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Techno-economic performance review of selected fishing fleets in Asia

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by

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Preparation of this document

This publication on the techno-economic performance of selected marine fishing fleets in Asia was prepared in 2019–2020 by Raymon van Anrooy of the FAO Fisheries Division, Rajdeep Mukherjee and Yugraj Singh Yadava of the BOBP-IGO, Hiroki Wakamatsu of Japan's Fisheries Research and Education Agency, Liming Song of the Shanghai Ocean University, Umi Muawanah of the Indonesian Agency for Marine Affairs and Fisheries Research, Bong Jin Cha of the Korean National Institute of Fisheries Science, R. Narayana Kumar and Shinoj Parappurathu of the Indian Council of Agricultural Research-Central Marine Fisheries Research Institute and Uwe Tietze, fisheries consultant.

It includes six national reports of the main marine capture fisheries fleets of Bangladesh, China, India, Indonesia, Japan and the Republic of Korea. The national reports on selected fishing fleets in Japan, and the Republic of Korea are based on the annual data and information collection programmes of the Japan Fisheries Agency and the National Institute of Fisheries Science (NIFS) of the Republic of Korea, respectively. The national reports of Bangladesh, China, India, and Indonesia are based on fishing vessel surveys conducted by the respective authors during 2018 and 2019. The costs and earnings data of these fishing fleets are related to the 2017-18 and 2018-19 fishing seasons.

The methodology for conducting the national review studies was discussed and agreed at the FAO/ BOBP-IGO Expert Meeting on Methodologies for Conducting Fishing Fleet Techno-economic Performance Reviews, held in Chennai, India, in the period 18–20 September 2018 (FAO, 2019). Following the preparation of the draft national review studies in 2019, an expert meeting to validate the outcomes and finalize the techno-economic performance review of the main global fishing fleets was held at FAO headquarters in Rome, Italy on 8–10 October 2019. This expert meeting considered it important to publish not just a global review, but to also finalize and publish the national review reports and produce regional reviews for Europe, North and South America, Africa, and Asia. This publication is accompanied by similar regional reviews from Europe and North- and South America. The preparation of the national fleet reports was coordinated and facilitated by Rajdeep Mukherjee of the BOBP-IGO.

This publication was formatted by Estefanía Burgos and editorial and design assistance was provided by Magda Morales and Marianne Guyonnet of the FAO Fisheries Division.

Abstract

This techno-economic performance review of selected fishing fleets in Asia was carried out as part of the 2020 FAO Review of the techno-economic performance of the main global fishing fleets. It includes a techno-economic performance review of major fishing fleets of six of the largest fish producing countries from the Asian region: Bangladesh (4 fleets), China (6 fleets), India (5 fleets), Indonesia (5 fleets), Japan (4 fleets), and the Republic of Korea (3 fleets). The country reports are based on information from fishing fleet data collection schemes in Japan and the Republic of Korea covering the period 2017-18, and fishing vessel surveys carried out in Bangladesh, China, India, and Indonesia during 2018-19. The review includes financial and economic information of 27 fishing fleet segments, including trawlers (10 fleets), purse seiners (7 fleets), gillnetters (3 fleets), long liners (2 fleets), jiggers (2 fleets), cast netters, stow netters, and a fleet of pole and line fishing vessels.

An analysis of the costs and earnings of the 27 fleet segments showed that, on average, labour costs (for example wages, labour shares, food, and crew travel) is the largest costs component, adding up to some 36 percent of the total annual operational costs. Running costs amounted to around 31 percent of the costs, with fuel costs as the largest item. Vessel costs (for example permits, insurance, repairs, and maintenance) constitute on average nearly 19 percent of the total cost. Capital costs (for example depreciation and interest payment) made up the balance of 14 percent. Ninety-three percent of the revenue of the fleet segments surveyed originated from the sale of fish caught. Fishing fleets in Bangladesh and Indonesia were only generating revenue from the sale of fish, while fleets in China, India, Japan and the Republic of Korea also received some income from other sources, such as government financial transfers.

Eighty-nine percent of the 27 fishing fleet segments reported positive net cash flows. Seventy percent of the fishing fleets realized net profit margins of more than 10 percent. Eighty-one percent of the fishing fleets reported positive results in terms of their capital productivity, as their returns on fixed tangible assets (ROFTAs) were positive.

The review shows that investments in fishing vessels and fishing operations of these major Asian fishing fleets are generally profitable. Marine capture fishing is a financially viable economic activity in all six major fishing nations included in the review. Most fishing fleets surveyed realized enough income to cover depreciation costs, interest and loan repayments, and provided sufficient financial resources for reinvestment. Nearly 60 percent of the fishing fleets generated returns on investment (ROIs) of 15 percent and higher, which signals an attractive sector for investments. The total gross value added (GVA) of the 27 fishing fleets to the Asian regional economy was substantial and is estimated at around USD 66 billion. The review also reveals a need for adequate management measures, including fleet capacity management plans, to improve the status of fish stocks in the region and maintain a healthy and profitable fishing sector.

Contents

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The authors would like to acknowledge the support received from fishing vessel owners and fishers in the countries included in this regional review paper. The vessel owners and fishers shared valuable insights, data, and information on the technical aspects of their fishing operations, and provided information on the costs and earnings of their fishing operations. Without their support, the preparation of the national reports presented in this paper would not have been possible.

The authors would also like to express appreciation for the valuable contributions by the participants of the two expert meetings on methodologies for conducting fishing fleet techno-economic performance reviews. The first meeting was held in Chennai, India, on 18–20 September 2018, and developed the survey methodology. The second meeting was held in Rome, Italy, on 8–10 October 2019, and reviewed the draft national reports.

The authors of the national report of Bangladesh would like to thank the support provided by the staff members of the Ministry of Fisheries and Livestock and the Department of Fisheries, especially, Md. Towfiqul Arif, Kazi Shams Afroz, Md. Sharif Uddin, Nripendra Kumar Singha, Md. Nazim Uddin, Suman Barua, Md. Zahirul Haque and SM Sajjad Uddin. The authors of the national report of India would like to acknowledge the important contributions to this technical paper by E. Vivekanandan, A. Gopalakrishnan, P. Laxmilatha, N. K. Sanil, Prathibha Rohit and N. K. Harshan of the Indian Council of Agricultural Research-Central Marine Fisheries Research Institute (ICAR-CMFRI).

Finally, the authors wish to express their gratitude to the BOBP-IGO, for the assistance provided in coordinating the global review work and for generously hosting an expert meeting in Chennai.

