

ON THE DISTRIBUTION OF THE ELASMOBRANCHS AND CHIMAERAS OF THE INDIAN REGION IN RELATION TO THE MEAN ANNUAL ISOTHERMS

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In the "Check list of the Fishes of India, Burma and Ceylon, Part I. Elasmobranchii and Holocephali", by one of us¹ the limits of the Indian region² have been indicated as "on the west, the Gulf of Oman and then from Ras-el-Haad southwards along Long. 60°E.; on the South, from Lat. 1°S., where it meets Long 60°E., eastwards to the coast of Sumatra; on the East, the coast of Burma" Hundred and nine species were listed in it from within this area, 106 of Elasmobranchs and 3 of Chimaeras. Besides, a new species of Elasmobranch, *Proscyllium alcocki*,³ has since been added to this list. A note on the geographical relationship of these 110 species of the Indian region with special reference to the isotherms is given below. It may also be mentioned here that other delimiting factors, both chemical and physical, such as salinity, currents, food, etc., in the distribution of these fishes, are left out of consideration in this note.

The *mean annual* isotherms of 6°C, 12°C and 20°C are shown by dotted lines in the accompanying map (Text-fig. 2). The 20°C isotherm north of the equator commences from a little above Florida (35°N. Lat. and 76°W Long.) on the eastern coast of N. America and traverses the Atlantic to reach the west coast of French West Africa (20°N. Lat. and 16°W Long.) and again extends from a little above Shanghai on the China coast (30°N. Lat. and 122°E. Long.) to California on the western coast of N. America (28°N. Lat. and 115°W Long.). The 20°C isotherm south of equator starts from about the middle of the eastern coast of S. America (28°S. Lat. and 52°W Long.) and gently curves to the western coast of S. Africa opposite to St. Helena (22°S. Lat. and 12°E. Long.) and is continued again from the Cape of Good Hope (35°S. Lat. and 20°E. Long.) traversing the Indian Ocean to the mid-western coast of Australia (28°S. Lat. and 115°E. Long.). From the mid-eastern coast of Australia (32°S. Lat. and 153°E. Long.) the isotherm smoothly curves across the Pacific to the coast of Ecuador in S. America (4°S. Lat. and 82°W Long.). The distribution of the pelagic Indian Elasmobranchs is remarkably correlated with the temperature of the sea water,

¹ Misra, K. S., *Rec. Indian Mus.* XLV, pp. 1-46 (1947).

² "Indian region" is not meant as a subfaunal area as such. We have tried only to show how far "Indian" elasmobranchs extend their distribution *vis a vis* the "Indian region" as defined by one of us in the check list.

³ Misra, K. S., *J. zool. Soc. India*, II, pp. 87-89, pl. i, figs. 1-5 (1950); *Rec. Indian Mus.* XLIX [1951], pp. 101, 104 (1952).

they being found restricted mainly within the range of the 20°C isotherms north and south of the equator, and extending eastwards far into the Pacific, even to the western coasts of tropical N. & S. Americas but not far westwards into the Atlantic beyond the Cape of Good Hope.

For detailed and specific distribution of the fishes under discussion, reference may be made to the Appendix showing their longitudinal and latitudinal ranges as well as their depth records wherever available. A close study of the range of their distribution reveals the following facts :—

i. Out of 110 species listed, 3 Chimaeras (2 of which have been recorded only from their egg-capsules), and 6 Elasmobranchs, being bathypelagic¹, are not affected by such physical barriers as the isotherms from the distributional point of view.

ii. Out of the 3 Chimaeras, 1, and of the 107 Elasmobranchs 23 species are known from single records and may be taken as exclusively endemic (until otherwise proved as found elsewhere by future surveys) being restricted only in the Indian region north of the equator.

iii. Out of the total number of Elasmobranchs, 8 species are remarkably cosmopolitan, extending from the east coast of Africa eastwards through the Indo-Pacific to the islands of Polynesia and even to the tropical zones of the west coasts of N. and S. Americas within the latitudinal range 8°S. to 35°S. and 20°N. to 35°N.

iv. Eight species of the Indian Elasmobranchs have a wide range extending from the Indian region eastwards through the Indo-Pacific to the islands of Polynesia beyond 180°E. longitude within the latitudinal range of 12°S. to 30°S. and 20°N. to 35°N., but not to the west coasts of N and S. Americas.

v. Sixtyeight species of Elasmobranchs are not so cosmopolitan and are confined within the 180°E. longitude, their range of distribution being 35°S. to 35°N. Lat. and 20°E. to 180°E. Long. Six species out of this group, viz., *Pentanchus indicus*, *Hypoprion hemiodon*, *Sphyrna mokarran*, *Physodon mulleri*, *Raja powelli* and *Narke dipterygia*, have, however, been recorded only from within a more restricted range of 2°N. to 35°N. and 40°E. to 130°E.

vi. Eleven species out of the 107 Elasmobranchs, viz., *Rhincodon typus*, *Isurus glauca*, *Carcharhinus lamia*, *Carcharhinus limbatus*, *Galeocerdo arcticus*, *Sphyrna tudes*, *Sphyrna zygaena*, *Dasyatis (Dasyatis) pastinaca*, *Pristis microdon*, *Pristis pectinatus* and *Aetobatus narinari* extend their range of distribution into the Mediterranean and the tropical Atlantic between 5°S. to 35°N. Lat. and 15°E. to 89°W Long.

