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Techno-economic performance review of selected fishing fleets in Asia

BOBP

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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.

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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


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CHATTOGRAM
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1. Introduction and background

In many countries, the marine capture fisheries sector plays an important role in terms of generating employment, income, and foreign exchange earnings. The sector also significantly contributes to meeting the nutritional requirements of the increasing global population.

The United Nations 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs) recognize that the fisheries sector offers many opportunities to reduce hunger, improve nutrition, alleviate poverty, generate economic growth, and to ensure better use of natural resources. In order to achieve SDG 14 (Conserve and sustainably use the oceans, seas and marine resources for sustainable development), it is imperative that fishing operations should become and remain environmentally sustainable, socially acceptable, and economically viable.

Great efforts are made worldwide towards achieving sustainable fisheries in terms of its interaction with the marine environment. A large number of academic research, conservation and fisheries management projects are focused on the environmental sustainability of the fisheries sector. This results in a plethora of information being available on environmental aspects of fisheries, while the economic and social aspects of fisheries often receive less attention.

It is important that the FAO Member States and their fisheries management and decision-makers are aware of the economic aspects of fishing operations, monitor the financial and economic feasibility of the fishing fleets, and compare differences between fleets and, over time, within fishing fleets. Information on the technological and economic performance of the fishing fleets will facilitate fisheries governance processes. Such information is also instrumental for fisheries sector stakeholders, both public and private, to aid in investment decisions about fishing fleets, fisheries-related infrastructure and logistics.

Technical and economic information on the fishing fleets is important for FAO Members in their implementation of the Code of Conduct for Responsible Fisheries,[1] and particularly its article 7 on Fisheries Management and article 8 on Fishing Operations. The information on the techno-economic performance of the world's fishing fleets will further assist the FAO Member States in the implementation of the International Plan of Action for the Management of Fishing Capacity (IPOA-Capacity).[2] For fisheries managers and stakeholders, it is essential to not only understand the status of the fisheries resources and the trends in seafood production, but also to know about the techno-economic performance of the fishing fleets. This will facilitate the development and implementation of national and regional action plans for the management of fishing capacity, in line with the IPOA-Capacity.

Therefore, FAO and particularly its Fisheries Division and Fishing Operations and Technology Branch (NFIO), regularly conduct global studies to analyze the cost structure and economic and financial performance of fishing fleets. These studies form part of the regular monitoring of the economic and financial viability of marine capture fisheries, conducted by FAO in close cooperation with national fisheries research institutions, fisheries administrations and experts in selected countries in Asia, Africa, the Americas, the Caribbean, and Europe.

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1 More information about the FAO Code of Conduct for Responsible Fisheries (1995) can be found at: www.fao.org/fishery/code/en

2 More information on the IPOA-Capacity can be found at: www.fao.org/fishery/ipoa-capacity/en

The findings of previous studies carried out from 1995 to 1997, 1999 to 2000 and 2003 to 2005 were reported in FAO Fisheries Technical Papers 377 (FAO, 1999), 421 (FAO, 2001) and 482 (Tietze, *et al*., 2005), respectively. The findings of these studies demonstrated that despite instances of increasing overexploitation of fisheries resources, marine capture fisheries were an economically and financially viable undertaking in the 1990s and the first years of this millennium, although not achieving the possible optimum returns due to underperforming fish stocks, decreasing catch per unit of effort (CPUE) and inadequate management leading to overcapacity (Willmann & Kelleher, 2009). The studies showed that marine fishing fleets generally generated enough revenue to cover the cost of depreciation as well as the opportunity cost of capital and generated funds for reinvestment in addition to employment, income, and foreign exchange earnings.

The last FAO global fishing fleet techno-economic performance review study was done in 2002-03 and published in 2005. Since then, FAO has not conducted any major comparative study on fishing fleet performance. However, many countries, including Japan, Norway, the United States of America, and the European Union have continued to carry out measurements on fleet performance in order to monitor the economic and financial feasibility of their fishing sector. In view of the range of methodologies being applied by countries for doing techno-economic performance evaluations of their fishing fleets, FAO held an Expert meeting on methodologies for conducting fishing fleet techno-economic performance reviews. The meeting was held in Chennai, India, on 18–20 September 2018 in close collaboration with BOBP-IGO. At the meeting, the advantages and disadvantages of various methodologies applied for reviewing the economic and technical performance of fishing fleets were discussed and a general sampling/survey methodology for conducting techno-economic performance reviews, which can be applied also in developing countries, was developed and adopted (FAO, 2019).

In 2018–2019, FAO collaborated with many fisheries economists worldwide to carry out national level techno-economic performance reviews of the main fishing fleets, applying the agreed methodology. These national reviews were validated in October 2019 and published in regional review reports. This report on the techno-economic performance of selected fishing fleets in Asia is accompanied by similar regional reviews for Europe (Carvalho *et al*., 2020), and North and South America (Kitts *et al*., 2020). The 2020 FAO Review of the techno-economic performance of the main global fishing fleets (FAO Fisheries and Aquaculture Technical Paper No. 654) compiles the findings of the national and regional reviews and includes a comparison with the findings of previous global reviews on this subject.

The Asian countries that were included in the two most recent global fishing fleet review studies were: China, India, Indonesia, Republic of Korea, and Thailand. In this review, the same countries, except Thailand, are included again. Information from Bangladesh and Japan is added for the first time. The six countries covered in this regional review together accounted for 33.5 percent of the global capture fisheries production in 2018 (see FAO, 2020). The number of fleets or fleet segments operating in Asia, covered in the 2001 global review[3] for which profitability could be calculated was 28, while for the current review it was possible to do so for 27 fleets (Table 1). Artisanal fishing fleets were not covered in this review.

[3] China and Indonesia were not covered in the 2003 review.

2. Fishing fleet characteristics of selected Asian fishing fleets

The fleets covered in this regional review are the three to six most important fleet segments of selected Asian countries in terms of volume and value of seafood landed. The vessel types covered are: cast netters (1 fleet), gillnetters (3 fleets), jiggers (2 fleets), long liners (2 fleets), pole and line vessels (1 fleet), purse seiners (7 fleets), stow netters (1 fleet), and trawlers (10 fleets) (see Table 1).

In 2018, the global total number of fishing vessels was estimated to be 4.56 million, a 2.8 percent decrease from 2016. The Asian region is the region, in which most vessels operate. It has 68 percent of the total number of fishing vessels. The reported number of fishing vessels in Asia declined from 3.4 million vessels in 2000 to 3.1 million vessels in 2018, after an increase to above 3.5 million in 2014. FAO's State of World Fisheries and Aquaculture 2020 reported that between 2013 and 2018, China's fleet was reduced by almost 20 percent from 1 071 000 vessels to 864 000 vessels (FAO, 2020). The same report also notes that in the Asian region in 2018 there were some 2.1 million motorized fishing vessels, which is almost 75 percent of the world's motorized fishing fleet. However, gaps in reporting on active fishing vessels, both large-scale industrial and small-scale vessels, do not allow the drawing of clear conclusions, on fishing vessel capacity trends in Asia.

Compared to the review study carried out in 2000-01 (Tietze *et al.*, 2001), some of the fishing fleet segments that are included in this 2019-2020 review study demonstrate major technical changes (Table 2). The length overall (LOA) of some fleet segments studied increased significantly in China and India. The gross tonnage of the fishing vessels studied showed an increasing trend in China, India and Indonesia, while the average vessel sizes remained stable in the Republic of Korea. In the case of the Korean fleet segments an increase in engine power by 138 to 184 percent over the last 2 decades could be observed. A large increase in average vessel engine power (kW) was observed for all fishing fleets segments that could be compared. The Chinese fishing fleet segments show a trend towards private ownership of fishing vessels, compared to locally shared or state ownership reported earlier.

TABLE 1
Typology and magnitude of fishing fleets studied in the Asian region

Vessel types	Number of fleet segments	Number of vessels in the segments covered by this study	Countries reported
Cast netters	1[4]	442	Indonesia
Gillnetters	3	136 931	Bangladesh, China, India
Jiggers	2	1 058	Indonesia, Republic of Korea
Long liners	2	549	Indonesia, Japan
Pole & line vessels	1	87	Indonesia
Purse seiners	7	11 118	China, India, Indonesia, Japan, Republic of Korea
Stow netters	1	18 281	China
Trawlers	10	69 875	Bangladesh, China, India, Japan, Republic of Korea
Total	**27**	**238 341**	

[4] Three to 12 fishing vessels were surveyed per fleet segment per country for this study.

TABLE 2
Technical characteristics of selected fishing fleets, comparing average vessels in 2000–2001 with those in 2019–2020

Country	Fleet	Length overall (metre)		Gross tonnage (GT)		Engine power (kW)	
		2001	2020	2001	2020	2001	2020
China	Single boat bottom trawlers	26	29	65	116[5]	110	161
	Pair trawlers	25–28	43	80–95	337	185	467
	Large purse seiners	28–42	46	38–80	648	280–440	889
India	Mechanized trawlers	17	10–29	-	-	87	89–410
	Purse seiners	15	10–28	-	-	79	75–261
Indonesia	Purse seiners	16–28	27	30–120	147	89–231	590
	Tuna longlines	26	22	67	75	256	383
	Pole and line vessels	13–25	30	10–50	80	61–258	586
Republic of Korea	Offshore jiggers	-	23	77	50	396	547
	Large otter trawlers	-	35	139	139	1 068	1 480
	Large purse seiner	-	38	126	129	742	1 368

The age structure of the main fishing fleets in Asia, measured by the age of the vessel hull, shows a mixed pattern. In Japan and the Republic of Korea, the industrial fishing vessels are generally older than 20 years. In Japan, over 50 percent of the vessels of the main fleets are more than 20 years of age. In the case of the Republic of Korea, more than 70 percent of the large otter trawlers are over 20 years of age and nearly all large purse seiners are older than 20 years. In the last 10 years, not a single new purse seiner entered the fleet in the Republic of Korea. The offshore jiggers in operation were generally between 10 and 20 years of age in 2018. If an expected lifespan of 35 to 45 years for a fishing vessel hull is applied, then the age structure of the main Japanese fishing fleets is well balanced, with between 7 and 14 percent of new vessels entering these fleets over a 5-year period. The Korean fishing fleet structures appear to fluctuate more over time.

In comparison, the Chinese fishing fleets are generally much younger. Of the fleet segments surveyed, all gillnetters and pair trawlers were younger than 10 years, while 80 percent of the single boat bottom trawlers entered the fleet during the last five years. This shows the build-up of specific fishing fleet segments in China in recent years, which is likely caused by good economic prospects. In the case of Bangladesh, new investments in fishing vessels are mainly directed towards wooden small- and medium scale gillnetters, as compared to the industrial scale bottom trawlers and shrimp trawlers. The survey in Indonesia estimated that more than 80 percent of the fishing vessels now in operation in the country have been built in the last 20 years, except for the cast netter fleet segment, which is slightly older. In India, all fishing vessels surveyed in the various fleet segments were less than 5 years of age. The shorter economic lifespan and lower initial capital requirements of wooden fishing vessels, compared to steel hull vessels, contribute to relatively higher investments in small-scale fishing vessels in Bangladesh, India and Indonesia.

