The Socio-economic Status and Sectoral Dynamics of Small-scale Marine Fishing Communities Dependent on Tuna and Tuna-like Fisheries in India

Shinoj Parappurathu[1] and Mohammed Koya[2]

[1]Principal Scientist, Fishery Resources Assessment, Economics and Extension Division, ICAR-Central Marine Fisheries Research Institute, Kochi, INDIA

[2]Fisheries Development Commissioner, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, New Delhi, INDIA

Abstract

Being the world's sixth-largest producer of captured fish, India has high stakes in the global marine fisheries sector. The sector contributes to India's economy in multiple ways by augmenting food and nutritional security, supporting livelihood, generating employment, and aiding in gender equity. Fish landings in India have grown at an average annual rate of about 3 percent between 1960 and 2022, estimated to be 3.53 million tonnes (Mt) in 2023. Marine fisheries productively engage nearly 1 million active fisherfolk, a significant proportion of which are small-scale and resource-poor, operating at subsistence levels. Among the various economically important segments of India's marine fisheries, the fishery of tuna and tuna-like species hold significance due to their livelihood potential, especially in the island territories, and their contribution to foreign exchange earnings. India's National Policy on Marine Fisheries, 2017 clearly states the intent of the Government of India to focus on sustainable exploitation and development of value chains for deep sea and oceanic resources such as tuna and tuna-like species, owing to their future potential. However, this would require technical upgrading of the tuna fishing fleet, skilling the fishers, and other value chain functionaries for efficient handling of the harvested fish, besides equipping the post-harvest industry to match the emerging requirements of the domestic and overseas markets. Moreover, there is a need to align India's tuna fishery in line with the shared governance frameworks of global institutions such as the IOTC. Against this backdrop, this paper presents an overview of the present status of tuna fishery in India, analyses its social and economic contribution to the marine fisheries economy, and explores the dynamics associated with the tuna value chains in recent times. Special emphasis is given to identifying and exploring appropriate and robust metrics and indicators to assess the social and economic dynamics of tuna fisheries in India. The paper also tries to suggest suitable approaches to analyze the social and economic implications associated with some of the recommended conservation and sustainable management measures.

Key words: Tuna fishery; IOTC; Social and economic assessment; Value chain approach; India

Tuna Fishery of India: An Overview

Fishing for tuna and tuna-like fishes has been an integral part of India's marine fisheries for centuries. Traditional fishing methods, such as pole-and-line, troll-line, long-line, and gillnetting, have been employed in regions like the Southern-most coasts of Tamil Nadu and Kerala, coastal belts along Andhra Pradesh and Gujarat, besides the islands of Lakshadweep and Andaman and Nicobar to harvest tuna and tuna-like species, contributing significantly to the local economy and foodways. The fishery can be distinctly categorized into 'coastal fishery' and 'oceanic fishery' depending on the area of fishing operation and the species targeted. The gillnet fishery around mainland India and the pole-and-line and troll-line fisheries around Lakshadweep islands mainly constitute the coastal fishery. In contrast, the oceanic fishery mostly relies on longlining in deep oceanic waters. The tuna fishery is mainly supported by nine species, five coastal/neritic species, and four oceanic species. Coastal tunas form close to two-thirds of the total catch and are represented by species such as the little tuna/kawa kawa tuna (*Euthynnus affinis*), frigate tuna (*Auxis thazard*), bullet tuna (*Auxis rochei*), longtail tuna (*Thunnus tonggol*) and bonito (*Sarda orientalis*). The oceanic species, which constitute the rest of the catch include yellowfin tuna (*Thunnus albacares*), skipjack tuna (*Katsuwonus pelamis*), dogtooth tuna (*Gymnosarda unicolor*), and bigeye tuna (*Thunnus obesus*) (Abdussamad et al, 2012).

As per the Indian Ocean Tuna Commission (IOTC), 'coastal fisheries' or 'artisanal fisheries' constitute fishing carried out using vessels having an overall length of less than 24 meters within a flag state's EEZ (IOTC, 2016). The fishery for tuna and tuna-like fishes in India is almost entirely 'artisanal' and carried out by traditional fishers who mostly use low-intensity fishing methods. Among the fishing nations that operate in the Indian Ocean region, India is one with the highest proportion of artisanal fleets, contributing almost entirely to the total catch (Figure 1). Even during the mid-1990s and early 2000s when foreign-assisted offshore fishing was at its peak, the share of industrial fishing in India never crossed 6 percent in terms of total fish landed (IOTC, 2019). Other prominent fishing countries operating in the Indian Ocean with substantial involvement of artisanal fleets include Indonesia, Sri Lanka, Pakistan, Yemen, and Oman.

