessed from Pollerspöck, J. & Straube, N. 2020, www.shark-references.com, World Wide Web electronic publication, Version 2020

The authors describe disarticulated remains of elasmobranch and actinopterygian fishes found in the Kota Formation (Middle to Upper Jurassic) and the Gangapur Formation (Lower Cretaceous) (Pranhita-Godavari valley, India). The Kota Fm. elasmobranchs are found in a single exposed area west of Paikasigudem village in Rebbana Mandalam, Adilabad District, Andhra Pradesh.

Prasad, G. V. R., Singh, K., Parmar, V., Goswami, A. & Sudan, C. S. (2008). Hybodont shark teeth from the continental Upper Triassic deposits of India. In G. Arratia, H. P. Schultze & M. V. H. Wilson (Eds.), *Mesozoic Fishes 4 - Homology and Phylogeny* (pp. 413 - 432). Verlag Dr. Friedrich Pfeil, Germany.

In the present paper, the authors describe, the hybodont fauna recovered from the continental upper Triassic Maleri and Tiki formations of peninsular India. The fauna from the Tiki formation includes four new species, *Lonchidion estesi* sp. nov., *L. incumbens* sp. nov., *Lissodus duffini* sp. nov., and *Parvodustikiensis* sp. nov., while the Maleri formation yielded *Polyacrodus contrarius* as well as a few unidentified taxa. This is the first record of hybodont sharks from the Lonchidiidae and Polyacrodontidae families from the Triassic of India.

Prasad, G. V. R., Verma, V., Sahni, A., Lourembam, R. S., & Rajkumari, P. (2017). Elasmobranch fauna from the upper most part of the Cretaceous Bagh Group, Narmada valley, India. *Island Arc*, 26(5), e12200.https://doi.org/10.1111/iar.12200

The authors describe new shark teeth recovered from the upper part of the marine Cretaceous Bagh Group, in the lower Narmada valley, Western India. This is the first detailed description of sharks from the Bagh Group and the first record of sharks from the youngest horizons (Coniacian to Late Maastrichtian) of this marine sedimentary sequence. The fauna, recovered from oyster shell-rich green

sandstone at the top of the youngest geological unit (the Coralline Limestone) of the Bagh Group, is assigned to *Ptychodus* sp., *Scapanorhynchus* sp. aff. *S. raphiodon* (Agassiz, 1844), *Cretodus* sp. aff. *C. crassidens* (Dixon, 1850), *Cretalamna* sp., *Squalicorax* sp. aff. *S. falcatus* Agassiz, 1843, and Elasmobranchii indet. This assemblage, previously widely documented from the Cretaceous deposits of North and South Americas, Europe, North and West Africa, Far East and Near East, demonstrates that there is a clear change in elasmobranch faunal composition of India from cool temperate water forms in the early Late Cretaceous to essentially cosmopolitan forms in the Late Cretaceous.

Prashad, B. (1920). Notes from the Bengal Fisheries Laboratory, No. 7. On some Indian Torpedinidae from the Orissa coast. *Records of the Indian Museum*, 19, 97 - 105.

The author describes species of the family Torpedinidae collected from Puri on the Orissa coast of the Bay of Bengal, belonging to four genera - *Torpedo marmorata*, *Narcine indica*, *Narke dipterygia* and *Bengalichthys impennis*. He describes the distribution range of *T. marmorata* and records its occurrence at Puri on the Orissa coast and near Vizagapatam along the same coast. The author observes that *N. indica* is fairly common around Puri and a large number of specimens are caught by shore seines every day. He provides a very detailed description of *N. dipterygia* and confirms that the species is widely distributed in the Indian seas, with specimens having been collected from the Sandheads, Orissa coast, Bay of Bengal, off Colombo and Bombay. He also describes in detail the genus *Bengalichthys* and the species *B. impennis.* He also provides a vivid description of the gravid uterus and embryos of *Narcine indica* from a female specimen measuring 31 cm in length with four embryos that had well-developed yolk sacs.

Pravin, P. (2000). Whale shark in the Indian coast - Need for conservation. *Current Science*, 79(3), 310 - 315.

The author outlines the details of whale sharks that have been sighted off the coastlines of India thus far. Based on incidental landings and captures in Indian coastal waters from 1889 to 1998, this report describes the distribution and occurrence of whale sharks year-by-year, season-by-season, state-by-state, depth-by-depth, and gear-by-gear. The whale shark's plight as a result of commercial exploitation, as well as its use and the necessity for conservation, are explored. He suggests an international collaboration in whale shark research with a focus on biology, migration, and shoaling behaviour. The author continues, "It is clear that the destiny of the whale shark, the world's largest fish, now depends on us."

Purushottama, G. B., Ramkumar, S., Thakurdas, Hotagi, J. S. (2013). Unusual landing of the sharks at Sassoon dock landing centre, Mumbai. *Marine Fisheries Information Service (T&E Series)*, (218), 17 - 18.

The authors report the unusual landing of the tiger shark *Galeocerdo cuvier*, the spot-tail shark *Carcharhinus sorrah*, the bull shark *Carcharhinus leucas* and the blacktip shark *Carcharhinus limbatus* at Sassoon dock on 5 June 2013. They document a total landing of 4 t by hook & line and mechanised units operated by fishermen from Thuthoor, Tamil Nadu.

Purushottama, G. B., Thakurdas, Ramkumar, S. & Tandel, S. (2013). First record of Bull shark, *Carcharhinus leucas* (Valenciennes, 1839) in commercial landings from New Ferry Wharf, Mumbai, Maharashtra. *Marine Fisheries Information Service (T&E Series)*, 218, 12 - 15.

The authors document, for the first time, the landing of a bull shark, *Carcharhinus leucas,* at New Ferry Wharf, Mumbai on 10 January 2013. They present detailed morphometric measurements of the 325 cm long shark, which was a pregnant female with 14 fully grown pups (5 males and 9 females) in the length range of 80 - 84 cm. They report that the shark was sold for ₹30,000/- and the pups for ₹700/- each.

Purushottama, G. B., Deshmukh, V. D., Singh, V. V., Ramkumar, S. & Karthireddy S. (2013). Mass envenomation during Ganesh idol immersion at Girgaum-Chowpathy beach, Mumbai, Maharashtra. *Marine Fisheries Information Service (T&E Series)*, 218, 34 - 35.

The authors report an incidence of mass envenomation of devotees who had gathered for the immersion of Ganesh idol at Girgaum Chowpathy beach, Mumbai on 10 September 2013. They report that in the surveys subsequently conducted the presence of stings rays, box jelly fish, flat head, spotted scat and eels was observed in the shallow waters at the beach. Following detailed investigations, while the authors first suggest that the box jelly fish, *Chiropsoides buitendijki* and stingray *Himantura imbricata* were the species that caused mass envenomation, they later conclude that it was likely to have been caused by the box jelly fish.

Purushottama, G. B., Thakurdas, Tandel, S. S., Mhatre, V. D. & Singh, V. V. (2018). Records of rare elasmobranchs and their biological observation from the north-eastern Arabian Sea, off Mumbai. *Indian Journal of Geo Marine Sciences*, 47(8), 1566 - 1573.

The authors document the occurrence of the batoids, the smalleye stingray *Dasyatis microps*, pelagic stingray *Pteroplatytrygon violacea* and the whitespotted wedgefish *Rhynchobatus djiddensis* from the north-west coast of India, off Mumbai, with observations on their distribution, morphometric measurements and biological characteristics. The specimens described are a male *D. microps* of 101.0 cm disc width (DW) and weighing 15.0 kg, a male *P. violacea* of 49.5 cm DW and weighing 1.8 kg and a gravid female *R. djiddensis* measuring 254.0 cm in total length and weighing 50.0 kg with seven pups in its uterus, of which three pups were in the left lobe and four in the right lobe. The authors compare the morphometric measurements of the collected specimens with previous records from other areas.

Purushottama, G. B., Dash, G., Thakurdas, Akhilesh, K. V., Kizhakudan, S. J. & Zacharia, P. U. (2017). Population dynamics and stock assessment of grey sharpnose shark *Rhizoprionodon oligolinx* Springer, 1964 (Chondrichthyes: Carcharhinidae) from the north-west coast of India. *Indian Journal of Fisheries*, 64(3), 8 - 17.https://doi.org/10.21077/ijf.2017.64.3.67657-02

The authors present the exploitation and stock status of the grey sharpnose shark *Rhizoprionodon oligolinx* from 711 specimens in the size range 36.4 to 93.0 cm TL and weight range 200 to 2600 g for females and length range 34.5 to 93.0 cm TL and weight range 200 to 2100 g for males collected from gillnet landings at Satpati, Sassoon Dock and New Ferry Wharf fish landing centres of Maharashtra during January 2012 to December 2015. They estimate the von Bertalanffy growth parameters L_∞, K and t_0 as 97.1 cm, 0.47 yr^{-1} and -0.79 yr respectively, and total mortality, fishing mortality and natural mortality as 2.16 yr^{-1}, 1.48 yr^{-1} and 0.69 yr^{-1} respectively. From their estimates of 49.7 cm length at capture (L_{50}) and 62.3 and 59.5 cm length at maturity (Lm_{50}) for female and male sharks, respectively, the authors conclude that most of the sharks enter peak phase of exploitation before attaining sexual maturity. The authors estimate a reduction of biomass to 32% of the virgin biomass and spawning stock biomass to 16% of the virgin spawning stock biomass at the existing exploitation level and suggest a reduction in exploitation by 40% for long-term sustainability of the resource.

Purushottama, G. B., Raje, S. G., Thakurdas, Akhilesh, K. V., Kizhakudan, S. J. & Zacharia, P. U. (2020). Reproductive biology and diet composition of *Rhynchobatus laevis* (Bloch and Schneider, 1801) (Rhinopristiformes: Rhinidae) from the northern Indian Ocean. *Indian Journal of Fisheries*, 67(4). 13 - 23.http://dx.doi.org/10.21077/ijf.2020.67.4.95636-02

The authors report the reproductive biology and feeding habits of *Rhynchobatus laevis* (Bloch and Schneider, 1801) collected off the northwestern coast of India, in the Arabian Sea, in the northern Indian

Ocean. This research provides detailed biological observations on *R. laevis* size, sex composition, length at maturity (Lm), length-weight relationship, and diet from the northern Indian Ocean, which can be used to develop effective management plans and conservation strategies for this species in the region.

Purushottama, G. B., Ramasubramanian, V., Akhilesh, K. V., Thakurdas, Raje, S. G., Kizhakudan, S. J. & Zacharia, P. U. (2020). Biological observations on the Bengal guitarfish *Rhinobatos annandalei* Norman, 1926 from the Eastern Arabian Sea, India. *Indian Journal of Fisheries*, 67(2), 23 - 34.http://dx.doi.org/10.21077/ijf.2019.67.2.94482-04

The authors provide information on reproduction, maturity, length-weight relationship and diet characteristics of the Bengal guitarfish, *Rhinobatos annandalei*, caught from the Eastern Arabian Sea along the north-west coast of India. They record an overall sex ratio (F:M) of 1.6:1 in the landings and estimate the length-weight relationship as TW = 0.000621 $TL^{3.410115}$ for females and TW = 0.000766 $TL^{3.333872}$ for males. They provide length at maturity (TL_{50}) estimates of 61.0 and 63.3 cm TL for females and males respectively. They observe that the litter size ranges from 2 to 11 and estimate the size at birth of *R. annandalei* in the north-west coast of India to range from 25.0 to 30.0 cm TL. From an analysis of stomach contents, the authors conclude that *R. annandalei* is a mesopredator with a preference for invertebrates including *Solenocera* spp. (18.7% IRI), *P. sculptilis* (0.5% IRI), *P. stylifera* (0.4% IRI) and *Loligo* spp. (0.4% IRI).

Purushottama, G. B., Thakurdas, Ramasubramanian, V., Dash, G., Akhilesh, K. V., Ramkumar, S., Kizhakudan, S. J., Singh, V. V. & Zacharia, P. U. (2017). Reproductive biology and diet of the grey sharpnose shark *Rhizoprionodon oligolinx* Springer, 1964 (Chondrichthyes: Carcharhinidae) from the north-eastern Arabian Sea. *Indian Journal of Fisheries*, 64(4), 9 - 20. http://dx.doi.org/10.21077/ijf.2017.64.4.63379-02

The authors present reproductive biology information for the grey sharpnose shark, *Rhizoprionodon oligolinx* Springer, 1964 (Chondrichthyes: Carcharhiniformes), which was caught off the coast of India in the Arabian Sea. The first detailed biological observation of *R. oligolinx* from the northern Arabian Sea on size, sex composition, size-at-maturity (Lm_{50}), and length-weight relationship is presented in this work. Based on specimens of *R. oligolinx* taken as bycatch in gillnets operated in the north-eastern Arabian Sea, they also provide information on size and sex composition, maturity, food, and the length-weight relationship.

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Radhakrishna, M. (1996). On the landing of a whale shark, *Rhineodon typus* at Kaveripattinam. *Marine Fisheries Information Service (T&E Series)*, 145, 17.

The author reports the landing of a whale shark, *Rhineodon typus* at Kaveripattinam on 19 June 1996, after being entangled in a bag net operated 7 km north of Kaveripattinam at a depth of 15 m. The author records some morphometric measurements of the 490 cm long shark, which weighed approximately 2 tonnes.

Raj, B. S. (1914). Note on *Trygon kuhlii* and note on the breeding of *Chiloscyllium griseum* Müller and Henle. *Records of the Indian Museum*, 10(4), 317 - 319.

The author describes in detail the behaviour of a pregnant female *Trygon kuhlii* captured off the coast of Madras on 15 January 1914 and kept in the Madras Marine Aquarium until 13 March 1914. He mentions that the specimen gave birth to two young males, but both died shortly after birth, and the mother died the next day. He also records the breeding of *Chiloscyllium griseum* in January,

1913, in one of the tanks in the marine aquarium at Madras along with a detailed description of eggs. The sizes of the largest and smallest egg-capsules from the collected nine eggs are also provided.

Rajan, P. T., Sreeraj, C. R. & Venkataraman, K. (2012). Diversity and abundance of Chondrichthian fishes in Andaman and Nicobar Islands. In K. Venkataraman, C. Raghunathan & C. Sivaperuman (Eds.), *Ecology of faunal communities on the Andaman and Nicobar Islands* (pp. 117 - 126). https://doi.org/10.1007/978-3-642-28335-2-8

The authors present a total of 65 species of Chondrichthian fishes distributed across 40 genera and 21 families in the Andaman and Nicobar Islands. They also provide new baseline data on diversity, abundance, fishing effort, and shark catches, as well as updates on recent shark fishing developments.

Rajapackiam, S., Balasubramanian, T. S. & Arumugam, G. (1990). On a large devil ray *Manta birostris* landed at Tuticorin. *Marine Fisheries Information Services (T&E Series)*, 106, 11.

The authors report the landing of two devil rays, *Manta birostis* at Tuticorin by gillnets operated at a depth of 50 m. The measures of total length and breadth were 2.17 and 2.11 m and 5.54 and 5.2 m respectively. The rays, one female and one male, weighed 1,200 kg and 1,150 kg and were sold for ₹400/- at the landing centre. The authors also present detailed mprphometric measurements of the two rays.

Rajapackiam, S., Gomathy, S. & Jaiganesh, P. (2007). Devil ray *Manta birostris* landed at Chennai Fishing Harbour. *Marine Fisheries Information Services (T&E Series)*, 191, 29 - 30.

This is a brief report on the landing of a female devil ray *Manta birostris* caught by gillnet off Chennai. The ray measured 5.2 m in width, 2.1 m in length and weighed 1050 kg.

Rajapackiam, S., Gomathy, S. & Rudramurthy, N. (2007). On the record of the largest (giant) bull shark *Carcharhinus leucas* caught off Chennai. *Marine Fisheries Information Services (T&E Series)*, 191, 28 - 29.

In this brief report, the authors record the landing of a 356 cm long female bull shark *Carcharhinus leucas* at Chennai Fishing Harbour on June 22, 2005, having been caught in a gill net operated at a depth of 50-60 m off Iskapalli, Nellore.

Rajapackiam, S. Mohan, S. & Rudramurthy, N. (2007a). Utilization of gill rakers of lesser devil ray *Mobula diabolus* - a new fish byproduct. *Marine Fisheries Information Services (T&E Series)*, 191, 22 - 23.

The authors record the recent development of processing and exporting of discarded gill rakers of the lesser devil ray, *Mobula diabolus* landed at Chennai. They note that the body of the rays, which are auctioned for ₹5 to 8 per kg, is cut up into pieces, salted and dried for human consumption, the gill rakers are removed from the head, washed and sun dried before being sold to traders in Chennai for ₹500 per kg.

Rajapackiam, S., Mohan, S. & Rudramurthy, N. (2007b). On the landing of large size guitarfish, *Rhina ancylostoma* at Chennai Fishery Harbour. *Marine Fisheries Information Services (T&E Series)*, 191, 28.

In this brief report, the authors record the landing of a 209 cm long mature female guitarfish *Rhina ancylostoma* at Chennai Fisheries harbour on 6 August 2006, fished by a mechanised gill net at 60 m depth off Chennai. They also mention the landing of a 187 cm long female on 27 April 2005.

