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Indian Tuna Resources: Distribution, Commercial Exploitation, Utilization and Trade

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Tuna and tuna-like fishes are important both from global demand and economic view points. They include 40 species occurring in the Atlantic, Indo-Pacific Oceans and in the Mediterranean Sea. Archaeological evidence showed that, tunas being harvested by early Europeans in the area around Sweden, by Native Americans near British Columbia and by the peoples of the Joman culture near Japan. However, industrial fishing for tunas began in the 1950's and global production has tended to increase continuously from 0.6 million tons in 1950 to over 6 million tons in 2008. Catch of principal market tuna species was estimated as four million tons in 2008, which represented about 67 per cent of the total catch of all tuna and tuna-like fishes. Most of these catches were taken from the Pacific Ocean (70.2 per cent), with the Indian Ocean contributing 20.4 per cent with an estimated catch of 870,000 tonnes and the rest by Atlantic Ocean and the Mediterranean Sea (9.5 per cent). Major contributors to the global tuna production are skipjack tuna (57.5 per cent), followed by yellowfin tuna (27.1 per cent), bigeye tuna (9.6 per cent), albacore tuna (4.7 per cent) and the rest (10.7 per cent) by other species. According to assessments carried out during 2010 by ICCAT, IOTC, IATTC and WCPFC the international organizations responsible for management of the tuna stocks of in the world Oceans, many tuna stocks are heavily exploited, some unsustainably, and the catches in many cases are declining.

Tunas have been exploited along the Indian coast since time immemorial with neritic tunas being the mainstay of the tuna fishery till recently. Tunas in Indian waters are represented by nine species belonging to five genera, *Auxis*, *Euthynnus*, *Sarda*, *Katsuwonus* and *Thunnus*. Coastal/neritic tunas are represented by five species and are being exploited as an incidental catch in many commercial coastal fishery. Increased demand for Sashimi grade tuna from export markets, improved harvesting methods, expansion of transportation and storage facilities and development of value added products provided an impetus for fishermen to harvest all commercially important resources including hitherto non-targeted oceanic resources. Modernization and adoption of innovative fishing methods, increased endurance of the fishing crafts and improved fishing efficiency encouraged extension of fishing activities beyond territorial waters, resulting in overall increase in production from few centres.

Though tuna fishery gained importance in recent years, only limited information is available on the recent developments in the tuna fishery, production trends, stock characteristics and potential in the Indian EEZ including Island territories.

Developmental history

Tuna fishery in India has a long history as that of the marine fisheries of the country. Tuna fishery involved coastal based fleets of varying specifications with different craft-gear combinations and large LOP vessels. Until eighties tuna remained as an incidental catch in many fisheries except in Lakshadweep, parts of Kerala and Tamilnadu, where targeted fishery for tunas were in vogue. In Lakshadweep well organised targeted fishery for skipjack tuna has been in vogue using pole and lines and trolllines. At Vizhinjam along the coast of Kerala bullet tuna enjoy considerable local demand and targeted exploitation carried out using hand line, small longlines and gillnets. At Tuticorin along the coast of Tamilnadu tunas and large pelagics were targeted by traditional fishermen using gillnets, trolllines and longlines from traditional crafts. Encouraged by the catch made by traditional fishermen, several trawlers were modified for gillnetting at Tuticorin for tuna and other large pelagics from deeper waters in eighties.

Commercial longlining under charter scheme by “letter of permit” (LOP) vessels as a prelude to joint venture for oceanic tunas was initiated in mid-eighties and witnessed phenomenal growth over the years. They undertake long duration fishing trips, operate large long lines and gillnets, stay at sea for extended periods of time and rarely return to registered port. They fish both in the EEZ and international waters and the catch is not landed nor reported properly, but is believed to be transshipped in the mid-sea.

