PELAGIC FISHERIES OF THE INDIAN OCEAN

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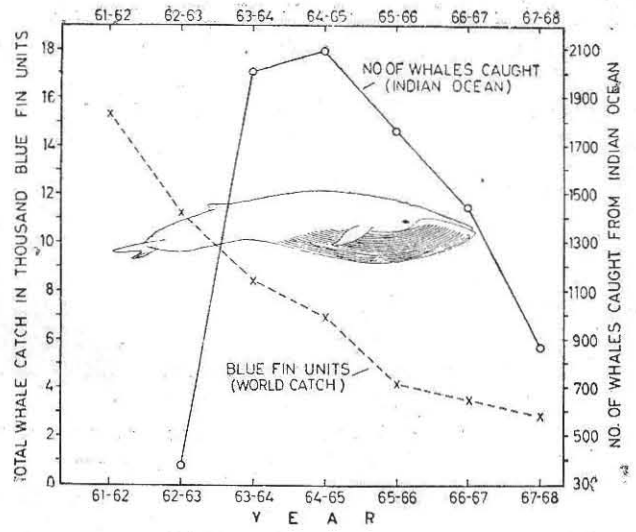
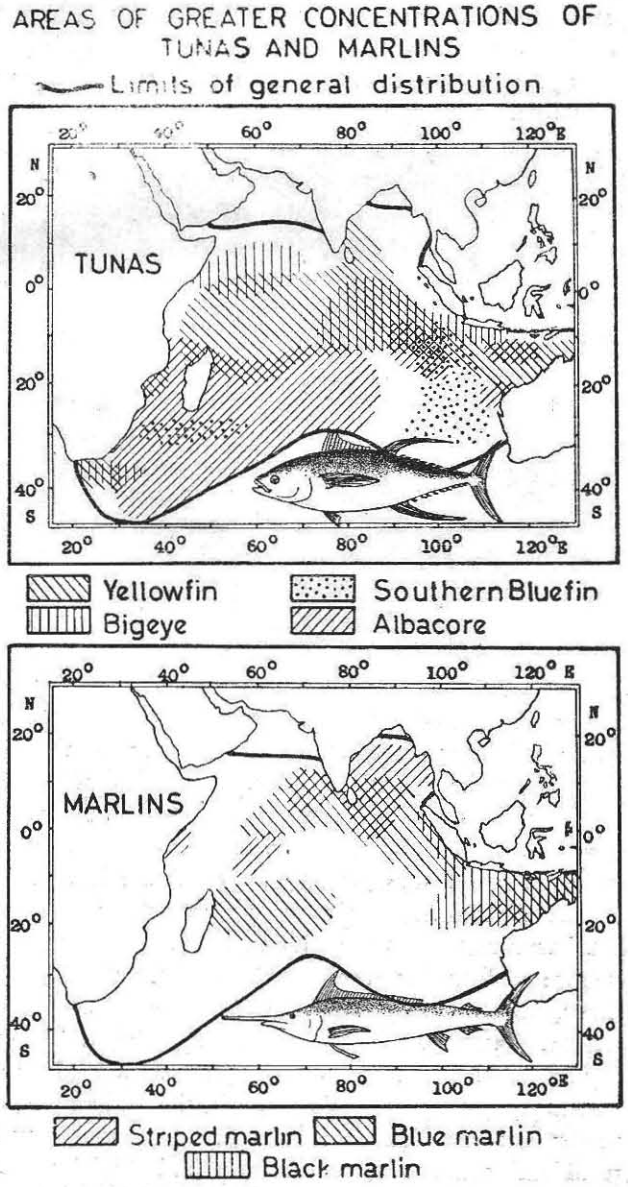


Whale catch in Indian Ocean



Abundance of tunas and marlins in Indian Ocean.