Figures 2 and 3 present the current status (data corresponds to triennium ending (TE) 2023) of India's fishing activity for tuna and tuna-like species in the Indian Ocean region. Among the major resources[1], kawakawa tunas contribute the highest (24%), followed by Spanish mackerel (17%), skipjack tuna (16%), yellowfin tuna (13%), frigate tuna (8%), king mackerel (6%), bullet tuna (5%), sailfish (4%), and other minor species together contributing 6% of the catch. Among tunas, kawakawa and skipjack formed the two largest groups followed by the yellowfin (Fig. 2). Among the various fishing gears used by artisanal fishermen, gillnet contributes the highest, with a catch share of 42 percent in TE 2023, followed by coastal longline (16%), hook & line/troll line (13%), purse seine (9%), trawl (7%) and others (13%) (Fig. 3).

[1] The data pertains only to the fish species covered by IOTC database in the Indian Ocean.

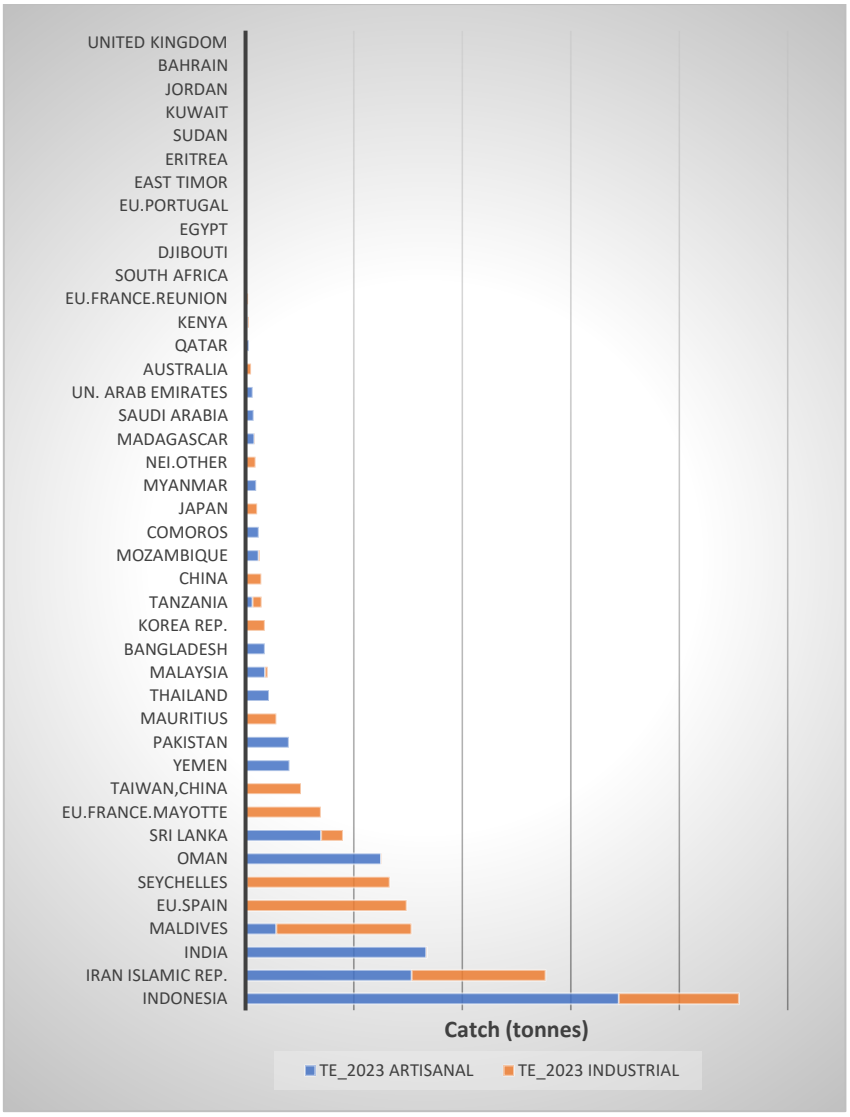

Figure 1. Relative distribution of artisanal and industrial offshore catches of tuna and tuna-like fishes by IOTC member countries in the Indian Ocean, TE 2023