Overall, it can be concluded that the vessel hull ages are slowly increasing in Asia, supported by a transition process from wooden to steel hull vessels. The vessel owners aim to increase the vessels' economic lifespan through timely maintenance and upgrading of engines and propulsion systems. Increasingly modern technologies for fish finding, navigation, and communication are installed on board that contribute to fishing operations, safety and economic performance of the vessels. The conversion

[5] The data received for the Chinese fishing fleet segments in 2020 were in gross registered tonnage (GRT), and presented as such in Table 2.

of vessels from one fishing method into another (for example bottom trawling to midwater trawling) to adjust to changes in resources, fisheries regulations or market demand, and to maintain or increase vessel profitability, is common practice in various Asian countries.


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3. Costs and earnings structures of selected fishing fleets in Asia

In this chapter, the costs and earnings structures of the selected fleet segments are compared, first by country followed by a regional comparison. As much as possible similar cost categories are applied:

Labour costs = personnel costs = labour share and wages (including social security contributions, life/accident and health insurance), food, other provisions, and crew travel related costs. Unpaid labour was excluded as insufficient information was available on this item.

Running costs = energy costs (including fuel, lubricants/oil/filters) and other variable costs (including harbour dues and levies, ice, bait, salt, fish selling costs, packaging materials and other related operational costs).

Vessel costs = gear replacements, gear repair & maintenance, vessel repair, and maintenance, other non-variable costs (including vessel, equipment and employer's insurance, accountancy, audit and legal fees, general expenses, subscriptions), fishing licenses, permits, and quota (only annual costs) and the purchase of fishing rights (quotas).

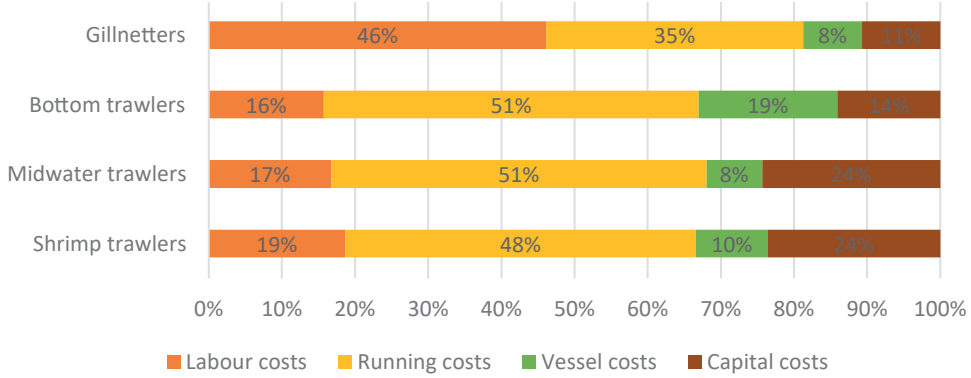
Capital costs = depreciation (of the vessel, engines, equipment, and gears that last more than 3 years), interest and amortization of intangible assets (fishing permits, licences, etc.). Information on amortization was lacking for all the fleets surveyed for this report. Fishing vessels owners often use credit from formal or informal sources for investment in a new vessel, engines, equipment and to cover short-term operational expenses. The fishing vessel owners in China, Japan and the Republic of Korea obtain their credit generally from formal financial institutions, including banks, cooperatives and credit unions. In Bangladesh, India and Indonesia, non-institutional credit is relatively important, particularly for fishing vessel owners active in the small-scale sector. Interest rates applied vary substantially from 0.2 percent per year in Japan to 11 percent per year in Bangladesh from institutional sources and could be as high as 60 percent per year from informal lenders.

The cost components shares in relation to the total costs of the fleets per country are described below:

BANGLADESH

Labour costs were the largest component within the total costs in the gillnetter fleet segments included in this analysis, accounting for 46 percent of the total costs in the 2018-19 fishing season. In contrast, the labour costs were relatively low for the other fleet segments with 16 to 19 percent. For trawlers (shrimp, midwater and bottom), running costs were the largest of the cost components, amounting to 48 percent to 51 percent of the total costs. Expenses on fuel were the main drivers for the higher share of running costs in the total costs. Fuel costs added up to about 78 percent of the running costs of shrimp trawlers, 84 percent for midwater trawlers and 67 percent for bottom trawlers. Expenses on ice for bottom trawlers and gillnetters and commissions for the sale of fish were other major running cost items. The vessel (owner) costs for all four fleet segments ranged between eight and 19 percent, while the capital costs were generally between 11 and 24 percent of total costs in the 2018-19 fishing season. Depreciation and interest payments were the largest cost items within the capital costs component (Figure 1).

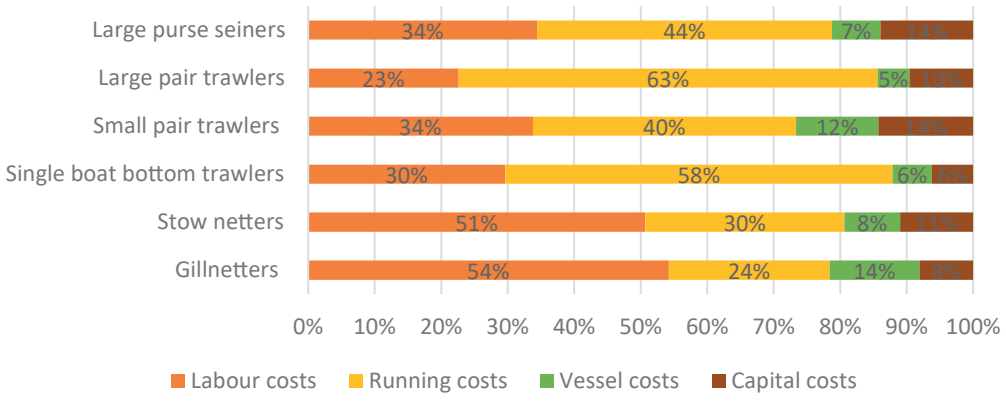
FIGURE 1
Cost items as percentage of the total gross costs for selected Bangladeshi fishing fleet segments



CHINA

Labour costs were the largest component of total costs in the gillnetter and stow netter fleet segments included in this analysis, accounting for 54 percent and 51 percent of the total costs in 2018, respectively. In contrast, the labour costs were relatively low for the large pair trawlers in the same year, accounting for just 23 percent of total costs. The running costs for vessels in this fleet segment amounted to 63 percent of the total costs, and this was largely due to high fuel costs (97 percent of the running costs). For the single boat bottom trawlers, the running costs added up to 58 percent of total costs in 2018, and within the running cost component, 87 percent was spent on fuel. The vessel (owner) costs for all six fleet segments ranged between five and 14 percent, while the capital costs were generally between six and 14 percent of total costs (Figure 2).

FIGURE 2
Cost items as percentage of the total gross costs for selected Chinese fishing fleet segments

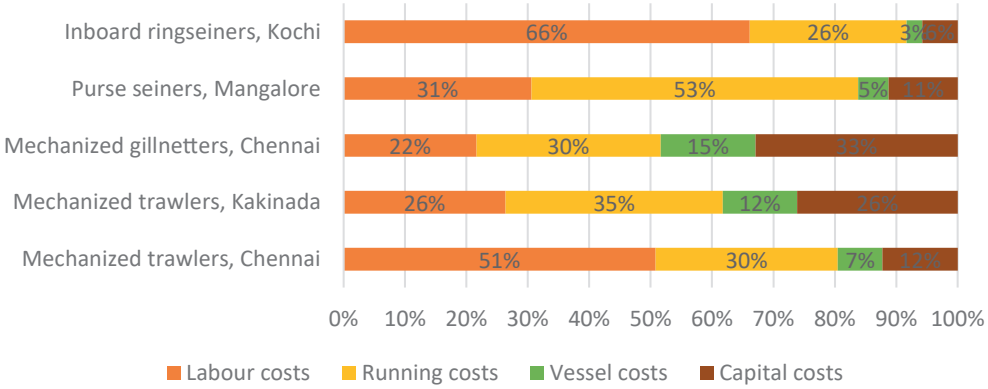


INDIA

The labour costs component summed up to two-thirds of total costs for vessels in the inboard ring seiner fleet in Kochi, Kerala State. These relatively high costs were due to the large number of crew involved in the ring seine operations. Similarly, labour costs of mechanized trawlers with inboard engines in Chennai accounted for over 50 percent of total costs. Running costs were the largest cost component for purse seine vessels in Mangalore, accounting for 53 percent of the total costs in 2018. The fuel costs for these vessels were substantial and added up to 58 percent of their operating costs.

The vessel costs ranged between three percent for a typical ring seiner and 15 percent for a mechanized gillnetter in Chennai. The capital costs showed a very large variation between vessel segments in India as well as among vessels in the same segment. The capital costs component was one-third of the total costs for gillnetters in Chennai and 26 percent for mechanized trawlers in Kakinada. The capital costs component for these vessels generally consisted of around 60 percent of depreciation and 40 percent of interest payments and principal repayments on loans (Figure 3).

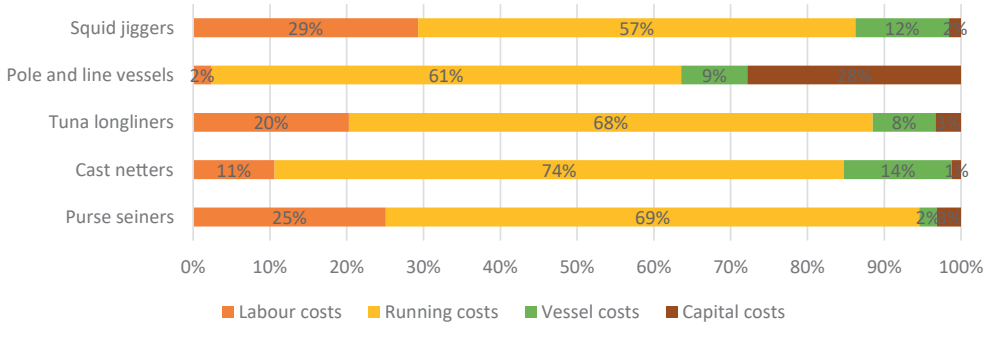
FIGURE 3
Cost items as percentage of the total gross costs for selected Indian fishing fleet segments



INDONESIA

The running costs were the largest cost component within the total gross costs for all Indonesian fishing fleet segments included in the fleet survey. Running costs ranged between 57 percent and 74 percent for squid jiggers and cast netters, respectively. In general, 70 to 80 percent of the running costs consisted of fuel expenses. Direct labour costs were low for pole and line fishing vessels, even though there are many fishers on-board. The reason for the low labour costs is that labour is remunerated by a share of the value of the catch, rather than by a transfer of money. Fishers get a share of the catch and do not get paid anything else (see the national report of Indonesia for more details). The pole and line fishing vessels reported significant capital costs, which were mainly related to the vessels' depreciation. For the other vessel segments, the capital costs were just between one and three percent of the total costs.[6] The vessel costs ranged between two and 14 percent (Figure 4).