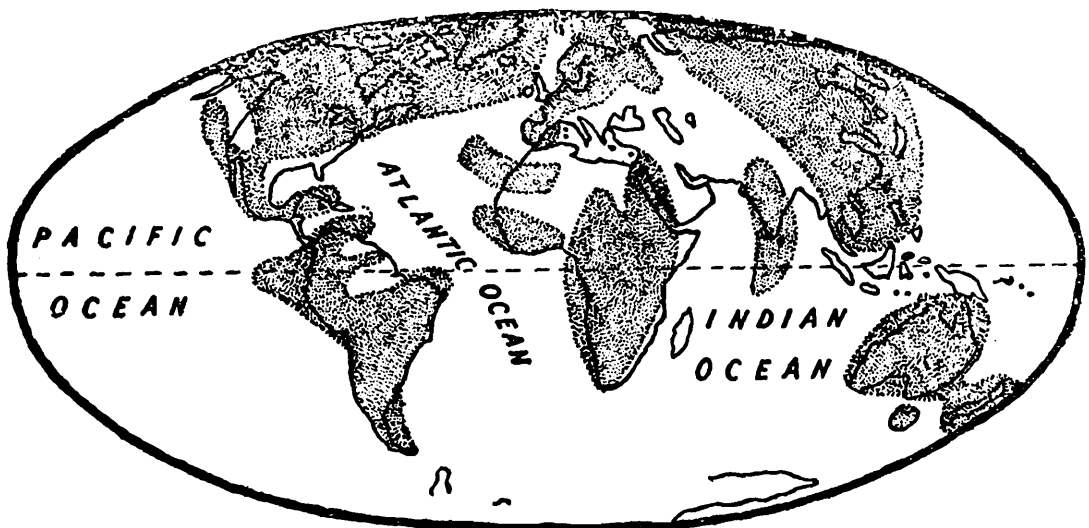
It can be seen from the above observations that the Elasmobranchs of the Indian waters are distributed widely from the Red Sea through the Indian and Pacific Oceans to the east coast of tropical N. and S. Americas, while their distribution towards the west is restricted, the Indian forms being hardly found beyond the west of the Cape of Good

¹ According to Norman, J. R., [*A History of Fishes*, p. 253 (1949)] bathypelagic fishes occur below 500 metres. Also see Myers, G. S., *Proc. 6th Pacific Science Congress*, III, p. 201 (1940).

Hope. The reason for this phenomenon is that the 12°C isotherm (Text-fig. 2), which borders the south-west coast of Africa beyond west of the Cape of Good Hope and extends upto 22°S. latitude, serves as a physical barrier for the free dispersal of the Indian species into the Atlantic. In this context it is worthwhile quoting Smith¹ who observes :

“ The blanket of cold water along our west coast is so much a barrier to most warm water forms, that to a large extent it prevents the intermingling of the fishes of the tropical Atlantic with those of the Indianic shores of South Africa. Further, the Benguella current flowing northwards tends to limit the penetration of Cape waters by fishes from even the colder parts of the Atlantic, and in consequence the Cape represents a well-defined line of division between the Atlantic and the Indo-Pacific fishes ”.

The occurrence of some of the Indian species, mentioned above, in the Mediterranean and the tropical Atlantic, however, requires explanation. “ It is probable, ” as suggested by Smith², “ that these are the relics of earlier intermingling, for not very long ago in geological time, conditions were different, and there was almost certainly a warm water connection between the Indian and Atlantic Oceans ”. It may also be explained by the configuration of the land masses during the Eocene period when the Mediterranean sea extended eastwards and opened into the Indian Ocean, and the isthmus of Panama was submerged under sea and the Atlantic and the Pacific Oceans were continuous (Text-fig. 1), thereby making it possible for a free dispersal of the species.



TEXT-FIG. 1.—Map showing land distribution in the Eocene (after Norman).

Besides, the recent and artificially constructed Panama³ and Suez canals may have, to a certain degree, served as a connecting passage for the migration of these species.

Thus it is seen that temperature has a profound effect on the life of these pelagic fishes limiting their penetration into the colder waters of the Atlantic west of the Cape of Good Hope. It is also known that ecological

¹ Smith, J. L. B., *The Sea Fishes of Southern Africa*, p. 8 (1949).

² Smith, J. L. B., *The Sea Fishes of Southern Africa*, p. 7 (1949).

³ Though the Panama canal is mostly freshwater, we feel, it may not be a real barrier at least to quite a few marine species that can live for sometime in freshwater. It is significant in this context to remember that one of the Indian marine elasmobranchs *Dasyatis (Pastinachus) sephen* is quite common in freshwater in the Ganges as high as Allahabad, while a few others occur all through the year in the Hooghly at Calcutta where the salinity is very low.

conditions of cold water zones of the ocean are bound to be so different from those of warmer water zones as to expect a certain degree of geographical raiation in many of the pelagic fishes. Scott¹ in his comparative study of the yellow tail flounder from three Atlantic fishing areas has recently established this truth beyond any doubt. Myers² also while discussing the distribution of the Californian sardine has observed that it is "extremely unlikely that a surface swimming, semipelagic fish inhabiting as cool water as does this sardine, could pass the equitorial regions", thereby emphasising temperature as a major factor in the distribution of fishes. And taxonomists in dealing with the relationship of the species or sub-species in the species-complex may give due consideration to the ecology of these marine forms as indicated by the isotherm (temperature), for instance. Besides, a detailed study of the geographical distribution of marine fishes in relation to the isotherms may be of use to taxonomists in revealing which of these widely ranging species are in more urgent need of a revisionary study on world basis. To cite two examples: Fowler³ in his "Contributions to the biology of the Philippine Archipelago and adjacent regions" has treated *Galeocerdo tigrinus* M. & H., whose type locality is Pondicherry in the 20°C isotherm, and *Squalus arcticus* Faber, whose type locality is Iceland in the 6°C isotherm, as synonyms of *Galeocerdo cuvier* (Lesueur) whose type locality is the northwest coast of New Holland in the 20°C isotherm. One of us⁴ has synonymised *G. tigrinus* with *S. arcticus*, but agreeing with Whitley⁵ separated *G. cuvier* from *G. arcticus*. Boulenger⁶ considers *G. arcticus* as confined to the Arctic seas and *G. tigrinus* as restricted to all tropical and temperate seas. From a study of the isotherms it seems probable that *G. tigrinus* of the Indian waters which is synonymous with *G. cuvier* (Lesueur) of the N. W. Australian waters may, after proper taxonomic investigation, prove to be a subspecies of *Galeocerdo cuvier*.