Data Source: IOTC (2024)

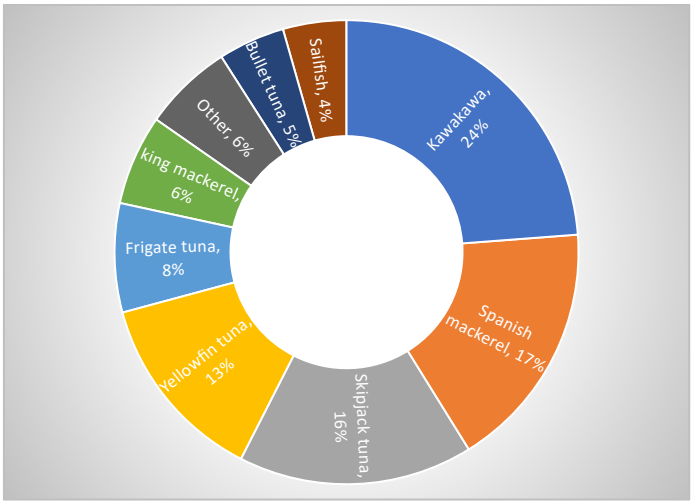

Fig. 2. India's tuna catches by species group, TE 2023

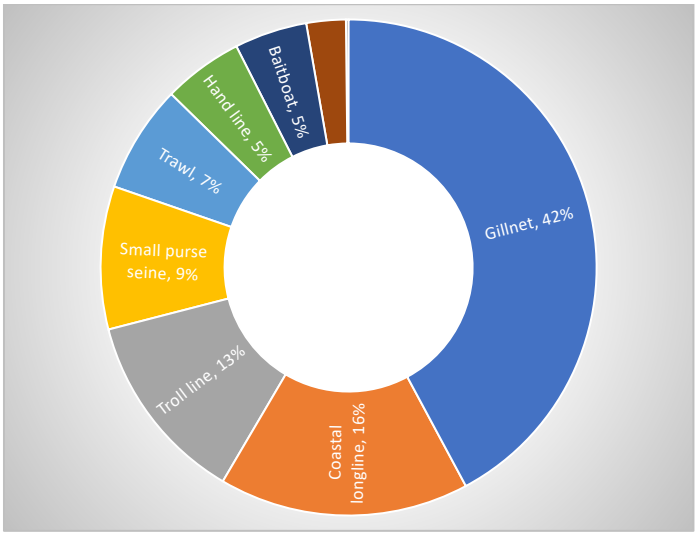

Fig. 3. India's tuna catches by gear group, TE 2023

Data Source: IOTC (2024)

India's Estimated Potential Yield for Oceanic Resources

As per the latest available estimate, India's annual Potential Yield Estimate (PYE 2018) from the Exclusive Economic Zone (EEZ) is 5.31 million tonnes (Mt) (GoI, 2018). India possesses a significant untapped potential for oceanic resources, which mainly include tunas, billfishes, oceanic sharks, oceanic squids, and other species such as barracuda, dolphin fish, wahoo, pelagic rays, etc. Together, the estimated potential yield of conventional oceanic resources is estimated to be 0.23 Mt (Table 1). Among the tuna and tuna-like species, the highest potential is for skipjack tuna (99500 t), followed by yellowfin tuna (83500 t), swordfish (6500 t), sailfish (5200 t) and marlins (6600 t).

Table 1: Resource potential of oceanic resources in the Indian EEZ

Species	Potential (t)
Skipjack tuna	99500
Yellowfin tuna	83500
Bigeye tuna	420
Albacore tuna	112
Swordfish	6500
Sailfish	5200
Marlins	6600
Pelagic sharks	25000
Other species (barracuda, dolphin fish, wahoo, pelagic rays, etc.)	4000
Total	230832

Source: GoI, 2018

Tuna Fishing Communities in India

In India, large pelagic resources like tuna and tuna-like species are mainly targeted by certain traditional fishing communities that are highly skilled in undertaking offshore fishing with their traditional fleets using less capital-intensive fishing techniques

(Vivekanandan, 2001; D'Cruz, 2004; CMFRI, 2014). Some of these prominent communities include (i) the Thoothoor fishing community, based in the Thoothoor region of Kanyakumari District of Tamil Nadu state (ii) The islanders of the Lakshadweep archipelago region in the Arabian Sea mostly engaged in oceanic tuna fishing (iii) the fishers from Visakhapatnam and Pudimadaka regions of Andhra Pradesh state engaged in offshore tuna fishing, (iv) a relatively new fishery operated by the traditional fishers hailing from the Coromandel coast of Tamil Nadu, mainly based at Nagapattinam, Poompuhar, Thoottukudi, and Puducherry and, (iv) the small-scale fishers based in Andaman and Nicobar islands situated in the Bay of Bengal.