FIGURE 4
Cost items as percentage of the total costs for selected Indonesian fishing fleet segments

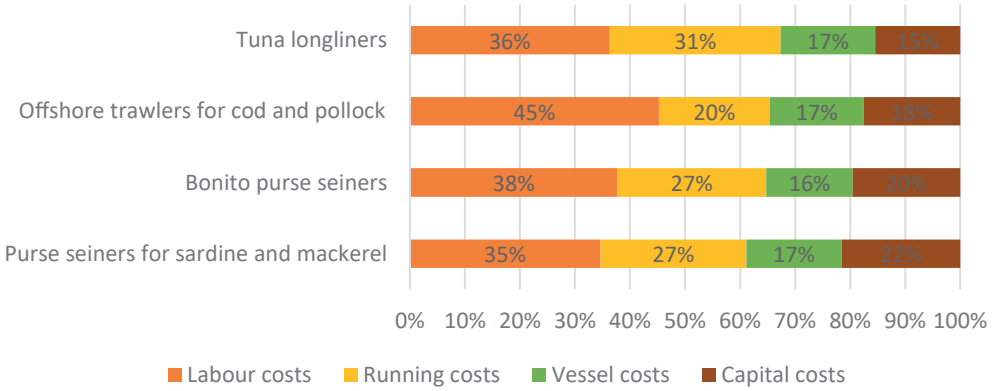


6 The relatively low capital costs for most fleet segments may be a result of the absence of data and information on interest paid and loan repayment for vessels in the Indonesian fishing fleet segments.

JAPAN

The vessels in the Japanese fishing fleet segments included in the survey showed a balanced distribution between cost categories. For each of the fleet segments, the labour costs were the largest cost component in 2018, ranging from 35 percent to 45 percent of total gross costs. Vessel costs were 16 percent to 17 percent of total costs for all fleet segments. The capital costs ranged between 15 percent and 22 percent of total costs. The relatively higher capital costs for sardine and mackerel purse seiners were largely due to higher depreciation of vessels in this fleet segment (Figure 5).

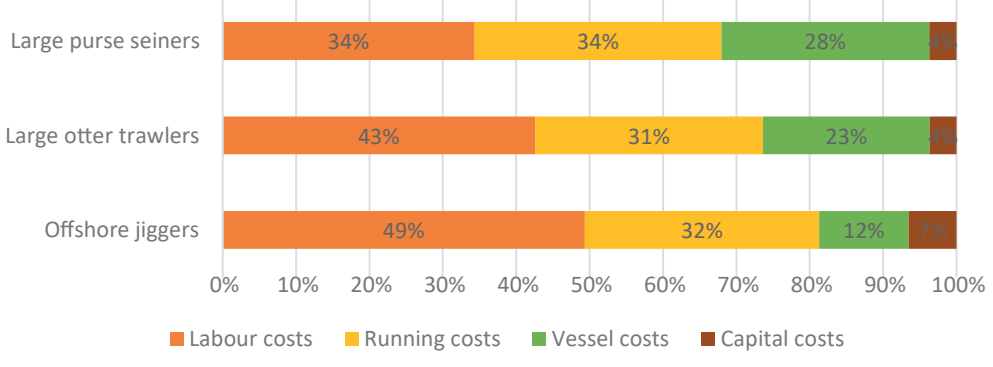
FIGURE 5
Cost items as percentage of the total costs for selected Japanese fishing fleet segments



REPUBLIC OF KOREA

In 2018, labour costs were the largest cost component for the main fishing fleet segments in the Republic of Korea. Labour costs ranged between 34 percent and 49 percent of total gross costs. The running costs component took up 31 percent to 34 percent of the total costs, and consisted largely of fuel and fish selling related costs. The vessel (owner) costs of large purse seiners were 28 percent, of which more than half was spent on vessel repair and maintenance and another 25 percent on fishing gears repair and maintenance. For large otter trawlers, the vessel costs were 23 percent of the total costs and most expenses (51 percent) were made for fishing gears repairs and maintenance. Capital costs were four to seven percent for the three Korean fishing fleet segments included in the survey. Interest payments were the largest contributor to the capital costs component expenses by purse seiners. Offshore jiggers reported relatively higher vessel depreciation costs (Figure 6).

FIGURE 6
Cost items as percentage of the total costs for selected Korean fishing fleet segments



Given the large differences between fishing fleet segments and within the fishing fleet segments between countries in the region, it is not possible to draw region-wide conclusions regarding cost component shares for specific vessel sizes or fishing methods. The labour and running costs components are generally the largest components in the total costs of vessels in these major Asian fishing fleets.

Compared to the 2003 FAO review of the economic performance and fishing efficiency of marine capture fisheries (Tietze *et al.*, 2005) it can be concluded that the cost component distribution of the Indian purse seiners has shifted slightly in terms of a higher percentage being spent for running the vessel; 53 percent in 2018 compared to 38 percent in 2002/2003. The relative expenditures for labour remained stable at 31 percent. However, overall the total annual costs increased for purse seiners nearly eight-fold over this period from USD 49 000 in 2003 to USD 383 000 in 2018. When comparing the gillnetter costs in 2001 and 2018, the increase in total costs is less dramatic; from USD 25 000 to USD 79 000. The average length (LOA) of this type of vessel increased since 2001 by more than 2 metres. In contrast, the size of mechanized trawlers in Chennai has remained largely the same for the last two decades. The total annual costs of operating these vessels have increased from around USD 23 000 to USD 171 000 over the same period, possibly due to declining CPUEs, leading to installation of larger engines to operate further offshore and higher fuel consumption.[7] A significant part of the cost increase over time may be attributed to inflation as well.

As shown in Table 2 above, some of the Chinese fishing fleet segments included in this review were also covered in the 2001 review study. The vessel sizes of these fleet segments have grown tremendously over this period. Bottom pair trawlers now have an average length of 43 metres, while the largest vessels in this segment in 2001 were 28 metres. Similarly, the length of stow netters increased from 30 to 39 metres in the same period. The tonnage and engine power of typical vessels in these segments doubled or tripled. Therefore, it is logical that the annual operational costs of these vessels were much higher in 2018. The total costs of the bottom pair trawlers increased from USD 81 000 to USD 704 000 and those of stow netters from USD 63 000 to USD 482 000. The relative expenses on labour within the total gross costs have reduced from 32 percent to 23 percent for bottom pair trawlers. In contrast, stow netters spent just 5 percent on labour in 2001 and saw labour costs grow to become the largest cost component with 51 percent of total costs in 2018.

As far as a comparison of the Indonesian purse seine vessel segments surveyed in 2001 and 2018 is concerned, the average length of the vessels has remained around 27 metres with a tonnage of 120 (GRT). However, the total annual costs of a vessel of this type was USD 53 000 in 2001 and has since increased to USD 204 000. This increase is not mainly due to an increase in labour costs, but can be largely attributed to inflation. While the labour cost component added up to 51 percent of the total costs in 2001, this was reduced to 25 percent in 2018. While in USD terms, labour costs doubled, most other cost components increased much faster than labour costs. The tuna long liners surveyed in 2018 were smaller than those surveyed in 2001: 22 versus 26 metres LOA. The engine power of the long liners increased over the same period with approximately 100 kW. The total annual costs of Indonesian long liners increased from USD 80 000 to USD 145 000 between 2001 and 2018.

Two Korean fishing vessel segments surveyed in 2018 were also covered in the 2003 review study of FAO: the offshore jiggers and the large purse seiners. The total annual costs of an average offshore jigging vessel increased from USD 239 000 to USD 341 000. The labour costs as a percentage of the total costs remained stable, with a slight increase from 44 percent to 49 percent, while vessel costs declined over the same period

[7] The catch per unit effort of multiday trawlers declined from 1.15 tonnes in 1997-2006 to 1.13 tonnes in 2007-2015. (Aswthy *et al.*, 2018).

from 20 to 12 percent. The total annual costs of an average large purse seiner in 2003 added up to USD 3.9 million. Since then the total costs have increased significantly to USD 11.2 million in 2018. The labour and capital cost components declined relatively to the running and vessel cost components. The labour share in the total costs declined from 42 percent to 34 percent, and capital costs from 10 percent to four percent. On the other hand, the running costs increased by 9 percent to 34 percent and vessel costs went up 4 percent within the total annual costs of the purse seine vessels.

About 93 percent of the average revenue of all the fishing fleet segments included in this review originated from income earned from the sale of seafood landed. 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. However, such transfers did not significantly affect the profitability of these fishing fleets as they accounted only for a very minor part of total earnings.[8] Table 3 presents the average revenue, from landed seafood only, for the various fishing fleet segments in thousands of USD per vessel.