Rajapackiam, S., Sundarajan, D. & Balasubramanian, T. (1997). On two large devil rays landed at Tuticorin. *Marine Fisheries Information Services (T&E Series)*, 149, 16.

The authors report the landing of two female specimens of *Manta birostris*, each measuring

about 5.5 m in disc-width and together weighing about 2.4 t, on April 28, 1997, at Tuticorin, having been caught by a deepsea trawler that operated at 100-125 m depth off Tuticorin. They present some morphometric measurements of the two specimens.

Rajapackiam, S., Ameer Hamsa, K. M. S., Balasubramanian, T. S. & Kasim, H. M. (1994). On a juvenile whale shark *Rhincodon typus* caught off Kayalpatnam, Gulf of Mannar. *Marine Fisheries Information Services (T&E Series)*, 127, 14 - 15.

The authors report the landing of a juvenile male whale shark entangled in a nylon drift gillnet operated in the Gulf of Mannar at 40 m depth off Kayalpatnam on 15 April 1993. They present detailed morphometric measurements of the shark and note that due to unpalatable meat and low demand for the fins, the shark was auctioned for a low price of ₹300/-.

Rajapackiam, S., Balasubramaniam, T. S., Ameer Hamsa, K. M. S. & Kasim, H. M. (1993). On the landing of giant sized white spotted shovelnose ray from Tuticorin waters, Gulf of Mannar. *Marine Fisheries Information Services (T&E Series)*, 121, 14.

The authors report the landing of two female shovelnose rays *Rhynchobatus djiddensis* at Tuticorin North landing centre in June 1992, by bottom-set (ray) gillnets, locally called thirukkaivalai, operated at a depth of 20-25 m. The rays measured 316 and 279 cm in total length and weighed 200 and 150 kg respectively. The rays were sold in open auction for ₹4620/- and ₹4625/. The authors present detailed morphometric measurements of the rays and note the total length (TL) of 316 cm as the largest record of the species from Indian seas.

Rajapackiam, S., Balasubramanian, T. S., Ameer Hamsa, K. M. S. & Kasim, H. M. (1994a). On the unusual landings of lesser devil ray *Mobula diabolus* (Shaw) from Gulf of Mannar. *Marine Fisheries Information Services (T&E Series)*, 129, 20 - 21.

The authors present an account of the landing of 20.5 and 13.3 t of the lesser devil ray, *Mobula diabolus* by drift gillnet Paruvalai at Kayalpattinam and Tuticorin North landing centre during July and August 1993. They also report a catch of 21 rays weighing 1.5 t by a single drift gillnet on 20 July 1993. These rays ranged in size from 160 to 269 cm in disc-width. The authors present the sex-wise size distribution of the rays in the landings in both months and detailed morphometric measurements of the four largest specimens. They report that the catch was auctioned at ₹7-9 per kg through an open auction.

Rajapackiam, S., Balasubramaniam, T. S., Ameer Hamsa, K. M. S. & Kasim, H. M. (1994b). On the landing of large sized hammer head shark *Sphyrna lewini* at Tuticorin. *Marine Fisheries Information Services (T&E Series)*, 127, 13 - 14.

The authors report the landing of a female hammerhead shark, *Sphryna lewini* caught by hook and line at 100 m depth off Tuticorin on March 30, 1993. They present detailed morphometric measurements of the shark, which measured 4 m in total length and weighed 520 kg.

Rajapackiam, S., Batcha, H., Mohan, S. & Subramani, S. (2011). Landing of giant devil rays at Chennai Fisheries Harbour. *Marine Fisheries Information Services (T&E Series)*, 209, 24.

The authors report the landing of the giant devil rays, *Manta birostris*, by mechanised gillnet at Chennai Fisheries Harbour in June 2011, along with the lesser devil ray, *Mobula diabolus*. They present details of the size, sex and price of three individuals and also note that the gill rakers were removed, cleaned and dried for 5 days, before being sold for prices ranging from ₹2500 to ₹5000 per kg.

Raje, S. G. (2000). Length-weight relationship of five species of rays from Mumbai, Maharashtra. *Indian Journal of Fisheries*, 47(2), 159 - 161.

In this brief note, The author presents the length-weight relationship of five species of rays caught from Mumbai, Maharashtra. He records the values of log 'a' and 'b' of the regression equations as-7.73348 and 2.54483 for *Dasyatis uarnak,* -8.09534 and 2.62806 for *D. sephen,* -7.47977 and 2.48397for *Trygon walga,* -9.91272 and 2.73408 for *Gymnura micrura* and -9.24263 and 2.67815 for *Rhinoptera javanica.*

Raje, S. G. (2003). Some aspect of biology of four species of rays off Mumbai water. *Indian Journal of Fisheries*, 50(1), 89 - 96.

The author discusses the biology of four species of rays - *Dasyatis sephen, Dasyatis uarnak, Trygon walga* and *Gymnura micrura*, caught off Mumbai. Noting that the sex ratio indicated the dominance of females in *D. spehen, D. uarnak* and *G. micrura*, and the dominance of males in *T. walga*, he documents the tendency of females to attain larger sizes than males, and a prolonged breeding season for all the species, with year-round breeding in Mumbai waters. He also reports the carnivorous feeding habits of all the species, with a predominance of demersal fishes, prawns and molluscs in the gut contents.

Raje, S. G. (2006). Skate fishery and some biological aspects of five species of skates off Mumbai. *Indian Journal of Fisheries*, 53(4), 431 - 439.

The author discusses the trends in the skate fishery in Mumbai waters during the period 1989 - 2003, and noting a general decline in the catch and catch rate, he suggests that the fishing pressure has reached an optimum level. Reporting the presence of five species in the catch, he documents the dominance of *Rhynchobatus djiddensis*, which formed 93.2% of the catch. A detailed account of the annual landing, species composition and seasonal abundance are given. He describes *R. djiddensis, Rhinobatos annandalei* and *Rhina ancylostoma* as benthic carnivores with a predominance of demersal fishes, crustaceans and molluscs in the diet. He also gives a brief description of the sex ratio, reproductive sizes, fecundity and litter size of the five species. He estimates the size at maturity of males as 140 cm in *R. djiddensis* and 80 cm in *R. annandalei* and *R. granulatus.*

Raje, S. G. (2007). Some aspects on the biology of *Himantura bleekeri* (Blyth) and *Amphotistius imbricatu*s (Schneider) from Mumbai. *Indian Journal of Fisheries*, 54(2), 235 - 238.

The author presents the results of his investigations on the biology of *Himantura bleekeri* and *Amphotistius imbricatus* exploited from Mumbai waters during 1998-2005 and 1997-2005, respectively. Observing the presence of a high number of poorly fed individuals in both species, he lists crustaceans as the preferred prey item in the food, followed by teleosts, molluscs and polychaetes. They breed throughout the year. Common length-weight relationships have been derived for both sexes in the two species with slopes of 2.79267 and 2.3119 respectively. He also describes briefly the sex ratio and probable breeding season of the two species.

Raje, S. G. & Joshi, K. K. (2003). Elasmobranchs. In M. Mohan Joseph & A. A. Jayaprakash (Eds.), *Status of exploited marine fishery resources of India.* CMFRI, Cochin. pp. 92-101.

The authors discuss the status of elasmobranch resources in India, with the fishery trends over the last 40 years. The average annual landing of the resource was 53,546 tonnes, contributing 2.5% to the total marine fish production of the country. They indicate the progressive trend, reaching a maximum of 75,623 t in 1998 due to high demand in the Southeast Asian countries.

Raje, S. G. & Thakurdas. (2007). Sharks trade in Mumbai. *Fishing Chimes*, 27(8), 50-52.

The authors give an overview of the shark trade in Mumbai by collecting information regarding

utilization from auctioneers, traders, wholesalers, retailors and processors of shark fin, flesh, liver oil and offal at New Ferry Wharf and Satpati landing centers, Mumbai.

Raje, S. G. & Zacharia, P. U. (2009). Investigation on fishery and biology of nine species of rays in Mumbai water. *Indian Journal of Fisheries*, 56(2), 95 - 101.

The authors investigate the fishery trend and biological characteristics of nine species of rays exploited from Mumbai waters during the period 1990-2004. The landings by trawl net accounted for 1% of the total trawl landings, with peak landings in September, December and February-April. Their study indicates a decrease in catch rate against increasing effort. They identify fourteen species in the fishery, dominated by *Himantura alcockii, H. bleekeri, Amphotistius imbricatus* and *H. uarnak.* They present details of size at maturity, sex ratio and litter size of nine species - *H. alcockii, H. bleekeri, A. imbricatus, H. uarnak, Pastinachus sephen, Dasyatis zugei, Gymnura japonica, G. poecilura* and *Mobula diabolus.* Suggesting long gestation period and differential growth of sexes, with females growing larger in all the species, they state that the innate biological characteristics such as limited brood size, late maturation and capture of spawning stock are the causes of the continuous decline, and conservation measures are required to protect these resources from further depletion.

Raje, S. G., Thakurdas, & Sundaram, S. (2012). Relationship between body size and certain breeding behaviour in selected species of Elasmobranchs off Mumbai. *Journal of the Marine Biological Association of India*, 54 (2), 85 - 89.

The authors attempt to present base-line information about breeding behaviour of eleven elasmobranch species based on their sex-wise body size data collected from trawl landings at New Ferry Wharf landing centre in Mumbai (Maharashtra, India) during 1999-2005. The species include seven sharks (although the authors mention six) - *Scoliodon laticaudus*, *Carcharhinus macloti*, *Rhizoprionodon acutus*, *Loxodon microrhinus*, *Carcharhinus sorrah*, *Carcharhinus limbatus* and *Sphyrna lewini*, two species of skates - *Rhinobatos annandalei* and *Rhynchobatus djiddensis*, and three species of rays - *Himantura imbricata*, *Himantura alcockii* and *Gymnura japonica*. This paper provides valuable information on the size and sex composition of major species that contributed to the fishery along the Maharashtra coast in north-west.

Raje, S. G., Sivakami, S., Mohanraj, G., Manojkumar, P. P., Raju, A. & Joshi, K. K. (2007). *An atlas on the elasmobranch fishery resource of India.* CMFRI Special Publication, 95.

The authors present a collection of concise but detailed information about the taxonomy, diagnostic characters, bathymetric distribution, method of fishing and biological information for different species of sharks, skates and rays along the Indian coast. They attempt, with appropriate illustrations, to describe the details of 84 elasmobranch species, including 47 species of sharks, 29 species of rays and 8 species of skates (including 4 species of saw fish) represented in the Indian fishery. Regional or seasonal abundance and peak breeding season of major species of elasmobranchs landed are also presented in addition to the maps that depict coastwise abundance. The book as a whole provides an understanding of the resource characteristics and eco-biological features of different species of sharks, skates, and rays.

Raje, S. G., Mathew, G., Joshi, K. K., Nair, R. J., Mohanraj, G., Srinath, M., Gomathy, S. & Rudramurthy, N. (2002). *Elasmobranch fisheries of India - An appraisal.* CMFRI Special Publication, 71.

The authors present the findings of voluminous data processing and consolidated knowledge available from the Indian EEZ on the status of the elasmobranch fishery. For the documentation,

data on elasmobranch landings from landing centres along the entire country's coastline between 1961 and 2000 were analysed using the Multistage Stratified Random Sampling Design developed by the Fishery Resources Assessment Division of the Central Marine Fisheries Research Institute. They also attempt to include data from previously published work on elasmobranchs of India, in addition to addressing biological parameters such as maturity, breeding and development, fecundity, length at birth, length-frequency distribution in the landings, food and feeding habits and population dynamics of sharks, rays, skates and guitarfishes. Furthermore, they highlight the trade and export scenario of elasmobranch fishery in India. There is also a special mention of the whale shark fishery along the Indian coast. This review of India's elasmobranch resources has highlighted the urgent need for a comprehensive taxonomy study as well as the development of appropriate action plans for research, development and conservation.

Raju, A., Venkatesan, V., Varghese, M., Ramamoorthy, N. & Gandhi, A. (2008). First record of rare skate off Gulf of Mannar. *Marine Fisheries Information Service (T&E Series)*, 196, 18.

The authors present a first report of the rare skate *Raja texana* from the Gulf of Mannar, based on a single male specimen caught by a trawl net at 70 m depth and landed at Pamban-Therkuvadi on 20 July 2007. They present some morphometric characters of the shark belong to the family Rajidae, which measured 360 m in length and 760 g in weight. The female skate measured 360 mm in length and weighed 760 g.

Raju, B., Kingsly, J. H. & Lipton, A. P. (2005). On a whale shark caught at Vizhinjam, Kerala. *Marine Fisheries Information Service (T&E Series)*, 184, 16.

The authors report the landing of an 8 meter long female whale shark, *Rhincodon typus*, at the Vizhinjam landing centre on 20 June 2005, after being entangled in a drift gillnet (ozhukuvala). The shark weighed about 1600 kg and was sold first for ₹1,600/- and subsequently for ₹6,000/-.

Ramalingam, P. Somayajulu, K. R., Dhanaraju, K., Burayya, N., Abbulu, V., Ellithathyya, Ch., Rao, T. N. (1993). Occurrence of whale shark off south Andhra coast. *Marine Fisheries Information Service (T&E Series)*, 121, 12.

The authors report the landing of a male whale shark measuring 4.45 m in length at Kakinada in Andhra Pradesh on 24 September, 1992. The shark was caught by a trawl net operated at a depth of 40 m, nearly 100 km south of Kakinada. The authors present detailed morphometric measurements of the shark, which weighed 1 ton. They mention that the only earlier report of a whale shark landing from Andhra Pradesh was that of a 6.1 m long specimen landed at Visakhapatnam in May 1965.

Ranade, M. R., Shenoy, S. S. & Ahmed, F. (1970). Capture of a whale shark *Rhincodon typus* Smith in Ratnagiri waters. *Journal of Bombay Natural History Society*, 67 (2), 337.

The authors report, for the first time, capture of the whale shark *Rhineodon typus* from Ratnagiri waters on 13 May 1965. They present morphometric measurements of the shark in the proforma suggested by Silas & Rajagopalan (1963) and note that the 5180 mm long male shark weighed about 900 kg and had two sucker fishes (*Remora remora*) adhering to its pectoral fins.

Rane, U. (2002). On a female devil ray, *Manta birostris* (Walbaum) entangled in bottom set gill net at Kelwa-Dandarpada, Maharashtra. *Marine Fisheries Information Service (T&E Series)*, 174, 14.

The author reports the incidental catch of a female devil ray *Manta birostris* of 594 cm disc-width and weighing 1500 kg in a bottom set gillnet on 24 September 2002 at Kelwa-Dandarpada in Maharashtra. He presents

details of some morphological features of the specimen, which was a pregnant female with a male embryo.

Ranjith, L., Sivadas, M., Kannan, K., Kanthan, K. P. & Madan, M. S. (2013). Occurrence of pelagic thresher shark, *Alopias pelagicus* (Alopiidae: Laminiformes) from the Tuticorin, Gulf of Mannar. *Marine Fisheries Information Service (T&E Series)*, 217, 25 - 26.

The authors record the landing of a female pelagic thresher shark, *Alopias pelagicus* at the Tharuvaikulam fish landing centre on 20 June 2013. The shark was caught by a drift gillnet at 100-150 m depth off Tuticorin in the Gulf of Mannar. The morphometric measurements are presented.

Rao, A. V. (1997). Landing of three whale sharks along the coastal Srikakulam district, Andhra Coast. *Marine Fisheries Information Service (T&E Series)*, 148, 10.

The author reports the incidental landing of three whale sharks, one each at Vadagangavada, Kothuru and Iskapalem landing centres in Srikakulam district, Andhra Pradesh in January 1997. While the first was entangled in a shore seine, the other two were caught in bottom set gillnets. He presents some morphometric measurements of the shark landed at Iskapalem and reports that the dorsal fins were cut off by the fishermen; there was no demand, however, for the flesh.

Rao, A. V. (1998). An instance of entangling whale sharks, *Rhinodon typus* in shore seine. *Marine Fisheries Information Service (T&E Series)*, 152, 16.

The author records the entangling of 3 whale sharks measuring 5.5, 5.7 and 5.8 m in total length in shore seines operated at depths of 8-9 m along the coast of Srikakulam district in Andhra Pradesh. He presents some morphometric measurements of two specimens, a male and a female, which were landed at the Iskapalem landing centre. In contrast to an earlier report by the same author (see Rao, 1997), he states that there was no demand for flesh or fins of this shark.

Rao, C. V. S. (1992). On the occurrence of whale shark *Rhincodon typus* along the Kakinada coast. *Marine Fisheries Information Service (T&E Series)*, 116, 19.

The author reports the accidental entangling and landing of a 601 cm long female whale shark *Rhincodon typus* at Dummulapeta landing centre in Kakinada on 18 April 1984. The author presents the morphometric measurements of the shark, which weighed about 3 tonnes, and also gives details of the landing of eight other whale sharks along the Kakinada coast during the period 1978-1987.

Rao, C. V. S. & Rao, K. N. (1992). Whale shark landing. *CMFRI Newsletter*, 57, 5.

In this very brief report, the authors record the landing of a 548 cm long male whale shark on 30 July at Visakhapatnam. The shark, weighing 2.5 tonnes, had been entangled in a gillnet operated at a depth of 40 m.

Rao, C. V. S. & Rao, K. N. (1993). On the landing of a whale shark *Rhincodon typus* smith at Dibhapalem south of Visakhapatnam. *Marine Fisheries Information Service (T&E Series)*, 120, 17.