Tuna fishers of Thoothoor

The Thoothoor fishermen hailing from the coastal fishing villages of *Thoottoor* are the most prominent among the offshore fishers, who operate mainly from *Thengapattanam* Fishing Harbour, Kanyakumari, and the Cochin Fisheries Harbor (CFH), Kerala state. Thoottoor is a coastal stretch situated along the Arabian Sea coast belonging to the *Vilavankode* Taluk, Kanyakumari District, Tamil Nadu, spread across eight fishing villages namely, *Thoottoor, Erayumanthurai, Poothurai, Chinnathurai, Eraviputhenthurai, Vallavilai, Marthandanthurai* and *Neerody*. Fishing is the primary occupation of people in these villages. The region houses a total population of about 32000 and close to 9000 fisher families. Almost all of them are traditional fishing families mainly dependent on fishing and allied activities for their livelihood. Their dwellings are mostly *Pucca* (solid and permanent) with access to electricity, potable drinking water, and other amenities. At an average rate of 1.01 active fishers per family, the total number of active fishers who find their livelihood in fishing was 8957. As per the Marine Fisheries Census of 2016, the total crafts in the fishery in Thoothoor were about 1684, the majority of which were motorized gillnetters, ring seiners, and longliners (Table 2). Close to 600 of these fishing crafts engage in multi-day voyage fishing trips targeting large pelagic fishes such as tunas and oceanic sharks, while the rest of them limit their activity within the inshore waters.

Table 2. Basic features of fishing villages in the Thoothoor region of Kanyakumari District

Fishing village	Population	Fisher families	Number of active fishers	Crafts in the fishery			
				Mech.	Mot.	Non-Mot.	Total
Eraviputhenthurai	3999	1110	1019	85	35	0	120
Erayumanthurai	2196	675	614	3	49	0	52
Marthandanthurai	4740	1320	1177	9	262	0	271
Neerody	5972	1608	1688	51	348	4	403
Poothurai	4176	1185	1532	18	174	0	192
Thoottoor	5427	1524	1294	232	70	4	306
Vallavilai	5566	1440	1633	91	248	1	340

Source: CMFRI-DoF (2020); Notes: The details of Chinnathurai village are not available; Mech: Mechanized crafts; Mot: Motorized crafts; Non-Mot: Non-motorized crafts.

The Thoothoor offshore fishers generally operate medium-sized fiber-board/steel/wooden fishing vessels with gillnet or a combination of gillnets, troll lines,

and longlines. A typical voyage fishing trip covers 1000 to 1500 nautical miles (NM) from the point of inception and generally lasts about 20-35 days. The technical profile of the Thoothoor fishing fleet taken from a recent study by Parappurathu *et al,* 2020 is presented in Table 3.

The Thoottoor fishermen target a wide array of offshore resources, the most common being deep sea sharks, tunas and tuna-like fishes, rays, seer fish, and billfishes (sailfish, swordfish) (CIFT, 2015). The offshore fish harvests by the Thothoor fishers are mostly landed in the Cochin Fisheries Harbour in Kochi, Kerala. This is mainly because of the availability of many processing and exporting units in Kochi and adjoining areas. The price received by fishers for tuna is relatively lower (Rs. 100-200/kg depending on the species and freshness). Long-duration fishing coupled with poorer refrigerated storage facilities on board and poorer handling yields relatively lower quality fish landed by most of the offshore fishing fleet.