TABLE 3
Average off-vessel landing value in thousands of USD per vessel from seafood landings per fleet segment

Country	Fleet segment	Revenue from landings (USD 1000)	Number of vessels in the same segment in the country
Bangladesh	Shrimp trawlers	1 717	30
	Midwater trawlers	1 572	127
	Bottom trawlers	365	47
	Gillnetters	152	20 359
China	Gillnetters	540	96 315
	Stow netters	530	18 281
	Single boat bottom trawlers	262	34 141[9]
	Small pair trawlers	90	
	Large pair trawlers	773	
	Large purse seiners	732	7 483
India	Mechanized trawlers, Chennai	203	30 486[10]
	Mechanized trawlers, Kakinada	88	
	Mechanized gillnetters, Chennai	93	6 502
	Purse seiners, Mangalore	437	1 189
	Inboard ring seiners, Kochi	257	943
Indonesia	Purse seiners	262	1 374
	Cast netters	141	442
	Tuna long liners	73	351
	Pole and line vessels	11	87
	Squid jiggers	273	470
Japan	Purse seiners for sardine and mackerel	8 122	60
	Bonito purse seiners	11 680	35
	Offshore trawlers for cod and pollock	3 411	268
	Tuna long liners	5 226	198
Republic of Korea	Offshore jiggers	363	588
	Large otter trawlers	4 074	34
	Large purse seiners	9 350	25

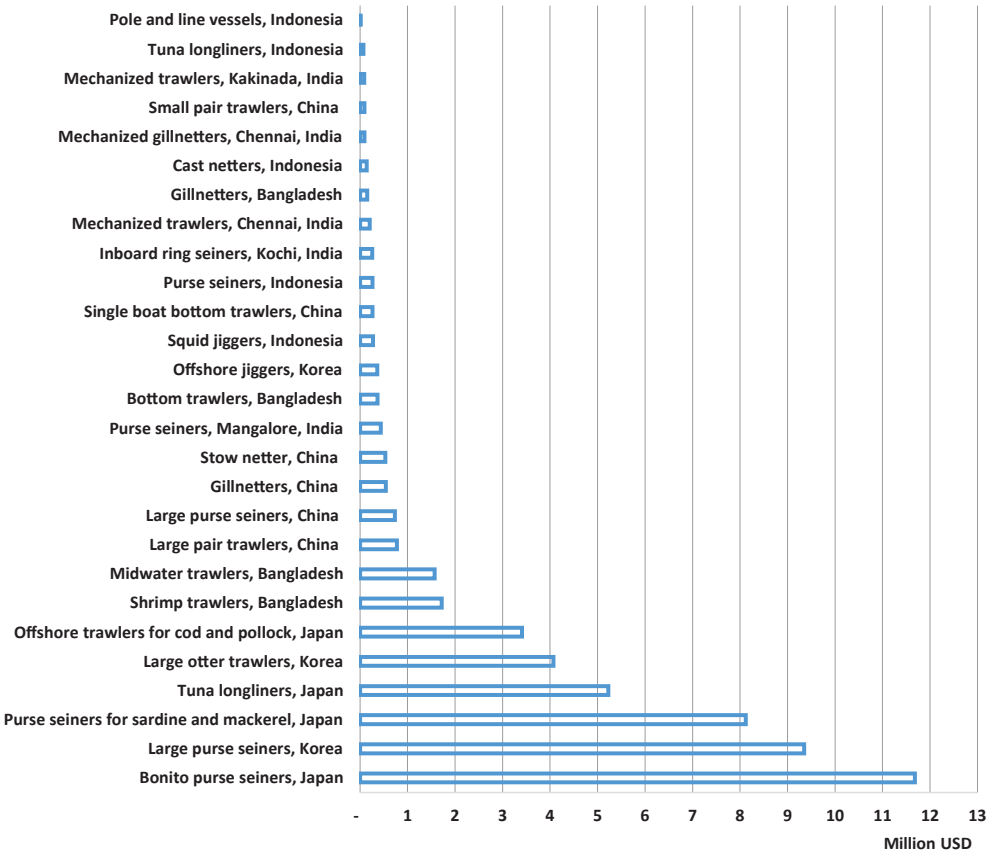
Source: Based on national reports.

[8] These findings are similar to the findings of the study carried out in 1999 and 2000 regarding the impact of government financial transfers on profitability and reported in FAO Fisheries Technical Paper No. 421.
[9] This number is the total number of vessels in the three Chinese trawler segments.
[10] This number is the total number of mechanized trawlers in India.

In terms of the value of seafood landed, and comparing the various Asian fishing fleets covered in this survey, it is clear that vessels in the Japanese and Korean industrial purse seine fleets landed the highest value of seafood per vessel in 2018. Japanese bonito purse seiners landed USD 11.3 million, while Korean large purse seiners landed fish with a value of nearly USD 9.4 million per vessel. In addition, the Japanese sardine and mackerel purse seiners landed seafood with an ex-vessel value of USD 8.1 million in 2018. The review showed that, in 2018, only Bangladeshi, Japanese and Korean vessels in the Asian region generated incomes from seafood landing, which were above USD 1 million. The majority of the fleets in this report landed significantly less seafood in value terms. In fact, most (56 percent) of the fleet segments generated average ex-vessel values in 2018 that were below USD 500 000. The review shows that there is a large variation among the Asian region's semi-industrial and industrial fishing fleets, in terms of vessel sizes, fishing methods used, species targeted and the stock status of the targeted species.

Seafood landings and revenues generated vary also between different fishing fleets targeting the same resources. For example, one Japanese tuna long liner (40 metre/ 475 tonnes) generates on average a revenue equal to 71 Indonesian tuna long liners (22 metre/75 tonnes). There is a vessel scale advantage which plays a role, but the fish quality assurance measures on the Japanese vessels are much stricter, and those affect the ex-vessel values of tunas caught tremendously. Trawlers from Bangladesh, which mostly fish in national waters and are relatively smaller in scale, were surprisingly part of the top earning vessels segments (Figure 7).

FIGURE 7
Comparison of average annual vessel revenues from seafood landings of selected fishing fleet segments




LITTLE FLOWER
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4. Financial and economic performance of selected fishing fleets in Asia

Analysis of the costs and earnings data of 27 of the main fishing fleet segments in Asia showed that 85 percent of the fishing fleets realized positive gross profit figures meaning that revenues from landings were larger than the total gross costs. Large purse seiners from the Republic of Korea, Pole and Line and Tuna Long line fishing fleet segments in Indonesia and small pair trawlers in China experienced losses in 2018.[11] In the other fleet segments covered in this review, there may have been individual fishing vessels with negative cash flows, but on average, vessels in these fleet segments were profitable.

Six indicators were used to assess the economic and financial performance of fishing vessels in the 27 surveyed fleet segments:

	Indicators
1	Net cash flow (NCF) = revenue from landings – total gross costs
2	Net profit margin (NPM) = net profit before taxes/revenue from landings
3	Return on fixed tangible assets (ROFTA) = net profit before taxes/value of tangible assets
4	Return on investment (ROI) = net profit before taxes/value of tangible and intangible assets
5	Gross value added (GVA) = net cash flow + labour costs
6	GVA to revenue = GVA/revenue from landings

The net cash flow (NCF) can be regarded a reward for entrepreneurship. A net profit margin higher than 20 percent is often considered good, while 10 percent is regarded as average in many industries.[12] The net profit margin is a measure of profitability after all costs have been accounted for and reflects the percentage of revenue that a vessel owner retains as profit. In this analysis, it is used to measure the relative performance of a fishing vessel segment compared to other vessel segments or other activities in the economy as it provides an indication of the vessel segment's operating efficiency as it captures the amount of surplus generated per unit of production.[13]

The return on fixed tangible assets (ROFTA) indicator provides a useful measure for the return on capital. A desirable result is positive as the cost of capital is considered. The return on investment (ROI) is the most commonly used indicator for financial performance. For the ROI any percentage higher than 10 percent is generally considered good (Tietze *et al.*, 2005), however in some other sectors only ROI percentages of 12 percent to 15 percent and higher is considered good.

Depreciation rates applied to the fishing vessels surveyed vary considerably. The variation is caused by the hull construction materials used (wooden or steel body), age, costs and quality of tangible assets (for example hull, engines, winches, on board freezers), climatic conditions in the area of operations and the maintenance regime

[11] The reported losses for Korean purse seiners could be the result of poor reporting. Vessels in this fishing fleet operate with a group of vessels. As a whole, the group operation could be profitable. The losses of Indonesian tuna longliners in 2018 can be partly attributed to the prohibition to transship fresh tuna at sea, which resulted in lower value landings of frozen tuna and hence lower revenues of vessels in this fleet segment.

[12] https://corporatefinanceinstitute.com/resources/knowledge/accounting/profit-margin/

[13] https://stecf.jrc.ec.europa.eu/documents/43805/1489224/2016_AER_6_METHODOLOGY.pdf

applied. Moreover, some owners prefer to apply high depreciation rates in the first years after construction to reduce taxable income. Detailed information on amortization of loans, interest payments and the value of intangible assets was not available for most of the vessels, but included when possible. The ROI was calculated (for the overview in Table 4) over the initial investments and not over the sum of the prevailing values of tangible plus intangible assets.[14]

The gross value added (GVA) figure is perhaps of less importance to individual vessel owners, but is an important figure for fisheries policy and decision-makers. It shows what the fishing vessel operations contribute to the economy, and is useful for making future fisheries sector investment and expenditure decisions. The GVA to revenue figure is expressed as a percentage and provides for the share of revenue that contributes to the economy through the production factors (here we focus on labour).

TABLE 4
Financial and economic performance of the various types of vessels covered in this review

Country	Fleet segment	Net cash flow (NCF)	Net profit margin (NPM)	Return on fixed tangible assets (ROFTA)	Return on investment (ROI)	Gross value added (GVA)	GVA to revenue
		Thousands of USD	%	%	%	Thousands of USD	%
Bangladesh	Shrimp trawlers	908	38%	67%	46%	1 106	64%
	Midwater trawlers	726	29%	51%	23%	913	58%
	Bottom trawlers	68	5%	13%	4%	122	33%
	Gillnetters	41	18%	85%	36%	98	65%
China	Gillnetters	280	46%	68%	55%	443	80%
	Stow netters	116	12%	12%	9%	360	66%
	Single boat bottom trawlers	16	-1%	-1%	-1%	100	35%
	Small pair trawlers	-37	-50%	-20%	-17%	29	22%
	Large pair trawlers	165	12%	13%	10%	325	40%
	Large purse seiners	176	10%	5%	3%	424	53%
India	Mechanized trawlers, Chennai	55	16%	86%	43%	140	68%
	Mechanized trawlers, Kakinada	46	33%	95%	42%	60	67%
	Mechanized gillnetters, Chennai	42	17%	36%	17%	57	60%
	Purse seiners, Mangalore	105	14%	51%	26%	215	48%
	Inboard ring seiners, Kochi	59	18%	142%	65%	189	73%
Indonesia	Purse seiners	64	22%	38%	31%	115	44%
	Cast netters	51	36%	266%	163%	61	43%
	Tuna longliners	-67	-100%	-93%	-53%	-38	-52%
	Pole and line vessels	2	-16%	-4%	-2%	2	19%
	Squid jiggers	51	17%	87%	46%	117	43%
Japan	Purse seiners for sardine and mackerel	1 990	41%	71%	21%	4 970	57%
	Bonito purse seiners	3 292	36%	143%	28%	7 840	60%
	Offshore trawlers for cod and pollock	1 032	29%	226%	13%	2 660	67%
	Tuna longliners	1 421	27%	88%	24%	3 279	57%
Republic of Korea	Offshore jiggers	52	8%	14%	4%	220	59%
	Large otter trawlers	1 109	26%	251%	49%	2 419	59%
	Large purse seiners	-660	-10%	-174%	-17%	3 208	31%

[14] The Asian fishing vessels surveyed did not possess transferable quota or licenses that can be traded. Therefore, the intangible assets value (such as fishing permits and licenses) was considered nil. In order to distinguish between the ROI and ROFTA, it was agreed by the experts involved to calculate the ROI over the initial investments.