THE marine fisheries of the world can be broadly grouped under two major categories, namely demersal fisheries and pelagic fisheries. Demersal fisheries are confined to the continental shelf and continental slope and are chiefly exploited by using various types of trawls which are towed from fishing vessels to drag along the bottom. The fisheries of organisms living freely in the water masses is termed pelagic fisheries, but this again can be considered under two divisions, namely pelagic-neritic fisheries and pelagic-oceanic fisheries. The former embraces the fisheries of sardines, other clupeoids, mackerel, etc., which are mainly confined to the waters above the continental shelf. The pelagic-oceanic fisheries with which we are concerned here comprise the fisheries of fishes and other animals which inhabit the oceanic realm or in other words the high seas outside the continental shelf. The major fisheries are those of:

1. *Fishes*: Tunas and related species; billfishes (marlins, sailfish, spearfish, and swordfish); pelagic sharks; sauries; flying fish; etc.
2. *Squids*: Oceanic squids.
3. *Whales*: The baleen whales; the sperm whale; and the lesser toothed whales.

But for the whaling industry which can be traced back to the 12th century, the development of pelagic-fisheries of the world in its present magnitude is a comparatively recent event, in fact a post World War II phenomenon. The greater distance to the fishing grounds, the heavy expenditure involved in having sophisticated fishing vessels and gear, the want of trained fishing personnel may partly explain why India, though advantageously situated, has not thus far made any headway in pelagic oceanic fisheries.

Tunas and Billfishes

The world catch of marine fishes has roughly doubled during each 10-year period since 1945 and by the end

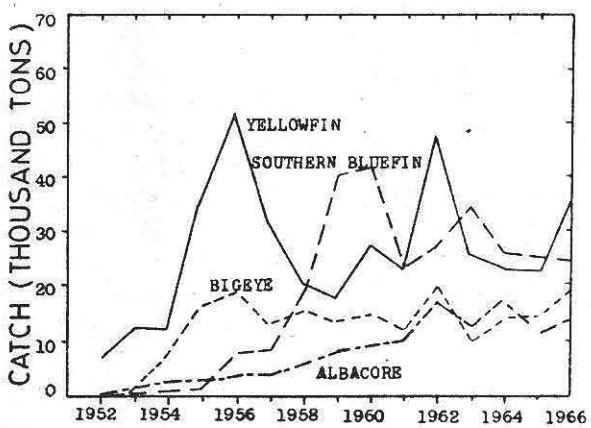
of 1948 has reached almost 55 million metric tons. An impressive development in this connection has been the increase in the world catch of tunas and related fishes, chiefly the yellowfin (*Thunnus albacares*), the bluefin (*T. thynnus*), the bigeye (*T. obesus*), the albacore (*T. alalunga*), and the skipjack (*Katsuwonus pelamis*) which along with the billfishes accounted for hardly 300,000 tonnes in 1948. From this the catch has steadily increased to 1,500,000 tonnes at present, the bulk of it due to tuna longlining. These figures only partly explain the explosive development in pelagic oceanic fisheries and the coming into being of a booming industry within such a short time.

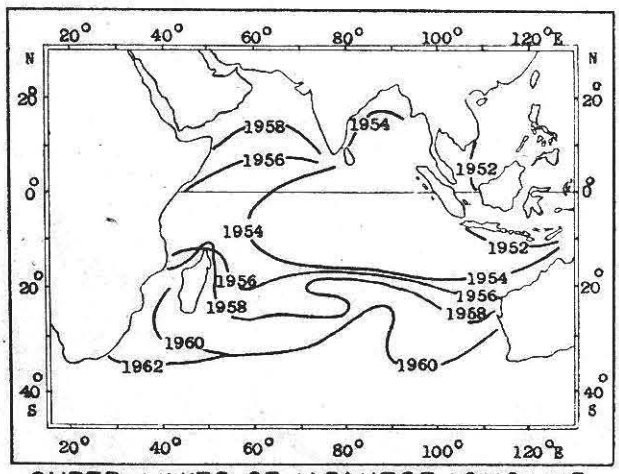
The importance of tuna and billfish resources of the Indian Ocean has been well recognised by other countries, notably by Japan and today Japanese tuna fishing boats are operating in all the great oceans. In the Indian Ocean the growth of this fishery is more spectacular as prior to 1952 an estimate of even 10,000 tonnes of tuna catch per year for this vast ocean would have been considered an over-estimate. The Japanese started post-war tuna longlining operations in the Indian Ocean in 1952 and the progress of their expanding tuna longlining activities side would explain the rapid development of this fishery in the Indian Ocean. Initially high longline catch rates were obtained from virgin areas for the different species of tunas and billfishes and at present the catch per year of these fishes from the Indian Ocean amounts to about 175,000 tonnes, in other words, a seventeen-fold increase than what it was in 1952. Among the four species of tunas most commonly caught by longline gear, the yellowfin is the most important followed by the southern bluefin, the bigeye and the albacore.