Table 3. Technical profile of the Thothoor offshore fishing fleet (2018)

Technical characteristics of the vessel	Estimates/particulars
Percent of vessels with individual ownership (%)	66
Length of the vessel (m)	10-21
Width of the vessel (m)	4.2-7.1
Horsepower range (HP)	110-190
Main gears used	Hook & line, gillnet, long line
Main resources targeted	Deep sea sharks, tuna, squids, Spanish mackerel, billfishes, rays
Fish hold capacity (tonnes)	7-20
Crew size (number)	9-18
Length of long line (m)	7,400-55,000
Length of Gillnet (m)	7,400-46,300
Number of trips/years	7-15
Number of days/trips	20-35
Consumption of fuel (diesel)/trip (litres)	2240, CV (%): 43.1
Average voyage time/trip (to and fro in hours)	216, CV (%): 42.4
Average actual fishing time/trip (hours)	336, CV (%): 33.9
Time taken to haul the gear (hours)	8-16
Depth of operation (range in m)	150-2000

Source: Parappurathu *et al,* 2020; Note: CV refers to the coefficient of variation expressed in percent.

The offshore fishing trips made by Thoothoor fishers were found to be economically profitable in general, but generated only modest returns. From an economic point of view, some of the salient characteristics of the enterprise are (i) relatively high costs incurred per fishing trip due to high expenditure on fuel and ice (ii) high dependence of fishers on informal credit which adds to the cost in the form of interest payments (iii) lower fishing efficiency due to manual operation of gear and the need to carry ice

throughout the trip due to lack of slurry ice making/freezing equipment onboard (iv) limited fish hold capacity owing to the lower size of vessels (v) skills deficit of the crew in post-harvest handling of fish leading to lower price realization for the produce and (vi) under-pricing of landed attributed to collusion between middlemen and exporters' agents at landing centres (Parappurathu et al, 2020).

The oceanic tuna fishery based in Lakshadweep islands

Lakshadweep is a tropical archipelago of 36 atoll coral reefs in the Laccadive Sea, off the coast of Kerala, India. The islands are located between the Arabian Sea to the west and the Laccadive Sea to the east, about 220–440 km (140–270 mi) off the Malabar Coast of mainland India. There has been a steady growth in fish production from the islands, which crossed 12,000 tonnes in recent years. Tuna landings constitute over 90 percent of total fish landings in Lakshadweep. As per GoI (2018), this region's estimated marine fishery potential is about 0.1 million tonnes mainly comprising tuna and tuna-like fishes, oceanic sharks, billfishes, deep-sea shrimps, and squids. A well-organized and thriving tuna fishery has been based at the islands for a long time. Targeted fishing, mainly for skipjack tuna, is mostly done using pole & lines and troll lines, which are low-impacting, and highly selective fishing method. The Yellowfin tuna resources in the oceanic waters around Lakshadweep are valuable, but mostly unexploited due to technological and logistical/value chain constraints. The estimated total fish landing of Lakshadweep in 2019 was 22 928 t of which tuna constituted 85%. Among tunas, skipjack (35.8%) and the yellowfin tuna (31.69%) were the major contributors. During the 2015- 2019 period, large pelagics constituted nearly 93% of the landings dominated by tunas (88%) in the total fish landing. Other large pelagics such as mahimahi, wahoo, billfishes, carangids, needlefishes, barracuda, etc. formed nearly 5% of the landing (Koya et al, 2021).

The prominent fishing gear employed is hook and line, principally pole & line, hand-line, and troll line in the order of importance. The use of drift gillnets is limited to the monsoon months. In the pole & line fishery, catch of skipjack alone constituted nearly 75% of the total catch, followed by yellowfin and neritic tunas, while others such as rainbow runner, mahimahi, billfishes, wahoo, sharks, and triggerfishes constituted 3% only. Yellowfin tuna constitute nearly 93% of the catch in hand-lines with other resources caught being billfishes, mahimahi, rainbow runner, and skipjack tuna. Local ownership and shorter fishing duration are the uniqueness of the fishery in Lakshadweep. Though, over the years, there has been progress in the fishing sector concerning mechanization; craft size, amenities on-board, marketing strategies, etc., the fishery is still rooted in sustainability principles (Koya et al, 2019; 2021). The basic features of fisherfolk households in the Lakshadweep islands are presented in Table 4.

Table 4. Basic features of fisherfolk of the Lakshadweep group of islands

Name of the Island	Population	Fisher families	Number of active fishers	Crafts in the fishery			
				Mech.	Mot.	Non-Mot.	Total
Agatti	4899	928	1591	1	177	126	304

Amini	2912	507	764	0	53	1	54
Androtт	1446	185	274	0	75	38	113
Bitra	222	44	70	0	25	11	36
Chetlat	1482	247	291	0	57	31	88
Kadmat	4156	681	843	0	80	213	293
Kalpeni	1440	227	481	0	107	96	203
Kavaratti	2717	365	561	1	43	74	118
Kiltan	1124	179	208	0	30	46	76
Minicoy	7536	800	1405	0	64	43	107
Total	27934	4163	6488	2	711	679	1392

Source: FSI-CMFRI-DoF (2020); Notes: Mech: Mechanized crafts; Mot: Motorized crafts; Non-Mot: Non-motorized crafts.