Twenty-four out of 27 (89 percent) fishing fleet segments included in this review study reported positive net cash flows. The pole and line fishing fleet segment in Indonesia, which had reported a negative gross profit, had a marginally positive net cash flow. The net profit margin for the selected fishing fleets varied significantly. For the tuna long liners in Indonesia the net profit margin was highly negative (-100 percent), while on the other extreme an average gillnetter in China showed a positive net profit margin of 46 percent. This means that an average gillnetter owner in China retains a high level of profit from investing in gillnet fishing operations. More importantly about 40 percent of the selected Asian fishing fleets reported net profit margins higher than 20 percent, which is considered as 'good' in any industry standard. In total, about 70 percent of the selected fishing fleets reported net profit margins above 10 percent. The average net profit margin of all 27 selected Asian fishing fleet segments was 12 percent.

Eighty-one percent of the selected fishing fleets reported positive results in terms of their capital productivity, as their ROFTAs were positive. Seventy-eight percent of the fishing fleet segments showed ROFTAs of 10 percent and higher.

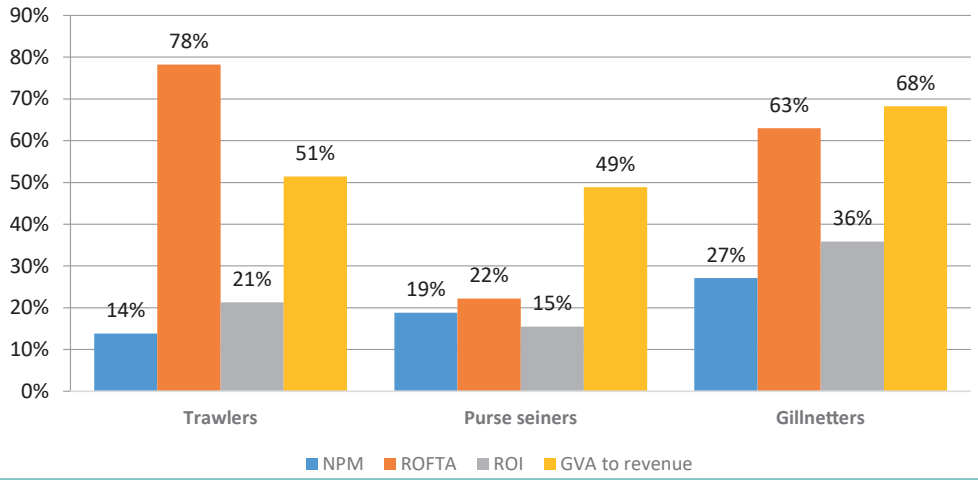
Sixty-three percent of the 27 major fishing fleet segments reported ROIs of above 10 percent, which is considered as 'good' in most industries. Altogether, 81 percent of the fishing fleets reported positive ROI figures. However, five fleet segments showed a negative ROI percentage. In particular, small pair and single boat bottom trawling fleets from China, tuna long liners and pole and line fishing vessels from Indonesia and large purse seiners from the Republic of Korea reported negative ROIs. On the other hand, the cast netter fleet in Indonesia reported a staggering 163 percent ROI in 2018.

The average GVA to revenue indicator of all 27 fleet segments analysed in this review study was high with 49 percent. The gillnetter fishing fleet segment in China reported with 80 percent the highest GVA to revenue.

Figure 8 presents some of the key performance indicator averages per common fishing vessel type in Asia. The averages were calculated based on fleet segments of similar vessel types of the six countries covered in this study. On average, the trawlers and the gillnetters realized the highest financial and economic performance figures.

FIGURE 8

Financial and economic performance averages by common fishing fleet segments in Asia



The GVA figure can be used to show the contribution of a fishing vessel or a fishing fleet to the national economy. The surveys conducted provided information on the average GVA per vessel. By multiplying the GVA per vessel with the total number of vessels in the fleet segment, it is possible to estimate the contribution of the fleet segment to the economy. The review showed that the total gross value added by the selected Chinese fishing fleets to the national economy was very large (see Table 5) and added up in 2018 to over USD 57.6 billion. The total GVA of the surveyed Indian and Bangladeshi fishing fleets amounted to USD 5.1 billion and USD 2.2 billion, respectively. The surveyed Japanese fishing fleet segments presented a total GVA of USD 1.9 billion in 2017. The contributions by the reviewed Korean and Indonesian fleets to their national economies were a bit smaller with total GVA figures of USD 292 million (Korea) and USD 227 million (Indonesia). All 27 Asian fishing fleet segments surveyed contributed an estimated USD 66 billion to the region's economy.

For some of the fishing fleet segments surveyed, a comparison between the 2018 financial and economic performance results and the findings of the 2001 review study was possible. Table 6 presents information on profitability trends of some of the fishing fleet segments. The net cash flow generated by the Indian purse seiners has increased tremendously from just over USD 1 000 to USD 105 000. This is likely due to increased catches by larger vessels and a general increase in the ex-vessel fish prices .

TABLE 5
Gross value added of selected Asian fishing fleet segments to the national economies (in million USD)

Fleet segment	GVA in millions (USD)	Fleet segment	GVA in millions (USD)
Gillnetters, China	42 668	Purse seiners, India	256
Stow netters, China	6 581	Inboard ring seiners, India	178
Trawlers, China	5 155	Purse seiners, Indonesia	158
Mechanized trawlers, India	3 049	Offshore jiggers, Korea	129
Large purse seiners, China	3 173	Midwater trawlers, Bangladesh	116
Gillnetters, Bangladesh	2 002	Large otter trawlers, Korea	82
Mechanized gillnetters, India	371	Large purse seiners, Korea	80
Offshore trawlers for cod and pollock, Japan	713	Squid jiggers, Indonesia	55
Tuna longliners, Japan	649	Shrimp trawlers, Bangladesh	33
Purse seiners for sardine and mackerel, Japan	298	Cast netters, Indonesia	27
Bonito purse seiners, Japan	274	Bottom trawlers, Bangladesh	6

TABLE 6
Relative profitability of selected fishing fleet in 2001 and 2020

Country	Fleet	Net cash flow (USD)		Profitability trend
		2001	2020	
China	Single boat bottom trawlers	-3 370	15 837	Became profitable
	Pair trawlers	-17 154	-36 621	Continued loss making
	Large purse seiners	149 604	176 385	Remained profitable
India	Mechanized trawlers	8 635	54 785	Remained profitable
	Purse seiners	1 376	105 418	Remained profitable
Indonesia	Purse seiners	10 214	63 732	Remained profitable
	Tuna long liners	9 766	-67 651	Turned into loss making
	Pole and line vessels	6 607	1 724	Remained profitable
Republic of Korea	Offshore jiggers	3 370	51 676	Remained profitable
	Large otter trawlers	330 041	1 108 560	Remain profitable
	Large purse seiners	1 111 222	-660 674	Turned into loss making

Demand from the fishmeal industry, which has developed in India since the last review study and opened a market for low value fishes, has also contributed to the revenue stream. The offshore jigging vessels of the Republic of Korea also saw a tremendous increase in profitability compared to 2001. The jigging vessels are now equipped with cold storage/freezers, and/or tanks with oxygen generators for live catch, which have contributed to better quality and fresher products and higher prices in the markets. In contrast, small bottom pair trawlers in China reported losses in both review studies. The change in ownership of these fishing vessels from commune/village property to private ownership has apparently not increased their profitability. However, larger bottom pair trawlers in China have moved towards profitable fishing operations. Large purse seiners of the Republic of Korea and the tuna long liners of Indonesia reported also a decrease in net cash flows. However, given that these vessels operate in groups, no conclusions can be drawn regarding the profitability of single vessels of these groups.

Overall, the performance of the main Asian fishing fleets covered in this regional review showed positive results. A large majority of the selected fishing fleets presented impressive financial and economic indicators. The contribution to the national economies was substantial for almost all the Asian fishing fleets surveyed, which is confirmed by the highly positive gross value added figures of the vessels analysed.

In general, there has been an improvement in financial and economic performance of the main Asian fishing fleets compared to 2001. This improvement might be unexpected to some observers, given the overall increase in fishing effort, continued overexploitation and depletion of many fishery resources in the region, and the challenges in managing the fisheries in some of the Asian countries. The reasons for these improvements against the odds could be efficiency gains in fishing operations of these major fishing fleets, supported by technology advances and favourable general market conditions. These have all contributed to the profitability of the major Asian fishing fleets included in this review. Innovations within the major fishing fleets in Asia in terms of adoption of improved navigation systems, fish finding technologies and gear modifications, have reduced the costs of operation, while an increased use of onboard freezers, ice and cold storage has allowed many of the Asian fleets to improve product quality and fetch higher ex-vessel prices for their landings.

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. It generates enough income to cover depreciation costs, interest and loan repayments, and provides sufficient financial resources for reinvestment. A fishery sector in which nearly 60 percent of the businesses realize ROIs of 15 percent and higher is an attractive sector for investors.

The average GVA to revenue indicator of all 27 fleet segments was as high as 49 percent. The total GVA of these fishing fleets to the Asian regional economy was estimated at USD 66 billion.[15] Considering the large contribution to Asian economies, it would be justified for policy and decision makers to invest in fisheries infrastructure development and maintenance, and facilitate innovation. This would expedite the ongoing transition towards more responsible fisheries operations. Investments and innovation in fish and fishery products value chains may further add to the sectors' contribution to the economy. Investments will not just contribute to employment and livelihoods in coastal areas, but also support national food security and export earnings objectives.

[15] This figure is composed of 2017 GVA data for Japan and Republic of Korea and 2018 GVA data for the other four countries.

The review also showed that there is a need for suitable management measures to avoid an uncontrolled growth in fishing fleets. Some of the fleets have been growing rapidly in recent years, which will likely constrain fishing vessels' profitability, in view of the poor status of many fishery resources in the region. It would be important to continue to monitor the profitability of the fishing fleets to facilitate timely introduction of adaptive fisheries management measures, including fleet capacity management plans, and to maintain a healthy fishing sector.

In order to maintain and continue the present very positive techno-economic performance of the fisheries sector in Asia, documented in this report, it is crucial to fully adopt responsible fishing operations, in line with the FAO Code of Conduct for Responsible Fisheries, and to apply an ecosystembased approach to fisheries.

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National report of Bangladesh

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1. OBJECTIVES AND CONTEXT

The People's Republic of Bangladesh lies in the northeastern part of South Asia, on the Bay of Bengal. India borders the country on the Northeast, North and West, Myanmar in the Southeast direction and the Bay of Bengal in the South. A riverine country, Bangladesh is a traditional fishing nation and fish is the most important source of protein for the population. Since its independence in 1971, the country has made significant progress in the fisheries sector. It is one of the leading nations in inland capture fisheries and aquaculture and exhibits a sound growth in marine fishery.