The world catch of billfishes has steadily increased from a few thousand tons in 1945 to about 113,000 tonnes in 1965 and the average for the last five years has been 108,000 tons. Since the bulk of this is landed by tuna longline gear, the increase in billfish landings in the light of the expanding tuna longline fishery is understandable.

No separate statistics is available of billfish landings in the Indian Ocean, but an estimate of 10 per cent of longline catch by weight would give a figure of about 15,000 tonnes. The species most commonly caught are the blue marlin (*Tetrapturus audex*), the striped marlin (*Makaira nigrescens*), and the black marlin (*Makaira indica*). However, the swordfish (*Xiphias gladius*), the sailfish (*Istiophorus platypterus*), and the short-nosed spearfish (*Tetrapturus angustirostris*) are also occeasionally caught in longlining.

ESTIMATED TOTAL TUNA CATCH BY JAPANESE LONGLINE FISHERY IN THE INDIAN OCEAN AND CONTIGUOUS SEAS





OUTER LIMITS OF JAPANESE LONGLINE FISHERY IN THE INDIAN OCEAN AND CONTIGUOUS SEAS IN THE DIFFERENT YEARS

Need for Tagging Programme for Tuna

On the basis of the last few years fishing, the areas of greater concentration of the different species of tunas and billfishes are shown in the figure on page 63. The proximity of some of these to India is to be noted. There is reason to believe that the present intensity of fishing the yellowfin tuna by longlines may be close to the maximum level of rational utilization of the species. However, we have very little knowledge of the relative extent of the stocks of the different species of tunas, their behaviour and biology. Particularly their migratory habits in the Indian Ocean are still a mystery. Tunas occur in shoals and they are very powerful swimmers. Tagged tuna in the North Atlantic and the Pacific are known to migrate over very long distances. For instance, tuna tagged off California Coast have been recovered from Japanese waters more than 3000 miles away. Similarly, those tagged off the east coast of the United States have been caught off Portugal. A crying need today is the initiation of a massive and intensive tagging programme for tuna in the Indian Ocean, the success of which alone will give answers to several problems concerning its fishery and biology, and thus help in the rational utilization of this resource.

Tuna longlining in Indian Ocean

Needless to say, such a venture cannot be undertaken without international cooperation, but India could play a leading role in such programme.

That the tuna resources of the Indian Ocean are not fully exploited will be clear when it is seen that several of the shelf-oriented species such as the little tunny (*Euthynnus affinis*), the bonito (*Sarda orientalis*), the Indian longtailed tunny (*Kishinoella tonggol*), and the frigate mackerels (*Auxis thazard* and *A. rochei*) are under-fished. More important is the oceanic skipjack, the catch of which is very negligible amounting to hardly 5000 tonnes annually. This when compared to the annual catch of about 250,000 tonnes of skipjack in the Pacific Ocean stresses the importance of this latent resource awaiting exploitation in the Indian Ocean. The meagre quantity of skipjack landed at present is almost exclusively from the Laccadive and Maldive seas where the islanders make the much relished product 'mass' (smoked fish stick) from the meat of this fish. Larvae of skipjack are known to occur in various parts of the Indian Ocean and so also large surface shoals of skipjack are encountered especially off oceanic islands such as the Laccadives and Maldives.