Smith⁷ in his work, "The Sea Fishes of Southern Africa", as also Fowler⁸ puts *Heptranchias platycephalus* (Tenore) of the 12°C isotherm in the synonymy of *Heptranchias cepedianus* (Peron) which has been recorded from S. Australia and New Zealand in the 12°C isotherm. They have also treated *Notidanus indicus* Agassiz of the 20°C isotherm as a synonym of *H. cepedianus*. Whitley⁹ in his "Fishes of Australia" maintains that *H. cepedianus* is endemic in Australia. We feel that *Notidanus indicus* may, as a result of proper taxonomic studies, turn out to be a subspecies of *H. platycephalus* as it is found in the 20°C isotherm :

¹ Scott, D. T., *J. Fish. Res. Board of Canada*, XI, No. 3, pp. 171-197 (1954).

² Myers, G. S., *Proc. 6th Pacific Sci. Congr.* III, pp. 201-210 (1940).

³ Fowler, H. W., *Bull. U. S. nat. Mus.* (100) XIII, p. 186 (1941).

⁴ Misra, K. S., *Rec. Indian. Mus.* XLV, p. 21 (1947).

⁵ Whitley, G. P., *Fishes of Australia*, pt. 1, p. 114 (1940).

⁶ Boulenger, G. A., *Camb. nat. Hist.* VII, pp. 448, 449 (1932).

⁷ Smith, J. B. L., *The Sea Fishes of S. Africa*, p. 38 (1949).

⁸ Fowler H. W., *Bull. U.S. nat. Mus.* (100) XIII, p. 6, (1941).

⁹ Whitley, G. P., *Fishes of Australia*, pt. 1, p. 70 (1940).

In order to study the distributional pattern of these fishes and to verify their nomenclatorial validity it will be necessary to conduct taxonomic investigations on an international basis as suggested by Horacio Rossa Jr.,¹ Fisheries Division, F. A. O. of the United Nations. But, these investigations involving the study of the species complex of the fishes have their own limitations in the present context of our knowledge of the Indian fishes.

LIST SHOWING THE LATITUDINAL AND LONGITUDINAL RANGES IN THE DISTRIBUTION OF THE ELASMOBRANCHS AND CHIMAERAS OF THE INDIAN REGION

Name of species	Range in Latitudes and Longitudes	Distribution ²
BATHYPELAGIC		
(1) <i>Chimaera monstrosa</i> L.	35°S.—0° and 20°E.—98°E.	Cape of Good Hope, Bay of Bengal in 820 metres, W. coast of Sumatra, North and Middle Atlantic and Mediterranean.
(2) <i>Harriotta indica</i> (Garman)	12°N.—13°N. and 45°E.—92°E.	Gulf of Aden, Bay of Bengal.
(3) <i>Rhinochimaera</i> sp.	90°N., 75°E.	Off Travancore coast, India.
(4) <i>Pentanchus indicus</i> (Br.) [= <i>Scyliorhinus (Halaehurus) indicus</i> Br.].	2°N.—23°N. and 47°E.—57°E.	E. Africa in 1289 metres, Gulf of Aden in 1840 metres, Gulf of Oman.
(5) <i>Benthobatis moresbyi</i> Alc.	15°N., 52°E.	Off Travancore coast, in 860 metres, India.
(6) <i>Raja andamanica</i> (Lloyd)	12°N., 92°E.	Andaman Sea in 558 metres India.
(7) <i>Raja mamillidens</i> Alc.	9°N., 79°E.	Gulf of Manaar, in 1194 metres.
(8) <i>Centrophorus rossi</i> Alc.	20°N., 76°E.	Travancore, in 430 fms., India.
(9) <i>Centroscyllium (Paracentroscyllium) ornatum</i> Alc.	20°N.—23°N. and 66°E.—89°E.	Arabian Sea, Bay of Bengal, in 285-405 fms.
ENDEMIC		
(1) <i>Rhinochimaera</i> sp.	9°N., 75°E.	Off Travancore coast, India.
(2) <i>Isurus guntheri</i> (Murray)	20°N., 68°E.	Karachi, W. Pakistan.
(3) <i>Negogaleus balfouri</i> (Day) (= <i>Hemigaleus balfouri</i> Day)	18°N., 84°E.	Waltair, India.

¹ H. Rossa, *Trans. Amer. Fish. Soc.* LXX, pp. 110-118 (1950), 1951.

² Certain errors and omissions which occur in the "Check List of the Fishes of India, Burma and Ceylon. I. Elasmobranchi and Holocephali" (*Rec. Indian Mus.* XLV, pp. 1-46, 1947), have been rectified.

LIST SHOWING THE LATITUDINAL AND LONGITUDINAL RANGES IN THE DISTRIBUTION OF THE ELASMOBRANCHS AND CHIMAERAS OF THE INDIAN REGION—*contd.*