The authors report the landing of a 742 cm long male whale shark, *Rhiniodon typus* accidentally caught in a nylon gillnet operated at a depth of 30 m in the early hours off Dibbapalem, south of Visakhapatnam, on 8 June 1992. The shark remained alive for about five hours after being towed to the landing centre. The authors present the morphometric measurements of the shark, which weighed about 4 tonnes. They also report the accidental entangling of another male shark in a nylon gill net operated at 40 m depth off Visakhapatnam on 30 July 1992.

Rao, G. S. (1986). A note on the unusual occurrence of the whale shark *Rhincodon typus* (Smith) off Veraval. *Marine Fisheries Information Service (T&E Series)*, 66, 30.

The author reports landings of the whale shark, *Rhincodon typus* at the trawl landing centre of Bhidiya in Veraval (Gujarat, India). This is a very significant report as the author documents that the whale shark is a regular visitor to the Gujarat coast during April every year, and that the fishermen hunted this shark using hooks in a practice similar to harpooning. The shark was hunted for its liver oil. The author notes that the flesh did not hold any market value and the fishermen would discard the carcass back into the sea after removing the liver. The author documents the hunting of about 40 sharks in a span of just four days, all in the size range of 900-950 cm total length. This report is perhaps the first indicator of the alarming rate of hunting for whale sharks along the Gujarat coast that became rampant in later years.

Rao, R. B. (1998). Hooks and line fishery for sharks at Janjira-Murud region, Raigad District, Maharashtra by migrated fishermen from Kanyakumari. *Marine Fisheries Information Service (T&E Series)*, 155, 18.

The author presents a brief report of the hook and line fishery for sharks by migrated fishermen in the Janjira-Murud region, Raigad District, Maharashtra. The fishery lasts from November to May and brings in large specimens of *Carcharhnius* spp. with the approximate weight of 40-50 kg and an average of 30 sharks are caught per day.

Rao, R. B. (2011). Honeycomb stingrays (*Himantura uarnak*) washed ashore at Uran coast in Maharashtra. *Marine Fisheries Information Service (T&E Series)*, 210, 23.

The author reports the stranding of 50-55 honeycomb stingrays, *Himantura uarnak* at Mankeshwar beach near Uran coast in the Raigad District of Maharashtra on 21 August 2010. The rays measured about 4 feet in length and 3 feet in disc-width. The author also notes that the local fishermen attributed this unusual stranding to an oil spill and the leakage of pesticides and chemicals following the collision of two ships near the Mumbai coast on 7 August 2010.

Rao, S. K. (1986). On the capture of whale sharks off Dakshina Kannada coast. *Marine Fisheries Information Service (T&E Series)*, 66, 22 - 29.

The author reports the capture of six juvenile whale sharks in a span of about two months between November and December, 1980 off the Dakshina Kannada coast in India, with details of the size, sex, area and date of capture of each shark. The author describes the method of capture and the utilization pattern. Morphometric measurements of all the sharks are given in detail, along with some information about their stomach contents.

Ravi, R. K., Venu, S. & Akhilesh, K. V. (2015). First report of magnificent catshark *Proscyllium magnificum* Last and Vongpanich, 2004 (Proscylliidae: Carcharhiniformes) from Bay of Bengal, Indian EEZ. *World Journal of Fish and Marine Sciences,* 7(6), 479 - 481.

The authors record the occurrence of the magnificent catshark *Proscyllium magnificum* in the Indian EEZ off the Andaman Islands in the Bay of Bengal based on two specimens caught by deep-sea trawlers that operated at 300 m depth to the south of Sentinel Island. They give a detailed description of the species and note that their observation is a new distributional record for the species.

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Sadhasivam, G., Muthuvel, A., Pachaiyappan, A. & Thangavel, B. (2013). Isolation and characterization of hyaluronic acid from the liver of marine stingray *Aetobatus narinari. International Journal of*

Biological Macromolecules, 54, 84-89.DOI: 10.1016/j.ijbiomac.2012.11.028

Reprint not obtained. Information accessed from from Pollerspöck, J. & Straube, N. 2020, www.shark-references.com, World Wide Web electronic publication, Version 2020

The authors discuss the isolation of the high molecular weight hyaluronic acid from the liver of *Aetobatus narinari* and its characterization by agarose-gel electrophoresis, FTIR, HPTLC and H-1 NMR. They report that the hyaluronic acid thus isolated showed significant inhibition against the proliferation of cells, substantiating its influence in regulation of cell functions.

Sajeevan, M. K. & Sanadi, R. B. (2012). Diversity, distribution and abundance of oceanic resources around Andaman and Nicobar Islands. *Indian Journal of Fisheries*, 59(2), 63-67.

The authors identify 29 species of fish including 15 species of pelagic sharks and the pelagic sting ray *Pteroplatytrygon violacea* in a study of oceanic resources around the Andaman & Nicobar Islands using exploratory tuna-longline survey data for the period January 2006-December 2008. Pelagic sharks formed 34% of the catch and the pelagic sting ray formed 11%. The shark species identified include *Carcharhinus longimanus, Carcharhinus albimarginatus, Carcharhinus dussumieri, Carcharhinus sorrah, Carcharhinus melanopterus, Carcharhinus macloti, Carcharhinus limbatus, Galeocerdo cuvier, Sphyrna lewini, Sphyrna mokarran, Sphyrna zygaena, Alopias vulpinus, Alopias pelagicus, Alopias superciliosus* and *Isurus oxyrinchus.* The authors report that the dominance of sharks over the other fishes in species richness and abundance is a significant feature of oceanic resources of the Andaman & Nicobar Islands, with pelagic sharks being abundant between lat. 08^0 N and lat. 12^0 N with maximum hooking rates from lat. 09^0 N and lat. 11^0 N, while pelagic stingray showed a decreasing trend towards upper latitudes with maximum hooking rate from lat. 06^0 N. They record higher seasonal abumdance of pelagic sharks during Novemebr-January and of pelagic sting ray during December-April.

Sajeevan, M. K. & Sanadi, R. B. (2016). Distribution and abundance in time and space of pelagic stingray *Pteroplatytrygon violacea* (Bonaparte, 1832). *Indian Journal of Geo Marine Sciences*, 45(12), 1709-1713.

The authors discuss the spatio-temporal distribution and abundance of the pelagic sting ray *Pteroplatytrygon violacea* in the sea around the Andaman & Nicobar Islands, and the effect of environmental factors on its distribution based on data collected from tuna longline surveys during the period from January 2006 to December 2008. They evaluate the seasonal and lunar variation in catch rates and report higher catch rates during pre- and post-monsoon periods and during new moon days. They observe an increasing trend in the quantum of pelagic sting rays caught as bycatch in tuna longlines compared to earlier years.

Samanta R., Chakraborty S. K., Shenoy L., Nagesh T. S., Behera S. & Bhoumik T. S. (2018). Bycatch characterization and relationship between trawl catch and lunar cycle in single day shrimp trawls from Mumbai coast of India. *Regional Studies in Marine Science*, 17, 47-58.

The authors present an account of the bycatch of shrimp trawl from experimental fishing operations comprising 40 hauls of 1 to 3 h duration in the depth range of 10-26 m at a trawling speed of 2.3-3 knots in the traditional trawl areas in coastal waters off Mumbai on the northwest coast of India, from October 2015 to May 2016 using a 33 m bottom trawl of 30 mm mesh size codend. From their examination of the catch from individual hauls and categorizing the catch into target catch (shrimp), bycatch and discards, they report that the main catch consisted of prawns, sciaenids, bombay duck, anchovies, ribbon fishes, flat fishes, sharks and rays, while discards included jelly fishes, mantis shrimps, bivalves, gastropods and other non-edible fishes, with maximum catch being contributed by smaller and bigger sciaenids (35%), sharks and rays (10%), anchovies (10%), prawns (8%), bombay duck (6%) and other demersal species. They report seven

elasmobranchs in the catch - *Scoliodon laticaudus, Chiloscyllum arabicum, Himantura alcocki, H. imbricata, H. pastinacoides, Pastinachus sephen and Rhynchobatus djiddensis.* The authors describe monthly variation in the catch and CPUE, and also attempt to relate the trawl catch to lunar cycles.

Sarada, S., Lakshmi, C. V. & Rao, K. H.(1986). Studies on a new species *Echinobothrium scoliodoni* (Order: Diphyllidea) from *Chiloscyllium indicum* from Waltair Coast. *Revista Ibérica de Parasitología*, 46: 53 - 57.
Reprint not obtained.

Sarada, S., Lakshmi, C. V. & Rao, K. H.(1992). Studies on a new species *Cephalobothrium neoaetobatidis* (Cestoda: Lecanicephalidea) from *Rhina ancylostomus* from Waltair Coast. *Rivista di Parassitologia,* 9(2): 189 - 193.
Reprint not obtained.

Sarada, S., Lakshmi, C. V. & Rao, K. H.(1993a). Description of a new species of *Acanthobothrium giganticum* from *Gymnura micrura* from Waltair coast. *Rivista di Parassitologia,* 10: 371 - 374.
Reprint not obtained.

Sarada, S., Lakshmi, C. V. & Rao, K. H.(1993b). Studies on a new species of *Cephalobothrium stegostomi* (Cestoda: Lecanicephalidea) from *Stegostoma fasciatum* from Waltair coast. *Indian Journal of Parasitology,* 17, 1 - 4.
Reprint not obtained.

Sarada, S., Lakshmi, C. V. & Rao, K. H. (1993c). Description of the new species *Acanthobothriums atyanarayanaraoi* from *Rhinobatus granulatus* from Waltair Coast, India. *Boletín Chileno de Parasitología,* 48(1 - 2): 15 - 17.
Reprint not obtained. Information accessed from from Pollerspöck, J. & Straube, N. 2020, www.shark-references.com, World Wide Web electronic publication, Version 2020

The authors describe a new species of the cestode genus *Acanthobothrium* obtained from the elasmobranch *Rhinobatus granulatus*. They report that the new species, designated as *Acanthobothrium satyanarayanaraoi* shows remarkable differences from other known species of *Acanthobothrium* in respect of length of the worm, craspedote nature, size of scolex, bothridia, hooks and unilateral genital pores.

Sarada, S., Lakshmi, C. V. & Rao, K. H.(1995). Studies on a new species *Carpobothrium rhinei* (Cestoda: Tetraphyllidea) from *Rhina ancylostomus* from Waltair coast. *Uttar Pradesh Journal of Zoology,* 15: 127 - 129.
Reprint not available

Sarangdhar, P. N. (1943). Tiger shark - *Galeocerdo tigrinus* Muller and Henle. Feeding and breeding habits. *Journal of the Bombay Natural History Society*, XLIV, 102-110, plates 1-3.

The author presents a detailed account of the tiger shark *Galecerdo tigrinus*, locally called *Waghbeer or Waghsheer.* He presents its description in detail along with its feeding and breeding characteristics, recording a wide diversity in its diet which includes fishes, prawns, crabs, squids and even sea snakes and corroborates earlier views of the shark being a quiet scavenger rather than a voracious predator based on the occurrence of freshly swallowed, whole and undamaged pomfrets in the stomach of one specimen. On the economic importance of the species, The author comments that it is of fair value on account of the liver which yields a high percentage of oil with good Vitamin A content. He notes that the livers of newly born sharks are considered a delicacy by fisherfolk and that while salted flesh is consumed in inland districts, the fins of this shark did not hold much value. He provides a detailed description of the breeding habits with vivid accounts of the structure of uterus and disposition of embryos, shell membranes and unfertilized eggs, and appearance of the embryos, yolk sac and umbilical cord. He concludes that the embryos grow to a size of nearly 2.5 ft in length before birth, and

at the time of birth they have conspicuous tiger-like markings and that a large quantity of yolk in the yolk-sac nourishes the embryos during their intra-uetrine life. He also suggests that a yolk-sac placenta may not form at all in the shark.

Sarangdhar, P. N. (1946). On the breeding of the tiger shark (*Galeocerdo tigrinus* Muller and Henle). *Journal of the Bombay Natural History Society,* 46, 193-193.

In this brief note, The author describes the reproductive condition of a female tiger shark with full-term foetuses. He records the female to be 12'11" long with an approximate weight of 1500 lbs, with 13 foetuses in each uterus, 7 males and 19 females in all. He describes the foetal stage and confirms the length at birth to be 2'6". He also concludes that the tiger shark is a non-placental form with the embryo deriving nourishment from a large quantity of yolk in the yolk sac.

Sathishkumar, R. S., Murugan, R., Sundaramanickam, A., Ramesh, T. & Balachandar, K. (2019). Incidental Catch of Whale Shark (*Rhincodon typus* Smith, 1828) at Cuddalore Coast, India. *Turkish Journal of Fisheries and Aquatic Sciences,* 19(6), 525 - 527. DOI: 10.4194/1303-2712-v19_6_08.

The authors report the landing of a dead adult whale shark by a gill net at Cuddalore on the southeast coast of India on 14 October 2017. They present morphometric measurements of the shark which was 315 cm long and weighed 1200 kg. They also suggest research and management requirements for the conservation of this species, which include awareness generation among fisher-folk, eco-tourism, strick implementation of existing rules, modified or alternative fishing methods to reduce incidental catch and document accurate information on their population and seasonal migratory pattern.

Sathish K., M., Uma, M. V., Rao, H. M. V. & Ghosh, S. (2013). Incidental landing of lesser devil ray *Mobula diabolus* (Shaw, 1804) at Dummulapeta and Bhairavapalem, Andhra Pradesh. *Marine Fisheries Information Service (T&E Series)*, 216, 17 - 18.

The authors report the landing of 23 devil rays (*Mobula diabolus*) at the Dummulapeta and Bhairavapalem landing centers of Andhra Pradesh from 21 to 23 March 2012. They note that the rays, which were caught incidentally in motorised drift gill net operations targeting yellow fin tuna shoals, measured 97 to 163 cm in disc width and weighed 40 to 110 kg. The authors also note that the catch was auctioned for ₹35 - 45/-per kg and that the gill rakers were cut out and processed for export to Japan, Singapore and China while the liver was processed for oil and salted and dried flesh strips were transported to Tamil Nadu and Kerala.

Sathyan, N., Philip, R., Chaithanya, E. R., Anil Kumar, P. R. & Antony, P. S. (2012). Identification of a histone derived, putative antimicrobial peptide Himanturin from round whip ray *Himantura pastinacoides* and its phylogenetic significance. *Results in Immunology*, 2, 120-124.

The authors report the identification of an antimicrobial peptide sequence from the histone H2A of round whip ray, *Himantura pastinacoides*. They obtained a 204 bp fragment cDNA encoding 68 amino acids from the mRNA of blood cells of *H. pastinacoides* by RT-PCR and confirmed that the peptide belonged to histone H2A family, by BLAST analysis of the nucleotide and deduced amino acid sequences. They report the similarity of the obtained nucleotide sequence to previously reported histone H2A nucleotide sequences with proven antimicrobial activity. They conclude that the physicochemical properties of Himanturin are in agreement with those of traditional antimicrobial peptides and since it is reported from a ''food grade'' source, i.e. the round whip ray, it has the potential to be developed into an effective antimicrobial agent with broad application potential. This is the first report of a histone H2A derived AMP from elasmobranchs.

Satsangi, P. P. & Bora, R. (1980). A fossil eagle ray fish from Eocene of Khasi Hills, Meghalaya. *Journal of the Geological Society of India,* 21: 566 - 567.

Reprint not obtained.

Sen, S. (2016). Biology and stock assessment of *Scoliodon laticaudus* Muller and Henle, 1838 and *Rhizoprionodon acutus* (Ruppell, 1837) from Gujarat coast. Ph.D. Thesis. ICAR-Central Institute of Fisheries Education, Mumbai.

The author presents the biology and stock status of two important shark species *Scoliodon laticaudus* and *Rhizoprionodon acutus* from Gujarat waters of India. From diet studies, she reports sexual and ontogenetic differences in feeding habits in both the shark species and that crustaceans (54.71%) were the preferred food of *S. laticaudus* followed by teleosts (36.06%) and molluscs (9.24%), while teleosts (78.40%) were preferred by *R. acutus*, followed by crustaceans (19.78%), molluscs (1.69%) and annelids (0.14%). The author discusses the reproductive biology of the two species, indicating that both are continuous breeders with peak breeding during March and October for *S. laticaudus* and during February and November for *R. acutus.* The author provides estimates for size at maturity (Lm_{50}) for female and male *S. laticaudus* as 35.79 and 33.73 cm total length (TL) respectively, 61.28 cm and 61.53 cm TL for female and male *R. acutus* respectively. The author also presents growth & mortality estimates and stock status of the two species, based on which the maximum sustainable yield (MSY) is calculated as 6502 t and 46.56 t for *S. laticaudus* and *R. acutus* respectively. Using spawning stock biomass (SSB) of 30% as a precautionary management reference point to determine the most sustainable exploitation levels for both the species, and considering the multi-species and multi-gear nature of the fishery, the author suggests that the fishing effort should be increased only by increasing the number of dedicated units such as gill nets, hooks and lines targeting sharks.