During the beginning of this decade, hundred’s of traditional fishermen from the southeast coast ventured specifically for exploiting oceanic tunas and associated resources with great success. They operate small longlines/handlines/trolllines/pole & lines/gillnets from artisanal crafts in the outer shelf areas. Encouraged by their success and also following the policy decision of the Government to tap oceanic resources, several commercial trawlers were modified for longlining, mainly to exploit yellowfin tunas during 2005-’06. These fleets based at several major and minor harbours of the country, operate multiple gears, along with longlines mostly in shelf edge and adjacent oceanic waters. But, later, driven by economic benefits several of these units diverted their main target from tunas to billfishes and elasmobranchs. The latest development in this line is the introduction of multiple pole and line with single hook fishery for medium sized yellowfin tunas in Lakshadweep waters.

Tuna resources and potential

Nine species representing coastal/neritic and oceanic species supported the resources and fishery. Little tuna (*Euthynnus affinis*), frigate tuna (*Auxisthazard*), bullet tunas (*Auxis rochei*), longtail tuna (*Thunnus tonggol*) and bonito (*Sarda orientalis*) represent the coastal/neritic species. Oceanic species were represented by Yellowfin tuna (*Thunnus albacares*), skipjack tuna (*Katsuwonus pelamis*), dogtooth tuna (*Gymnosarda unicolor*) and bigeye tuna (*Thunnus obesus*).

Little tuna/Kawakawa

Most dominant commercial species, widely distributed along the Indian coast including island territories with large concentration along the southern coasts, especially southwest coast of India. Epipelagic and mainly neritic in habitat and form multispecies shoals in association with skipjack, frigate tuna and yellowfin tuna. Occurs in open waters but young remain close to near-shore areas and often enter bays and harbors. Grows to over one meter.

Bullet tuna

The bullet tunas are distributed along the west and east coast of India, with large concentration along the southern coasts, especially along the coasts of Kerala and Tamilnadu. Epipelagic fish, found in neritic and oceanic waters with large abundance in deeper waters associated with knolls and oceanic ridges and often form large schools. Adults are caught from deeper waters around knolls, sea ridges and Islands. They grow to a maximum size of 50 cm.

Frigate tuna

The second dominant coastal species, distributed along the along the west and east coast of India with major abundance towards southern coasts. Epipelagic fish, distributed in neritic and oceanic waters with large abundance in deeper waters associated with knolls and oceanic ridges. Large abundance was observed along the Indian side of Chagos-Laccadive ridge. They exhibit strong shoaling behavior and supported round the year commercial fishery.

Striped bonito

Neritic species distributed along the coasts of mainland and island territories and show close association with coral reefs and knolls. Major areas of abundance are coasts of Kerala, Andaman & Nicobar and Gujarat. Exhibit schooling behavior and often found along with other small tunas. Support occasional fishery along with other tunas.

Longtail tuna

Distributed mainly along the west coast and Andaman waters with major abundance in northwest coast comprising Maharashtra and Gujarat. Epipelagic species, aggregate in large numbers over knolls and sea mounts. They are observed in appreciable numbers over knolls and seamounts of Chagos-Laccadive and Andaman ridges. Generally avoid turbid and low saline waters. Attain a maximum size of 145 cm and weight of around 36 kg.

Skipjack tuna

Epipelagic species, strictly oceanic in distribution. Distributed along the coast of mainland and island territories. They used to aggregate in areas of convergence, boundaries between cold and warm water masses, upwelling region and other hydrographical peculiarities showing any type of discontinuity. Exhibit a strong tendency to school in surface waters with birds, drifting objects, sharks, whales and may show a characteristic behavior like jumping, foaming, etc. They remain in surface waters during night and move to deeper waters during day. Large shoals were generally observed around oceanic Islands, over seamounts and along the shelf break areas of east and west coast of the mainland.

Yellowfin tuna

Most dominant oceanic species in oceanic waters. Epipelagic in habitat with oceanic in distribution. Major areas of their aggregation are oceanic waters around island territories seamounts and shelf break areas of mainland coasts. Young and sub-adults forms large aggregations along the shelf-break area and over seamounts. They school primarily by size, either in mono-species or multi-species groups. Larger fish frequently school with porpoises, also associated with floating debris and other objects in oceanic waters.