Name of species	Range in Latitudes and Longitudes	Distribution
ENDEMIC— <i>contd.</i>		
(4) <i>Centrophorus rossi</i> Alc.	20°N., 76°E.	Travancore, in 430 fms., India.
(5) <i>Centroscyllium</i> (<i>Paracentroscyllium</i>) <i>ornatum</i> Alc.	20°N.—23°N. and 66°E.—89°E.	Arabian Sea, Bay of Bengal, in 285-405 fms.
(6) <i>Galeorhinus omanensis</i> Norman.	18°N., 64°E.	Gulf of Oman.
(7) <i>Zanobatus schoenleinii</i> (M. H.)	13°N., 80°E.	Madras, India.
(8) <i>Dasyatis</i> (<i>Himantura</i>) <i>alcockii</i> (Ann.)	20°N., 85°E.	Puri coast, in 20-30 fms., India.
(9) <i>Dasyatis</i> (<i>Himantura</i>) <i>favus</i> (Ann.)	20°N., 85°E.	Orissa coast, India, in 20-30 fms.
(10) <i>Dasyatis</i> (<i>Amphotistius</i>) <i>jenkinsii</i> (Ann.)	19°N., 85°E.	Off Ganjam coast, in 46-54 metres, India.
(11) <i>Dasyatis</i> (<i>Amphotistius</i>) <i>microps</i> (Ann.)	18°N.—22°N. and 85°E.—92°E.	Off Orissa coast, India, Off Chittagong coast, in 34 metres, Pakistan.
(12) <i>Aetomylus nichofii cornijera</i> (Ann.)	21°N., 87°E.	Balasore, India, in 20-30 fms.
(13) <i>Rhinoptera jayakari</i> Boulenger.	23°N., 60°E.	Off Muscat coast, Arabia.
(14) <i>Rhinoptera sewelli</i> Misra	11°N., 76°E.	Off the coast of Calicut, India.
(15) <i>Narcine brunnea</i> Ann. ¹	1°S.—22°N. and 80°E.—88°E.	India, in 20-30 fms., Ceylon.
(16) <i>Scyliorhinus</i> (<i>Halaelurus</i>) <i>quagga</i> (Alc.).	12°N., 75°E.	Malabar coast in 204 metres, India.
(17) <i>Bengalichthys impennis</i> Ann.	18°N., 85°E.	Orissa coast, India, in 20-30 fms.
(18) <i>Raja reversa</i> (Lloyd)	25°N., 65°E.	Arabian Sea, off the Baluchistan coast, in 820 fms., Pakistan.
(19) <i>Benthobatis moresbyi</i> Alc.	15°N., 52°E.	Off Travancore coast, in 860 metres, India.
(20) <i>Raja andamanica</i> (Lloyd)	12°N., 92°E.	Andaman sea, in 558 metres, India.
(21) <i>Raja mamillidens</i> Alc.	9°N., 79°E.	Gulf of Manaar, in 1194 metres.
(22) <i>Rhinobatos lionotus</i> (Norman)	21°N., 90°E.	East Channel, mouth of River Hooghli, India.
(23) <i>Proscyllium alcocki</i> Misra	5°S.—10°N. and 46°E.—95°E.	E. Africa, Andaman Islands, in 342-400 metres.

LIST SHOWING THE LATITUDINAL AND LONGITUDINAL RANGES IN THE DISTRIBUTION OF THE ELASMOBRANCHS AND CHIMAERAS OF THE INDIAN REGION—*contd.*

Name of species	Range in Latitudes and Longitudes	Distribution
COSMOPOLITAN, <i>extending from the east coast of Africa eastwards to the tropical zones of the west coasts of N. and S. Americas.</i>		
(1) <i>Aetobatus narinari</i> (Euphr.)	30°S.—20°N. and 32°E.—80°W. and 25°N., 80°W.	Natal, Madagascar, Seychelles, Red Sea, Arabia, India, in 20-30 fms., Burma, Ceylon, Malay Peninsula, Borneo, Celebes, Java, Siam, Cochinchina, Philippines, Melanesia, Micronesia, Polynesia, Hawaii Group, along the American shores of the tropical eastern Pacific and tropical Atlantic (W. Indies, Cuba).
(2) <i>Sphyrna tudes</i> (V.)	10°S.—20°N. and 40°E.—80°W. and 10°N.—36°N. and 20°E.—40°W.	E. Africa, India, Indo-China, Philippines, Melanesia, Hawaii, Panama, N. Carolina, Brazil, Mediterranean, Atlantic (West Indies).
(3) <i>Alopias vulpinus</i> (Bonnaterre)	35°S.—35°N. and 20°E.—80°W.	S. Africa, Natal, Arabia, Ceylon, Philippines, China, Korea, Japan, California, Chile.
(4) <i>Isurus glauca</i> (M.H.)	35°S.—35°N. and 20°E.—80°W. and 20°N.—50°W.	Cape of Good Hope, Red Sea, Arabia, India, Ceylon, Indo-China, Japan, Chile, St. Helena in the tropical Atlantic.
(5) <i>Carcharhinus lamia</i> (Blainville).	8°S.—30°N. and 58°E.—80°W. and 35°N.—30°E.	Arabia, India, Burma, Malay Archipelago, China, Melanesia, also in California, tropical Atlantic Ocean and Mediterranean.
(6) <i>Carcharhinus menisorrhah</i> (M.H.)	10°S.—20°N. and 40°E.—80°W.	Red Sea, Arabia, India, Burma, Malay Peninsula, Java, Indo-China, Philippines, Panama.
(7) <i>Galeocerdo arcticus</i> (Faber)	30°S.—30°N. and 32°E.—80°W. and 65°N.—20°W.	Natal, Red Sea, Arabia, India, Ceylon, Java, Indo-China, Philippines, China, Japan, Melanesia, Hawaii, the Galapagos, California and the Atlantic.
(8) <i>Rhincodon typus</i> Smith	35°S.—35°N. and 20°E.—80°W. and 30°N.—80°W.	S. Africa, Seychelles, India, Ceylon, Java, Siam, Philippines, Japan, Australia, California, Panama, Chio and the tropical Atlantic.