Acronyms and abbreviations

AIS	automatic identification system
BHP	brake horse power
BOBP-IGO	Bay of Bengal Programme Inter-Governmental Organisation
CPUE	Catch per unit of effort
DoF	Department of Fisheries of a particular country
EEZ	exclusive economic zone
FAO	Food and Agriculture Organization of the United Nations
FTE	fulltime-equivalent (employment figures)
GDP	gross domestic product
GPS	global positioning system
GT	gross tonnage
GRT	gross registered tonnage
GVA	gross value added
HP	horse power
IFO	intermediate fuel oil
IOTC	Indian Ocean Tuna Commission
ITQ	individual transferable quotas
kW	kilowatt
LOA	length overall
MFO	Marine Fisheries Office (Bangladesh)
NFIO	Fishing Operations and Technology Branch (FAO)
nm	nautical mile
OECD	Organisation for Economic Co-operation and Development
PFD	personal flotation device
ROI	return on investment
ROFTA	return on fixed tangible assets
RFMO	Regional Fishery Management Organization
SDG	Sustainable Development Goal
TAC	total allowable catch
USD	United States Dollar

Report of India

National report of India

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EXECUTIVE SUMMARY

The fishery sector in India supports the livelihoods of about 16 million people. In 2017-18, the sector contributed 6.2 percent to the agricultural Gross Value Added (GVA) and earned foreign exchange valued at USD 7 082 million through the export of 1.38 million tonnes of seafood.

According to the National Marine Fisheries Census, 2016 conducted by the Indian Council of Agricultural Research – Central Marine Fisheries Research Institute (ICAR-CMFRI), the mechanized fishing fleet in India included 42 656 vessels with inboard engines (fitted in the hull), 95 957 vessels with outboard motors and 25 689 non-motorized boats. In 2017, mechanized fishing vessels accounted for 85 percent of the total marine fish landings.

The semi-industrial fishing fleet, which is the most economically important segment of the Indian fishing fleet in terms of volume of seafood landed, mainly includes trawlers, gillnetters, purse seiners and inboard motor (IBM) ring seiners. The overall length of trawlers ranged from 10 to 29 m (engine power: 120–550 hp), gillnetters 10 to 17 m (engine power: 120–225 hp) and purse seiners 10 to 28 m (engine power: 100–350 hp). While trawlers targeted mostly *penaeid* shrimps, gillnetters caught mainly small pelagics and perches, and purse seiners and motorized ring seiners caught small pelagics and carangids. Most vessels use several gear variants with different specifications, depending upon the seasonal availability of resources.

The analysis, presented in this report, provides information on the average capital investments in trawlers (USD 70 000 to 79 000), gillnetters (USD 95 000), purse seiners (USD 235 000) and ring seiners (USD 72 000). The average annual net profits ranged between USD 16 000 for mechanized gillnetters in Chennai to USD 62 000 for purse seiners in Mangalore. All fishing fleet segments surveyed, *i.e.* trawlers, gillnetters, purse seiners, and ring seiners were found to be economically viable and generated considerable gross value added. The net profit margins ranged between 14 percent for the purse seiners and 33 percent for the mechanized trawlers of Kakinada. There were marked differences in terms of returns on fixed tangible assets (ROFTA) among the fleet segments covered in the analysis. Ring seiners had the highest ROFTA (142 percent), followed by trawlers (86 percent and 95 percent), purse seiners (51 percent), and gillnetters (36 percent). The gross value added (GVA) to revenue for the surveyed fleets was between 48 percent and 73 percent, which indicates that a significant share of the revenue contributes to the national economy through the production factors (labour in this case). The Government of India is providing financial assistance to fishers through the State and Union Territory (UT) Governments for

the motorization of traditional fishing boats, rebates on diesel fuel used for fishing, construction of fishing harbours and fish landing centres, and for the establishment of inland fish marketing centres. In 2017-18, the total Government subsidy provided to the fisheries sector was USD 114.6 million. The key policy in the marine fisheries of India is the National Policy on Marine Fisheries (NPMF) 2017, which is based on seven pillars: sustainable development, socio-economic uplift of fisherfolk, the principle of subsidiarity, partnership, inter-generational equity, gender justice as well as the precautionary approach. The Marine Fishing Regulation Act (MFRA) of the coastal States/UTs has provisions for regulating fishing and conservation measures in the territorial waters, which are under their jurisdiction.

The fishing sector in India has witnessed several technological advances in recent years. Though fishing in the country has not reached industrial-scale, technologically advanced equipment for fish preservation and communication is being used. Also, the introduction of vessel monitoring systems (VMS) is presently (2020) being considered and field tested. Several maritime States in India have made Automatic Identification System (AIS) mandatory for their large fishing vessels.

1. GENERAL INFORMATION ON FISHERIES IN INDIA

The fisheries sector serves as a significant source of income, employment, food, nutritional and livelihood security, as well as a source of foreign exchange earnings. It supports the livelihoods of about 16 million people (Government of India, 2019). During the last seven decades, fisheries in India have gradually transformed from a subsistence level to a multi-million-dollar industry. Over the last five years (2014-18), the sector has been contributing around one percent to the country's Gross Domestic Product (GDP). During 2017–2018, the fisheries and aquaculture sector contributed 6.2 percent to the agricultural Gross Value Added (GVA) and contributed USD 7 082 million to foreign exchange earnings through export of 1.38 million tonnes of seafood (MPEDA, 2019). During 2016-17, the contribution of the fisheries sector to GVA at current prices was USD 19 867 million[1] (Government of India, 2019).

The marine fisheries in India take place along a coastline of 8 129 km, comprising nine maritime states and four Union Territories (UTs). There are 1 265 landing centers and 3 477 marine fishing villages (Table 1).

TABLE 1
Marine fishery profile of India

Characteristics	Profile
Area of the country	3.29 million km^2
Length of coastline	8 129 km
Exclusive economic zone (EEZ)	2.02 million km^2
Continental shelf	500 000 km^2
Inshore area (< 50 m depth)	180 000 km^2
Marine fish landing centres	1 265
Fishing villages	3 477

Source: CMFRI-DOF, 2020.