Value chain dynamics of tuna and other large pelagic species

India has an extensive network of 95 fishing harbors and over 1400 fish landing centers to cater to the needs of landing and berthing requirements of the fishing vessels and to act as a hub for post-harvest activities. However, only a few of them are equipped with specialized infrastructure to handle offshore fish landing and associated operations. Some of the leading harbors that presently handle tuna and other offshore fish species include Paradeep in Odisha; Visakhapatnam in Andhra Pradesh; Chennai, Mookaiyur, Kunthukal and Poompuhar in Tamil Nadu; Cochin and Vizhinjam in Kerala; Mangalore in Karnataka and Veraval in Gujarat. Most of these harbours are located in vibrant fish processing and export hubs where adequate facilities for cold storage, refrigerated transportation, primary and secondary processing, and export logistics are available. Nevertheless, India's offshore fish value chain faces several constraints that necessitate concerted efforts to upgrade fleet modernization with onboard handling and processing facilities, skill enhancement of the fishing crew, strengthen post-landing and cold chain infrastructure, upgrading secondary and tertiary processing infrastructure, besides the adoption of advanced technologies that can enhance operational efficiency, and reduce post-harvest losses.

Offshore caught landings of tuna and tuna-like fishes are marketed both in domestic and overseas markets. Resources such as tunas, barracudas, billfishes, ribbon fishes, squids and cuttlefishes, sharks and rays, etc. constitute a significant share of marine exports, contributing notably to foreign exchange for the country. In a recent study conducted by the ICAR-Central Marine Fisheries Research Institute, Kochi (ICAR-CMFRI, 2022) it was observed that marketing costs and margins of tunas vary considerably depending on the marketing channels through which they pass. Some of the most common value chains for tuna and tuna-like species are presented below:

Value chain 1 (domestic): Fisher-Auctioneer-Whole Sale Agent-Whole sale Market-Commission Agent-Retailers

Value chain 2 (domestic): Fisher- Supplier (Auctioneer)-Whole sale agent- Interstate wholesale markets- Commission Agent-Retailers

Value chain 3 (domestic): Fisher-Auctioneer-Whole Sale Agent-Local value addition unit-Retailer-Consumer

Value chain 4 (Export): Fisher- Auctioneer-Commission Agent- Export Processing Unit (Weighing-Grading-Pre-processing – Processing-Tunnel Freezing)-Terminal market

Along mainland India, the length of the channel depends on the number of intermediaries involved such as the auctioneers, wholesale agents, exporting/processing unit agents who operate at the landing centres; and marketing agents in the wholesale and other terminal markets. The first sale of the landed fish is done through auctions, with the mediation of auctioneers who charge a commission in the form of a share in the value of the fish transacted. The auction commission varied between 1-2 without credit involved and 4 percent and above if the fishers have existing credit contracts with the auctioneers in most of the landing centres. In the wholesale markets also, the prices of the fish transacted are determined by marketing agents who charge commissions ranging from 8-14 percent of the transacted value. The profit margins of the traders at various stages of the value chain constitute another component of the gross marketing margin. The marketing costs included labor charges incurred on sorting, grading, icing, packing, and other logistic services; loading charges, transportation charges, market fees, adjustments for weight changes due to drying and other forms of value addition, deductions on spoilage at various stages, and so on. The fishers' share in consumers' rupee varied widely across products and channels and ranged from 30 percent to 60 percent across the supply chain. In large harbours like Veraval, Gujarat, the fishers' share was assessed as a percent of the price at which the fish lots were transacted for other interstate markets and ranged from 64 percent to 80 percent. In the case of the export supply chain, the fishers' share ranged between 60 percent and 74 percent (Table 5).