LIST SHOWING THE LATITUDINAL AND LONGITUDINAL RANGES IN THE DISTRIBUTION OF THE ELASMOBRANCHS AND CHIMAERAS OF THE INDIAN REGION—*contd.*

Name of species	Range in Latitudes and Longitudes	Distribution
WIDE RANGE, <i>extending from the Indian region eastwards beyond 180° E., but not reaching the tropical zones of the west coasts of N. and S. Americas.</i>		
(1) <i>Carcharhinus gangeticus</i> (M.H.)	16°S.—23°N. and 58°E.—155°W.	Arabia, India, Ceylon, Burma, Java, Indo-China, Philippines, China, Japan, Fiji, Hawaii.
(2) <i>Dasyatis kuhlii</i> (M.H.) (<i>Ampkotistius</i>)	12°S.—35°N. and 40°E.—170°W.	Zanzibar, India, in 20-30 fms., Ceylon, Singapore, Java, Celebes, Siam, Cochin-China, Philippines, China, Japan, Australia, Melanesia, Polynesia.
(3) <i>Gymnura (Gymnura) poecilura</i> (Shaw)	15°S.—35°N. and 40°E.—155°W.	Red Sea, India, in 20-30 fms., Ceylon, Malay Peninsula, Sumatra, Java, Siam, China, Japan, Polynesia.
(4) <i>Nebrius ferrugineum</i> (Lesson)	20°S.—20°N. and 40°E.—170°W.	Madagascar, Red Sea, India, Ceylon, Malay Peninsula, Malay Archipelago, Indo-China, Melanesia, Polynesia.
(5) <i>Carcharhinus limbatus</i> (M.H.)	30°S.—20°N. and 32°E.—170°W. and 20°N.—30°N. and 75°W.—80°W.	Natal, Seychelles, Red Sea, Arabia, India, Cochin-China, Polynesia, and also in tropical Atlantic (Mexico, Cuba, West Indies).
(6) <i>Carcharhinus melanopterus</i> (Q.G.)	30°S.—35°N. and 40°E.—155°W.	S. Africa, Red Sea, Arabia, India, Burma, Ceylon, Andamans, Malay Peninsula, Java, Amboinas, Siam, Indo-China, Philippines, China, Japan, Australia, Melanesia, Polynesia, Hawaii.
(7) <i>Sphyrna zygaena</i> (L.)	25°S.—35°N. and 40°E.—155°W. and 30°S.—35°N. and 25°E.—45°W.	E. Africa, Madagascar, Zanzibar, Seychelles, Red Sea, Arabia, India, Ceylon, Malay Peninsula, Indo-China, Philippines, China, Japan, Polynesia, Hawaii, Eastern Pacific, tropical Atlantic (Brazil, Malta).
(8) <i>Triaenodon obesus</i> (Rupp.)	25°S.—20°N. and 40°E.—155°W.	Madagascar, Seychelles, Red Sea, India, Pakistan, Ceylon, Malay Archipelago, Melanesia, Polynesia, Hawaii.

LIST SHOWING THE LATITUDINAL AND LONGITUDINAL RANGES IN THE DISTRIBUTION OF THE ELASMOBRANCHS AND CHIMAERAS OF THE INDIAN REGION—*contd.*

Name of species	Range in Latitudes and Longitudes	Distribution
NON-COSMOPOLITAN, <i>not extending eastwards beyond 180°E.</i>		
(1) <i>Heptranchias platycephalus</i> (Tenore)	35°S.—35°N. and 20°E.—130°E.	South Africa, India, Indian Ocean, China, Japan.
(2) <i>Chiloscyllium griseum</i> (M.H.)	35°S.—35°N. and 20°E.—130°E.	S. Africa, Red Sea, India, Malay Peninsula, China, Japan.
(3) <i>Chiloscyllium indicus</i> (Gmelin)	35°S.—22°N. and 20°E.—160°E.	Cape of Good Hope, Red Sea, Arabian Sea, India, Burma, Ceylon, Malay Peninsula, Malay Archipelago, Siam, Indo-China, Formosa, China, Melanesia (Solomon Islands).
(4) <i>Chiloscyllium ocellatum</i> (Bonnaterre)	20°S.—9°N. and 80°E.—160°E.	India, Malay Archipelago, N. W. Australia, Queensland, Melanesia.
(5) <i>Chiloscyllium plagiosum</i> (Bennett)	35°S.—35°N. and 20°E.—130°E.	Cape Conolly, Madagascar, India, Burma, Malay Archipelago, Siam, China, Japan.
(6) <i>Nebrius concolor</i> (Rupp.)	20°S.—20°N. and 40°E.—160°E.	Madagascar, Red Sea, India, Ceylon, Malay Peninsula, Java, Philippines, Solomon Islands.
(7) <i>Steoptostoma varium</i> (Seba)	25°S.—35°N. and 40°E.—152°E.	Zanzibar East Africa, Madagascar, Red Sea, India, Ceylon, Malay Peninsula, Malay Archipelago, Siam, Indo-China, Formosa, China, Japan, Australia.
(8) <i>Scyliorhinus capensis</i> (M.H.) (<i>Scyliorhinus</i>)	35°S.—15°N. and 20°E.—75°E.	Cape of Good Hope, Natal, in 20-200 fms., India.
(9) <i>Scyliorhinus burgeri</i> (M.H.) (<i>Halaaelurus</i>)	4°S.—25°N. and 30°E.—130°E.	India, Malay Archipelago, China, Japan.
(10) <i>Scyliorhinus hispidum</i> (Alc.) (<i>Halaaelurus</i>)	5°S.—10°N. and 46°E.—95°E.	E. Africa, Andaman Islands, in 342-400 metres.
(11) <i>Atelomyxterus marmoratus</i> (Bennett)	10°S.—5°N. and 80°E.—125°E.	Ceylon, India, Malay Peninsula, Singapore, Java, Sumatra, Amboina, Siam, Indo-China, China.
(12) <i>Physodon mulleri</i> (M.H.)	20°N.—22°N. and 85°E.—125°E.	India, Philippines, China.
(13) <i>Scoliodon palasorrah</i> (C.)	35°S.—35°N. and 20°E.—130°E.	S. Africa, Red Sea, Arabia, India, Ceylon, Malay Peninsula, Java, Siam, Indo-China, Philippines, China, Japan.