Big-eye tuna

A typical oceanic species found only in deeper waters and enjoy wide distribution throughout most of the world's oceans. They occurs mostly in waters below the thermocline. Big eye make extensive vertical movements and often observed in depths deeper than other tunas. Among their unique adaptations to life at greater depth is a layer of subcutaneous fat which insulates them from the cold.

Dogtooth tuna

Enjoy restricted distribution in the seas around Andaman-Nicobar, Lakshadweep and oceanic ridges and associated seamounts. In the Indian waters, their rich abundance was observed in Andaman seas.

Tuna potential

The expert committee set up for estimating marine fishery potential of Indian EEZ estimated a potential of 277,972 t for tunas. The potential of coastal/neritic tuna is 65,472 t and that of oceanic tuna is 212,500 t. The potential of important oceanic species, yellowfin tuna is 114,800 t, skipjack tuna 85,200 t and bigeye 12,500 t.

Fishing methods

Tunas were exploited by a variety of gears like, gillnets, longlines, handlines, pole and lines, troll lines, purse seines, ring seines and even by trawls based on the fishing ground and targeted species.

Gillnetting:

Drift gillnets are generally used to capture tunas in the open ocean, consist of a series of individual nets connected together. Because of the high incidental capture of other species, the use of drift gillnets longer than 2.5 km. was banned on the high seas by the United Nations. Only a small per centageof the world catch of tunas is taken with gillnets. Only a small per centageof the world catch of tunas is taken with gillnets.

Longlining:

Longlines arepassive and non-selective to the extent that it can capture several species of tunas along with other types of fishes particularly swordfish and marlins. The gear fishes mostly below 100 m depth, where temperatures are cool and the largest tunas frequented. The longline vessels target yellowfin tuna, bigeye tuna and bluefin tuna. The largest long line fleets are those of Japan followed by those of Taiwan and Republic of Korea. In terms of tonnage of tuna captured long lining captures about 14 per cent of the world catch of tunas.

Purse-seining:

Purse seiners target mostly yellowfin tuna and skipjack and on a world scale account for roughly 60 per cent of all the tuna landed. In recent years the purse-seine catch of Bigeyetuna has been increasing rapidly, mostly due to the increased use of FADs. Scientists have urged caution regarding expansion of fishing effort in the surface fisheries and have expressed concern over the fact that the increased use of FADs has increased the catch of juveniles of large tuna species, which could be reducing the yield per recruit and hence the total potential yield.

Pole and lining:

Pole-and-line fishing is a two-mode type of fishing targeting mainly skipjack and yellowfin tunas. The live bait was used to attract the tuna to the vessel where they were caught by pole-and-line gear. If good aggregation of tunas attracted towards the live bait, several tonnes could be captured in a short time. Though pole-and-line fishing was at one time the major type of tuna fishing in terms of catch, because of improvements in purse-seining and other methods it has diminished in importance.

Trolling:

Trolling consists of towing several lines with bait or lures attached from vessels, generally less than 20 meters in length. Most troll fisheries target albacore tuna (*Thunnusalalunga*), but several other species are also taken. Trolling accounts for only a very small percent of the world catch of tunas.

Fish Aggregating Devices (FADs):

Fish Aggregating Devices are structures located at surface or at midwater depths to take advantage of attraction of pelagic fish to floating objects. FADs anchored in depths beyond 500 m are generally more successful in attracting schools of skipjack (*Katsuwonuspelamis*), yellowfin (*Thunnusalbacares*) and bigeye (*T. obesus*) tunas. Smaller tunas (skipjack and immature yellowfin) at the surface and larger tunas (mature yellowfin and bigeye) at depths of 300-400 m. More than 50 per cent of the world catch of tropical tunas come from fishing under FADs

Tuna production

Following modernization of the fishing practices along with the diversification, intensification and extension of fishing to new grounds, status of tuna fishery changed from incidental bycatch to targeted commercial fishery. Landings registered steady increase from 848 ton in 1951 t to 129,801 t in 2008. During 2006-'10, the average tuna landings was 112,365 t. The landing thereafter registered a decline. The average catch by LOP vessels during the same period was 87,239 t with peak (100,268 t) in 2008. Their catch also showed a declining trend since 2008.