Sen, S., Chakraborty, S. K., Vivekanandan, E., Zacharia, P. U., Jaiswar, A. K., Dash, G., Bharadiya, S. A. & Gohel, J. (2018). Feeding habits of milk shark, *Rhizoprionodon acutus* (Ruppell, 1837) in the Gujarat coastal waters of north-eastern Arabian Sea. *Regional Studies in Marine Science*, 17, 78 - 86.

The authors provide necessary baseline information to understand the ecological significance of *R. acutus* by studying the dietary composition, breadth and any possible changes due to maturity stage and sex along Gujarat coast of India. Teleosts (Dietary coefficient, %QI = 83.05 and index of relative importance, %IRI = 78.40) were found to be the preferred food items followed by crustaceans (%QI = 16.21; %IRI = 19.78), which formed the secondary food item group. Molluscs (%QI = 0.74; %IRI = 1.69) and annelids (%QI = 0.01; %IRI = 0.14) constituted the accidental or accessory food items. They propose that the species is likely to migrate vertically in quest of prey despite being a pelagic predator.

Sen S., Chakraborty, S. K., Vivekanandan, E., Zacharia, P. U., Kizhakudan, S. J., Jaiswar, A. K., Dash, G. & Jayshree, G. (2017). Population dynamics and stock assessment of milk shark, *Rhizoprionodon acutus* (Ruppell, 1837) along Gujarat coast of India. *Indian Journal of Geo-Marine Sciences*, 46, 936 - 946.

The authors discuss the status of exploitation and stock assessment of milk shark, *Rhizoprionodon acutus*, during 2012 - 2014 along the Gujarat coast of India. They provide estimates of L_{∞}, K, t_0, total mortality rate (Z), fishing mortality rate (F) and natural mortality rate (M) as 93.8 cm, 0.32 yr^{-1}, -1.3 yr, 1.0 yr^{-1}, 0.39 yr^{-1} and 0.61 yr^{-1}, respectively. They also provide estimates of length at capture (Lc_{50}) and length at maturity (Lm_{50}) as 50 cm and 61 cm respectively, indicating that the majority of sharks are exploited before attaining sexual maturity. They further mentioned that the current exploitation ratio (E_{cur}) is 0.39, which is lower than the $E_{0.1}$, which was calculated using Beverton and Holt yield per recruit analysis for the species. They found that current exploitation is reducing

the virgin stock biomass (B_0) and spawning stock biomass (SSB) by 55% and 34%, respectively, according to the Thompson and Bell prediction model. As a result, the authors propose that the species' exploitation level be increased by 20%, increasing yield while keeping the SSB at a relatively safe 28% level for sustainability.

Sen, S., Chakraborty, S. K., Vivekanandan, E., Zacharia, P. U., Jaiswar, A. K., Dash, G., Kizhakudan, S. J., Bharadiya S. A. & Gohel, J. (2018). Reproductive strategy of milk shark, *Rhizoprionodon acutus* (Ruppell 1837), along north-eastern Arabian Sea. *Ichthyological Research,* 1 - 10.

The authors present critical information on the reproductive strategy of *Rhizoprionodon acutus* from the north-eastern Arabian Sea. Between January 2013 and December 2014, 684 specimens were collected for the study from four important fish landing centres along the Gujarat coast (India) of the north-eastern Arabian Sea, namely Veraval, Mangrol, Porbandar, and Okha. They also present some region-specific information on the reproductive biology of *R. acutus*, which will aid in the development of a good management strategy for sustainable exploitation of the species in this region.

Sen, S., Chakraborty, S. K., Vivekanandan, E., Zacharia, P. U., Kizhakudan, S. J., Jaiswar, A. K., Dash, G., Gohel, J., & Bharadiya S. A. (2019). Population dynamics and stock assessment of spadenose shark *Scoliodon laticaudus* Müller and Henle 1839 along Gujarat coast of India. *Indian Journal of Geo-Marine Sciences*, 48(4), 423 - 433.

The authors discuss the status of exploitation and stock assessment of spadenose shark, *Scoliodon laticaudus*, during 2012 - 2016 along the Gujarat coast of India. They provide estimates of L_∞, K, t_0, total mortality rate (Z), fishing mortality rate (F) and natural mortality rate (M) as 75.53 cm, 0.54 yr^{-1}, -0.4 yr, 1.95 yr^{-1}, 1.04 yr^{-1} and 0.91 yr^{-1}, respectively. They also provide estimates of length at capture (Lc_{50}) and length at maturity (Lm_{50}) as 39.74 cm and 35.79 cm respectively, indicating that the majority of sharks are exploited after attaining sexual maturity. They further mentioned that the current exploitation ratio (E_{cur}) is 0.53, which is lower than the $E_{0.1}$, which was calculated using Beverton and Holt yield per recruit analysis for the species.

Sen, S., Chakraborty, S. K., Zacharia, P. U., Dash, G., Kizhakudan, S. J., Bharadiya S. A. & Gohel, J. (2018). Reproductive strategy of spadenose shark, *Scoliodon laticaudus* Müller and Henle, 1839 along north-eastern Arabian Sea. *Journal of Applied Ichthyology*, 1 - 10.

The authors attempt to derive information about the maturity parameters, reproductive periodicity and reproductive potential of *Scoliodon laticaudus* from the Gujarat waters by collecting 1227 specimens. They estimated the mean and modal lengths of the exploited shark to be 40.5 cm and 47.5 cm, respectively, and the length at maturity for males and females to be 33.8 cm and 35.8 cm, respectively, which were lower than the predominant length group of the fishery. During March and April, the authors note an increase in mean ova diameter, followed by October and November, which suggests the shark's peak reproductive time. They also observed developing embryos throughout the year, which suggests the species' breeding behavior is continuous. The length at birth (L_0) was calculated to be 13.7 cm.

Sen, S. & Dash, G. (2019). Heavy landings of bull sharks in Digha, West Bengal. *Marine Fisheries Information Service (T&E Series)*, 239, 22 - 23.

The bulk landing of bull sharks in Digha, West Bengal is highlighted by the authors. Between October 2018 and March 2019, 56 bull sharks with total lengths ranging from 95-295 cm and weights ranging from 9 to 335 kg were landed at Digha Mohana fish landing centre in West Bengal, India. There were 35 males and 21 females, all of them were adults and mostly mature.

Sen S., Dash, G., & Bharadiya S., A. (2014). First record of blue-spotted stingray, *Neotrygon kuhlii* from Gujarat, north-west coast of India. *Marine Biodiversity Records*, 7 (81), 1 - 3.

The authors describe a single specimen of blue-spotted stingray landed at Veraval fishing harbour (India) on 1 October 2013 by a single day trawler operating in the waters off Veraval at a depth range of 40 - 50 m, which was the first record from Gujarat. Aside from that, they provide information about the fishing grounds, the gear, the depth of operation, and the morphometric measures in detail.

Sen, S., Dash, G., Kizhakudan, S. J., Chakraborty. R., & Mukherjee, I. (2020). New record of the giant freshwater whipray, *Urogymnus polylepis* from West Bengal waters, east coast of India. *Ichthyological Exploration of Freshwaters*, 30 (1), 91 - 95.

The authors refer to a new record of *Urogymnus polylepis* from the waters of West Bengal on India's east coast. From December 2018 to March 2019, they recorded five specimens of *Urogymnus polylepis*: two males (DW: 144 and 141 cm; weight: 120 and 117 kg) and three females (DW: 144 and 141 cm; weight: 120 and 117 kg) (DW: 144, 145, 223 cm, weight: 160, 190 and 300 kg). They further indicate that the specimens were caught by the trawlers operating in the waters of the Hooghly River.

Sen, S., Dash, G. & Mukherjee, I. (2018). Overview of elasmobranch fisheries of West Bengal in 2018. *Marine Fisheries Information Service (T&E Series)*, 238, 18 - 22.

The authors provide a brief outline of the elasmobranch fisheries of West Bengal for the year 2018. They point out that the fishery has grown in importance as a result of demand on the national and worldwide markets, despite the fact that it is not a targeted resource. The fishery has been in decline since 2016, according to capture data. Sharks account for the majority of the elasmobranch fisheries (48%) followed by rays (40%) and guitarfishes (12%). The first (January-March) and last (October-December) quarters of the year were the best for fishing. They emphasise that despite the diversity of West Bengal's elasmobranch resources, landings are on the decline, which could be disastrous in the future if the resources are not properly managed. They recommend that proper management methods be followed to ensure the resources' long-term sustainability.

Sen, S., Dash, G, & Mukherjee, I. (2019). Deformities recorded in fishes. *Marine Fisheries Information Service (T&E Series)*, 241, 21 - 22.

The authors discuss deformities in fishes obtained from commercial landings during field trips to Digha Mohana fish landing centre (West Bengal, India) between August 2018 and October 2019. Specimens of *Brevitrygon walga*, *Pateobatis bleekeri* (rays), an embryo of the shark *Scoliodon laticaudus*, guitarfish *Glaucostegus granulatus*, and pomfret *Pampus argenteus* were found to be deformed. For the first time, anomalies in granulate guitarfish have been discovered in India. The authors suggest investigating further the aetiology of these malformations as well as their influence on the affected fishes.

Sen, S., Dash, G., Valappil, A. K., Kizhakudan, S. J. & Chakraborty. R. (2020). Occurrences of Intersexual Hound Sharks*, Iago* cf.*omanensis* (Triakidae: Carcharhiniformes) from North-western Bay of Bengal. *Thalassas* 36, 525 - 534. https://doi.org/10.1007/s41208-020-00220-0

The authors report a rare and exceptional case of hermaphroditism in huge numbers in *Iago* cf.*omanensis* (Triakidae) population. Most of the sharks among the 154 samples collected from Digha Mohana fish landing centre (West Bengal, India) appeared to be male juveniles, but upon dissection, it was discovered that all but one were fully functional females with clearly visible ovaries, oviducal glands, oviducts, uteri, and a few

with pups. As a result, the authors argue that a comprehensive and concentrated investigation is required to fully comprehend the species' reproductive strategy.

Sen, S., Kizhakudan, S. J., Zacharia, P. U. & Dash, G. (2020). Reproductive adaptation: a description of claspers of the Spadenose shark and Milk shark from Gujarat. *Indian Journal of Geo-Marine Sciences*, 49 (7), 1238 - 1241.

The authors describe the reproductive adaptations of males of the species *Scoliodon laticaudus* (spadenose shark) and *Rhizoprionodon acutus* (milk shark) in Gujarat seas. They discovered that the clasper's terminal end has been transformed into an umbrella-like organ known as rhipidion, which ensures that the clasper stays within the female's cloaca until the sperm is delivered. They also note that the predominance of mature specimens from conventional gears during the monsoon season shows reproductive segregation behaviour in these two shark species, with adults moving close to shore for copulation.

Seshappa, G., Chennubhotla, V. S. H. & Somasekhar Nair K. V. (1972). A note on the whale shark *Rhincodon typus* Smith caught off Calicut. *Indian Journal of Fisheries*, 19 (1&2), 200 - 201.

The authors report the landing of a 5600 cm long juvenile male whale shark by gillnet at Calicut on 5 January 1970. They present some morphometric measurements of the shark, which weighed ~3500 kg, with the liver weighing 68 kg, and note that the stomach was full of some green matter in a completely digested state.

Sethuraman, V. (1998). On a whale shark landed at Pamban. *Marine Fisheries Information Service, Technical and Extension Series,* 157: 23.

This is a very brief article indicating the landing of a male whale shark by a bottom-set gill net locally called *Paruvalai* at Pamban on 17 April 1998. The author reports that the shark which measured 9.2 m in length and weighed 1.5 t was buried after the liver was extracted as there was no demand for the flesh.

Setna, S. B. & Sarangdhar, P. N. (1946). Selachian fauna of the Bombay waters. Proc. Nat. Inst. Sci. India, XII, 243-259.

The authors present a taxonomic classification of 41 species of sharks, skates and rays belonging to 23 genera and 10 families, occurring in Bombay waters. They also provide a key to aid identification, based on the specimens they observed, cautioning that the key would be regional in its application. The 41 species include *Chiloscyllium griseum, Ginglymostoma ferrigineum, Stegostoma tigrinum, Rhineodon typus* (Family: Orectolobidae), *Carcharias tricuspidatus* (Family: Odontaspidae), *Scoliodon sorrakowah, S. palasorrah, S. walbeehmi, S. ceylonensis, Hypoprion macloti, Carcharhinus limbatus, C. melanopterus, C. bleekeri, C. watu, C. menisorrah, Carcharhinus* sp., *Galeocerdo tigrinus, Hemigaleus balfouri, Hemipristis pingali, Murmille mustelus* (Family: Carcharhinidae), *Sphyrna blochii, S. zygaena* (Family: Sphyrnidae), *Rhynchobatus djiddensis, R. ancylostomus* (Family: Rhinobatidae), *Pristis cuspidatus, P. microdon* (Family: Pristidae), *Dasyatis uarnak, D. uarnak* var. *variegatus, D. alcockii, D. gerrardii, D. bleekeri, D. walga, D. sephen D. zugei, Gymnura poecilura* (Family: Tygonidae), *Aetomylaeus maculatus, Aetobatus flagellum, Rhinoptera javanica* (Family: Myliobatidae), *Mobula diabolus, M. mobular* (Family: Mobulidae), *Narcine indica* and *Torpedo zugmayeri* (Family: Torpedinidae). They also provide a list of the local names used in Bombay for all these elasmobranchs.

Setna, S. B. & Sarangdhar, P. N. (1949a). Breeding habits of Bombay elasmobranchs. *Records of the Indian Museum*, Vol XLVII, 107-124.

The authors record their observations from the examination of gravid females of twenty

species of sharks and rays from Bombay waters during 1940-1944. They describe the various stages of gestation and salient features of embryonic development on *Scoliodon palasorrah, Scoliodon walbeehmi, Hypoprion macloti, Carcharhinus limbatus, Carcharhinus melanopterus, Carcharhinus sorrah, Carcharhinus menisorrah, Carcharhinus temminckii, Galeocerdo tigrinus, Hemigaleus balfouri, Sphyrna blochii, Rhynchobatus djiddensis, Pristis cuspidatus, Dasyatis uarnak* var. *variegatus, Dasyatis bleekeri, Dasyatis walga, Dasyatis zugei, Gymnura poecilura, Rhinoptera javanica* and *Mobula diabolus.* They provide tabulated information on the date of capture, length of the parent, number of embryos, length of embryos and observations on the stage of preganacy and uterine condition of all the specimens of the twenty species they observed during the period. Based on their study, they indicate the breeding/parturition period for these elasmobranchs in Bombay waters.

Setna, S. B. & Sarangdhar, P. N. (1949b). Studies on the development of some Bombay elasmobranchs. *Records of the Indian Museum*, Vol XLVII, 203-216.

The authors describe the developmetal stages of seven viviparous elasmobranchs often landed at Sassoon Dock Bombay - *Scoliodon acutus, Carcharhinus temminckii, Hemigaleus balfouri, Hemipristis elongatus, Myrmillo mustelus, Sphyrna blochii* and *Mobula diabolus.* They categorize the development into different stages which they describe as "intermediate stage" denoting those stages of pregnancy in which the embryonic yolk-sac, while still containing a quantity of yolk within its cavity, displays a rudimentary placental connection with the uterine wall, and "advanced stage" denoting that the foetal development has advanced to an extent when the yolk-sac no longer contains any yolk and the placental condition has assumed a purely haemotrophic character. They provide detailed description, with diagrams, of the embryo, yolk-sac placenta and umbilical cord in all the sharks, with additional descriptions of the peculiarly plaited and frilled appendicula on the placental cord of *H. elongatus* and the fertilized eggs of *M. mustelus.* In the case of *M. diabolus*, they report that the observed foetus, which was a perfect replica of its parent, was completely formed and ready to be born with the yolk-stalk and sac being completely absorbed so that even the umbilical scar was not visible.

Shiledar, B. A. A. (2008). A whale shark caught at Dandi (Malvan) landing centre, Maharashtra. *Marine Fisheries Information Service (T&E Series)*, 198, 19.

The author reports the landing of a whale shark, *Rhincodon typus*, by a *nahijal* net operated at 35 m depth off Malvan, Maharashtra on 10 January 2008 at Dandi landing centre. He notes that the shark, which was 5 m long and weighed 2 tonnes, was alive at the time of landing but could not be saved in spite of rescue attempts as its gills were clogged with mud and it had sustained injuries.

Shinde, G. B., Jadhav, B. V. & Deshmukh, R. A. (1980). Two new species of the genus *Pedibothrium* Linton, 1909 (Cestoda: Oncobothriidae). *Proceedings of the Indian Academy of Parasitology*, 1, 21 - 24.

Reprint not obtained.

Shriram, M. (1986). On a whale shark *Rhiniodon typus* smith landed at Cuffe Parade Bombay. *Marine Fisheries Information Service (T&E Series)*, 66, 37.

The author reports the landing of a whale shark, *Rhiniodon typus*, at the Cuffe Parade landing centre, Bombay on 10 November 1985. He notes that the shark, which measured 5 m in total length and weighed approximately 5 t, had got entangled in gillnet operated at a depth of 30 m, and was sold for ₹3,000/-.

Shriram, M. & Katkar, B. N. (2003). Landing of tiger shark *Galeocerdo cuvier* at New Ferry Wharf, Mumbai. *Marine Fisheries Information Service (T&E Series)*, 179, 22.