LIST SHOWING THE LATITUDINAL AND LONGITUDINAL RANGES IN THE DISTRIBUTION OF THE ELASMOBRANCHS AND CHIMAERAS OF THE INDIAN REGION—*contd.*

Name of species	Range in Latitudes and Longitudes	[Distribution
NON-COSMOPOLITAN, <i>not extending eastward beyond 180°E.</i> — <i>contd.</i>		
{14} <i>Scoliodon sorrakowah</i> (C.)	10°S.—35°N. and 60°E.—130°E.	Mekran, India, Ceylon, Burma, Malay Peninsula, Java, Siam, Indo-China, Philippines, Japan.
{15} <i>Garcharias tricuspidatus</i> Day	35°S.—10°N. and 20°E.—115°W.	South Africa, India, Indo-China.
{16} <i>Scoliodon walbeehmi</i> Blkr.	29°S.—35°N. and 30°E.—130°E.	Natal, India, Ceylon, Malay Peninsula, Java, Indo-China, Philippines, Formosa, China, Japan.
{17} <i>Aprionodon acutidens</i> (Rupp.)	4°S.—20°N. and 55°E.—115°E.	Seychelles, Red Sea, Arabia, India, Indo-China.
{18} <i>Hypoprion hemiodon</i> (M.H.)	14°N.—23°N. and 58°E.—123°E.	Arabia, India, Indo-China, Philippines.
{19} <i>Hypoprion macloti</i> (M.H.)	5°S.—25°N. and 62°E.—70°W.	Mekran, India, Ceylon, Malay Peninsula, Philippines, Melanesia, Chile.
{20} <i>Carcharhinus</i> <i>bleekeri</i> Dumeril	4°S.—20°N. and 40°E.—79°E.	Seychelles, Red Sea, India, Pondicherry.
{21} <i>Carcharhinus</i> <i>dussumieri</i> (M.H.)	15°S.—23°N. and 44°E.—123°E.	E. Africa, Arabian Sea, India, Ceylon, Malay Peninsula, Java, Indo-China, Philippines.
{22} <i>Carcharhinus ellioti</i> (Day.)	1°S.—25°N. and 58°E.—80°E.	Arabia, Pakistan, Karachi, Ceylon.
{23} <i>Carcharhinus pleurotzenia</i> (Blkr.)	10°S.—18°N. and 40°E.—123°E.	India, Singapore, Java; Philippines.
{24} <i>Carcharhinus sorrah</i> (M.H.)	25°S.—22°N. and 40°E.—155°E.	Madagascar, Red Sea, India, Malay Peninsula, Malay Archipelago, Indo-China, China, Melanesia, Hawaii.
{25} <i>Carcharhinus temminckii</i> (M.H.)	5°S.—22°N. and 80°E.—118°E.	India, Burma, Malay Archipelago.
{26} <i>Mustelus manazo</i> Blkr.	30°S.—35°N. and 32°E.—130°E.	Natal, India, Pakistan, Ceylon, Indo-China, China, Korea, Japan.
{27} <i>Sphyrna blockii</i> (C.)	5°S.—22°N. and 72°E.—110°E.	Ceylon, India, Burma, Malay Peninsula, Malay Archipelago, Siam, Indo-China
{28} <i>Sphyrna mokarran</i> (Rupp.)	20°N.—24°N. and 40°E.—115°E.	Red Sea, India, Pakistan, China.

LIST SHOWING THE LATITUDINAL AND LONGITUDINAL RANGES IN THE DISTRIBUTION OF THE ELASMOBRANCHS AND CHIMAERAS OF THE INDIAN REGION—*contd.*