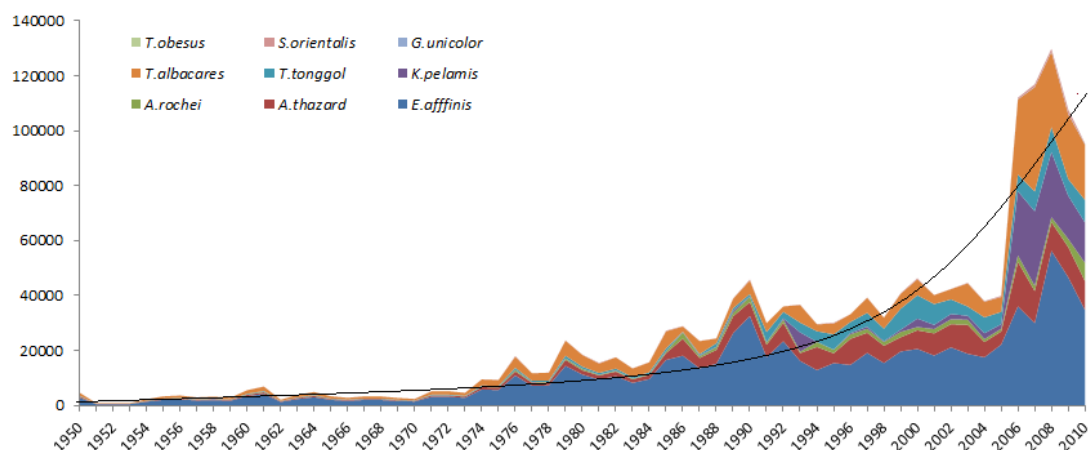


Figure 10.1 Growth in tuna landings in tons by coastal based fishery (*landings by Island territories included from 2006 onwards).

Catch composition

The tuna fishery was supported by nine species, five coastal & neritic species and four oceanic species. Coastal & neritic tunas represent 57 per cent of the total tuna catch with an average landing of 64,039 ton. Fishery was supported by little tuna (36.3 per cent), frigate tuna (10.7 per cent), bullet tunas (2.8 per cent), longtail tuna (6.5 per cent) and bonito (0.8 per cent). Among the oceanic species, yellowfin tuna represent 24.3 per cent, skipjack, 18.6 per cent and dogtooth and bigeye tunas of the total tuna catch. Catch by LOP vessels was supported by three species; yellowfin tuna (94.6 per cent) and small proportion of dogtooth (1.5 per cent) and big-eye tuna (3.9 per cent).

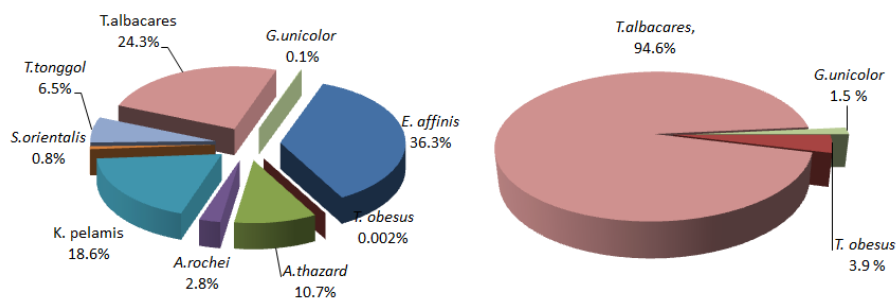


Figure 10.2 Component species in the tuna catch (per cent) in coastal and LOP fishery during 2006-'10

Production by gear

Tunas were caught both as incidental and targeted catch in many gears. Major share of the catch was realized in gillnets (51.7 per cent) and hooks and line (24.8 per cent). Other gears, which land tunas are pole & line, purseseines, ringseines, trawls and bagnets. Considerable variation was also observed in the catch composition by different gears. Major share of the landings by trawl was small yellowfin tunas followed by little tunas. Little tunas formed the major share of the catch in gillnets, hooks and line, bagnets, ringseines, purseseines and artisanal gears and skipjack tunas in pole and line. Yellowfin tunas formed the second dominant component in gillnets, hook and line and in artisanal gears.