Table 5. Marketing costs and marketing margins associated with export value chains of selected tuna/tuna-like fish species landed in Cochin Fishing Harbour, Kochi, 2020

Items	Yellowfin tuna		Skipjack tuna		Swordfish	
	Cost/ margin	%	Cost/ margin	%	Cost/ margin	%
Price quoted in auction (Rs/kg)	129		90		150	
Auction allowance charged (Rs/kg)	19.5		13.5		22.5	
Final price received after adjusting for auction allowance and auction commission (Rs/kg)	109.5	45.3	76.5	38.5	127.5	49.9
Commission charged (Rs/kg)	0	0.0	0	0.0	0	0.0
Labour charges incurred (Rs/kg)	1.5	0.6	1.5	0.8	1.5	0.6
Icing charges (Rs/kg)	2.5	1.0	2.5	1.3	2.5	1.0

Grading/Packing/Other charges (Rs/kg)	1.5	0.6	1.5	0.8	1.5	0.6
Loading charges (Rs/kg)	1.5	0.6	1.5	0.8	1.5	0.6
Market fee (Rs/kg) Specify	0	0.0	0	0.0	0	0.0
Transportation charges (Rs/kg)	2	0.8	2	1.0	2	0.8
Any other charges (Rs/kg) (Transaction cost + interest)	5	2.1	5	2.5	5	2.0
Profit margin of commission agent (Rs/kg)	17	7.0	5	2.5	13	5.1
Spoilage (%)	4	1.7	5	2.5	6	2.3
Price at which fish is sold /transferred (Rs/kg)	144.5	59.8	100.5	50.6	160.5	62.8
Average maximum processing capacity fish production per day (kg)	5000		5000		5000	
Labour charges incurred (Rs/kg)	7	2.9	7	3.5	10	3.9
Icing/freezing charges (Rs/kg)	6	2.5	6	3.0	6	2.3
Grading/Packing/Other charges (Rs/kg)	2	0.8	2	1.0	2	0.8
Loading charges (Rs/kg)	2	0.8	2	1.0	2	0.8
Transportation charges (Rs/kg)	10	4.1	10	5.0	10	3.9
Administration cost (Rs/kg)	5	2.1	5	2.5	5	2.0
Electricity cost (Rs/kg)	10	4.1	10	5.0	10	3.9
Water cost (Rs/kg)	3	1.2	3	1.5	3	1.2
Insurance cost (Rs/kg)	7	2.9	7	3.5	7	2.7
Certification and inspection cost (Rs/kg)	3	1.2	3	1.5	3	1.2
Other operating cost (Rs/kg)	6	2.5	6	3.0	6	2.3
Interest on capital investment (Rs/kg)	7	2.9	7	3.5	7	2.7
Depreciation (Rs/kg)	2.5	1.0	2.5	1.3	2.5	1.0
Interest (Rs/kg)	2	0.8	2	1.0	2	0.8
Spoilage (%)	2	0.8	3	1.5	5	2.0
Profit margin (Rs/kg)	22.5	9.3	22.5	11.3	14.5	5.7
Price at which fish is sold /transferred to terminal market (Rs/kg)	241.5	100.0	198.5	100.0	255.5	100.0

Source: ICAR-CMFRI (2022)

The majority of the pole and line-caught skipjack tuna landed in Lakshadweep islands is converted to a specialized Indigenous traditional product called *masmin,* while a small proportion is kept aside for fresh sales or consumption. After landing, tuna is split into two halves longitudinally, cleaned and boiled in brine, smoked, and then thoroughly sun-dried. The majority of the *masmin* is exported from the islands to mainland India, in particular to Tuticorin, from where it is further exported to Sri Lanka (Dakshin Foundation, 2020). Apart from *masmin* production, secondary processing activities in the islands are rather limited. Freezing and processing plants exist only on Minicoy Island. Fresh tuna intended for domestic markets are transported in bulk to port cities like Kochi and Mangalore in the mainland with the intermediation of wholesale market agents.

The tuna value chain in India has enormous potential for improvement, which needs concerted efforts from the government and intensified investment by private entrepreneurs and the processing industry. Developing export-oriented fish processing industries of an appropriate scale to meet the twin objective of economic utilization of the resources and ensuring livelihood opportunities for the stakeholders are called for. The yellowfin tuna fisheries can be expanded further to tap deep-swimming larger tunas with appropriate fishing infrastructure and logistic arrangements put in place for an added objective of developing the high-end, sashimi-grade tuna (Koya et al, 2021; Parappurathu et al, 2020).