[1] *One USD = INR 67.19 in 2016-17 and INR 65.12 in 2017-18.*

TABLE 2
Fish production by environment (marine and inland) in India in million tonnes and annual production growth rates

Year	Fish production (million tonnes)			Annual growth rate (percent)		
	Marine	Inland	Total	Marine	Inland	Total
2006-07	3.02	3.85	6.87	7.39	2.37	4.52
2007-08	2.92	4.21	7.13	-3.44	9.41	3.76
2008-09	2.98	4.64	7.62	1.99	10.24	6.86
2009-10	3.10	4.89	8.00	4.23	5.52	5.02
2010-11	3.25	4.98	8.23	4.70	1.78	2.91
2011-12	3.37	5.29	8.67	3.75	6.28	5.28
2012-13	3.32	5.72	9.04	-1.51	8.03	4.32
2013-14	3.44	6.14	9.58	3.67	7.29	5.96
2014-15	3.57	6.69	10.27	3.66	9.04	7.11
2015-16	3.60	7.16	10.76	0.87	7.04	4.89
2016-17	3.63	7.81	11.43	0.70	8.99	6.21
2017-18	3.69	8.90	12.59	1.73	14.05	10.14

Source: Government of India, 2019.

The total fish production (marine and inland) in India increased from 6.87 million tonnes in 2006-07 to 12.59 million tonnes in 2017-18 (Government of India, 2019).

2. DEMOGRAPHICS AND SOCIO-ECONOMIC DATA

In India, fishers are considered as a distinct socio-economic community. The National Marine Fisheries Census carried out in 2016,[2] estimated the total population in the distinct fishing communities at 3.774 million people, out of which the male population was 1.952 million (51.71 percent) and the female population was 1.822 million (48.29 percent) (Table 3). The total number of households (families) involved in marine fishing was estimated at 893 258 and the average family size was 4.20 persons. The total number of active fishermen was estimated at 927 000 people.

3. NATIONAL FLEET

In India, the marine fishing fleet is grouped into the following three categories:

i. Mechanized craft: vessels with engines permanently fitted to the hull and which use mechanical power for propulsion/gear operation;

TABLE 3
Social profile of marine fishers in India, 2016

	Details	Number
1	Male fisher population	1 952 068
	Adult fishers	1 291 640
	Children fishers (<15 years)	660 428
2	Female fisher population	1 822 509
	Adult fishers	1 230 277
	Children fishers (<15 years)	592 232
3	Total fisher population	3 774 577
4	Number of families[3]	893 258
5	Average family size	4.20
6	Active fishermen	927 081

Source: CMFRI-DOF, 2020.

[2] The 2016 census information is the latest available information on the fishing fleet and fishers population in India. Earlier surveys did not encompass all states.

[3] The census defines a fisher family as: a family in which at least one member is engaged in marine fishing or associated activities or both.

ii. Motorized craft: vessels with outboard motors (temporarily fitted) used for propulsion; and
iii. Non-motorized craft: vessels that do not use any engine/motor for propulsion and gear operation.

The estimated total number of commercial fishing vessels decreased from 194 490 in 2010 (CMFRI, 2012) to 164 302 in 2016, a decline of 15.5 percent. The fishing fleet distribution by fishing methods in India is presented in Table 4.

4. CHARACTERISTICS OF FISHING FLEETS INCLUDED IN THIS REVIEW

The economically most important semi-industrial fishing fleets in India in terms of volume of seafood landed, include trawlers, gillnetters, purse seiners, and in-board motor (IBM) ring seines. In 2018, mechanized vessels accounted for 81.4 percent of the total marine fish landings, motorized crafts for 17.5 percent, and non-motorized vessels for 1.1 percent (CMFRI, 2019). Most of the fishing fleets operate within the EEZ of India. Fishing takes place in FAO fishing areas 57 (Eastern Indian Ocean) and 51 (Western Indian Ocean).

4.1 Fishing harbours and fleets

The main fishing harbours are shown in Table 5 and an overview of the main fishing fleets is shown in Table 6.

TABLE 4
National fishing fleet, India, 2016

Category	Vessels by fishing method	Number	Percentage
Mechanized crafts	Trawlers	30 486	
	Gillnetters	6 502	
	Dol netters	3 394	
	Liners	49	
	Ring seiners	943	
	Purse seiners	1 189	
	Others	88	
	Total mechanized	**42 656**	26.0
Motorized	Motorized	**95 957**	58.4
Non-motorized	Non-motorized	**25 689**	15.6
Total fishing fleet		**164 302**	**100.0**

Source: CMFRI-DoF, 2020.

TABLE 5
Main fishing harbours in India

State/Union territory	Fishing harbours
West Bengal (East coast)	Digha
Odisha (East coast)	Paradeep
Andhra Pradesh (East coast)	Visakhapatnam, Kakinada, Masulipatnam
Tamil Nadu (East coast)	Chennai, Cuddalore, Nagapattinam, Rameswaram, Tuticorin
Pondicherry (East coast)	Pondicherry
Gujarat (West coast)	Veraval
Maharashtra (West coast)	New Ferry Wharf, Sassoon Docks, Versova, Ratnagiri
Karnataka (West coast)	Karwar, Managalore
Kerala (West coast)	Calicut, Cochin, Munambam and Vizhinjam

TABLE 6
Overview of the main fishing fleets

Fishing fleets by gear name	Number of vessels*	Scale	FAO fishing area	Important fishing ports
1. Trawlers	30 486	Semi-industrial	51 and 57	Digha (West Bengal); Paradeep (Odisha) Chennai (Tamil Nadu) Rameswaram (Tamil Nadu) Kakinada (Andhra Pradesh) Cochin Fisheries Harbour (Kerala) Versova (Maharashtra) Veraval (Gujarat)
2. Gillnetters	6 502	Semi-industrial	51 and 57	Chennai (Tamil Nadu) Rameswaram (Tamil Nadu) Nagapattinam(Tamil Nadu) Masulipatnam (Andhra Pradesh)
3. Purse seiners	1 189	Semi-industrial	51	Mangalore, Karwar (Karnataka)
4. Ring seiners (IBM)	943	Semi-industrial	51 and 57	Munambam, Cochin, Calicut, Vizhinjam (Kerala), Cuddalore, Nagapattinam (Tamil Nadu) Visakhapatnam (Andhra Pradesh)

Source: CMFRI-DOF, 2020.

4.2 Fish landings and species targeted

In 2018, the total value of marine fish landings in India was USD 8 083 million (CMFRI, 2019). From the data on the contribution of the three categories of the fleet to total fish landings, it can be estimated that the ex-vessel value of landings from mechanized fishing vessels was USD 6 578 million, from motorized vessels USD 1 413 million, and from non-motorized crafts USD 93 million (compiled from CMFRI, 2019).