Production by region

Tunas are landed along the coast of mainland and Island territories and supported fishing at varying levels from different region. Almost 90.5 per cent of the total tuna landings of the country is from the mainland coast with 47.3 per cent of the landings from west coast and 43.2 per cent from east coast. The major share of the catch, 41.3 per cent is from southeast coast, followed by 28.4 per cent from southwest and 18.9 per cent from northwest coast. Contribution by northeast is only nominal (1.9 per cent). Lakshadweep contributed 7.3 per cent and Andaman & Nicobar 2.2 per cent to the national tuna landings.

Production by group Coastal/neritic tunas

Average annual production was 64,074 t. After a peak (78,680 t) in 2008, production registered continuous decline. Major share of the landing was from southwest coast (43 per cent), followed by southeast coast (28 per cent) and northwest (20 per cent) coast. Present production was very close to the estimated potential (65,472 t) and had only limited scope for improved production from present grounds. Considerable scope exists for increasing the

production from selected areas like northeast coast, coast of Karnataka, Maharashtra and Andaman-Nicobar Islands, where the present level of production remains low.

Little tuna/Kawakawa

They are the most dominant species abundantly available in Indian waters. They are exploited mainly by gillnets, hooks and lines, ringseines and purseseines. Their average annual production was 40,780 t and the major share (79.5 per cent) was contributed by southern coasts. Only limited scope remains for increasing their yield from these grounds. However, considerable scope exists for increasing the production from waters of Karnataka, Maharashtra, Orissa and West Bengal. They support fishery round the year with peak during June-October. 14-78 cm fishes support the fishery with 34-58 cm as the commercial size.

Frigate tuna

Frigate tuna are the second dominant species available among coastal tunas, with fishery mainly from southern coast, contributing 86.4 per cent in the landings. Exploited by gillnets, hooks and line, ring seines, trawl and purseseines (13.8 per cent). Average annual landing was 11,970 t. Fishery was supported by 14 to 50 cm fishes. Fishery occurred round the year with peak during June to September. There exists only limited scope for enhancing yield from the present grounds. Considerable scope is available for improving their yield from the Indian side of Chagos-Laccadive ridges and from coastal waters of northeast region, Karnataka, Maharashtra and Andaman-Nicobar.

Bullet tuna

Major fishery is restricted to the southernmost part of Indian waters with nearly 75 per cent of the landings from Kerala alone and 21 per cent from Tamilnadu. Average annual production was 3,132 t. Target fishing for bullet tuna by longlines and handlines, driven by local demands, prevails only along the southern districts of Kerala. They are also landed trawls, purse seines and ring seines. Fishery occurred round the year with peak during June to September and the fishery was supported by 15 to 38 cm fishes. Considerable scopes were available for improving their yield by target exploitation from other areas.

Long tail tuna

Fishery is mainly along the west coast and Andaman waters with major abundance and fishery (96 per cent) from northwest coast comprising Maharashtra and Gujarat. Several gears landed the species, with the major share by gillnet and hooks and lines. Fishery maintaining an uptrend with an average annual production of 7,340 t. Pattern of distribution, abundance and fishery indicated scope for improving production from less exploited areas like knolls, Chagos-Laccadive ridge and associated seamounts of west coast and Andaman and Nicobar waters. Fishery was supported by 26-112 cm fishes.

Oriental bonito

Fishery is highly seasonal from and major share of the catch was from coasts of Kerala, Andaman & Nicobar and Gujarat coast. They are exploited by hooks and line and gillnets. Yield exhibiting an uptrend with average annual landings of 853 t. The resource is at its initial phase of exploitation, had scope for improving production. Fishery was supported by 18-55 cm fishes.