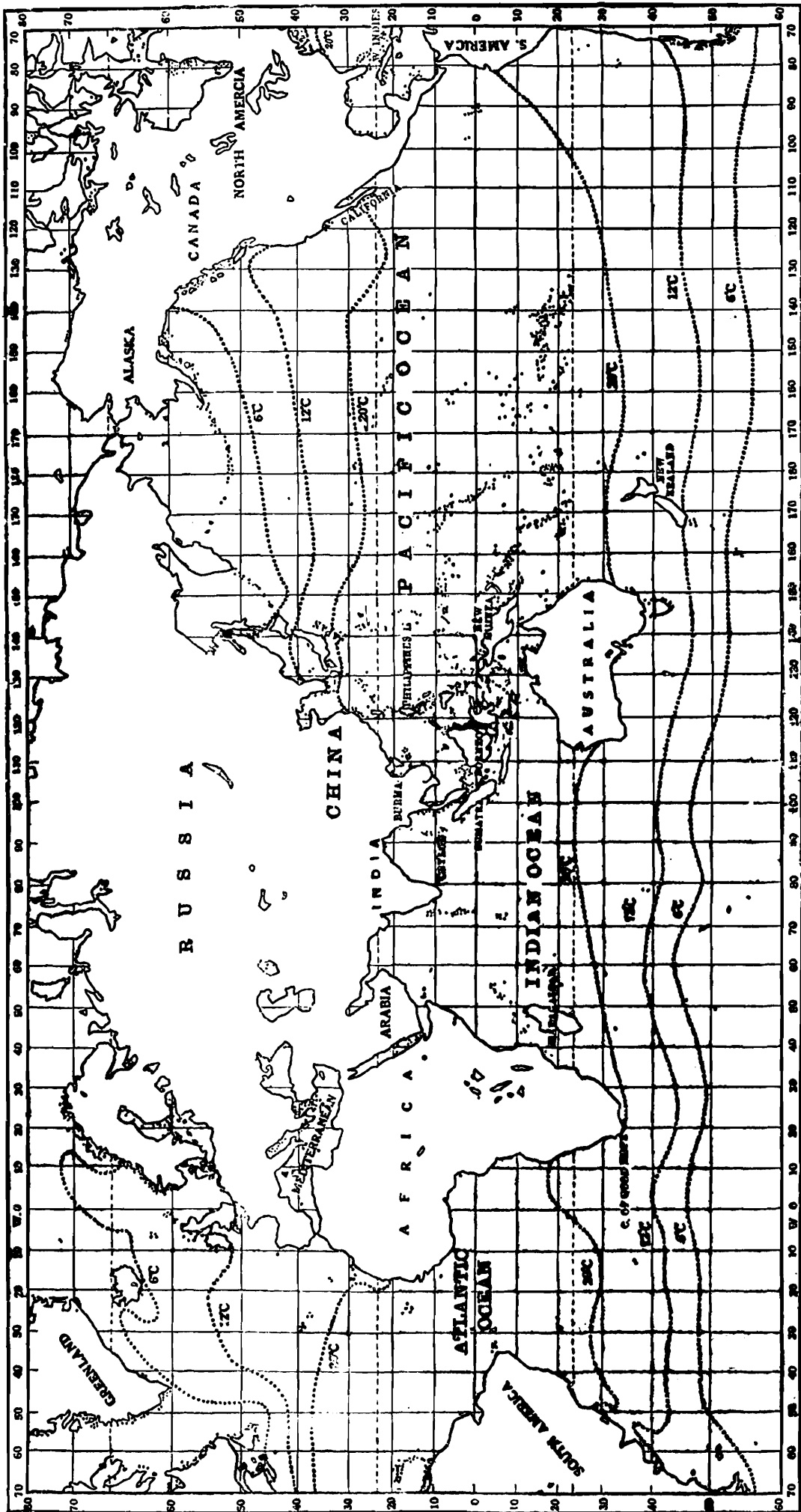
Name of species	Range in Latitudes and Longitudes	Distribution
NON-COSMOPOLITAN, <i>not extending eastwards beyond 180°E.</i> — <i>contd.</i>		
(29) <i>Manta ehrenbergii</i> (M.H.)	35°S.—25°N. and 40°E.—85°E.	Natal, S. Africa, Red Sea, Karachi, Pakistan, Puri, India.
(30) <i>Rhinobatos annandalei</i> (Norman)	5°S.—21°N. and 80°E.—100°E.	India, in 20-30 fms., Ceylon, Malay.
(31) <i>Rhinobatos armatus</i> (Gray)	5°S.—10°N. and 75°E.—116°E.	India, Malay Peninsula, Malay Archipelago.
(32) <i>Rhinobatos granulatus</i> (C.)	1°S.—29°N. and 75°E.—130°E.	India, in 20-30 fms., Ceylon, Andamans, Burma, Malay Peninsula, Malay Archipelago, Siam, Cochin-China, China.
(33) <i>Rhynchobatus djiddensis</i> (Forsk.)	25°S.—35°N. and 40°E.—180°E.	E. Africa, Madagascar, Seychelles, Zanzibar, Red Sea, Arabia, India, in 20-30 fms., Ceylon, Andamans, Malay Peninsula, Malay Archipelago, Cochin-China, Philippines, Japan, Melanesia.
(34) <i>Pristis cuspidatus</i> Latham	10°S.—20°N. and 40°E.—110°E.	Red Sea, India, in 20-30 fms., Ceylon, Andamans, Burma, Malay Peninsula, Cochin-China.
(35) <i>Pristis microdon</i> Latham	25°S.—20°N. and 40°E.—125°E. and 5°S.—15°N. and 15°W.—50°W.	Zanzibar, Madagascar, India, in 20-30 fms., Ceylon, Malay Archipelago, Philippines, tropical Atlantic (Senegal, Amazon river).
(36) <i>Pristis pectinatus</i> Latham	35°S.—20°N. and 20°E.—125°E. and 15°N.—25°N. and 75°W.—95°W.	S. Africa, Red Sea, India, in 20-30 fms., Burma, Philippines and tropical Atlantic (West Indies, Mexico).
(37) <i>Pristis zijeron</i> (Blkr.)	10°S.—25°N. and 62°E.—150°E.	India, in 20-30 fms., Ceylon, East Indies, Queensland.
(38) <i>Rhinobatos obtusus</i> (M.H.)	30°S.—22°N. and 32°E.—110°E.	S. Africa, India, Malay Archipelago.
(39) <i>Rhinobatos thouniana</i> (Shaw)	10°S.—20°N. and 40°E.—140°E.	Red Sea, India, Siam, Malay Archipelago, New Guinea.
(40) <i>Rhina ancylostoma</i> Schn.	4°S.—35°N. and 40°E.—125°E.	E. Africa, Red Sea, Seychelles, India, in 20-30 fms., Ceylon, Malay Peninsula, Cochin-China, Philippines, Japan, Australia.

LIST SHOWING THE LATITUDINAL AND LONGITUDINAL RANGES OF THE DISTRIBUTION OF THE ELASMOBRANCHS AND CHIMAERAS OF THE INDIAN REGION—*contd.*