On breaking down the value of landings further by type of fishing gear used, trawlers accounted for USD 3 193 million (1.38 million tonnes of catch); gillnetters for USD 1 836 million (790 000 tonnes); purse seiners for USD 110 million (50 000 tonnes); motorized crafts for USD 1 413 million (610 000 tonnes) and traditional/artisanal crafts for USD 93 million (40 000 tonnes) (compiled from CMFRI, 2019). While trawlers targeted mostly penaeid shrimps, gillnetters caught mainly small pelagics and perches, and purse seiners and motorized ring seiners caught small pelagics and carangids. Most vessels use several gear variants with different specifications, depending upon the seasonal availability of resources (Table 7).

4.3 General characteristics of the selected fishing vessel segments

4.3.1 Trawlers

Otter board trawlers are the most common type of trawlers operating in India. The use of otter boards to open the trawl net mouth horizontally has been in vogue for many years. Shrimp trawls, fish trawls, combination trawls, wing trawls, bobbin trawls, herring trawls, semi-pelagic trawls, and mid-water trawls are also commonly used.

The overall length of mechanized trawlers operating in India ranges from 10 to 29 metres and the crew size varies from 5 to 15 (Table 8). Typically, a variety of trawl nets are used by the vessels in this fleet segment.

TABLE 7
Species targeted by fishing fleet (ranked from 1 - highest to 5 – lowest)

Fleets/rank/ species	1	2	3	4	5
1. Trawlers	Penaeid prawns *(Metapenaeus dobsoni, Metapenaeus affinis, Parapenaeopsis stylifera, Fenneropenaeus indicus)*	Indian mackerel *(Rastrelliger kanagurta)*	Seer fish *(Scomberomorus commerson, Scomberomorus guttatus, Scomberomorus cavalla)*	Carangids *(Megalapsis cordyla, Decapterus russelli, Selar crumenophthalmus)*	Sardines *(Sardinella longiceps, Dussumieria acuta, Sardinella albella)*
2. Gillnetters	Wolf herrings *(Chirocentrus dorab, Chirocentrus nudus)*	Indian mackerel *(Rastrelliger kanagurta)*	Sardines *(Sardinella longiceps, Dussumieria acuta, Sardinella albella)*	Snappers *(Lutjanus argentimaculatus, Lutjanus malabaricus, Lutjanus johnii)*	Perches *(Lates calcarifer)*
3. Purse seiners	Indian mackerel *(Rastrelliger kanagurta)*	Sardines *(Sardinella longiceps, Dussumieria acuta, Sardinella albella)*	Carangids *(Megalaspis cordyla, Decapterus russelli, Selar crumenophthalmus)*	Pomfrets *(Pampus argenteus, Pampus chinensis, Parastromateus niger)*	Lizard fishes *(Saurida tumbil, Saurida undosquamis)*
4. Ring seiners (IBM)	Oil sardine *(Sardinella longiceps)*	Lesser sardines *(Dussumieria acuta, Sardinella albella)*	Anchovies *(Stolephorus commersonii, Stolephorus indicus, Encrasicholina punctifer)*	Indian mackerel *(Rastrelliger kanagurta)*	Tunas, Clupeids *(Tenualosa ilisha, Tenualosa toli, Anadontostoma chacunda)*

Source: Field survey.

TABLE 8
Common characteristics of trawlers

Type of vessel	Overall length (LOA) in metres	Engine (hp)	Equipment used	Gear	Crew size
Trawler	10–29	120–550	Echo sounder, compass, GPS, radio transmission set	Shrimp nets, cuttle fish net, *Nemipterus* net, *Saurida* net, roller/ gundu net, sardine net, common fish net	5–15

Source: Field survey.

4.3.2 Gillnetters

Gillnets are a common fishing gear used in India in the mechanized, motorized and non-motorized fleets. The length of a mechanized gillnetter ranges from 10 to 17 m (Table 9). Different types of gillnets varying in length, mesh size and depth of operation are used for fishing (Table 10).

Gillnetters commonly have Indian made inboard engines to keep the operating cost low. Many of these vessels also apply hand line fishing. Gillnetters sometimes also use crab nets, bottom set gillnets, as well as drift gillnets.

TABLE 9
Main features of mechanized gillnetters

Type of vessel	Overall length (LOA) in metres	Engine (hp)	Equipment used	Gear	Crew size
Gillnetter	10–17	120–225	Compass, GPS, echo sounder	Gillnets, handlines	8–10

Source: Field survey.

TABLE 10
Classification of gillnets

Name	Weight of net (kg)	Twine No.	Mesh size	Remarks
Gillnet (large)	>100	4/3 and above	90 mm and above	These type of nets are mainly used in large mesh driftnet operations in the high seas.
Gillnet (medium)	30–100	1/3, 3/2 and 2/3	60–70 mm	This net type is also used in driftnet fishing operations. The net is commonly used for catch of mackerels.
Gillnet (small)	10–30	1/2, 1/3 and monofilament	12–50 mm	This smaller gillnet type includes a wide range of nets, including nets for catching anchovy, sardine and prawns.
Gill net (very small)	2–10	1/2 monofilament	12–40 mm	These very small nets are used by non-motorized boats with one or two crew members.

Source: Field survey.

4.3.3 Purse seiners/ring seiners

Purse seining and ring seining are fishing methods used in India for the harvesting of shoaling fishes, such as sardines and mackerels. The mechanized fishing vessels use their inboard engines not only for reaching and returning from fishing grounds but also for operating the gear systems. Marine diesel engine brands frequently used by purse seine vessels include Ashok Leyland (made in India), Weichai Power (China), Cummins (USA), Yuchai (China), Suzuki (Japan), Caterpillar (USA), Ruston (England) and Greaves (India).

The main structural difference between a ring seine and a purse seine net is that the purse seine is made of comparatively heavy tarred webbing, uniform in its entire length, and is practically square on the ends, whereas a ring seine net is typically made of light tanned webbing gathered on the ends, and is made in three parts: a central "bag" of fine webbing and two end portions or "wings" of coarse mesh. Seiners operate both purse and ring seines, depending on targeted species and operating conditions (Table 11).

The main features of the vessels operating purse seines and ring seines are shown in Table 12.

TABLE 11
Classification of purse seines/ring seines

Local name	Weight of net (kg)	Mesh size (mm)	Length (m)	Depth of operation (m)
Ring vala (Large)	> 500 kg	18–22	450–1000	75–90
Ring vala (Medium)	< 500	18–22	300–400	50–70
Choodavala	>250 (150–300)	8–12	150–250	30–50
Rani vala	250–400	18–22	250–300	30–40
Nanduvala	150–200	12	150–250	20–30

Source: Field survey; 'vala' means net.

TABLE 12
Main features of seiners

Type	Overall length (LOA) in metres	Engine (hp)	Equipment used	Gear	Crew size
Ring seine/ purse seine	10–28	100–350	VHF radio, compass, GPS, Eco sounder	Ring seine/ purse seine	8–55

Source: Field survey.