The maritime zone of Bangladesh comprises 9 060 km^2 of territorial waters and 118 813 km^2 of Exclusive Economic Zone (EEZ). The finfish and shellfish biodiversity is rich with 475 species of fishes, 36 species of shrimps, 5 species of lobsters and over 15 species of crabs (MFO, 2016). Marine fishing is carried out in 14 coastal districts; spread over 710 km of coastline. Ilish (*Tenualosa ilisha*), the national fish of Bangladesh, and shrimps (especially tiger shrimp, *P. monodon*) are the most prized catch from the marine waters of Bangladesh. Other dominant commercial species are pomfrets, Indian salmon, grunter, lobster, and cuttlefish.

The fishing season of Bangladesh starts in July and continues until June next year. Winter months, November to February are usually the peak season. However, depending on species and gear, the fishing season varies. In the 2017-18 fishing season, 654 687 tonnes of fish and fishery products were landed in Bangladesh (DoF, 2018). The estimated value was USD 1.79 billion at the point of the first sale,[1] which is about 0.65 percent of the GDP at current prices.[2] Marine fisheries of Bangladesh comprise both industrial and artisanal sub-sectors (non-powered). The artisanal sub-sector dominates the fishery in terms of the number of vessels. The industrial sector is also vibrant. There has been a considerable increase in the number of vessels and tonnage of the industrial fishing fleet (MFO, 2016). In addition, a large fleet of mechanized (powered) gillnetters operates in the country. Figures 1 and 2 provide the catch composition of Bangladesh with respect to species caught by the main fishing fleets.

The current fleet assessment is part of a global assessment by the Food and Agriculture Organization (FAO) of the United Nations and aims to compare the financial and economic performance between fleets and over time within fleets, where possible. Previously, such assessments were carried out from 1995 to 1997, 1999 to 2000 and 2003 to 2005. However, Bangladesh was not covered in previous studies.

1 Estimated by authors based on information on first sale prices collected during the survey.
2 *GDP of Bangladesh at current prices in 2018 was USD 274.039 Billion.* Data from World Bank Last updated: Apr 8, 2020. Accessed from https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=BD. Last accessed on 07 September 2020.

FIGURE 1
Catch composition by species for the main fishing fleets (2017-18)

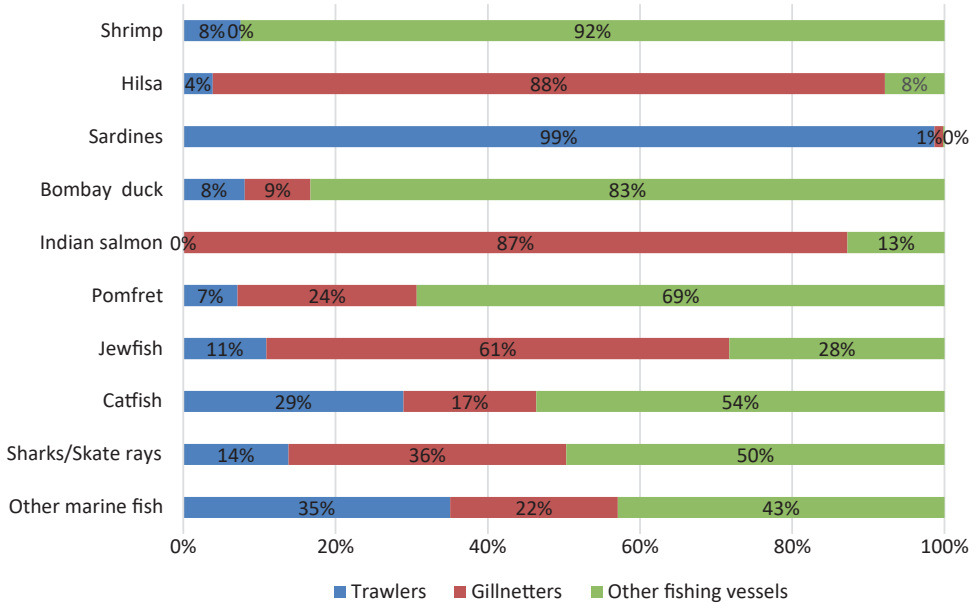
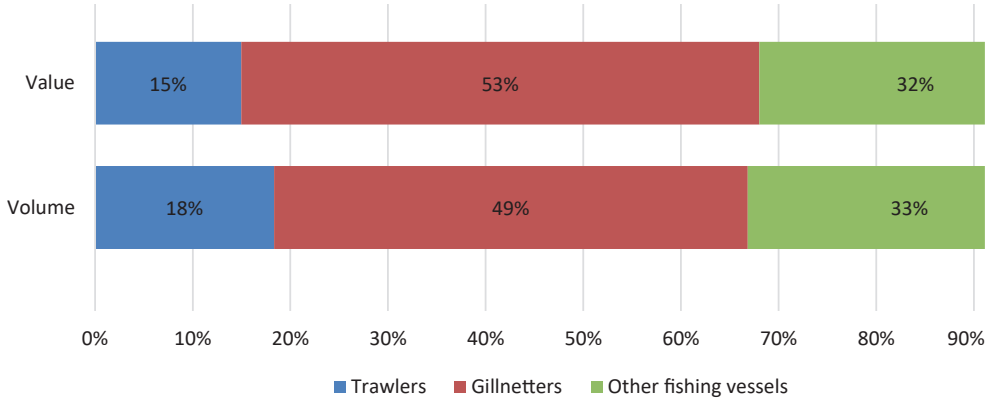


FIGURE 2
Distribution of landings by volume and value of the main fishing fleets (2017-18)



The two main reasons for the inclusion of Bangladesh in the current study are the following: (i) to contribute to Sustainable Development Goal 14: Life Below Water, especially to Target 14.7: By 2030, increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism; and Target 14.B: Provide access for small-scale artisanal fishers to marine resources and markets by 2030; and (ii) Bangladesh embarked on a series of reforms in its fisheries management system starting with a management plan for Ilish fishery. The study would set a performance benchmark that could be tracked over time to evaluate policy performance.

Bangladesh produced approximately 11 percent of the total marine fish production in South Asia and about 0.77 percent of the global marine fisheries production in 2018. During the period 2009–2018, the country recorded an average annual growth rate of 0.86 percent in the marine fisheries sector as against 2.41 percent in the rest of South

Asia and 0.69 percent at the global level.[3] The information presented in this analysis was collected from three sources: (i) global comparative figures from FAO and the World Bank publicly available databases, (ii) official publications of the Department of Fisheries, Government of Bangladesh, and (iii) field surveys carried out by the authors in collaboration with the Marine Fisheries Office (MFO) and Marine Fisheries Survey Management Unit (MFSMU), Department of Fisheries, Government of Bangladesh within the period October to December 2019.

2. CHARACTERISTICS OF FISHING FLEETS OPERATING IN BANGLADESH

The marine capture fisheries production in Bangladesh increased gradually in the last 10 years from 0.51 million tonnes in 2009 to 0.65 million tonnes in 2018. Around the same time, survey reports (2010, 2016) from the Bangladesh Marine Fisheries Capacity Building Project show that the number of fishing vessels increased from 50 431 to 67 913, a change of 35 percent (MFO, 2016). However, except for trawlers, registration and licensing of mechanized and non-mechanized fishing vessels is an ongoing exercise in Bangladesh and this growth at best is indicative. Table 1 provides an overview of the marine fishing fleets of the country. The classification of fishing vessels follows the groups used in national statistical reports.

Boats operating set bag nets and mechanized gill netters comprise the majority of the fishing fleet. As such, most of the fishing fleet is in the artisanal and small-scale category. The artisanal longline fishing fleet operates mostly from Cox's Bazar and mainly targets jewfish using hooks and lines.

The present report reviews the techno-economic performance of the industrial and small-scale fishing fleet of the country. Hence, it covers different types of trawlers and the mechanized gillnetters (Sl. No. 1 – 4 in Table 1). The selected fishing fleets land about 67 percent of the total catch, which represents 68 percent of the total value landed at the point of first sale. About 41 percent to 45 percent of the fisheries workforce is employed in these fleets. This report provides detailed information on the selected fishing fleets only. All fishing fleets operate in the Eastern Indian Ocean (FAO major fishing area 57).

TABLE 1
Overview of the national fishing fleets

C	Fishing fleet	Number of vessels[4]	Scale	FAO fishing area	Main fishing ports
1	Shrimp trawlers (steel)	37 (30)	Industrial	57	Chattogram, Cox's Bazar
2	Midwater trawlers (steel)	150 (127)	Industrial	57	Chattogram
3	Bottom trawlers (wooden)	60 (47)	Industrial	57	Chattogram, Khulna
4	Mechanized gillnetter (wooden)	20 359	Small-scale	57	Chattogram, Cox's Bazar, Bhola, Potuakhali, Borguna
5	Non-mechanized gillnetter (wooden)	16 831	Artisanal	57	All over the coast
6	Set bag netter (wooden)	20 750	Artisanal	57	Chattogram, Cox's Bazar, Patuakhali
7	Longliner (wooden)	3 225	Artisanal	57	Cox's Bazar
8	Trammel netter (wooden)	131	Artisanal	57	All over the coast
9	Vessels using other gears	6 373	Artisanal	57	All over the coast
Total		**67 913**			

[3] Estimated from FAO. 2020. Fishery and Aquaculture Statistics. Global capture production 1950–2018 (FishstatJ). In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2020. www.fao.org/fishery/statistics/software/fishstatj/en

[4] Data in Table 1 are estimates from MFO, 2016. The number of trawlers reflects the total number authorized to fish until 30 June 2016. The numbers in parenthesis present the number of operational trawlers.

Shrimp trawlers using outriggers are made of steel. They carry out bottom trawling. Bottom trawlers (wooden hull) were initially introduced to target white fishes. These stern trawlers do not have onboard freezing facilities and carry ice for preserving the fish. In 2014, the Government directed bottom trawlers to convert to midwater trawling for resource conservation. Subsequently, steel-body bottom trawlers converted to midwater trawling, while the wooden body bottom trawlers continued to engage in bottom trawling. Midwater trawlers are also equipped as stern trawlers. They are steel built, larger in size, and have on-board freezing facilities. Both the bottom trawlers and the midwater trawlers are reflected in the national statistics as fish trawlers. Bottom trawlers are usually smaller. The main differences are in the fishing arrangements, such as the days at sea and the use of ice. The duration of the voyage is about half of the steel trawlers. Mechanized gillnetters use power for both hauling and propulsion. They are also made of wood. However, unlike trawlers, which are usually imported, gillnetters are built locally.

The main species targeted by each fleet are listed in Table 2. Fishing vessels, especially gillnetter, carry different types of nets, in terms of mesh size and length, to target different types of fish during different seasons.

The main species caught by each fleet are listed in Table 3. In terms of commercial value generation, shrimps, ilish and pomfrets are of key importance to these fleets.