The authors record the landing of two male tiger sharks *Galeocerdo cuvier* at New Ferry Wharf, Mumbai on 13 September and 16 October 2003 by trawl nets that operated to the north and west of Mumbai at 40 - 50 m depth. They present morphometric measurements of the two sharks which measured 393.5 cm and 411.5 cm in total length.

Shriram, M., Joskutty, C. J. & Jayadev, S. H. (1994). A note on a whale shark *Rhincodon typus* landed at Cooperage landing centre, Bombay. *Marine Fisheries Information Service (T&E Series)*, 126, 16.

The authors report the landing of a female whale shark, measuring 665 cm in total length, at Cooperage landing centre, Bombay, on 16 March 1993 after being entangled in a monofilament gillnet. They present some morphometric measurements of the shark and note that the shark was discarded back into the sea as there were no buyers for it.

Shyni, K., Hema, G. S., Ninan, G., Mathew, S., Joshy, C. G. & Lakshmanan, P. T. (2014). Isolation and characterization of gelatin from the skins of skipjack tuna (*Katsuwonus pelamis*), dog shark (*Scoliodon sorrakowah*), and rohu (*Labeo rohita*). *Food Hydrocolloids*, 39, 68-76.

The authors discuss the properties of gelatin extracted from the skin of three fishes, including the dog shark *Scoliodon sorrakowah*. They provide a detailed account of the process of gelatin extraction and of the physical and chemical properties of the extracted gelatin. Their study revealed that shark skin which have comparatively more connective tissue and hence more collagenous material tends, to swell more in the alkaline and acidic solutions and gave better gelatin yield due to increased opening of cross-links during swelling. They observe that shark skin gelatin is significantly lighter and presents a pearly white appearance with good transmittance and is free of fishy odour but has a mild putrid odour. They present the proximate composition of skins and gelatin of the three fishes and the amino acid composition of the gelatins. Their assessment of the physico-chemical properties indicates that shark skin gelatin has significantly higher ($p < 0.01$) viscosity, gel strength, melting point, setting point, foaming capacity and water holding capacity compared to gelatin from tuna and rohu skins, while tuna skin gelatin has higher fat binding capacity and setting time. They conclude that there is potential for exploitation of processing waste for gelatin extraction from all three species, with the potential being higher for dog shark skins since the gelatin yield is higher and shows better functional properties.

Sijo, P. (2006). Whale shark *Rhincodon typus* landed at Kollam. *Marine Fisheries Information Service (T&E Series)*, 190, 22.

In this very brief report, the author documents the landing of a male whale shark at Sakthikulangara Fisheries Harbour on 12 September 2006, after being entrapped in a trawl net operated at a depth of 46 m off Kollam, Kerala and brought to Sakthikulangara Fisheries Harbour. He notes that the shark, which measured 445 cm in total length and weighed approximately 2 tonnes, was sold for ₹1000/-

Sijo, P. (2011a). Rare occurrence of ornate eagle ray at Cochin Fisheries Harbour. *Marine Fisheries Information Service (T&E Series)*, 208, 34 - 35.

The author reports the landing of the rare and endangered ornate eagle ray, *Aetomylaeus vespertilio*, at Cochin Fisheries Harbour on 25 January 2011, having been caught by a drift gillnet operated at a depth of 200 m. He records the disc width and weight of the ray as 190 cm and 110 kg, respectively.

Sijo, P. (2011b). Landing of a pregnant female tiger shark, *Galeocerdo cuvier* at Cochin Fisheries Harbour. *Marine Fisheries Information Service (T&E Series)*, 208, 34 - 35.

The author reports the landing of a 4 m long female tiger shark at Cochin Fisheries Harbour, accidentally caught by a drift gillnet, on 25 January 2011. The shark had thirty advanced young ones in the length range of 70-75 cm. The author notes that the whole shark body, the liver and the advanced embryos were carried off for sale.

Sijo, P. (2012). Whale shark landings at Cochin Fisheries Harbour, Kerala. *Marine Fisheries Information Service (T&E Series)*, 212, 17.

The author reports the landing of two small whale sharks at Cochin Fisheries Harbour by gillnetters on 20 November 2010 and 3 February 2011. He notes that the first shark measured 148 cm in total length and weighed 17 kg, while the second, which was 172 cm long, weighed 19 kg.

Sijo, P. (2013). Rare bluntnose sixgill shark *Hexanchus griseus* landed at Sakthikulangara Fisheries Harbour, Kollam. *Marine Fisheries Information Service (T&E Series)*, 215, 31.

The author reports the landing of a bluntnose sixgill shark, *Hexanchus griseus* at Sakthikulangara Fisheries Harbour on 15 November 2012 by a deepsea trawler operated at a depth of 300 m west of Kollam, Kerala. He presents some morphometric measurements of the shark which measured 18 cm in total length and weighed 7 kg.

Silas, E. G. (1986). The whale shark *Rhiniodon typus* smith in Indian coastal waters is the species endangered or vulnerable? *Marine Fisheries Information Service (T&E Series)*, 66, 1 - 17.

The author discusses the conservation status, occurrence and taxonomy of the whale shark (*Rhiniodon typus*) from Indian coastal waters, Pakistan & Sri Lanka. He presents previous data and reports of the occurrence of the same in the region and also along both the coasts of India. He also discusses the mode of development, size and feeding, its centre of origin and dispersal, natural enemies and longevity, schooling behavior, association with tuna and other animal associates and its status, concluding that it was more likely to be highly vulnerable rather than endangered.

Silas E. G. & Prasad N. K. (1969). On the occurrence of the deep water squaloid shark *Squalus fernandinus* Molina from the continental slope off west coast of India. *Current Science*, 38(20), 484 - 486.

The authors report their observations on a single specimen of the squaloid shark *Squalus fernandinus* obtained during exploratory trawl surveys in the depth range of 290 - 325 m in the continental slope off Quilon, on the south-west coast of India. This is a new distributional record for the species in Indian waters. The authors present a detailed description with an illustration of the specimen, which was a male measuring 495 mm in total length and weighing 480 g.

Silas, E. G. & Rajagopalan M. S. (1963). On the recent capture of a whale shark (*Rhincodon typus*) Smith, at Tuticorin, with a note on information to be obtained on whale sharks from Indian waters. *Journal of the Marine Biological Association of India*, 5(1), 153 - 157.

The authors report the landing of a female whale shark at Tuticorin on 29 July 1961, after being entangled in nylon gillnets operated off Tuticorin, north of Thollaiyiram Paar, the previous day. They note that the shark was auctioned for ₹385/- and immediately cut up for curing. The authors present morphometric measurements of the shark, which measured 5.62 m in total length. They also describe the stomach contents, which are comprised predominantly of zooplankton, particularly crustacean forms. The authors discuss the need for gathering more data on whale sharks from the Indian coast and provide a model data recording sheet enlisting the information needed.

Silas, E. G. & Selvaraj, G. S. D. (1972). Description of the adult and embryo of the bramble shark

Echinorhinus brucus (Bonnaterre) obtained from the continental slope of India. Journal of the Marine Biological Association of India, 144(1) (1992), 395-401.

The authors describe the bramble shark *Echinorhinus brucus* from samples obtained from the continental slope of India. The specimens they examined include three adults - two males and one female, collected between depths of 270 to 360 m off Quilon on the southwest coast of India and one female embryo collected from 216 m depth in the northeastern Gulf of Mannar. They provide detailed descriptions with illustrations, morphometric measurements and details of dentition and dermal armature and also provide information on the proximate composition of the muscle and liver. They report high moisture content of 78.66%in the meat and high oil content of 78.07 % in the liver, with negligible Vitamin A content of only 360 USP/gm of oil. Based on the dates of their collections, they suggest that the species breeds during April-July but recommend further studies on the breeding season and habits.

Silas, E. G. & Selvaraj, G. S. D. (1985). On the occurrence of the rough-tail sting ray *Dasyatis centroura* (Mitchill) in Indian waters. *Indian Journal of Fisheries*, 32(2), 248 - 255.

The authors record, for the first time, the occurrence of the rough-tail stingray *Dasyatis centroura* in Indian waters, based on a male specimen obtained during exploratory trawling at 250 m depth in the upper continental slope off Quilon on the west coast of India. They present a detailed description with illustrations and morphometric measurements of the specimen, which measured 242 cm in total length and 123 cm in disc width. They also describe the variations seen from earlier descriptions of the species from the Atlantic and Mediterranean regions. They observe that *D. centroura* shows some geographical variations in the number and disposition of tuberculated scales, the number of caudal spines, the length of tail and its caudal fold, and the shape of the pelvic fin, and presents some similarities and variations with *D. uarnak*, *D. sephen*, *Taeniura meyeni* and *D. pastinacus*.

Silas, E. G., Selvaraj, D. & Reghunathan, A. (1969). Rare chimaeroid and elasmobranchs fish from the continental slope off the west coast of India. *Current Science*, 38(5), 105 - 106.

The authors record the occurrence of the rare chimaeroid fish *Neoharriotta pinnata* and two rare sharks, *Echinorhinus brucus* and *Atractophorus armatus* Gilchris, at 180 - 450 m depth on the upper continental slope off the west coast of India through exploratory trawl survey. The identification of *Neoharriotta pinnata* is based on two adult females obtained from 360 m depth on 24 May 1968 at 12° 17' N, 74° 13' E, and five juveniles (2 males and 3 females) from 396 m depth on the same day, at 12° 12' N, 74° 10' E; they also record two empty egg cases from 180-206 m depth at 10° 53' N, 75° 08' E, on 27 April 1968. They confirm the occurrence of *E. brucus* based on a 1.62 m long male, obtained from 405 m depth at 12° 06' N, 74° 23' E on 27 July 1968. The occurrence of *Atractophorus armatus* is confirmed from seven females fished from 329 m depth at 09° 00' N, 75° 42' E, on 12 November 1968. The authors present diagnostic description of the three species.

Siraimeetan, P. (1998). On a whale shark *Rhincodon typus* (Smith) caught off Manapad, Gulf of Mannar. *Marine Fisheries Information Service (T&E Series)*, 154, 17.

The author reports the accidental capture of a stray whale shark, locally called 'uruvi' or 'amminiuluvai', in the Paruvalai net of mesh size 12 - 15 cm, operated at a depth of 30 m off Manapad in the Gulf of Mannar. The whale shark was landed at Periyathalai on 27 November 1997. The author notes that there was no demand for the shark. He presents some morphometric measurements of the specimen, which measured 5.93 m in total length and weighed 2 tonnes.

Siva, M. U. & Haq, M. A. B. & Selvam, D., Babu, G. D. & Bakyaraj, R. (2013). Investigation of stingray spines by Fourier transform infrared spectroscopy analysis to recognize functional groups. *Journal of Coastal Life Medicine*, 1(3), 169 - 174.

The authors discuss the results of their investigations on the venom extract of stingrays *Himantura gerrardi, Himantura imbricata* and *Pastinachus sephen* to identify the functional groups of their toxic spines by Fourier transform infrared spectroscopic analysis. They identify the presence of free amino acids and protein having beta-sheet and random coiled secondary structure and report that the presence of O-H stretch, C=O stretch, C-H stretch, N-H deformation, O-H deformation and C-O stretch in the sample align with standard bovine serum albumin and that the influence of frictional groups within the molecule was because of the impact of preferred spatial orientation, chemical and physical interaction on the molecule. They conclude that since standard medicine is not available for treatment against injuries caused by stingray toxins, this study will serve as a baseline to further studies aimed at producing effective antibiotics.

Sivadas, M. (1991). Note on a whale shark *Rhincodon typus* landed at Beyore Calicut. *Marine Fisheries Information Service (T&E Series)*, 110, 11.

The author reports the capture of a juvenile male whale shark, in a ring net operated at 20 m depth off Beypore, Calicut on 28 February, 1991. He presents some morphometric measurements of the 3.27 m long whale shark, the smallest recorded till then from the west coast of India.

Sivadas, M., Sathakathullah, S. M., Suresh Kumar, K. & Kannan, K. (2013). Unprecedented landing of spine tail devil ray *Mobula japanica* (Müller & Henle, 1841) at Tharuvaikulam, Tuticorin. *Marine Fisheries Information Service (T&E Series)*, 217, 30 - 31.

The authors report an unusual instance of ten spinetail devil rays *Mobula japanica*, caught in a single haul by a drift gillnet operated at a depth of 150 m off Kanyakumari, being landed at Tharuvaikulam landing centre in Tuticorin on 13 September 2013. They report that the disc width (DW) of the rays ranged from 108 - 234 cm, and one female measuring 234 cm had one pup which measured 110 cm in DW, much larger than the reported size at birth of 70 - 85 cm DW.

Sivadas, M., Ranjith, L., Sathakathullah, S. M., John James, K. & Suresh Kumar, K. (2013). Pregnant female spinner shark, *Carcharhinus brevipinna* (Müller & Henle, 1839) landed at Tharuvaikulam, Tuticorin. *Marine Fisheries Information Service (T&E Series)*, 215, 18.

The authors record the landing of a pregnant spinner shark, *Carcharhinus brevipinna*, at the Tharuvaikulam landing centre in Tuticorin on 9 August 2012, having been caught by a drift gillnet operated at 40 m depth off Manapad. They note that the pregnant shark, which measured 283 cm in total length, carried 18 pups, nine in each uterus, and present morphometric measurement of 8 pups. The length of the pups ranged from 31 to 53 cm and their weight from 507 to 606 g. The authors also note that this observation is the maximum record for both the size of the fish and the number of pups.

Sivaprakasam, T. E. (1966). On the capture of two giant ray *Manta birostris* Walboum at Veraval, Saurashtra. *Journal of the Marine Biological Association of India*, 7 (1), 204 - 205.

The author reports the capture of two female giant devil rays, *Manta birostris*, by fishermen from Maharashtra who carried out long line fishing along the Saurashtra coast. The first was caught on 28 December 1961 at 50 m depth off Veraval, using hooks with catfish and ray fillets as bait. The second was entangled in bottom-set nylon gillnet at 30 m depth on 15 March 1962. The author notes that on both occasions, the liver was extacted for oil extraction and the flesh, being considered

inedible, the carcasses were discarded back into the sea. The author records some morphometric measurements of the two specimens, and notes two instances of misnomenclature by earlier researchers for specimens of the same species recorded from Puri and Karachi.

Sivasubramaniam, K. (1969). New evidences on the distribution of predatory pelagic sharks in the tuna grounds of the Indian Ocean. Bulletin of the Fisheries Research Station of Ceylon, 20, 65-72.

The author presents an account of the pattern of tuna and shark species in the tuna fishing grounds in the Indian Ocean, extending from 20°N to 45°S latitudes. He states that though there is only a small difference in the percentage of carcharhinids in the catches made in the ranges 0°-10°N and 0°-10°S, there is very significant difference in the extent of the damages from these two ranges because of the large difference in the hooked rates of sharks for the respective ranges; maximum damage to tuna catches by predatory shark was observed between 20°-10°N (19.4%) and 10°N-0° (18.9%). He reports the genera *Isurus*, *Carcharhinus* and *Alopias* between 20°-10°N and *Prionace, Isurus*, *Carcharhinus, Alopias, Galeoerdo, Sphyrna, Mobula* and *Myrlobatus* between 10°N-0° latitudes.

Sobhana, K. S., Seetha, P. K., Kishore, T. G., Divya, D. D., Najmudeen, T. M., Nair, R. J., Kizhakudan, S. J., & Zacharia, P. U. (2013a). Heavy landings of the shortfin mako shark *Isurus oxyrinchus* at Cochin Fisheries Harbour. *Marine Fisheries Information Service (T&E Series)*, 215, 30.

In this article, the authors discuss the heavy landings of shortfin mako shark *Isurus oxyrinchus* during January-February 2013 at Cochin Fisheries Harbour (CFH) by multiday gillnet-hooks and line units. They report the length and weight ranges of the sharks as 100 - 220 cm and 7 - 75 kg, respectively, and also note that the species dominated the shark landings at CFH on some days, second only to the silky shark *Carcharhinus falciformis*. A noteworthy observation is that the fishing grounds extend from Gujarat to Kerala on the west coast of India.

Sobhana, K. S., Seetha, P. K., Kishore, T. G., Divya, D. D. Najmudeen, T. M., Nair, R. J., Kizhakudan, S. J., & Zacharia, P. U. (2013b). Unusual landing of the whitetip reef shark *Triaenodon obesus* at Cochin Fisheries Harbour. *Marine Fisheries Information Service (T&E Series)*, 215, 31 - 32.

The authors report the unusual landing of about 500 kg of the whitetip reef shark *Triaenodon obesus* at Cochin Fisheries Harbour on 28 January 2013 by gill netters operating at 30 m depth off Mangalore. They note the length and weight ranges of the sharks as 90-110 cm and 2-8 kg, respectively. Although reported earlier in stray numbers, this is the first instance of bulk landings of the species at Cochin, and is relevant in the light of the species having been categorised as Near Threatened in the IUCN Red List.

Sonali, S. M., Vaidya, N. G., Sharma, S. R. K. & Philipose, K. K. (2012). Observation on a deformed specimen of grey bamboo shark *Chiloscyllium griseum*, Müller & Henle, 1838 from the Arabian Sea off Karwar, Karnataka. *Marine Fisheries Information Service (T&E Series)*, 213, 14 - 15.