5. FINANCIAL AND ECONOMIC CHARACTERISTICS OF INDIVIDUAL FISHING UNITS

The basic information of the fishing vessels surveyed and included in the 2018-19 study is presented in Table 13. The average length overall (LOA) was the highest for purse seiners, followed by gillnetters, trawlers and ring seiners. The purse seiner is large in size to accommodate large-sized nets and also has more crew. Similarly, the average horsepower of a purse seiner vessel is the highest at 493 hp. Most vessels in these fleet segments carry out multi-day fishing trips with an average duration of 3–5 days. Only the ring seiners operate on a single day fishing trip basis.

5.1 Capital investments

The analysis of the average initial investments made in the fishing vessels indicated that the initial investment was highest for vessels in the purse seine fleet segment with nearly USD 235 000 per vessel (Table 14). This is due to the size of the vessel, the engine power required for the fishing operations and the costs of the fishing gears.

TABLE 13
Basic information of the fishing vessels surveyed by fleet segment, 2018-19[4]

Technological/operational characteristics	Trawler, Chennai	Trawler, Kakinada	Gillnetter, Chennai	Purse seine, Mangalore	Ring seine, (IBM), Kochi
Length overall (LOA) in metres	16	15	19	22	13.9
Gross tonnage (GT)	36.5	24.4	51.5	126	37.9
Total power of main engines (hp)	140	232	163	493	115
On-board storage facilities (metric tonnes)	5.8	23	23	35.6	NIL
Fishing gear	Trawl	Trawl net	Gill net	Purse seine	Ring seine
Crew size (persons)	10	9	8	32	31
Ownership	Individual	Individual	Individual	Shared	Shared
Total days fishing at sea in a year	223	234	216	146	184
Number of fishing trips in a year	46	47	43	73	184
Fishing season (in months)	9	9	9	9	9

Source: Field survey.

TABLE 14
Average initial investments made in vessels of five fishing fleet segments, 2018-19 (USD)

Item	Trawler, Chennai	Trawler, Kakinada	Gillnetter, Chennai	Purse seiner, Mangalore	Ring seiner, (IBM) Kochi
Vessel (hull)	41 389	30 278	46 944	89 444	23 194
Main engine(s)	10 652	15 444	19 917	34 708	12 222
Equipment on deck (*e.g.* cranes, beams)	5 000	2 708	0	4 071	1 472
Equipment below deck (*e.g.* cold storage, ice making, freezers)	NA	NA	NA	2 708	NA
Fishing gear with a lifespan of 3 years or more	15 000	16 667	22 674	94 721	32 951
Electronic devices (navigation, fish finding and communication)	3 431	3 250	3 250	4 615	1 288
Other items	3 611	2 333	2 333	4 655	1 041
Total investment in USD	**79 083**	**70 680**	**95 118**	**234 922**	**72 170**

Source: Field survey.

[4] The fleet surveys were conducted in 2019 and included five randomly selected vessels per fishing fleet segment.

Most of the vessel owners and operators surveyed in 2019 reported that their vessels were relatively new. The oldest vessel included in the survey had a hull of 8 years. Fishing vessel hulls, which are made of wood, are expected to have a limited lifetime of around 12–15 years. Wooden vessel construction and repair is a flourishing business in India, as a consequence of the limited vessel lifetime and needs for repair and maintenance associated with the materials and the way the vessels are built. The fishing vessel engines used are often of mediocre quality and are expected to be operational for five to eight years. The average age of hulls, engines and major equipment items of the vessels in the fleet segments surveyed is presented in Table 15.

5.2 Operating and owner costs

The average annual operating cost and earnings of the selected fleet segments in the 2018-19 fishing year is presented in Table 16. It can be observed that the annual revenue was the highest for purse seiners at USD 445 000 followed by ring seiners at USD 257 000, trawlers (Chennai) at USD 206 000, gillnetters at USD 95 000 and trawlers (Kakinada) at USD 90 000.

The higher revenue of purse seiners could be attributed to a higher scale of operations as well as the catch composition which includes some high-value fish species. The main source of vessel earnings in all five fleet segments originated from the sale of fish (97 to 100 percent) and the remaining income came from fuel subsidies. No other sources of income were reported.

Labour and fuel were the two largest operating costs components in 2018–2019. Labour share and wages added up to 61 percent of the total operating costs for trawlers in Chennai and 66 percent for ring seiners in Kochi. Particularly ring seine fishing is a labor-intensive operation because the nets used are very large and are operated manually. The ring seine fishing operations, therefore, need significant manpower. Ring seine vessels of 16–20 metres in length can have as many as 50–55 crew onboard who all participate in the fishing. Not all crew may be gainfully employed, but the sheer number of crew clarifies the relatively high labour costs. The same ring seiners also have relatively high crew travel expenses, because they assemble every morning at the fishing port or landing site from different places. Many of the crew live at faraway places of 10 km or more from the fishing port. The vessel owner generally arranges small mini busses for the transport for which rent is paid on a monthly basis.

The labour costs of the various fleets in India show large differences, particularly as a result of the crew share. In Kakinada (Andhra Pradesh State), the crew share ranges from 15 to 20 percent of gross revenue. In Chennai (Tamil Nadu State), the crew share - owner share is generally divided 40:60. In Kerala, which is a labour organized state, the crew-owner catch share distribution is 50:50 or even 60:40 at certain places. These differences clarify the variation in labour costs for vessels in Chennai and Kakinda, while the number of crew on-board doesn't differ much (10 versus 9 crew members).

Table 16 shows substantial fish selling related costs for ring seiners. Fish selling costs involve auction commission, auction allowance deducted over the auction price arrived at, and other costs incurred at the landing sites, such as costs related to fish sorting, grading, icing and packing. The auction commission ranges from 1–2 percent of gross revenue. The labour charges in Kerala are 1.5 to 2 times higher in Kerala compared to other states. Therefore the reported fish selling and fish handling costs are higher for ring seiners based at Kochi in Kerala State.

Purse seiners in Mangalore spent a substantial share (58 percent) of their operating costs on fuel. The trawlers in Kakinada and gillnetters in Chennai also had significant fuel costs, of respectively 49 percent and 37 percent of the operating costs of these vessels.

TABLE 15
Average age of vessels, engines and equipment of the surveyed fleet segments, 2019

Item	Trawler, Chennai	Trawler, Kakinada	Gillnetter, Chennai	Purse seiner, Mangalore	Ring seiner (IBM) Kochi
Vessel (hull)	5	5	5	3.2	4.6
Main engine(s)	5	5	5	2.4	3.6
Equipment	5	5	-	3.2	2.8
Gears	3	3	3	2.6	2.5
Electronics	3	3	3	3.2	2.0

Source: Field survey.