Name of species	Range in Latitudes and Longitudes	Distribution
NON-COSMOPOLITAN, <i>not extending eastwards beyond 180°E.</i> — <i>contd.</i>		
(41) <i>Raja powelli</i> Alc.	8°N.—12°N. and 40°E.—78°E.	Gulf of Aden, Arabian Sea, in 260 metres, Gulf of Martaban, Burma, in 194 metres.
(42) <i>Raja johannis-davisi</i> Alc.	10°S.—12°N. and 40°E.—78°E.	Zanzibar, Travancore coast, in 448-558 metres, Gulf of Aden.
(43) <i>Taeniura lymma</i> (Forsk.)	20°S.—20°N. and 40°E.—180°E.	Zanzibar, Mozambique, Mauritius, Red Sea, Arabia, India, Ceylon, Malay Peninsula, Malay Archipelago, Siam, Melanesia, Polynesia.
(44) <i>Dasyatis (Himantura) bleekeri</i> (Blyth)	1°S.—20°N. and 80°E.—110°E.	India, in 20-30 fms., Ceylon, Burma, Siam, Cochin-China.
(45) <i>Taeniura meyeri</i> (M.H.)	20°S.—5°N. and 59°E.—81°E.	Mauritius, Ceylon.
(46) <i>Dasyatis (Himantura) gerrardi</i> (Gray)	10°S.—35°N. and 40°E.—180°E.	Zanzibar, Red Sea, in 20-30 fms., India, Burma, Malay Archipelago, Japan, Polynesia.
(47) <i>Dasyatis (Himantura) uarnak</i> (Forsk.)	35°S.—20°N. and 20°E.—180°E.	Cape of Good Hope, Natal, Madagascar, Seychelles, Zanzibar, Red Sea, Arabia, India, in 20-30 fms., Ceylon, Andamans, Burma, Malay Peninsula, Malay Archipelago, Siam, Cochin-China, Philippines, M e l a n e s i a, Polynesia.
(48) <i>Dasyatis (Pastinachus) bennett</i> (M.H.)	10°S.—17°N. and 80°E.—120°E.	India, Cochin-China, Philippines.
(49) <i>Dasyatis (Pastinachus) sephen</i> (Forsk.)	40°S.—20°N. and 40°E.—170°E.	Seychelles, Red Sea, Arabia; India, in 3-30 fms., Ceylon, Burma, Singapore, Malay Archipelago, Siam, Indo-China, Micronesia.
(50) <i>Dasyatis (Dasyatis) pastinaca</i> (L.)	35°S.—8°N. and 20°E.—70°E. and 35°N.—15°E.	S. Africa, Natal, Madagascar, India, and also in the Atlantic (Mediterranean).
(51) <i>Dasyatis (Amphotistius) imbricata</i> (Shn.)	20°S.—20°N. and 40°E.—115°E.	Red Sea, Mauritius, Seychelles, India, in 20-30 fms., Ceylon, Burma, Malay Peninsula, Java, Siam, Indo-China, China.
(52) <i>Dasyatis (Amphotistius) uarginatus</i> (Blyth)	1°S.—22°N. and 80°E.—94°E.	India, in 20-30 fms., Ceylon, Burma.

LIST SHOWING THE LATITUDINAL AND LONGITUDINAL RANGES IN THE DISTRIBUTION OF THE ELASMOBRANCHS AND CHIMAERAS OF THE INDIAN REGION—*contd.*

Name of species	Range in Latitudes and Longitudes	Distribution
NON-COSMOPOLITAN, <i>not extending eastwards beyond 180° E.</i> — <i>contd.</i>		
(53) <i>Dasyatis (Amphotistius) zugei</i> (M.H.)	10°S.—35°N. and 73°E.—115°E.	India, in 20-30 fms., Burma, Ceylon, Malay Peninsula, Java, Cocein China, Japan.
(54) <i>Urogymnus africana</i> (Sohn.)	20°S.—20°N. and 40°E.—180°E.	E. Africa, Seychelles, Red Sea, Arabia, India, in 20-30 fms., Ceylon, Malay Peninsula, Borneo, Java, Siam, Indo-China, Melanesia.
(55) <i>Gymnura (Aetoplatea) tentaculata</i> M.H..	30°S.—20°N. and 32°E.—85°E.	Natal, Red Sea, India, in 20-30 fms.
(56) <i>Gymnura (Aetoplatea) zonurus</i> Bleeker	10°S.—18°N. and 85°E.—115°E.	India, Singapore, Java.
(57) <i>Gymnura (Gymnura) micrura</i> (Sohn.)	10°S.—17°N. and 62°E.—120°E.	Arabian Sea, India, in 20-30 fms., Ceylon, Burma, Malay Peninsula, Malay Archipelago.
(58) <i>Aetomylus maculatus</i> (Gray)	1°S.—20°N. and 80°E.—115°E.	India, in 20-30 fms., Ceylon, Malay Peninsula, Malay Archipelago, Siam, China.
(59) <i>Aetomylus milvus</i> (M.H.)	10°S.—20°N. and 40°E.—120°E.	Red Sea, India, Penang, Malay Archipelago, Philippines, China.
(60) <i>Aetomylus nichoffi</i> (Sohn.)	10°S.—35°N. and 78°E.—115°E.	India, Ceylon, Burma, Malay Peninsula, Malay Archipelago, Cochin China, China, Japan.
(61) <i>Rhinoptera adspersa</i> (M.H.)	10°S.—13°N. and 80°E.—115°E.	India, Ceylon, Malay Archipelago.
(62) <i>Rhinoptera javanica</i> (M.H.)	25°S.—25°N. and 32°E.—120°E.	Delagoa Bay, India, Ceylon, Malay Peninsula, Malay Archipelago, Siam, Philippines, China.
(63) <i>Mobula diabolus</i> (Shaw)	20°S.—20°N. and 40°E.—150°E.	Red Sea, Arabia, India, Ceylon, Penang, Malay Archipelago, Queensland.
(64) <i>Narcine indica</i> Henle	10°S.—12°N. and 45°E.—115°E.	Gulf of Aden, India, Malay Archipelago.
(65) <i>Narcine timlei</i> (Sohn.)	10°S.—35°N. and 78°E.—130°E.	India, in 20-30 fms., Ceylon, Malay Archipelago, China, Japan.
(66) <i>Torpedo marmoratus</i> Risso	35°S.—15°N. and 20°E.—120°E.	Cape of Good Hope, Madagascar, Mauritius, Seychelles, Red Sea, India, Philippines.
(67) <i>Torpedo sinsuspersici</i> Olfers.	35°S.—25°N. and 20°E.—52°E.	Cape of Good Hope, Madagascar, Persian Gulf, India.
(68) <i>Narke dipterygia</i> (Sohn.)	5°N.—35°N. and 72°E.—130°E.	Arabian Sea, India, in 20-30 fms., Ceylon, Malay Peninsula, Indo-China, China, Japan.



TEXT FIG. 2.—Map showing the mean annual surface isotherms 6°C, 12°C and 20°C in the Indian Pacific and Atlantic Oceans.