Oceanic tunas

Oceanic tuna landings over the years exhibited a general increasing trend till 2007 and thereafter registered a downtrend. Annual average landings during 2008-10 was 48,335 t and the catch by LOP was 87,240 t. Production exhibited a general increasing trend till 2007 and thereafter registered a downtrend.

Yellow fin tuna

The most dominant oceanic tuna species exploited from Indian waters. Landings exhibited a general increasing trend till 2007 and thereafter registered a continuous downtrend. Average annual landings during 2006-'10 was 27,269 t and the catch by LOP vessels was 82,526 ton. Major contribution was from southeast and southwest coast. Exploited by gillnet and hooks and lines. The exploitation range by the coastal based fishing fleets are very limited and fishery is mainly by small surface tunas. Catch was supported by 24-202 cm fishes. Considerable scope remains for improving production from deeper oceanic areas. Exploited by long lines and drift gillnets.

Skipjack tuna

The second dominant component of oceanic tuna landings of the country and the landings exhibited increasing trend till 2007 and thereafter registered downtrend. Average annual landing was 20,924 t. Exploited mainly by gillnets, pole and lines and hooks and lines. They formed targeted fishery only along the Lakshadweep coast. Exploitation range of this species is also very limited and considerable scope for expanding the fishery. Fishery occurred round the year. Catch was supported by 24-78 cm fishes.

Big-eye tuna

They were not caught by the coast based fishery, except stray numbers from the Andaman waters and the entire potential remain untapped. Average catch by LOP vessels during the period was 3,402 ton. Catch after the peak in 2008, registered decline. Increased production of this species is possible through extension of fishery to deeper waters using long lines.

Dogtooth tuna

Average annual landings was low, 173 t with major share of the catch from Andaman waters. Average catch by LOP vessels during the period was 1,311 ton. Catch after peak in 2008, registered decline. Fishery is at its initial phase and had considerable scope for increasing their production.

Conclusion

Coastal tunas have been exploited from Indian waters both as incidental by-catch and also as targeted catch since very long and the production reached very close to their estimated potential. Coasts of Kerala, Andhra Pradesh, Tamilnadu, Goa and Gujarat are intensely exploited. Considerable scope remains for increasing the production from less exploited coastal areas including Andaman-Nicobar.

Oceanic tunas were being exploited as targeted fishery at some part and as incidental catch in several coastal fishery. The operational areas limited to outer continental

shelf, adjacent oceanic waters, knolls and seamounts where these resources congregate. Yield can be improved by extending fishery to un-exploited areas.

Utilization

The internationally traded tuna are raw material for canning (*sashimi&loins*- fresh, frozen and frozen pre-cooked loins) tuna for direct consumption (fresh/chilled and frozen) and canned (solid pack. chunks, flakes, grated). Other tuna commodities include dried and smoked tuna, tunasteaks. tuna burgers. Tuna sausage and tuna roe. Animal feed and pet foodre produced from processing waste of tuna canneries

Domestically tunas were considered a low value fish, below sardines and mackerel until recently, when production of oceanic increased and demand from export markets picked up. During these periods they were consumed mainly as salt dried forms and small portion afresh. Recent days they are being consumed mainly afresh and part in different dried forms or exported to several destinations.. During in 2009/'10, 75 per cent of the total tuna landings, were sold in internal markets. About 97 per cent of the coastal and neritic tuna and 64 per cent of oceanic tunas landed were sold in domestic market. Among coastal/neritic tunas only longtail tuna (23.2 per cent of the production) and a small portion of little tunas find place in overseas markets. The oceanic species exported were skipjack (71 per cent), yellowfin (59 per cent) and bigeye (67 per cent).

The tuna exported from the country in various forms as whole tuna, tuna gutted, gilled and gutted, HL gutted tail off, fillets, chunks, chunks in brine, loins, smoked loins, steak, cubes, belly flaps and tuna roe either in chilled, frozen or IQF forms. Considerable quantity was also exported in canned and smoked dried products. Japan and US are the main market for Indian tuna products. It was also exported to Sri Lanka, Malaysia and several Gulf countries in different forms.