TABLE 16
Average operational costs and earnings of the selected fleet segments, 2018-19 (in USD)[5]

Category	Item	Trawler, Chennai	Trawler, Kakinada	Gillnetter, Chennai	Purse seiner, Mangalore	Ring seiner (IBM), Kochi[6]
Earnings	Fishing revenue (gross value of landings)	203 077	88 209	92 933	437 208	257 420
	Income from sale of fishing rights, licenses, permits and quotas	0	0	0	0	0
	Subsidies and grants[7]	2 500	2 261	2 500	8 125	0
	Other vessel income (from tourism, charters, etc.)	0	0	0	0	0
Total revenue		**205 577**	**90 470**	**95 433**	**445 333**	**257 420**
Operating cost	Fuel	29 128	18 686	15 086	187 542	35 780
	Lubricants/oil/filters	400	0	378	2228	809
	Harbour dues and levies	11	100	10	203	607
	Ice	4 982	1 095	1 870	8 880	4 988
	Bait	0	0	0	0	0
	Salt	0	0	0	0	0
	Food, stores and other provisions	1 822	1 355	2 215	4 633	4 418
	Fish selling costs (auction commission, etc.)	4 062	1 323	605	4 372	11 497
	Materials (packaging, boxes)	0	0	0	0	0
	Crew travel	0	0	0	3 296	5 318
	Other operating costs	12 430	179	5 831	588	0
	Labour share and wages (including social security contributions, life/accident and health insurance)	85 480	14 604	14 941	109 302	129 368
Total operating costs		**138 315**	**37 342**	**40 935**	**321 045**	**192 785**

5 The table includes the average costs and earnings of five vessels per fleet segment.
6 The variability in costs and revenue across sampled vessels was most pronounced among ring seiners. This can be attributed to the variation in LOA and engine power.
7 Subsidies listed in the table are limited to the notified amounts of fuel subsidy only, which varies across states.

Category	Item	Trawler, Chennai	Trawler, Kakinada	Gillnetter, Chennai	Purse seiner, Mangalore	Ring seiner (IBM), Kochi[6]
Vessel costs	Fishing licenses, permits and quota (only annual costs)	400	50	400	400	42
	Insurance (vessel, employers, equipment)	347	0	0	417	0
	Purchase of fishing rights (quotas)	0	0	0	0	0
	Gear replacements, repairs & maintenance	5 092	4 444	5 059	9 403	1 919
	Vessel repairs & maintenance	4 138	1 816	5 800	5 873	3 123
	Other fixed costs (accountancy, audit and legal fees, general expenses, subscriptions, etc.)	2 500	1 000	1 000	2 778	350
	Depreciation (vessel, engine, equipment, and gears that last more than 3 years)	12 632	9 490	15 666	16 394	5 931
	Interest on investment	8 416	6 327	10 444	26 772	6 157
	Taxes on profit	0	0	0	0	0
	Amortization of intangible assets (fishing permits, licenses)	0	0	0	0	0
Total vessel owner costs		**33 526**	**23 127**	**38 370**	**62 036**	**17 522**
Total annual operational cost		**171 841**	**60 469**	**79 305**	**383 081**	**210 308**

Source: Field survey.

All five fleet segments reported higher operating costs than vessel owner costs. Vessel owner costs compared to operating costs were relatively highest for the gillnetters in Chennai, as 48 percent of their total operational costs in 2018–2019 were the vessel owner costs. Vessel owner costs were lowest for ring seiners with nearly USD 18 000 and highest for purse seiners in Mangalore with USD 62 000.

The depreciation in Table 16 was a substantial item in the vessel owner costs. It was estimated by using a linear method. The average lifespan of a wooden vessel hull was considered to be 12–15 years, with some variations from case to case. The engine lifespan was estimated at 5 to 8 years depending on the information received from the vessel owner. For major gears, a 3 years lifespan was applied.

In India, commercial banks charge annual interest rates for loans in the fisheries sector of 10 to 12 percent. The 'interest on investment' in Table 16 applies these interest rates over the total capital investment cost (hull, engine, gear and other equipment combined).[8] Most fishing vessel owners depend on credit to meet 70–80 percent of their total initial capital cost. Moreover, they often get short-term loans for working capital. They have multiple options for sourcing their loans, including commercial banks, rural credit associations, non-banking financial institutions, and informal lenders. The informal lenders generally charge interest rates of 35 percent and more per annum and are thus much more costly compared to formal loans. The interest on investment estimate in Table 16 was validated and found to be generally applicable.

6. ECONOMIC AND FINANCIAL PERFORMANCE OF FISHING VESSELS

The comparative analysis of the economic performance of the fishing gears shows that in 2018-19, all fishing fleet segments surveyed, *i.e.* trawlers, purse seiners, ring netters and gillnetters earned substantial net profits before taxes[9] and generated considerable gross value added (Table 17).

[8] Whether a fisherman takes a loan from a bank or not, interest on capital is a cost incurred due to loss of value caused by inflation. If not investing on a fishing vessel, the fishing vessel owner can obtain an annual interest rate of 8-8.5 percent on the savings in his savings account.

[9] Income from fishing is not taxable in India.

TABLE 17
Financial and economic indicators per fleet segment in 2018-19 (in USD)

Financial Indicators	Code	Mechanized trawler, Chennai	Mechanized trawler, Kakinada	Mechanized gillnetter, Chennai	Purse seiner, Mangalore	Inboard ring seiner, Kochi
Revenue from landings	A	203 077	88 209	92 933	437 208	257 420
Total revenue	A2	205 577	90 470	95 433	445 333	257 420
Labour costs	B	87 303	15 959	17 156	117 232	139 103
Running costs	C	51 013	21 383	23 779	203 813	53 682
Vessel Costs	D	12 477	7 310	12 259	18 870	5 434
Total gross cost (E) = B + C + D	E	150 793	44 652	53 194	339 915	198 219
Total costs (E2) = E + G + J + S	E2	171 841	60 469	79 305	383 081	210 308
Net cash flow (F) = A2 - E	F	54 785	45 818	42 239	105 418	59 201
Depreciation	G	12 632	9 490	15 666	16 394	5 931
Amortization	H	0	0	0	0	0
Gross profit (I) = F - G - H	I	42 152	36 328	26 573	89 024	53 269
Interest	J	8 416	6 327	10 444	26 772	6 157
Net profit before taxes (K) = I - J	K	33 737	30 001	16 129	62 252	47 112
Net profit margin (L) = K/A2 (%)	L	16%	33%	17%	14%	18%
Value of tangible assets (2018-19)	M	39 128	31 498	44 859	123 151	33 210
ROFTA (N) = K/M in (%)	N	86%	95%	36%	51%	142%
Value of intangible assets (2018-19)	O	0	0	0	0	0
ROI (P) = K/(T + O) (in %)	P	43%	42%	17%	26%	65%
GVA (Q) = F + B	Q	140 265	60 422	57 180	214 720	188 568
GVA to revenue (R) = Q/A2 (in %)	R	68%	67%	60%	48%	73%
Taxes	S	0	0	0	0	0
Initial investment costs	T	79 083	70 680	95 118	234 922	72 170

Source: Field survey.