The authors report the occurrence of a deformed specimen of the grey bamboo shark, *Chiloscyllium griseum*, in the landings by a trawl net operated at 20 m depth off Karwar, at the Baithkol landing centre on 30 April 2012. They note that the specimen, which measured 33.2 cm in total length and weighed 186 g, had a deformed wavy body with dorsal and ventral curvatures of the spine. The specimen has been deposited by them in the museum of the Research Centre of CMFRI at Karwar.

Sreelekshmi, S., Sukumaran, S., Kishore, T. G., Sebastian, W. & Gopalakrishnan, A. (2020). Population genetic structure of the oceanic whitetip shark, *Carcharhinus longimanus*, along the Indian coast. *Marine Biodiversity*, 50 (78), 1 - 5.

The authors report the results of their investigation on about 150 samples of the oceanic whitetip shark, *Carcharhinus longimanus*, from various locations along the Indian coast in a bid to study intraspecific diversity and genetic stock structure using mitochondrial control region sequences in order to develop viable management guidelines for the Indian Ocean region. They report a lack of considerable genetic difference in the species along the Indian coast, indicating substantial gene flow and connectivity among populations. They recommend that this species can be handled as a single stock along the Indian coast.

Sreeram, M. P., Kakati, V. S., Vaidya, N. G., Dinesh, C. K. & Pai, S. V. (2011). Whale shark landings in Uttar Kannada, Karnataka. *Marine Fisheries Information Service (T&E Series)*, 208, 12 - 13.

The authors report two instances of the landing of the whale shark, *Rhincodon typus* in Uttar Kannada District, one on 27 January 2007 at Baithkol, Karwar and the other on 31 January 2009 at Gabithwada, near Ankola. They report that the first one was live but injured and that under persuasion by CMFRI staff, the fishermen released it back to the sea as the whale shark is protected in India under Schedule I of the Wildlife Protection Act, 1972 and it is illegal to catch the species. The second one was landed with a deep cut in the caudal peduncle and the authors note that an attempt was made by the fishermen to market it, but this was abandoned when they were made aware of the offence. According to the fishermen, there was a demand for the fins and flesh of this shark, though not locally. The authors present some morphometric details of the sharks, both juveniles, and suggest the need for telemetric studies to obtain data on their migration in the Arabian Sea.

Srinivasarengan, S. (1979). Occurrence of a large shoal of Javanese cownose ray, *Rhinoptera javanica* Müller & Henle in the Bay of Bengal off Madras. *Indian Journal of Fisheries*, 26 (1&2), 239.

The author records a large congregation of the cownose ray, *Rhinoptera javanica*, off Madras on 3 April 1973. Based on the fishermen's report, he notes that a majority of the shoal escaped and 690 numbers, ranging in length from 102 to 156 cm and weighing 15 - 25 kg each, were landed at Royapuram the next day. He observes that 85% of these were females, mostly gravid, measuring over 128 cm and with empty stomachs, suggesting a seasonal breeding migration. This report confirms the distribution of the species further north of the Gulf Mannar reported earlier, up to the Madras coast.

Subramani, S. (1988). On a whale shark *Rhincodon typus* Smith landed at Pudumanaikuppam. *Marine Fisheries Information Service (T&E Series)*, 81, 16.

This is a brief report on the landing of a whale shark at the Pudumanaikuppam landing centre in Madras (now Chennai) in March 1987. The author notes that it was discarded into the sea as there were no buyers for this shark. He presents a few morphometric details of the shark, which measured 506 cm in length and weighed 1250 kg.

Sukumaran, K. K., Mohammed, K. S., Chandran, K., Gupta, A. C., Bhat, U. S., & Kemparaj (1989). Long lining for deep-sea shark at Malpe- a lucrative fishery. *Marine Fisheries Information Service (T&E Series)*, 98, 10 - 13.

This article provides information on lucrative longline fishing for sharks off Malpe, by about 100 units. The authors describe the units and note that the fishing operations were carried out mostly at night at depths greater than 100 m off Malpe using tuna and dolphin meat as bait; each longline unit had about 200 - 250 baited hooks. The fishing season extended from September to May, with peak catches in November and December. The authors report good catches of *Carcharhinus sorrah*, *Sphyrna lewini* and *C. melanopterus* in decreasing order of dominance, with a total catch of about 2000 t during 1987 - 88. They present details of the sex ratio and length

measurements of the landed sharks. They also give a detailed account of the utilisation, markets and price structure of the processed products, viz., salted flesh, liver oil and dried fins.

Sukumaran, S., Sebastian, W., Mukundan, L., Muktha, M., Akhilesh, K. V., Zacharia, P. U. & Gopalakrishnan, A. (2020). Molecular analyses reveal a lack of genetic structuring in the scalloped hammerhead shark, *Sphyrna lewini* (Griffith & Smith, 1834) along the Indian coast. *Marine Biodiversity*, 50 (18), 1 - 6.

The authors use mitochondrial cytochrome C oxidase 1 and control region sequences to look into the intra-specific genetic diversity and population genetic structure of *Sphyrna lewini* along the Indian coast (Arabian Sea and Bay of Bengal). In addition, they made comparisons of the current study's sequence data with *S. lewini* sequences received from GenBank, which revealed the presence of three (3) haplogroups belonging to the Indian/Indo-Pacific, Atlantic, and Pacific areas. Since mitochondrial DNA is maternally inherited, there was no genetic differentiation along the Indian coast and considerable differentiation between ocean basins (FST; 0.80; p 0.001), showing female philopatry and the study suggests the possibility of managing this species as a single stock.

Sundaram, S., & Thakurdas (2012). Scalloped hammerhead shark, *Sphyrna lewini* (Griffith landed by gillnetters at Sassoon Docks, Mumbai. *Marine Fisheries Information Service (T&E Series)*, 212, 20.

The authors report the landing of about 650 kg of the scalloped hammerhead shark, *Sphyrna lewini*, by 11 gillnetters at Sassoon Docks, Mumbai on 22 December 2010. This report highlights the availability of this resource in good numbers at a depth of 30 - 40 m, about 40 - 50 km off the Mumbai coast. The catch fetched a price of ₹110/kg.

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Talwar, P. K. (1974a). The hammerhead shark *Sphyrna lewini* (Griffith and Smith) from the east coast of India, with remarks on its taxonomy. *Current Science*, 43(1), 15 - 16.

The author presents a detailed description of the hammerhead shark *Sphyrna (Sphyrna) lewini* based on three specimens collected during May-June 1972 from the Orissa coast. He mentions that hammerhead sharks constituted an important catch in the drift gillnet fishery along the coast and two species, *Sphyrna (Eusphyra) blochii*, and *Sphyrna (Sphyrna) lewini* were recognized in the catch. He also mentions the capture of *Sphyrna (Sphyrna) mokarran* off the coast of Puri.

Talwar, P. K. (1974b). A contribution to the taxonomy of *Rhizoprionodon oligolinx* Springer, 1964: an important component of the shark fishery of Orissa, India. *Indian Journal of Fisheries*, 21(2), B604 - 607.

The author reports the occurrence of *Rhizoprionodon oligolinx* as an important constituent of the shark fishery of Orissa. He presents a detailed description of the species, with its taxonomic status and concludes that Day's *{nee* Ruppell) *Carcharias acutus* and Misra's*{nee* Bleeker) *Scoliodon palasorrah* were conspeciflc with *Rhizoprionodon oliogolinx* Springer and that *Scoliodon ceylonensis* Setna & Sarangdhar was also probably a synonym of *Rhizoprionodon oliogolinx.*

Talwar, P. K. (1974c). On a new bathypelagic shark, *Scyliorhinus (Halaelurus) silasi* (Fam: Scyliorhinidae) from the Arabian Sea. *Journal of the Marine Biological Association of India*, 14(2), 779 - 783.

The author describes the bathypelagic shark *Scyliorhinus (Halaelurus) silasi* from the examination of four specimens collected by

otter trawl operations off Quilon on the south-west coast of India. While the specimens were initially identified as *Halaelurus garmani*, it later became evident that they differed from the type description and figure of *H. garmani* in the colour pattern and other salient characters. Thus, this report recorded the species for the first time from the south-west coast of India. Other elasmobranchs collected with the four specimens were *Heptranchias indicus* (Agassiz), *Proscyllium alcocki*, *Raja powelli*, *Heteronarce mollis* and *Torpedo panthera.*

Talwar, P. K. (1981a). The electric rays of the genus *Heteronarce* Regan (Rajiformes: Torpedinidae), with the description of a new species. *Bulletin of the Zoological Survey of India*, 3(3), 147 - 151.

The author describes *Heteronarce prabhui*, a new Torpedinidae species from India, based on six specimens trawled at 300 metres off Quilon in the Arabian Sea. This is the first record of the genus *Heteronarce* Regan from India. He also includes a key to the three known species that have all been gathered in the region earlier. The link of *Heteronarce* to other torpedinoid taxa is also examined, as are the features used to distinguish the five Indian genera.

Talwar, P. K. (1981b). Identity of the type specimen of the Scylliorhind shark *Scyllium hispidum* Alcock. *Bulletin of the Zoological Survey of India*, 4, 231 - 234. ***Reprint not obtained.***

Talwar, P. K. (1990). Fishes of Andaman and Nicobar Islands: a synoptic survey. *Journal of the Andaman Science Association*, Port Blair 6, 71 - 102.

The author provides a complete list of fishes found in the Andaman and Nicobar Islands' freshwater, mangrove, and marine environments. The number of new species discovered in this region is listed, as well as their current status besides a complete bibliography of the fish fauna.

Talwar, P. K. & Jhingran, A. G. (1991). *Inland fishes of India and adjacent countries.* In 2 vols. Oxford & IBH Publishing Co., New Delhi, Bombay, Calcutta.

This book is a comprehensive and authoritative reference work on the freshwater fish species of the Indian subcontinent and neighboring regions. The book covers a wide range of topics related to the ichthyofauna of India, including taxonomy, distribution, biology, and ecology of inland fish species. Both volumes primarily focus on the systematics and classification of fish species, providing detailed descriptions of various families, genera, and species found in the rivers, lakes, and reservoirs of India, Pakistan, Sri Lanka, Nepal, Burma, and Bangladesh. It also includes a wealth of information on their habitat preferences, migratory behavior, and economic importance. The Elasmobranch species described are *Chiloscyllium griseum, C. indicum, Stegostoma fasciatus, Carcharhinus hemiodon, C. leucas, C. limbatus, C. melanopterus, Galeocerdo cuvier, Glyphis gangeticus, Lamiopsis temmincki, Scoliodon laticaudus, Eusphyra blochii, Sphyrna lewini, Anoxypristis cuspidata, Pristis microdon, P. pectinata, Rhinobatos annandalei, R. lionotus, Dasyatis zugei, Himantura bleekeri, H. fluviatilis, H. imbricata, H. marginata, H. uarnak, Hypolophus sephen, Aetobatus flagellum, A. narinari* and *Aetomylaeus nichofi.*

Talwar, P. K. & Kacker, R. K. (1984). *Commercial Sea Fishes of India.* Zoological Survey of India, Calcutta.

Described species: *Aetobatus narinari, Aetomylaeus maculatus, Aetomylaeus milvus, Aetomylaeus nichofii, Alopias vulpinus, Anoxypristis cuspidatus, Atelomycterus marmoratum, Carcharhinus brevipinna, Carcharhinus dussumieri, Carcharhinus hemiodon, Carcharhinus limbatus, Carcharhinus longimanus, Carcharhinus macloti, Carcharhinus melanopterus, Carcharhinus sorrah, Centrophorus moluccensis, Chaenogaleus macrostoma, Chiloscyllium griseum, Chiloscyllium indicus, Dasyatis bleekeri, Dasyatis imbricata, Dasyatis jenkinsii, Dasyatis kuhlii, Dasyatis marginatus,*

Dasyatis microps, Dasyatis pastinacus, Dasyatis sephen, Dasyatis uarnak, Dasyatis walga, Dasyatis zugei, Echinorhinus brucus, Galeocerdo cuvier, Gymnura japonica, Gymnura poecilura, Gymnura tentaculata, Gymnura zonurus, Hemipristis elongatus, Isurus oxyrinchus, Lamiopsis temminckii, Loxodon macrorhinus, Manta birostris, Mobula diabolus, Mobula mobular, Mustelus mosis, Nebrius ferrugineus, Negaprion acutidens, Pristis microdon, Pristis pectinata, Pristis zijsron, Rhina ancylostoma, Rhiniodon typus, Rhinobatos annandalei, Rhinobatos granulatus, Rhinobatos lionotus, Rhinobatos thouiniana, Rhinobatos typus, Rhinobatos variegatus, Rhinoptera adspersa, Rhinoptera javanica, Rhinoptera sewelli, Rhizoprionodon acutus, Rhizoprionodon oligolinx, Rhynchobatus djeddensis, Scoliodon laticaudus, Sphyrna blochii, Sphyrna mokarran, Sphyrna lewini, Sphyrna zygaena, Squalus blainvillei, Taeniura lymna, Taeniura melanospila, Triaenodon obesus, Urogymnus africanus.

Telang, K. Y. & Harikantra, T. B. (1988). On a large devil ray landed at Karwar. *Marine Fisheries Information Service (T&E Series)*, 85, 11.

The authors report the landing of a large female devil ray (*Manta birostris*) at Karwar by a mechanised gillnet boat on 01.12.1987. The ray measured 386 cm in length and 447 cm in breadth and weighed 800 kg.

Tewari, B. S. (1959). On a new fossil shark teeth from the Miocene beds of Kutch, western India. *Proceedings of the National Institute of Sciences*, India, 25B, 230 - 236.
Reprint not obtained.

Tewari, B. S. & Awasthi, N. (1960). A preliminary note on fossil shark teeth from Baripada beds, Orissa. *Proceedings of the Indian Science Congress Association*, Bombay, 47th Session, 3, 277.
Reprint not obtained.

Tewari, B. S., Chaturvedi, M. N. & Singh, M. P. (1960). Two new species of shark teeth from Gaj beds of Matanumarh, Kutch. *Journal of the Palaeontological Society of India*, 5-9, 74 - 76, Plate 1.

The authors describe two fossil shark teeth procured from grey coloured gypseous shales in the neighbourhood of Matanumarh village in south-western Kutch, Gujarat. They assign the teeth to the species *Carcharhius feddeni* and *Galeocerdo gajensis*. They present detailed descriptions and photographs of the teeth. The holotypes are kept in the museum of the Geology Department, Lucknow University.

Thakurdas, Sawant, A. D., Sundaram, S. & Katkar, B. N. (2006). Observations on a shoal of the Javanese Cownose Ray *Rhinoptera javanica* landed at New Ferry Wharf, Mumbai. *Marine Fisheries Information Service (T&E Series)*, 189, 22 - 23.

This paper documents the capture of a shoal of the Javanese cownose ray, *Rhinoptera javanica* by a single trawler operating off Mumbai on December 9, 2005. The authors report that the catch consisted of 28 individuals ranging in size from 98 to 99 cm in disc width for males and between 100 and 104 cm for females, and that all the females caught were pregnant with fully-grown embryos without yolk and the males were all mature with calcified claspers. This is a significant observation, suggesting a breeding aggregation of the species. The authors note that similar shoals were reported earlier from the Gulf of Mannar. The total weight of the shoal measured 425 kg and the catch fetched a price of ₹400/piece. The authors also document that the embryos fetched a good price at ₹60/piece.

Thakurdas, & Sundaram, S. (2011). First record of tawny nurse shark, *Nebrius ferrugineus* (Lesson, 1830) from the north-west coast of India. *Marine Fisheries Information Service (T&E Series)*, (209), 16.

The authors document the first record of the tawny nurse shark *Nebrius ferrugineus* from the north-west coast of India when a female shark

measuring 3.2 m in total length and weighing approximately 42 kg was caught by a multiday trawler from a depth of 45-65 m and was landed at New Ferry Wharf. The shark was auctioned for ₹22,000/-at the landing centre.

Thakurdas, Sundaram, S., Katkar, B. N. & Chavan, B. B. (2010). Accidental capture and landing of whale shark, *Rhincodon typus* (Smith, 1828) and tiger shark, *Galeocerdo cuvier* (Peron and Le Sueur, 1822) by trawlers at New Ferry Wharf, Mumbai. *Marine Fisheries Information Service (T&E Series)*, 205, 17 - 19.

The authors report the accidental capture of a female whale shark, *Rhincodon typus* and a female tiger shark *Galeocerdo cuvier* by trawlers off Mumbai coast. The sharks were landed at New Ferry Wharf on 23 March 2009 and 17 January 2009 respectively. The authors note that the whale shark measuring 3.1 m weighed 0.4 t and is the smallest recorded whale shark caught from Maharashtra waters, while the tiger shark measuring 4.2 m in total length weighed 1.1 t and is the largest tiger shark recorded from Maharashtra waters. They also present details of earlier records of landings of whale sharks and tiger sharks in Maharashtra.

Thakurdas, Sundaram, S., Khandagale, P. A. & Mhatre, V. (2011). Observations on the fecundity of *Rhynchobatus djiddensis* (Forskal, 1775). *Fishing Chimes*, 31 (8), 28 - 29.

This paper is a brief observation on the fecundity of *Rhynchobatus djiddensis* based on two pregnant females landed at New Ferry Wharf, Mumbai, on 8 June 2009. The fishes were caught by trawlers while fishing at depths of 30-40 m at 60-70 km towards north-west coast of Mumbai. The guitarfishes, measuring 225 and 230 cm in total length, carried seven and nine embryos each, which the authors record to be of 279-300 mm total length. The authors present the length, weight, sex, length of placental cord, and diameter of yolk sac of these embryos.