Methods of Fishing

As in other pelagic fisheries, a single type of gear may not be helpful in judiciously exploiting the tuna resources. The shoaling behaviour of tunas and their bathymetric distribution indicate that the larger fish keep to deeper water. For a species such as the skipjack which lives in surface waters, the tuna longline gear is ineffective. The young of yellowfin tuna and the albacore shoal at the surface. Hence the different methods used in tuna fishing from oceanic waters are as follows.

1. Pole-and-line fishery with live bait. This method is used in the traditional tuna fishery in the Laccadives and Maldives and in some areas in the Pacific and is meant primarily for the skipjack and young yellowfin tuna. Recently Australia has taken up pole and line fishing for the southern bluefin. Fluctuations in the availability and abundance of live bait (small reef fish or species such as *Tilapia mossambica* which are cultured) affect the fishery. To overcome this, artificial baits are being experimented with.

2. The gear for tuna longlining has been evolved by the Japanese with due consideration given to the habits of the larger tunas, especially their swimming layer. Between 2000 and 2500 hooks are used per operation and the lines may extend to about 40 or more nautical miles. The hooks are set to fish depths of about 75 to 200 metres or more depending on the length of the main line, float line and dropper, distance between the buoys and the prevalent currents. In addition to tunas and billfishes, large numbers of pelagic sharks are also caught by this method.

3. Purse seine fishing for tunas has been the most important development of pelagic oceanic fisheries during the present decade. A successful operation may yield as much as 40 tonnes, which is not unusual if a good shoal is encircled successfully. For oceanic species such as the skipjack, albacore and young yellowfin and for shelf-oriented tunas the use of purse seine has been found to be very effective. In fact, more than 75 per cent of the pole-and-line fishing boats in California, Hawaii and other areas in the Pacific have been changed over to purse seiners.

4. Shelf-oriented species of tunas are also caught in troll lines, traps and in beach seines in small quantities.

Oceanography and Tuna Ecology

To tackle many problems of oceanic fisheries such as tuna ecology and to obtain quicker results which could be made use of by the fishing fleets in the Indian Ocean, international co-operation will be necessary. The role of the environment in oceanic fisheries is well understood by Japanse fishermen who collect extensive data on temperature and salinity in all places where longlining is carried out. Slight differences in temperature may not vitally affect the behaviour of tunas, but it is an easy indicator of good fishing grounds. The surface temperature in the tropics is fairly uniform throughout the year and localised differences may point to areas of slow upwelling, current boundaries, etc. The mixing zones of areas of convergence and divergence in the current system where zooplankton and other forage will be abundant are places where tunas will tend to congregate. The thermocline ridges are also preferred places of aggregation due to abundant food concentration. The optimum current for good tuna fishing has been found to be 0.5 to 1.0 knots. Areas such as oceanic islands, sea mounts and continental slopes with higher bottom topography are also good tuna fishing grounds as they affect the surface currents and internal waves giving rise to eddies, rise in the thermocline level and so on.

Trends in Tuna Investigations

The work carried out at the Central Marine Fisheries Research Institute has for the first time given us an idea of the species of tunas and billfishes occurring in the Indian seas, aspects of their biology, especially food, fecundity, spawning, spawning grounds and early life-history. The organic productivity of tuna waters in the Laccadive Sea and off the west coast of India has been investigated. However, the gaps are many and detailed investigations on several problems need urgent attention.

The population structure and possible existence of sub-populations of the different species of tunas need investigation to understand whether they are discrete or intermingle. Besides tagging, the studies of blood group characteristics revealed by antigen-antibody reactions which are under genetic control may help to determine whether the members of a single group of

tunas have or have not originated from a single in-breeding sub-population. Investigations on sperm morphology have shown promise as yet another approach to solve this problem.

An urgent requirement is for adequate statistics of both catch-per-unit-effort for the different areas, and vital statistics such as information on growth, mortality and recruitment. Little is known about the biotic part of the tuna food chain. The data obtained by the various expeditions which investigated the Indian Ocean during this decade will give us a better picture of the areas of high productivity, relationship between abundance of phytoplankton, zooplankton, micronekton and possible abundance of tuna forage. In any oceanic fisheries research programme studies on behaviour of tunas will have to be given priority.