Mechanized trawlers, Chennai

The average gross profit of vessels in the mechanized trawler fleet in the 2018-19 fishing season was just over USD 42 000. The net profit of a vessel in this fleet was estimated to be around USD 33 000, after deducting interest payments and before taxes. The ratio of net profit to total revenue (net profit margin) was 16 percent. This means that for every dollar made by the fishing operations some 16 cents is kept as profit. The return on fixed tangible assets (ROFTA) was high with 86 percent and the return on investment (ROI)[10] was 43 percent. The gross value added (GVA) of a vessel in this fleet was more than USD 140 000.

Mechanized Trawlers, Kakinada

The average gross profit of vessels in the mechanized trawler fleet of Kakinada in 2018-19 was just over USD 36 000. Net profit of a vessel in this fleet was estimated to be USD 30 000 and the net profit margin was 33 percent. The ROFTA was high with 95 percent, which is largely caused by the low depreciated value of vessels in this fleet. Their depreciated value was estimated at 44 percent of the initial investment cost in the hull, engine and main on-board equipment. The ROI was very good as well with 42 percent. The gross value added of a vessel in this fleet was USD 60 000 in 2019.

[10] The return on investment in Table 17 was not calculated over the value of tangible assets in 2019, but instead over the initial capital investment. The reason for doing so was that the value of intangible assets was zero, and ROFTA and ROI would therefore give the same values.

Mechanized Gillnetters, Chennai

The average gross profit of vessels in the mechanized gillnetters fleet in Chennai in the 2018-19 fishing season was nearly USD 27 000. Net profit of a vessel in this fleet was estimated to be around USD 16 000, after deducting USD 10 000 in interest payments. The ratio of net profit to total revenue (net profit margin) was 17 percent. The ROFTA was 36 percent and the ROI[11] was 17 percent. The gross value added of a vessel in this fleet was more than USD 57 000.

Purse seiner, Mangalore

The average gross profit of vessels in the purse seiner fleet of Mangalore was in the survey year around USD 89 000. Net profit of a vessel in this fleet was estimated to be USD 62 000 and the net profit margin was 14 percent. The large difference between gross and net profit can be explained by interest payments of USD 26 000 in 2018–2019. The ROFTA was 51 percent. The ROI was good with 26 percent. The gross value added of a vessel in this fleet was nearly USD 215 000 in 2019.

Inboard Ringseiner, Kochi

The net cash flow of vessels in the ringseiner fleet of Kochi (Kerala State) was in 2018-19 the survey year around USD 59 000, while the average gross profit was USD 53 000. The net profit of a vessel in this fleet was estimated to be USD 47 000 and the net profit margin was 18 percent, which indicates that for every dollar invested, a net profit of 18 cents was made. The ROFTA was very high with 142 percent. The ROI was very good as well with 65 percent. The gross value-added of a vessel in this fleet was nearly USD 189 000 in 2019 and the GVA to revenue rate was 73 percent.

7. SUBSIDIES AND SUPPORT TO THE SECTOR

The Government of India has been providing financial assistance to the marine fisheries sector through the State and Union Territory Governments. The financial assistance *inter alia* includes support to motorization of traditional fishing boats, rebates on High Speed Diesel (HSD) fuel, improvement of landing and berthing facilities, construction of fishing harbours and fish landing centres, and establishment of inland fish marketing centres. The purpose of financial assistance and support is to enhance the production of marine fisheries and strengthen infrastructure to provide high-quality fish and fisheries products to the fish processing industry and consumers. The financial assistance schemes have continued under subsequent development plans with some modifications. The fleets surveyed for this study received diesel subsidies as per the prevailing norms.

The National Fisheries Development Board (NFDB) was established in 2005 and is entrusted with the implementation of the Centrally Sponsored Scheme on Development of Marine Fisheries, Infrastructure and Post-Harvest Operation. Various schemes under the umbrella of a Blue Revolution programme are being implemented across the country supporting both marine and inland fisheries.

Regarding subsidies, the total amount of subsidy provided in 2017-18 was USD 114.6 million (Table 18). The States also provide assistance for the purchase of new nets and boats, life-saving jackets and navigation systems, and development of marine infrastructure.[12]

[11] The return on investment in Table 17 was calculated over the initial capital investment.

[12] Some examples of state level subsidies for marine fisheries can be found at Government of Andhra Pradesh, Fisheries Budget 2018-19. Department of Fisheries (www.fisheries.ap.gov.in/schemes.html); Government of Tamil Nadu, Budget Highlights 2017-18. Department of Finance (www.tnbudget.tn.gov.in/tnweb_files/budget%20highlights/2017-18_Budget%20Highlights-English.pdf); Government of Kerala, 2019. Scheme Highlights. Department of Fisheries (http://fisheries.kerala.gov.in/scheme-highlights); Government of Karnataka, 2015. Budget 2015-16 (www.finance.kar.nic.in/bud2015/bs2015eng.pdf)

TABLE 18
Subsidies given for the fisheries sector in India, 2015-18 (in USD millions)

States/Union territories	2015-16	2016-17	2017-18
Andhra Pradesh	6.57	7.87	8.39
Goa	4.27	NA	1.67
Gujarat	16.55	14.75	32.47
Karnataka	13.43	20.56	22.82
Kerala	2.26	4.90	2.87
Maharashtra	3.91	3.92	4.60
Odisha	1.90	3.29	1.93
Tamil Nadu	NA	29.16	35.09
Andaman &Nicobar	NA	0.09	0.15
Daman & Diu	NA	4.01	4.55
Puducherry	0.08	0.05	0.10
Lakshadweep	NA	0.11	0.19
MPEDA[13]	NA	2.34	3.49
Total	**48.97**	**90.10**	**114.64**

Source: World Trade Organization Notification G/SCM/N/343/IND G/SCM/N/315/IND/Suppl.2 G/SCM/N/284/IND/Suppl.4 19 July 2019.