Discarding of fish is prohibited in Bangladesh. However, in the past, discard of fish was reported. In recent years, the development of the fishmeal industry in Bangladesh has initiated the use of low-value fishes. Trash fish is now sold at about USD 252 per tonne.

The Marine Fisheries Ordinance of 1983 is the main law governing fishing operations in Bangladesh. Under this Ordinance, the area from the coastline up to the 40-metre depth contour is reserved for non-industrial fishing vessels. Industrial trawlers are prohibited from fishing in this reserved area. The Ordinance also stipulates conditions for fishing gear regulation. Annual fishing licenses are issued based on this Ordinance. Fishing vessels, (especially trawlers) are registered under the Bangladesh Merchant Shipping Act of 1983. This Act specifies the technical requirements for the seaworthiness of fishing vessels.

TABLE 2
Main species targeted by fishing fleet (ranked from 1 to 5)

Fleets/species targeted	1	2	3	4	5
1. Shrimp trawlers	Giant tiger shrimp (*P. monodon*)	Indian white shrimp (*P. indicus*)	Brown shrimp (*M. monoceros*)	Other shrimps	
2. Midwater trawlers (Steel)	Ilish (*Clupeidae*)	Pomfrets (*Stromateidae*)	Mackerel (*Rastrelliger kanagurta*)	Sardines (*Sardinella spp.*)	Thread fin bream (*Nemipterus spp.*)
3. Bottom trawlers (Wooden)	Shrimps	Grunters (perch-like fishes) (*Terapontidae*)	Red snapper (*Lutjanidae*)	Pomfrets	Catfishes (*Ariidae*)
4. Mechanized gillnetter	Ilish	Croakers (*Sciaenidae*)	Pomfrets	Indian salmon (*Polynemidae*)	Catfishes

TABLE 3
Main species commonly caught by fleet (ranked from 1 to 5)

Fleets/species commonly caught	1	2	3	4	5
1. Shrimp trawlers	Brown shrimp	Indian white shrimp	Giant tiger shrimp	Catfishes	Croakers
2. Midwater trawlers	Sardines	Ilish	Mackerels	Catfishes	Ribbon fish (*Lepturacanthus savala*)
3. Bottom trawlers	Croakers	Ribbonfish	Pomfrets	Catfishes	Shark and rays
4. Mechanized gillnetters	Ilish	Croakers	Mackerels	Anchovies	Indian salmon, sharks and rays

The Protection and Conservation of Fish Act (1950), amended in 1995, provides for protection and conservation measures for fisheries resources, such as seasonal and area closures. This Act provides the basis for Ilish conservation measures in the country.

Table 4 presents an overview of the indicative age structure of vessels in the main fishing fleets. Since trawlers are mostly imported (purchased second hand), the year of construction is often not known. Trawlers are also rebuilt or refurbished during their operational lifetime; often engines and equipment on board are renewed. Therefore, it is difficult to determine the actual age of the fishing fleet. Many gillnetters are not registered, and owing to lack of information on the transfer of ownership, it is difficult to collect information on the age structure of vessels in this fleet.

During the survey, information on the age structure was collected from vessel registries for a sample of trawlers and gillnetters, and the same was then discussed with the boat owners to arrive at the age structure presented in Table 4. From the information, it is clear that the vessels in the mechanized gillnetter fleet and midwater trawlers are relatively young with 78 percent and 51 percent fishing vessels respectively below 10 years of age. In contrast, the vessels in the shrimp and bottom trawling fleets are generally older. The main reason for the differences in investment between the three types of trawlers is the Government regulation prohibiting the introduction and replacement of shrimp and bottom trawlers for conservation purposes, which entered into force in 2014. In the case of mechanized gillnetters there is no restriction on the introduction of new fishing vessels. This is leading to a rapid growth in the number of vessels of this type. Further, the economic life of wooden body fishing vessels is short and there is a high casualty rate among these types of vessels. These factors are also keeping the fleet relatively young.

3. TECHNO-ECONOMIC AND OPERATIONAL CHARACTERISTICS OF INDIVIDUAL FISHING UNITS

3.1 Shrimp trawlers

Most shrimp trawlers are between 24 to 50 metres of length (average: 30 m). A gross tonnage of 100 tonnes to 200 tonnes is most common (the fleet average is 194 tonnes). The power of the main engine usually ranges from 500–1000 BHP[5] (Table 5) and average engine power is about 692 BHP. The volume of the fish holds is generally between 80 and 120 tonnes and the freezing capacity is 3 tonnes to 5 tonnes per day.

The main fishing gear used is the outrigger shrimp trawl net. Equipment available on-board generally include nets, winches, net haulers, cranes, radio communication devices, sonars, and radars. Safety equipment are also available on-board.

TABLE 4
Average age of fishing vessels by fleet in years (in percentages)

Fleets/average age of vessels in percentages of total fleet size (%)	0–5 years	5–10 years	10–15 years	15–20 years	more than 20 years
1. Shrimp trawlers	10%		5%	10%	75%
2. Midwater trawlers	15%	36%	30%	15%	4%
3. Bottom trawlers	0%	20%	0%	0%	80%
4. Mechanized gillnetter	68%	10%	9%	4%	9%

[5] BHP or Brake Horse Power is the horsepower of an engine measured by the degree of resistance offered by a brake, which represents the useful power that the engine can develop. 1 BHP = 0.7457 kilowatt.

TABLE 5
General characteristics of shrimp trawlers in Bangladesh

Length overall (m)			
<10	11–24	24–50	>50
3%	11%	86%	0%
Gross tonnage			
<100	**100–200**	**200–300**	**>300**
0	54%	41%	5%
Engine power (BHP)			
200–500	500–1 000	1 000–1 500	>1 500
24%	73%	3%	0%

Source: Estimated from MFO reports.

The average crew size is generally around 25. The number of days at sea per vessel during the 2018/2019 fishing season was about 200 to 220 days. The average number of fishing trips in 2018/2019 was 8 (Table 6).

3.2 Midwater trawlers

Most midwater fish trawlers are between 24 to 50 metres of length (average: 34 m) with a gross tonnage of more than 300 tonnes. The vessels often have a 1 000 BHP main engine (Table 7). The volume of the fish holds is generally around 200 tonnes and the freezer capacity is around 15 tonnes per day.

The main fishing gear used is the fish trawl net. Equipment available on-board generally include nets, winches, net haulers, cranes, radio communication devices, sonars and radars. Safety equipment are also available on-board.

TABLE 6
Basic information of each fishing vessel surveyed: Shrimp trawlers

Parameters	Vessel 1	Vessel 2	Vessel 3	Vessel 4
Length overall (LOA) (m)	33.1	24.3	27.5	28
Gross tonnage (GT)	450	350	250	250
Total power of main engines in BHP	1 282	774	680	680
On-board storage facilities (tonnes)	120	120	80	80
Fishing gear	Outrigger trawl	Outrigger trawl	Outrigger trawl	Outrigger trawl
Crew size (persons)	30	24	20	20
Ownership (state, shared, chartered, company)	Company	Company	Company	Company
Total days fishing at sea	200	220	200	200
Number of fishing trips	8	8	8	10
Fishing season (months)	8	8	8	8

TABLE 7
General characteristics of midwater trawlers in Bangladesh

Length overall (m)			
<10	11–24	24–50	>50
0%	15%	85%	1%
Gross tonnage			
<100	**100–200**	**200–300**	**>300**
3%	6%	35%	56%
Engine power (BHP)			
200–500	500–1 000	1 000–1 500	>1 500
3%	53%	36%	8%

The average crew size is about 38. The number of days at sea per vessel in 2018/2019 was 210 days. The vessels surveyed carried out eight fishing trips in 2018/2019 (Table 8).

3.3 Bottom trawlers

The bottom trawlers[6] have a wooden body and do not have on-board freezers. The overall length of the bottom trawlers is commonly between 24 metres to 50 metres (average: 28 m), however many vessels are in the 11–24 metres category. The gross tonnage of bottom trawlers is usually 100–200 tonnes with an average GT of 137 tonnes. The engine capacity is 500–1 000 BHP with an average engine power of 616 BHP (Table 9).

The main fishing gear used is the bottom trawl net. Equipment available on-board generally include nets, winches, net haulers, cranes, radio communication devices, sonars and radars. Safety equipment are also available on-board.

The average crew size is 22. The number of days at sea per vessel in the 2018/2019 fishing season was between 210 and 230 days. The number of fishing trips in 2018/2019 of the vessels surveyed was 21 to 23 (Table 10).

TABLE 8
Basic information of each fishing vessel surveyed: Midwater trawlers

Parameters	Vessel 1	Vessel 2	Vessel 3
Length overall (LOA) (m)	45.5	40	38.5
Gross tonnage (GT)	500	415	304
Total power of main engines in BHP	1 360	1 000	1 050
On-board storage facilities (tonnes)	250	200	120
Fishing gear	Fish trawl	Fish trawl	Fish trawl
Crew size (persons)	40	40	35
Ownership (state, shared, chartered, company)	Company	Company	Joint
Total days fishing at sea	210	210	210
Number of fishing trips	8	10	10
Fishing season (months)	8	8	8

TABLE 9
General characteristics of bottom trawlers in Bangladesh

Length overall (m)			
<10	11–24	24–50	>50
0%	46%	50%	4%
Gross tonnage			
<100	**100–200**	**200–300**	**>300**
48%	49%	3%	0%
Engine power (BHP)			
200 -500	500–1 000	1 000–1 500	>1 500
27%	63%	8%	2%

[6] Bottom trawlers in Bangladesh can have a steel hull or a wooden hull. Most of the steel body bottom trawlers were converted to midwater trawlers. However, some wooden hull bottom trawlers cannot be converted for midwater trawling. Therefore wooden hull trawlers were included as separate fleet segment in this report.

TABLE 10
Basic information of each fishing vessel surveyed: Bottom trawlers

Parameters	Vessel 1	Vessel 2
Length overall (LOA) (m)	23.8	26.2
Gross tonnage (GT)	146	77.5
Total power of main engines in BHP	650	510
On-board storage facilities (tonnes)	-	-
Fishing gear	Bottom trawl	Bottom trawl
Crew size (persons)	24	20
Ownership (state, shared, chartered, company)	Company	Company
Total days fishing at sea	230	230
Number of fishing trips	23	21
Fishing season (months)	9	9

3.4 Mechanized gillnetters

The mechanized gillnetters are wooden body fishing vessels. The overall length of the mechanized gillnetters is often between 16–20 metre (average: 16 metre), but some 46 percent of the vessels are between 11 and 15 metres in length. The gross tonnage of gillnetters is commonly more than 20 tonnes. The vessels generally do not have much on-board storage capacity. The engine capacity is highly diverse with an average engine power of 112 BHP (Table 11).

The main fishing gears used are gillnets, drift nets and marine set bag nets (seine nets). Equipment available on-board generally includes nets and net haulers. Safety equipment are also available on-board.