Thakurdas, Sundaram, S. & Mane, S. (2007). Ray skin- an emerging unconventional source of leather. *Marine Fisheries Information Service (T&E Series)*, 192, 17 - 18.

The authors discuss an emerging trend in leather production from fish skin, including the skin of rays. Listing the commercially important rays landed at Mumbai, they note that among the rays, the skin of *Himantura uarnak* was the most expensive because of its colourful and intricate patterns. They mention Nepal as the major market for ray skin, followed by America (presumably U.S.A.), Germany and France. The authors estimate the production cost of fish skin leather to be ₹40 per sq. feet, which is lower than the production cost of conventional leather (₹70-90 per sq. feet).

Thakurdas, Waghmare, K. B. & Sreeram, M. P. (2007). Unprecedented landing of sharks by hook and lines at New Ferry Wharf, Mumbai. *Marine Fisheries Information Service (T&E Series)*, 192, 15.

The authors report an unusual landing of 3.2 t of sharks by two hand-operated hook & liners of south Tamil Nadu at New Ferry Wharf, Mumbai, on August 31, 2006. The number of sharks landed was 300, out of which the authors record 270 *Carcharhinus limbatus* of 110-125 cm total length (TL), 21 *Galeocerdo cuvier* of 173-210 cm TL and 3 *Carcharhinus sorrah* of 115-128 cm TL.

Thanapati, V., Ravindran, M., Leslie, V. A., Ganesan, S., Pakkiri, A., Janakiraman, A. & Anbu, M. (2006). *Rhiniodon typus* landed at Kovalam fish landing centre. *Marine Fisheries Information Service (T&E Series)*, 190, 22.

In this very brief report, the authors document the washing ashore of a 21.1 ft long dead female whale shark trapped in a multifilament polypropylene net, at Kovalam on 18th July 2005.

Thangavelu, R., Ghosh, S., Mohamed, G., Zala, M. S., Dhokia, H. K., Avinash, R. & Fofandi, M (2009). Rare occurrence of the bramble shark

Echinorhinus brucus (Bonnaterre, 1788) along the Veraval coast. *Marine Fisheries Information Service (T&E Series)*, 202, 17 - 18.

The authors report the landing of a bramble shark *Echinorhinus brucus*, caught in a trawl operated near the Pakistan border, at the Veraval landing centre. The shark measured 87.5 cm in length and weighed 2.63 kg. The authors have listed some morphometric measurements of the shark.

Thathayya, Ch. E. (1996). Landing of whale shark *Rhiniodon typus* at the Kakinada coast. *Marine Fisheries Information Service (T&E Series)*,143, 27.

The author reports the landing of a male whale shark accidentally entangled, on 6 February 1996, in a nylon gillnet operated at a depth of 15 m off Myapatnam in the Upppada region of the Kakinada coast (Andhra Pradesh). It was landed the next day, but as there was no demand for the flesh, the shark was definned and disposed of back into the sea on 8 February 1996. The author presents some morphometric measurements of a 530 m long shark which weighed 1 tonne.

Theivasigamani, M. & Subbiah, S. (2014). Elasmobranch fishery resources of Gulf of Mannar, southeast coast of India. *World Journal of Fish and Marine Sciences*, 6(1), 24 - 29. https://doi.org/10.5829/idosi.wjfms.2014.06.01.7662

This is a brief article in which the authors list the elasmobranch species recorded in the fishery in the Gulf of Mannar on the southeast coast of India during a seven-month study from April 2012 to October 2012. The list includes 6 orders, 19 families and 65 species of elasmobranchs and the authors note that species of the orders Myliobatiformes and Carcharhiniformes form 49.23% and 32.31% of the elasmobranch landings in the region.

Thillayampalam, E. M. (1928). *Scoliodon* (the common shark of the Indian seas). In *The Indian zoological memoirs on Indian animal types*. Lucknow, Methodist Publishing House.

In this work, the author offers an exhaustive and detailed account of *Scoliodon*, commonly known as the dogfish or common shark, which inhabits the Indian seas. As Part of the *Indian Zoological Memoirs on Indian Animal Types* series, the book presents comprehensive observations on the species' morphology, including intricate descriptions of its skin, exoskeleton, and endoskeleton. It also provides in-depth analysis of the shark's respiratory system, blood-vascular system, nervous system, and urogenital systems, along with important developmental insights. The work includes well-executed diagrammatic representations that enhance the clarity of these descriptions. In addition to these biological details, the book explores the species' behavior and distribution within the Indian marine environment. A notable feature of this work is its practical section, which offers clear and precise instructions for the dissection of *Scoliodon*, making it a valuable resource for researchers and students alike. The book is an early example of scientific documentation of marine life in India, adding valuable information to the study of Indian zoology.

Thomas, M. M. & Kartha K. K. (1964). On the catch of the juvenile whale shark *Rhincodon typus* Smith from Malabar Coast. *Journal of the Marine Biological Association of India*, 6(1), 174 - 175.

The authors report the capture of a juvenile whale shark, *Rhincodon typus*, in a boat seine, 'Paithuvala', operated at 12 fathoms off the Cannanore coast and landed at Thayyil landing centre on 27th February 1963.

Thomas, S., Purushottama, G. B., Nataraja, G. D. & Kizhakudan, S. J. (2020). Fishery and biological characteristics of the spadenose shark *Scoliodon laticaudus* Müller & Henle, 1838 from the Eastern Arabian Sea. *Regional Studies in Marine Science*, 34, 1 - 9.

The authors describe the relative abundance and biological characteristics of the spadenose shark,

Scoliodon laticaudus, from the southeastern Arabian Sea along Karnataka, India. They report that the species, which is landed mostly by trawl nets, formed about 13% of the total shark landing in the region during 2012-2017, with an average annual landing of 112 t and maximum landing in January. From observations on 852 specimens, the authors provide estimates of LWR for sexes separately and pooled, with "b" values of 2.2386, 2.7497 and 2.6840 for male, female and sexes pooled, respectively. Lm^{50} for females and males were estimated as 32 and 33 cm. They report a predominatly piscivorous diet. The authors advocate the need for immediate measures to ensure sustainable exploitation of resources in the light of a declining fishery.

Thomas, S., Raje, S. G., Gowda, C., Naik, N. A. & Kempuraju, S. (2007). On the first record of pigeye shark *Carcharhinus amboinensis* (Muller and Henle) from Karnataka. *Marine Fisheries Information Service (T&E Series)*, 194, 20 - 21.

The authors record a pregnant pigeye shark, *Carcharhinus amboiensis* caught by a trawler at 60-80 m depth during night operations off Mangalore in November 2006. The animal measured 2 m in length and weighed 500 kg; morphometric measurements of the shark are presented. They report this as a first record from the Arabian Sea off Karnataka.

Thomas, V. J., Hezhakiel, K. C., Varghese, M. & Sreekumar, K. M. (2013). Whale shark, *Rhincodon typus* landed at Kalamukku fish landing centre, Kerala. *Marine Fisheries Information Service (T&E Series)*, 217, 8.

In this brief report, the authors document the landing of a whale shark, *Rhincodon typus*, by a trawl net at the Kalamukku fish landing centre on 23 May 2013. The fish was caught at 70 m depth off Kochi and measured 5 m in total length.

Tombazi, N. A. 1934. Battle with a giant bat-ray (*Dicerobatis eregoodoo*). *Journal of Bombay Natural History Society*, 37, 227 - 229.

The author describes an encounter with a large-sized devil ray *Dicerobatis eregoodoo* during an expedition off the Karachi coast (now in Pakistan) in 1933. The ray, entangled in the anchor warp and finally struck with harpoons and "*kukris*" weighed about 4000 to 5000 lbs. The author records some length measurements and notes the distance wing to wing as 22 feet and width of mouth as 4 feet. While describing the ray, The author mentions the fact that these rays have often been seen in good numbers in the Gulf of Kutch.

Tyabji, Z., Jabado, R. W. & Sutaria, D. (2018). New records of sharks (Elasmobranchii) from the Andaman and Nicobar Archipelago in India with notes on current checklists. *Biodiversity Data Journal*, 6, e28593. https://doi.org/10.3897/BDJ.6.e28593

The authors present an updated checklist of shark species occurring in the Andaman and Nicobar Islands, based on fish landing surveys conducted from January 2017 to April 2018. They report 59 species, with 12 species being reported for the first time from the region. These include the bignose shark (*Carcharhinus altimus*), pigeye shark (*Carcharhinus amboinensis*), bull shark (*Carcharhinus leucas*), snaggletooth shark (*Hemipristis elongata*), slender weasel shark (*Paragaleus randalli*), Arabian smoothhound shark (*Mustelus mosis*), Indonesian houndshark (*Hemitriakis indroyonoi*), sand tiger shark (*Carcharias taurus*), Indonesian bambooshark (*Chiloscyllium hasseltii*), tawny nurse shark (*Nebrius ferrugineus*), dwarf gulper shark (*Centrophorus atromarginatus*), and the Indonesian shortsnout spurdog (*Squalus hemipinnis*). They also report a size extension in the total length of *C. hasseltii* by 27 cm and of *P. randalli* by 8 cm. They present the diagnostic features of each of the twelve species with photographs. They also provide a list of published literature on the biodiversity of sharks in the Andaman and Nicobar Islands. Citing issues of inaccurate identification of species, the authors suggest integrating morphological identification with molecular techniques to confirm the occurrence of a species, and adopting a precautionary approach in managing the fishery.

V

Vankara, A. P., Vijayalakshmi, C. & Gangadharam, T. (2007). On a new species, *Cathetocephalus leucas* (Tetraphyllidea: Cathetocephalidae) from the bull shark, *Carcharhinus leucas* (Valenciennes, 1839) from Bay of Bengal, Visakhapatnam coast, Andhra Pradesh, India. *Journal of Parasitic Diseases*, 31(2), 114 - 119.

Reprint not obtained.

Vankara, A. P., Vijayalakshmi, C. & Vijayalakshmi, J. (2006). Description of a new species, *Polypocephalus kuhlii n. sp.* (Lecanicephalidea: Polypocephalidae) from *Dasyatis kuhlii* (Müller & Henle) from Visakhapatnam Coast, Bay of Bengal, India. *Journal of Parasitology and Applied Animal Biology*, 15(1 - 2), 63 - 68.

Reprint not obtained.

Vankara, A. P., Vijaya Lakshmi, C. & Vijaya Lakshmi, J. (2007). *Polypocephalus viskhapatnamensis* sp. nov. (Lecanicephalidea: Polypocephalidae) from *Himantura uarnak* (Forsskål) and *Dasyatis* (Amphotistius) *zugei* (Müller and Henle) from Visakhapatnam coast. *Journal of Parasitic Diseases*, 31(2), 152 - 154.

Reprint not obtained.

Varghese, S. P., Gulati, D. K., Unnikriishnan, N. & Ayoob, A. E. (2016). Biological aspects of silky shark *Carcharhinus falciformis* in the eastern Arabian Sea. *Journal of the Marine Biological Association of the United Kingdom*, 96(7), 1437 - 1447. https://doi.org/10.1017/S0025315415001575

The authors discuss the reproduction, diet and growth of the silky shark *Carcharhinus falciformis* from 473 specimens in the length range of 67-275 cm collected from Cochin fisheries harbour during 2012-2014. They estimate the von Bertalanffy growth parameters L_{∞}, K and t_0 as 309.80 cm, 0.10 $year^{-1}$ and -2.398 year respectively, and longevity as 27.56 years. Length at first maturity is 217 cm for males and 226.5 cm for females, with the corresponding ages being 9.66 years and 10.73 years, respectively. They report the brood size of silky sharks to be 3-13, averaging 7.6 embryos and they estimate the length at birth to be 65.1-67 cm. From observations on the stomach contents of 113 specimens, they conclude that the diet spectrum of silky shark is diverse, including at least 17 teleost species, seven species of cephalopods, one crab and one scyphozoan species.

Varghese, S. P., Somvanshi, V. S. & Dalvi, R. S. (2014). Diet composition, feeding niche partitioning and trophic organisation of large pelagic predatory fishes in the eastern Arabian Sea. *Hydrobiologia*, 736, 99 - 114. https://doi.org/10.1007/s10750-014-1895-4

The authors present information on the prey species composition, trophic level, diet overlap and trophic organisation of 12 large oceanic predatory fishes cohabiting in the eastern Arabian Sea, including three elasmobranchs - the pelagic thresher shark *Alopias pelagicus*, silky shark *Carcharhinus falciformis* and pelagic sting ray *Pteroplatytrygon violacea*. They observe that most of the large pelagic predators in the eastern Arabian Sea fed mainly on three preys, namely, the purple-back flying squid *Stenouteuthis oualaniensis*, swimming crab *Charybdis smithii* and flyingfishes. They classify *C. falciformis* and *P. violacea* as crab feeders foraging in epipelagic waters and *A. pelagicus* as a mesopelagic predator foraging in mesopelagic waters. While the sharks fed mainly at night and occasionally during the day, the stingray fed mainly during the day and occasionally during night-time. The authors suggest that resource partitioning among the large predatory fishes in the eastern Arabian Sea is achieved through differences in prey types and depth and time of feeding.

Varghese, S. P., Unnikriishnan, N., Gulati, D. K. & Ayoob, A. E. (2017). Size, sex and reproductive biology of seven pelagic sharks in the eastern Arabian

Sea. *Journal of the Marine Biological Association of the United Kingdom*, 97(1), 181 - 196.

The authors present information on the size structure, sex and maturity of seven pelagic sharks -pelagic thresher *Alopias pelagicus*, bigeye thresher *A. superciliosus*, oceanic whitetip shark *Carcharhinus longimanus*, tiger shark *Galeocerdo cuvier*, shortfin mako *Isurus oxyrinchus*, longfin mako *I. paucus* and blue shark *Prionace glauca* from the eastern Arabian Sea based on 1449 specimens collected from landings at the Cochin fisheries harbour during 2013-2014. From 656 pelagic threshers in the length range of 142-319 cm, they estimate the L_{T50} for males and females as 254.96 and 271.39 cm respectively. They estimate that the size at birth of pelagic threshers in the eastern Arabian Sea will be 137.8-142 cm. The L_{T50} for male and female bigeye threshers are estimated at 263.5 and 310.69 cm respectively, from 217 specimens in the length range of 135-361 cm. The authors estimate the size at birth of bigeye threshers in the eastern Arabian Sea at 118-135 cm. From 212 oceanic whitetip sharks in the length range of 65-265 cm, the authors estimate the L_{T50} for males and females as 207.19 and 187.74 cm respectively. They estimate the size at birth at 64.2-65 cm. From 217 tiger sharks in the length range of 85-398 cm, the authors estimate the L_{T50} for males and females as 286.56 and 300.31 cm respectively, and size at birth to be 79.6-85.2 cm. They estimate the L_{T50} for male and female shortfin makos at 189.05 and 266.42 cm respectively, from 96 specimens in the length range of 97-269 cm. The number of samples of longfin mako and blue shark being limited, the authors preclude the estimation of reliable maturity indices in these species.

Varghese, S. P., Vijayakumaran, K., Tiburtius, A. & Mhatre, V. D. (2015). Diversity, abundance and size structure of pelagic sharks caught in tuna longline survey in the Indian Ocean. *Indian Journal of Geo-Marine Science*, 44(1), 26 - 36.

The authors present information on the diversity and abundance of pelagic shark bycatch in tuna longline operations in the northern Indian Ocean during 2004-2010. They report the capture of 1501 sharks, with the maximum contribution from the Andaman & Nicobar region, followed by the eastern Arabian Sea. The lowest contribution was from the western Bay of Bengal. Sharks constituted 19.5% of the tuna longline surveys they conducted during the period. *Alopias pelagicus*, *Carcharhinus limbatus*, *A. superciliosus* and *C. falciformis* were the dominant species of sharks. The authors present details of the year-wise hooking rate and catch by number and weight of each species in different areas of the Indian Ocean. In addition to unidentified sharks, they record the occurrence of 19 species of sharks in the bycatch. They also provide information on the sex ratio and length-weight parameters of three thresher sharks and two requiem sharks.

Veena, S., Sujitha, T., Raje, S. G. & Durgekar, N. (2011). Case of leucism in the spadenose shark, *Scoliodon laticaudus* (Müller and Henle, 1838) from Mangalore, Karnataka. *Indian Journal of Fisheries*, 58(1), 109 - 112.

The authors report leucism in the spadenose shark, *Scoliodon laticaudus*, caught by a commercial trawler off Mangalore coast, from a single male specimen measuring 50 cm in total length and weighing 430 g. Presenting the morphometric measurements and pattern of decolouration noticed in the specimen, the authors attribute their definition of this case as leucism due to the colour irregularity, partial depigmentation of the body surface and normal retinal pigmentation.

Velankar, N. K. & Kamasastri, P. V. (1955). Shark spoilage bacteria. *Current Science*, 24(8), 272 - 273.

In this letter to the Editor, the authors highlight their findings on a study of bacterial isolates from spoiling muscle of the shark *Scoliodon* sp.