Policy thrusts and the Way Forward

The Government of India is currently working out the modalities and governance arrangements for developing a high-value tuna value chain in the country that would lead to realizing higher returns to its fishers and others in the clientele for the existing harvests. Legal and policy instruments for harnessing the opportunities on the high seas, in tandem with the management strategies of the regional fisheries management organizations (RFMOs) are under consideration by the government. India is also giving considerable thrust to reinforce its engagements with RFMOs like the IOTC in evolving strategies to explore optimum, equitable harvests of the biological resources in the high seas, especially the straddling and highly migratory species. There is a need to establish institutional arrangements for the regular collection, analysis, and archival of data related to the socio-economic parameters linked to the fishery of tuna and tuna-like species. Presently, much of it is staggered and not readily accessible for common use by stakeholders. Some relevant variables for inclusion are (i) The economic indicators of tuna fishing like fixed and variable cost and efficiency parameters (ii) demographic and socio-economic details related to major fishing communities at the unit level (iii) statistics related to fishing crafts and gear, landing centres, markets, processing and value addition facilities, social and financial institutions, etc. (iv) economic indicators associated with tuna value chains like market prices, costs and margins, economic efficiency, infrastructure and logistical arrangements in place, measures for traceability and certification, etc. (iv) statistics related to capital and revenue expenditure/ investments incurred on tuna fishing and allied activities at disaggregate level (v) social safety net measures in place for the fishing community (vi) government support in terms of financial

and technical assistance (vii) research and development initiatives connected to tuna fishing and post-harvest operations (viii) relevant government regulations and policies in place, and so on. Efficient mechanisms can be put in place for the timely sharing of relevant indices and metrics with international organizations and development agencies which can facilitate in overall development of the sector.

References

Abdussamad, E.M., Syda Rao, G., Said Koya, K.P. et al (2012). Indian tuna fishery - production trend during yesteryears and scope for the future, *Indian Journal of Fisheries*, 59 (3): 1-13.

CMFRI (2014). A value chain on oceanic tuna fisheries in Lakshadweep sea, Report of National Agricultural Innovation Project, ICAR-Central Marine Fisheries Research Institute, Kochi.

D' Cruz, T.S. (2004). *Artisanal deep sea fishing in Kerala: Prospects and Problems*, Discussion Paper No. 74, Centre for Development Studies, Thiruvananthapuram.

FSI-CMFRI-DoF (2020). Marine Fisheries Census 2016, Fishery Survey of India and Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India and ICAR-Central Marine Fisheries Research Institute, Kochi. ISBN 978-93-82263-41-8.

GoI (2018). Report of the Expert Committee for Revalidation of the Potential Yield of Fishery Resources in the Indian EEZ, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India, New Delhi.

ICAR-CMFRI (2022). Offshore Fisheries in India: An Economic Assessment of Fishing and Associated Value Chains, Final Report of the ICAR Network Project on Agricultural Value Chains, ICAR-Central Marine Fisheries Research Institute, Kochi.

IOTC (2016). Online data query service of the Indian Ocean Tuna Commission accessed at https://iotc.org/oqs in June 2019.

IOTC (2019). Development of harmonized terms and definitions for IOTC conservation and management measures, Final Report, Indian Ocean Tuna Commission, accessed at https://www.iotc.org/sites/default/files/documents/2016/04/IOTC-2016-CoC13-Inf05_-IOTC_Terms_Defintions_Report_0.pdf

IOTC (2024). Online data query service of the Indian Ocean Tuna Commission accessed at https://iotc.org/oqs in October 2024.

Koya, M.K., Abdul Azeez, P., Rohit P., Sreenath K. R., Rajesh K.M. and Abdussamad E.M. (2019). Lakshadweep Livebait Fisheries Management Plan. ICAR-CMFRI Mar. Fish. Policy Series No 12, 56 p.

Koya, M.K., Said Koya, K. P., Abdul Azeez, P., Rohit, P. and Abdussamad, E. M. (2021). Marine Fisheries Information Service Technical & Extension Series No. 249, 2021.

Parappurathu, S., Ramachandran, C., Menon, M., Baiju, K.K., Rohit, P., Kumar, R.N., Padua, S. and Kumar, S. (2020). Harnessing artisanal prowess in offshore fisheries: The case of Thoothoor fishers from India, *Marine Policy,* 121 (2020) 104174, doi: 10.1016/j.marpol.2020104174.

Vivekanandan, V. (2001). An ill-thought ban, *Samudra,* 30: 3-9 available at www.icsf.net/jsp/publication/samudra/pdf/english/issue_30/art01.pdf).