Location of surface tuna schools could be done visually from the fishing vessel which would mean that the vessel would have to cover considerable distances scouting for shoals. Sonar is now successfully used for detecting surface and sub-surface tuna shoals. oceanic birds also help in the detection of surface tuna shoals. Aerial scouting for pelagic fish is used in many parts of the world. Modern techniques in fish location need emphasis.

In tuna longlining, pelagic sharks may constitute about 20 per cent of the catch. This is a sizable quantity and in the Indian Ocean though no precise figures are available the catch may easily be expected to exceed 25,000 tonnes. The white tip shark, the thresher, the great blue shark, the probeagle, and the mako are some of the species frequently caught. While the meat of some of these may not be used, the fins when dried fetch good price.

It is felt that a fishery for the saury (*Scomberesox saurus*) could be developed in the southern Indian Ocean, especially as this species is good eating and also excellent bait for longlines.

Flying fish fishery could be develpeod off oceanic islands but this will be of very minor importance.

Importance of Oceanic Squids

There is practically no fishery for oceanic squids in the Indian Ocean. The oceanic squid fishery is very important in the North Pacific and on the average about 600,000 tonnes are landed by Japan annually. The fishery exploratory surveys carried out by the Central Marine Fisheries Research Institute in the Indian seas have shown the occurrence in large quantities of commercially important oceanic squids, especially off the west coast of India and in the Laccadive Sea. Expeditions have reported similar occurrence in other parts of the Indian Ocean. It is high time that a fishery for this potentially important resource be started in the Indian Ocean. Squid meat is also an exportable commodity and India should take an initiative in exploiting this resource.

The discovery of the harpoon gun and the use of large mechanised factory ships in the mid-1920's were chiefly responsible for the considerable depletion of the whale population of the world oceans. Unrestricted whaling had by 1930 so alarmingly reduced the number of whales that an international agreement was finally reached and adopted in 1937 to set limits on the seasons and areas of fishing and the numbers of each species of whale to be fished to conserve and protect the remaining stocks. According to the Convention, each contracting Government was to exercise broad powers of regulation and enforcement over whaling by its own vessels besides supporting whale research programmes. A history of whaling shows that in the past good whaling grounds for the sperm whale and the baleen whales existed in the Indian Ocean. The former was particularly abundant in the Western and Eastern Indian Ocean and good catches were obtained even from grounds south of Ceylon. Similarly, the baleen whales were more abundant in the southern Indian Ocean. Within the last eight years, the total whale catch in the world expressed as blue fin units (1 blue whale=2 fin whales= 2.5 humpback whales=6 sei whales) has shown a steady decline from about 16,000 blue fin units to about 3000 blue fin units. During the years following the World War, hardly any whaling was done in the Indian Ocean, but a revival of the interest in the early 1960's resulted in catches of over 2000 numbers of whales during the 1964-1965 season. However, there has again been a steady decline and during the 1967-1968 season hardly 850 whales were caught from the Indian Ocean. With the development of other fisheries whaling is on the decline. Particularly the blue whale, the largest of all living animals which at one time was the mainstay of the whaling industry is now a rarity which is being protected from becoming extinct. Just as the enforced closure of whaling during the war years gave a breathing time for the revival of some of the depleted whale stocks, the lack of interest in whaling by some of the nations may help revive the industry. With increased demands for protein foods, what will be India's role then? There are large populations of even dolphins and lesser toothed whales in the Indian Ocean which are not at present fished. This is yet another potential resources.

Future Prospects

As far as India is concerned, pelagic oceanic fisheries have a bright future. If the present trend holds good, the estimated Indian Ocean landings of tunas and billfishes alone should top 350,000 tonnes by 1975. The U.S.S.R. has become a keen competitor with Japan in exploiting the pelagic oceanic fishery resources of the Indian Ocean. Among countries bordering the Indian Ocean, Australia, Union of South Africa, Pakistan, Malaysia and Ceylon are expanding their oceanic fishing activities. Every effort should be made to catch up in this field of fisheries development where we have lagged thus far.