Venkatesan, V., Ramamoorthy, N., Boominathan, N. & Gandhi, A. (2008). Stranding of a whale

shark, *Rhincodon typus* (Smith) at Pamban, Gulf of Mannar. *Marine Fisheries Information Service (T&E Series)*, 198, 19 - 22.

The authors report the stranding of a dead male whale shark measuring 875 m in length and weighing approximately 2.1 t at Pamban, Gulf of Mannar. They provide detailed morphometric measurements of the animal and an updated list of all reported instances of whale shark capture/sighting/stranding along the Indian coast from 1988 to 2006. They conclude that the maximum numbers of whale sharks have been reported in the months of March and December.

Venkateswarulu, T. (1967). *Rhina ancylostoma*, Schneider from the inshore waters off Porto Novo, S. India. *Journal of Bombay Natural History Society*, 64(1), 118 - 119.

The author reports the capture of a single specimen of *Rhina ancylostoma* from the inshore waters off Porto Novo in September, 1961. He provides a brief description of the specimen, with some morphometric measurements, and notes that the gut contents include appendages of *Squilla*, crabs and semi-digested organic matter. The specimen is preserved at the Ichthyological Museum of the Marine Biological Station, Porto Novo.

Verlecar, X. N., Desai, S. S. R. & Dhargalkar, V. K. (2007). Shark hunting - An indiscriminate trade endangering elasmobranchs to extinction. *Current Science*, 92(8), 1078 - 1082.

In this general article, the authors capsule available information on Indian shark fisheries, shark fin exports in India in relation to Asian countries, shark products, grading of shark fins, species extinct and under threat in India, species-specific DNA tests and actions to encourage protection of sharks.

Verma, K. K. (1965). On fossil shark teeth from the Bagh Beds of Amba Dongar area, Gujarat State. *Current Science*, 9(5), 289 - 290.

In this letter to the Editor, The author records the discovery of fossil shark teeth from the oyster bed zone of the Bagh Beds of Amba Dongar area in Baroda district of Gujarat. The records are of 12 species (including 2 new species and one new variety of sharks) - *Scapanorhynchus baghensis* Verma n.sp., *S. subulate* (Agassiz), *Lamna appendiculate* (Agassiz) var. *mongraensis* Verma, n. var., *L. marginata* (Egerton), *L. basalis* (Egerton), *L. cf. libyca* Quaas, *Oxyrhinahastalis* Agassiz, *Corax pristodontus* Agassiz, *Ginglymostomasokotense* white, *Carcharhius* (*Prinodon*) *egertoni* (Agassz), and *C.* (*P.*) *ambadongarensis* Verma, n. sp. The author provides a brief description of the new species and variety, with a photograph plate of the fossil teeth.

Verma, O. (2015). Cretaceous vertebrate fauna of the Cauvery Basin, southern India: Palaeodiversity and palaeobiogeographic implications. *Palaeogeography, Palaeoclimatology, Palaeoecology,* 431,53 - 67. DOI: 10.1016/j.palaeo.2015.04.021
Reprint not obtained.

Verma, O., Khosla, A., Kaur, J. & Prashanth, M. (2017). Myliobatid and pycnodont fish from the Late Cretaceous of Central India and their paleobiogeographic implications. *Historical Biology*, 29 (2), 253 - 265. https://doi.org/10.1080/08912963.2016.1154954
Reprint not obtained.

Verma, O., Prasad, G. V. R., Goswami, A. & Parmar, V. (2012). *Ptychodus decurrens Agassiz* (Elasmobranchii: Ptychodontidae) from the Upper Cretaceous of India. *Cretaceous Research*, 33(1), 183 - 188. https://doi.org/10.1016/j.cretres.2011.09.014
Reprint not obtained.

Verma, S. C. (1928). Some cestodes from Indian fishes, including four new species of Tetraphyllidea and revised keys to the genera *Acanthobothrium* and *Gangesia. Allahabad University Studies*, 4, 119 - 176.
Reprint not obtained.

Vijayakumaran, K. & Philip, K. P. (1994). On a pelagic thresher *Alopias pelagicus* caught off North of Kakinada. *Marine Fisheries Information Service (T&E Series)*, 133, 19.

In this brief technical report, the authors document the capture of a male pelagic thresher shark (*Alopias pelagicus*) by a bottom trawlnet from 70 m depth off Kakinada (Andhra Pradesh) on the east coast of India. They observe that common misidentification of *A. pelagicus* as *A. vulpinus* and the landing of these sharks by commercial vessels after removal of tails might have contributed to the lack of continuity in the spatial distribution of this species.

Vijayalakshmi, C. & Sarada, S. (1995). Studies on the new species *Tylocephalum chiralensis*, parasite from *Dasyatis (Himantura) uarnak* (Förskal) from Chirala coast, Andhra Pradesh, India. *Boletín Chileno de Parasitología*, 50 (3 - 4), 73 - 75.
Reprint not obtained.

Vijayalakshmi, C. & Sarada, S. (1996). A new species of *Phyllobothrium*, parasite from *Rhinoptera javanica* from Waltair Coast, Andhra Pradesh, India. *Boletín Chileno de Parasitología*, 51 (1 - 2), 12 - 14.
Reprint not obtained.

Vijayalakshmi, C., Vijayalakshmi, J. & Gangadharam, T. (1996). Some trypanorhynch cestodes from the shark *Scoliodon palasorrah* (Cuvier) with the description of a new species, *Tentacularia scoliodoni. Rivista di Parassitologia*, 13 (57), 83 - 89.
Reprint not obtained.

Vinu, J., Rajeeshkumar, M. P., Parmeswaran, U. V., Sumod, K. S., Akhilesh, K. V., Manjebrayakath, H. & Sanjeevan, V. N. (2017). Redescription and sexual dimorphism of Andaman leg-skate *Cruriraja andamanica* (Chondrichthyes: Rajiformes) with comments on the zoogeography of the genus *Cruriraja*. *Journal of Fish Biology*, 91 (2), 587 - 602. http://dx.doi.org/10.1111/jfb.13371.

The authors redescribe *Cruriraja andamanica*, based on five juvenile (four males, one female) and four adult (three males, one female) specimens taken from Andaman waters, with a thorough representation of its secondary sexual dimorphic traits. They also provide an updated key to the species and discuss the zoogeography of the genus *Cruriraja* across the world's oceans.

Vishnu, K. V., Ajeesh Kumar, K. K., Asha, K. K., Remyakumari, K. R., Ganesan, B., Anandan, R., Chatterjee, N. S. & Suseela M. (2015). Protective effects of *Echinorhinus brucus* liver oil against induced inflammation and ulceration in rats. *Fishery Technology*, 52, 252-257.

The authors present the results of their studies on the anti-inflammatory and anti-ulcer activities of bramble shark liver oil in rats. They report that oral administration of shark liver oil at 1 g kg^{-1} concentration significantly attenuated the formalin-induced paw edema in experimental rats and that it exerted a potent anti-ulcer effect against acid-ethanol mixture-mediated lesion formation in the rat gastric mucosa. They found that the fatty acid profile of bramble shark liver oil included major nutritionally significant fatty acids such as the saturated fatty acids palmitic acid, myristic acid, and stearic acid and unsaturated fatty acids oleic acid, linoleic acid, linolenic acid, arachidonic acid, EPA and DHA, which contribute to the bioactivity of the oil.

Vishnu, V., Ajeesh Kumar, K. K., Chatterjee, N. S., Suvanish, K., Shyni, K. Jayarani, R. N. & Suseela M. (2016). Biochemical characterization of liver oil of *Echinorhinus brucus* (bramble shark) and its cytotoxic evaluation on neuroblastoma cell lines (SHSY-5Y). *Scientifica*, 2016, 6294030. http://dx.doi.org/10.1155/2016/6294030

The authors profile biochemical constituents of liver oil extracted from *Echinorhinus brucus* and also evaluate the cytotoxic activity against neuroblastoma cell lines. Characterization of the liver oil revealed the presence of palmitic acid (15%), oleic acid (12%), stearic acid (8%), docosahexaenoic acid (DHA) (18%),

and eicosapentaenoic acid (EPA) (16%). It was also found to be a good source of squalene (38.5%) and fat-soluble vitamins such as A, D, and K (vitamin A: 17.08 mg/100 g of oil, vitamin D: 15.04 mg/100 g oil, and vitamin K: 11.45 mg/100 g oil). It showed a high *in vitro* cytotoxic effect in a dose-dependent manner against the human neuroblastoma cell line (SHSY-5Y) with IC50 value between 35 and 45 ng. Based on these results, the authors suggest that bramble shark liver oil is a good candidate for studies in cancer therapy.

Vishnu, V., Doke, S. N. & Thomas, P. (1997). Thermostable water dispersion of shark meat and its application to prepare protein powder. *Journal of Aquatic Food Product Technology*, 6 (3), 53 - 68. http://dx.doi.org/10.1300/J030v06n03_04

The authors attempt to prepare gel from shark myofibrillar proteins by reducing the pH of washed, collagen-free, shark meat homogenate in water to 4.0 by acetic acid. The proteins in the dispersion remained stable after being heated to 100 degrees Celsius. They note that when the dispersion was heated after increasing the pH to 6.0 or adding salts, the proteins precipitated. They have also discussed some characteristics of the protein powder.

Vivekanandan, E. & Zala, M. S. (1994). Whale shark fishery of Veraval. *Indian Journal of Fisheries*, 41(1), 37 - 40.

The authors review the whale shark fishery in Veraval coast. They give information on the modus operandi of whale shark fishing. The hunting estimate for the year 1988-1991 is given as 648 by 701 units. Whale shark hunting, triggered by demand for whale shark oil, would commence in March every year, with peak fishing in April-May. The authors describe utilization and trade of whale shark byproducts. While they made observations on 92 of the 648 sharks caught during the period, they provide details of the length frequency and sex ratio of 63 sharks. They observe that there are no records to indicate a directed fishery for the whale shark elsewhere in the world and the objective of their study was limited to reporting the existence of the whale shark fishery at Veraval.

Y

Yadagiri, P. (1986). Lower Jurassic lower vertebrates from Kota Formation, Pranhita-Godavari Valley, India. *Journal of the Paleontological Society of India*, 31, 81-96.

The author describes lower vertebrates from well-preserved skeletal parts recovered from the Lower Jurassic Kota Formation of Pranhita-Godavari valley, including a freshwater shark (hybodont), *Lonchidion indicus* (Heterodontiformes: Hybodontidae). He presents a systematic description of the species with pictures of the teeth plates in labial and occlusal views.

Z

Zacharia, P. U. & Kanthan, K. P. (2010). Unusual heavy landing of rays and skates at Tuticorin Fisheries Harbour. *Marine Fisheries Information Service (T&E Series)*, 205, 13-15.

In this technical report, the authors discuss unusually heavy landings of rays and skates at Tuticorin Fisheries Harbour on 15 July 2009. The landing of rays and skates on this day alone was estimated as 33.3 t consisting of nine species of rays and four species of skates. The authors provide a detailed report of the fishing voyages, species composition, length range and sex ratio of the major species and price structure and marketing. They conclude by stating the need for regulating the batoid fishery in the Gulf of Mannar.

Zacharia, P. U. & Vivekanandan, E. (2013). Shark fishery and conservation in Indian waters: need for a National Plan of Action. In: *Regional Symposium on Ecosystem Approaches to Marine Fisheries & Biodiversity*, October 27-30, 2013, Kochi.

The authors discuss the status of shark fishing in India. Ranked second among the shark fishing nations in the world, India contributed 9% to world production of sharks in 2010. The authors note that small-sized sharks have increased in landings as opposed to larger sharks. Shark landings in India showed an increasing trend till 2000 and a decreasing trend thereafter. The authors state that as developing strategies for conservation and management of shark populations are becoming increasingly important globally, and considering the importance of India as a major shark fishing nation and the vulnerability of sharks to fishing, it is important that the country evolves a management plan for shark fisheries. Preparation of the National Plan of Action for Sharks (NPOA - Sharks) following FAO's technical guidelines will pave the way for implementation of an effective management plan. The authors also suggest guiding principles for NPOA-Sharks.

Zacharia, P. U., Joshi, K. K. & Kanthan, K. P. (2011). First record of the pelagic stingray *Pteroplatytrygon violacea* (Boneparte, 1832) (Family: Dasyatidae) from the east coast of India. *Indian Journal of Fisheries*, 58(1), 95-98.

The authors document the first record of the pelagic stingray *Pteroplatytrygon violacea* from the east coast of India based on a female specimen of 91 cm TL they collected from hook & line landings at Tuticorin on 9 July 2009. They compare the morphometric measurements of this specimen with those recorded earlier from the North Sea and found variations in certain characters from the paratype, which they attributed to sex specific changes.

Zacharia, P. U., Kizhakudan, S. J., Thomas, S., Manojkumar, P. P., Nair, R. J., Najmudeen, T. M., Purushottama, G. B., Muktha, M., Dash, S. S., Akhilesh, K. V. & Remya, L. (2017). *Non-Detriment Findings (NDF) for the export of Shark and Ray species listed in Appendix II of the CITES and harvested from Indian waters. CMFRI Marine Fisheries Policy Series No-6;* Central Marine Fisheries Research Institute, Kochi, pp. 1-102. ISBN ISSN 2394-8019

The authors present the outcome of Non-Detriment Findings studies on the scalloped hammerhead shark *Sphyrna lewini*, great hammerhead shark *Sphyrna mokarran*, smooth hammerhead shark *Sphyrna zygaena*, oceanic whitetip shark *Carcharhinus longimanus*, giant manta ray *Manta birostris* and reef manta ray *Manta alfredi,* all of which were included in Appendix II of CITES in September 2014, in keeping with the guidelines laid down by CITES, to enable decisions on the extent of trade regulation in a signatory nation. The NDF suggests that while the fishery of hammerhead sharks and oceanic whitetip sharks did not pose a serious threat to the stocks of these species, there must be a check on the exploitation of juvenile hammerheads from the inshore waters. The NDFs allow international trade in these sharks and their by-products can be done with CITES certification, subject to existing regulatory laws on shark fin trade implemented by the Government of India. In the case of manta rays, however, it was found that while available information was insufficient to assess the stock, the high biological vulnerability of the rays calls for a precautionary approach, which includes intensive awareness generation among stakeholders.

Zacharia, P. U., Kizhakudan, S. J., Sobhana, K. S., Manojkumar, P. P., Thomas, S., Nair, R. J., Najmudeen, T. M., Purushottama, G. B., Dash, S. S., Santhosh, B., Ranjith, L., Saravanan, R. & Yousuf, K. S. S. M. (2014). भारतीय वन्यजीव (संरक्षण) अधिनियम के तहत संरक्षित उपास्थिमीन प्रजातियों का विवरण. In: विशेष प्रकाशन सं. 115 जलीय पारितंत्र का टिका ऊपन. A description of elasmobranchs protected under the Indian Wildlife (Protection) Act. In: Special Publication No. 115 - Sustainability of aquatic ecosystems. ICAR- Central Marine Fisheries Research Institute, Kochi, pp. 28-30.

In this article, the authors present a brief account of each of the ten species of elasmobranchs that were included under Schedule I of the Indian Wildlife (Protection) Act, 1972 - whale shark *Rhincodon typus*, sawfishes *Pristis microdon*, *Pristis zysron* and *Anoxypristis cuspidata*, gangetic shark *Glyphis gangeticus*, speartooth shark *Glyphis glyphis*, Pondicherry shark *Carcharinus hemiodon*, giant guitarfish *Rhynchobatus djiddensis*, porcupine ray *Urogymnus asperrimus* and ganges stingray *Himantura fluviatilis.*

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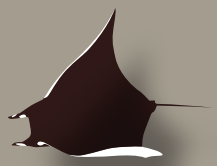
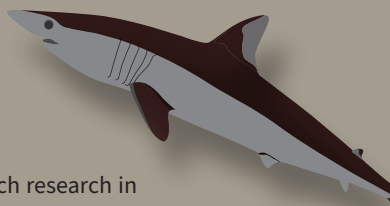
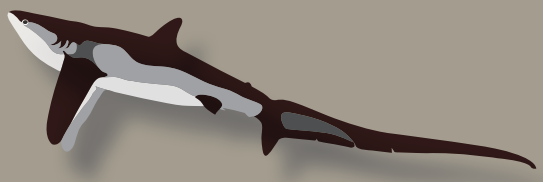
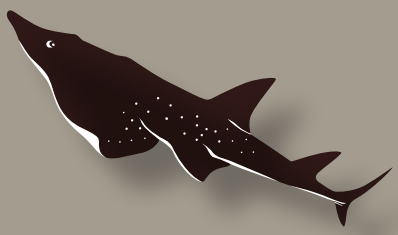
Annotated **Bibliography** of Elasmobranch Research in India





This annotated bibliography offers a thorough overview of elasmobranch research in Indian waters, showcasing the depth and richness of studies conducted over decades. It focuses on critical areas such as taxonomy, species diversity, fisheries, biology, and stock assessment of elasmobranchs. However, much of the early work has remained scattered and difficult to access. This volume addresses that challenge by compiling a comprehensive collection of documents, some of which were previously elusive. Through detailed annotations, it organizes this wealth of knowledge into a single, user-friendly electronic resource. This compilation not only provides easy access to historical and contemporary research but also serves as a crucial reference for scientists, students, and marine enthusiasts. By bridging gaps in accessibility, this bibliography enhances understanding and promotes further research on elasmobranchs in India's marine ecosystems.





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