8. TECHNOLOGICAL ADVANCEMENTS IN MARINE FISHERIES SECTOR IN INDIA

Technology improvement has moved at a comparatively slower pace than the proliferation of fishing boats and fishing effort that has increased unabated over the last couple of decades in India. Except for the increasing use of Fiber-reinforced Plastic (FRP) for hull construction, thereby reducing the use of wood, there have been limited technical improvements in terms of better boat designs to reduce fuel consumption and increase stability. Also, improvements to operational efficiency, such as through the adoption of better navigation, communication and safety at sea equipment have been lagging behind, compared to the developments in OECD countries. Likewise, the use of modern technologies in post-harvest operations to retain the quality of fish and reduce losses/wastage is still limited. On the other hand, there is a growing tendency to increase the size of the fishing vessels and use higher horsepower engines, mostly imported from China (even at the cost of their shorter lifespan than the traditional (made in India) makes such as Ashok Leyland, Caterpillar or Ruston[14]).

However, to address the increasing demand for high quality and safe fish and fishery products and also to adapt to the increasing frequency of bad-weather events, the following technological advancements could be observed in the sector in the recent years.

Slurry ice machine

With the increasing scarcity of fish resources in the near-shore waters, fishers have to move further offshore and stay out at sea for longer periods of time to catch enough fish to make a living. While the time-tested practice of carrying blocks of ice was good for fishing in the near-shore waters, these longer trips result in either spoilage or poor quality of fish at the time the fish was landed. The use of Refrigerated Sea Water (RSW) was initially contemplated, but it soon gave way to the use of slurry ice. Many boats under construction in Southern India are now being fitted with slurry-ice machines.

[13] Marine Products Export Development Authority.

[14] A Chinese made inboard engine of 210 hp was priced in Andhra Pradesh State in 2018 at about USD 12 000–13 000 all-inclusive, while a branded engine would be priced at USD 16 000 and above. According to the survey data collected the lifespan of a Chinese engine is usually 2-3 years shorter than a branded engine (e.g. Ashok Leyland -made in India). Due to taxation of imported Chinese made engines the price differences were not significant anymore from late 2019 onwards.

Once widely used in fishing operations, the lessons from these boats would perhaps catch the interest of fishers in other regions too.

Satellite phone

Recently, there was a policy decision by the Government of Tamil Nadu (province of India) to provide satellite phones to fishermen fishing further offshore (in the EEZ up to 200 nautical miles). The decision was taken in view of the death of 204 fishermen during the Cyclone Ockhi in November 2017. Many fishing vessels usually operate further off-shore in areas not covered by normal mobile phone networks. Therefore, they often failed to receive weather warnings, as happened during Cyclone Ockhi. Similar initiatives are being contemplated by other coastal states.

Potential Fishing Zones (PFZ)

Of the many satellite-based applications being adopted by fishermen across India, receipt of the information on the abundance of pelagic species through the Potential Fishing Zone (PFZ) advisories is considered most useful. While the PFZ advisories have been provided to the fishermen since the nineties, their delivery to the fishermen has become more widespread over the years. Recently, the portal, m@krishi launched by the ICAR-CMFRI in partnership with the Indian National Centre for Ocean Information Services (INCOIS), Hyderabad and Tata Consultancy Service (TCS) for the fishermen of Maharashtra has gone a step further by providing advisories as short messages to the fishermen on their mobile phones. Based on a survey conducted by ICAR-CMFRI, it is estimated that adoption of the m@krishi service has resulted in a 30 to 40 percent increase in fish catch and 30 percent savings in fuel costs for fishermen of Maharashtra (Singh and Singh, 2016). Another study by George *et al.* (2011) in Andaman and Nicobar Islands for selected vessel types has indicated an increase in fishing revenues by 40–50 percent following receipt of PFZ advisories on fishers' mobile phones.

9. SUMMARY DESCRIPTION OF NATIONAL PLANS AND POLICIES AND LEGAL SUPPORT FOR ADJUSTMENT OF FLEET CAPACITIES

The National Policy on Marine Fisheries (NPMF) of 2017 is the overarching policy that presently governs the marine fisheries sector in India.

The Policy is based on seven pillars, namely sustainable development, socio-economic development of fishers, the principle of subsidiarity, partnership, inter-generational equity, gender justice and the precautionary approach. The following are the major thrust areas of NPMF with respect to fleet capacity optimization and ecosystem conservation:

- With a view to enforcing fisheries management in tune with the potential of marine fisheries resources, the focus will be on fishing effort management; fleet-size optimization; mainstreaming biodiversity conservation in production processes; species-specific and area-specific management plans, including conservation of Ecologically and Biologically Sensitive Areas (EBSAs) and Vulnerable Marine Ecosystems (VMEs), protection of endangered and threatened species; and, spatial- and temporal measures for sustainable resource utilization.
- An Ecosystem Approach to Fisheries Management (EAFM) will be promoted.
- Private investments will be promoted in off-shore fishing operations and fish processing to fully harness the potential of marine fishery for inclusive development. New schemes will be introduced for enhancing the skills and capabilities of traditional fishermen to undertake off-shore fishing.

A minimum legal size (MLS) is prescribed as a fisheries management tool to protect juvenile fish, maintain spawning stocks and control the sizes of fish caught. The MLS sets the smallest size at which a particular species can be legally retained if caught. The MLS also contributes to maximizing marketing and economic benefits. The government of Kerala declared MLS for 58 commercially important fish species in 2018. Other than this, the State Governments of Tamil Nadu, Karnataka, Andhra Pradesh and Maharashtra are actively considering the introduction of MLS, based on the technical inputs provided by ICAR-CMFRI.

The Marine Fishing Regulation Acts (MFRAs) of coastal States have various provisions for regulating fishing and putting in place conservation measures in the territorial waters. These include: regulation of mesh size to reduce the catch of juvenile fish; minimum-maximum fish sizes; regulation of gear to avoid overexploitation of certain species; reservation of zones for traditional fisheries and declaration of closed seasons (Parappurathu and Ramachandran, 2017). These Acts also demarcate fishing zones in territorial waters for fishing by non-motorized fishing vessels only. The distance from the shore earmarked for each category (non-motorized, motorized, and mechanized vessels) varies from State to State. In general, 5 to 10 km is reserved for operation by artisanal (non-motorized) vessels. Since fisheries is a State subject, each coastal State has its own MFRA, which is reviewed and amended from time to time.

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