The average crew size is 20. The number of days at sea per vessel in the 2018/2019 fishing season was similar for all vessels surveyed: 230 days. The average number of fishing trips in 2018/2019 was 18 to 22 (Table 12).

TABLE 11
General characteristics of gillnetters in Bangladesh

Length overall (m)			
<10	11–15	16–20	>20
1%	46%	53%	0%
Gross tonnage			
<10	**10–15**	**15–20**	**>20**
28%	18%	23%	31%
Engine power (BHP)			
<50	50–100	100–200	>200
30%	34%	18%	18%

TABLE 12
Basic information of each fishing vessel surveyed: Gillnetters

Parameters	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5
Length overall (LOA) (Metre)	16	17	16	17	17
Gross tonnage (GT)	25	19	15	22	22
Total power of main engines in BHP	140	185	175	140	65
Fishing gear	Gillnet	Gillnet, seine net	Gillnet	Gillnet	Gillnet, seine net, drift net
Crew size (persons)	20	25	22	20	22
Ownership (state, shared, chartered, company)	Sole proprietor	Sole proprietor	Sole proprietor	Sole proprietor	Sole proprietor
Total days fishing at sea	230	230	230	230	230
Number of fishing trips	20	22	20	20	18
Fishing season (months)	8	8	8	8	8

Table 13 presents the estimated employment on each of the main fleets. Almost all the crew on these fishing vessels are full time employed. There are no women working on fishing vessels. Not much information is available on the age structure of the labour force of these fleets, but it is clear that most of the crew are below 50 years. Skippers are usually 35 to 45 years. Table 14 provides the age structure of the crew of vessels surveyed.

4. FINANCIAL AND ECONOMIC CHARACTERISTICS OF INDIVIDUAL FISHING UNITS

For all 16 fishing vessels surveyed the only source of revenue reported was the income from the sale of fish. The Marine Fisheries Ordinance of 1983 does not allow the transfer of license. In the case of gillnetters, the entry of new vessels is so far unrestricted.

For the purpose of this report, investment is defined as the cost of procurement of a particular item at the time it was procured (not the current price of the item); the current average value of the investment is calculated after applying a depreciation rate on the items. To find the depreciated value of an item a constant (linear) technical depreciation rate (D percent) is multiplied by the age of the item.

For example, the hull of a fishing vessel was purchased 10 years ago at a cost of USD 100 000 (the original investment). The hull is depreciated at the rate of 5 percent per year, which carries an expectation that the lifespan of the hull would be 20 years of operation. Then the current (depreciated) value of the investment is USD 100 000 – (USD 100 000 x 10 years x 5 percent depreciation per year) = USD 50 000. For different items, the depreciation value is estimated by considering the economic life of the item. That is the period over which an asset is expected to be used, assuming a normal level of usage and maintenance. Given this, the depreciation rate is 1/Economic Life of an asset. In practice an asset may be beyond its economic life but still in use due to periodic repair and overhauling. The following annual depreciation rates (Table 15) are used in this report.

TABLE 13
Labour employed in fishing

Fleet type	Full time employment (FTE)
Shrimp trawlers	600–750
Midwater trawlers	4 500–6 000
Bottom trawlers	850–1 100
Mechanized gillnetters	305 400–407 200

TABLE 14
Age structure of the fishing vessel crew (in percentages)

Age distribution of fishing vessel crew	Under 20	20–29	30–39	40–49	50–59	Over 60
Shrimp trawlers	3%	26%	30%	30%	10%	1%
Midwater trawlers	3%	20%	35%	35%	6%	1%
Bottom trawlers	5%	24%	25%	40%	5%	1%
Mechanized gillnetters	7%	30%	30%	20%	12%	1%

Source: Survey data.

TABLE 15
Annual depreciation rates across assets classes used in this report

Asset	Depreciation rate
Hull (steel)	5%
Hull (wooden)	10%
Engine(s) (trawlers)	10%
Engine(s) (gillnetters)	14%
Equipment on deck	14%
Equipment below deck	14%
Fishing gears	20%
Electronic devices	20%
Other	20%

Interest on investment is any amount of interest that is paid on loan proceeds used to purchase investments. In fisheries, interest payment greatly varies depending on the source of loan. An informal lender may charge 4 to 5 times more than a commercial bank or rural credit institution, which affects the profitability of the fishing operation.

Operating and owner costs

The total annual operational cost (ATC) comprises vessel operating cost (OC) and vessel owner cost (VC). The vessel operating cost (OC) comprises vessel running cost (RC: fuel, ice, packaging, etc.) and labour cost (LC: wage, labour share, food, labour travel, etc.). The vessel owner cost (VC) comprises of total vessel cost (TVC: registration, license, maintenance, etc.) and total capital cost (TCC: depreciation, interest, etc.).
That is:

$$ATC = OC + VC = RC+LC+TVC+TCC$$

$$OC = RC + LC$$

$$VC = TVC + TCC$$

4.1 Shrimp trawlers

Capital investments

The average initial investment in hull, engines and propulsion, equipment, fishing gears and electronic devices for a shrimp trawler was USD 1.4 million. The current average value of the investment made in a vessel and related equipment of this fleet is estimated at USD 978 000. The average age of the hull was 3.25 years in 2019 at the time of the survey. In terms of the original investment, the principal investments were generally made in the hull (38 percent), followed by investment in the engines (21 percent) and equipment below deck (14 percent). During the survey, it was also found that shrimp trawlers keep personal flotation devices (PFDs) in adequate numbers on board. On average, around 3 percent of the invested capital of a shrimp trawler was spent on PFDs and other equipment.

Earnings

Shrimp trawlers obtained their income in 2019 solely from the sale of shrimp and fish. The total earnings of the shrimp trawlers ranged between USD 1.3 million and USD 2.0 million. The average earnings of a shrimp trawler in 2019 added up to USD 1.7 million.

Operating and owner costs

For an average shrimp trawler, the operating costs add up to 67 percent and the owner costs to 33 percent of the total annual operational cost. The vessel-operating costs of shrimp trawlers were in 2019 composed for 72 percent of running costs and 28 percent of labour costs. Expenditures on fuel were on average USD 393 000, which added up to 56 percent of the running cost and were therefore the most significant cost component. Labour wages factored about 22 percent of the operating cost for an average vessel in this fleet, while food and other supplies during the voyage amounted to about 6 percent of the operating costs in 2019. The commission for selling fish contributes to about 7 percent of the cost.

The average vessel owner costs in 2019 were nearly USD 250 000 and mainly consisted of depreciation (39 percent) and interest payment (32 percent). The other important cost categories were audit and legal fees, insurance, and vessel repair and maintenance. Vessel repair and maintenance also included repair and maintenance costs of fishing gears. Further, the user fees, such as expenses for fishing licenses and permits constituted a negligible share of the total costs.

4.2 Midwater trawlers

Capital investments

The average initial investment in hull, engines and propulsion, equipment, gears, and electronic devices for a midwater trawler was USD 1.9 million. The current (2019) average value of the investment made in a vessel and related equipment of this fleet is estimated at USD 887 000. The average age of the hull was 9.3 years at the time of the survey. In terms of the original investment, the main investments were generally made towards the hull (59 percent), followed by investment in the engines (14 percent) and equipment below deck (9 percent). During the survey, it was also found that midwater trawlers keep adequate numbers of PFDs onboard. On average, about 3 percent of the initial investment in midwater trawlers was spent on PFDs and other (safety) equipment.

Earnings

Midwater trawlers obtained in 2019 their income solely from the sale of fish. The total earnings of these trawlers were around USD 1.5 million, with only small variations between vessels.

Operating and owner costs

For midwater trawlers, the operating costs contribute on average 68 percent to the total operational cost. The average total operational costs of a vessel in this fleet in 2019 added up to USD 1.46 million. The vessel-operating costs of midwater trawlers were composed of 75 percent running costs and 25 percent labour costs. Fuel costs amounted to USD 480 000 (63 percent of the running costs) and were the largest cost item. Labour wages factored about 13 percent of the total operational costs. The commission for selling fish contributed about 4 percent of the total operational costs.

The main vessel owner costs categories were depreciation (USD 170 000) and interest payment (USD 103 000). The other important cost items were insurance (USD 25 000) and vessel repair and maintenance (USD 30 000). Vessel repair and maintenance also included repair and maintenance costs of fishing gears. License fees and permits constituted a negligible share of the total vessel owner costs.

4.3 Bottom trawlers

Capital investments

The average initial investment in hull, engines and propulsion, equipment, fishing gears, and electronic devices for a bottom trawler was USD 457 000. The current (2019) average value of the investment made in a vessel and related equipment of this fleet is estimated at USD 141 000. The average age of the hull was 6.5 years in 2019. In terms of the original investment, the principal investments were generally made in the hull (51 percent), followed by investments in the engines (38 percent) and equipment on deck (5 percent). During the survey, it was also found that the bottom trawlers invested on average around USD 1 900 on life-saving equipment (such as PFDs).

Earnings

The bottom trawlers surveyed obtained in 2019 their income solely from the sale of fish. The average total annual earnings of these trawlers were around USD 365 000.

Operating and owner costs

In 2019, the operating costs (running cost and labour costs together) added up to 67 percent of the total operational costs of a bottom trawler. The operating costs of bottom trawlers consisted of 77 percent of running costs and 23 percent of labour costs. Fuel costs were the largest cost item, amounting to around USD 118 000 in 2019. Labour wages were for an average vessel around USD 50 000 in the same year and nearly USD 19 000 was spent on ice.

The owner costs amounted to 33 percent of the total operational costs of a bottom trawler in 2019. The main owner costs categories were vessel and equipment depreciation, which was around USD 47 000 in 2019, followed by gear replacement costs (USD 36 000) and vessel maintenance expenses (USD 25 000). The costs of license fees and permits were minor and constituted a negligible share (0.83 percent) of the total operational cost.

4.4 Mechanized gillnetters

Capital investments

The average initial investment in hull, engines and propulsion, equipment, gears, and electronic devices for a wooden gillnetter was around USD 78 000. The current average value of the investment made in a vessel and related equipment of this fleet is estimated at nearly USD 33 000. The average age of the hull of the vessels surveyed was 5.8 years in 2019. In terms of the original investment, the main investments were generally made in the hull of the vessel (64 percent), gears (18 percent), and engines (14 percent). During the survey, it was found that also gillnetters have PFDs on board. On average, gillnetters spent about 3 percent (USD 2 400) of their total initial investment on PFDs and related safety equipment.

Earnings

The gillnetters surveyed obtained in 2019 their income solely from the sale of fish. The total average earnings of these gillnetters were around USD 152 000 in 2019. Total earnings ranged between USD 120 000 and USD 188 000.

Operating and owner costs

The total operational costs of gillnetters consisted largely of vessel operating costs (81 percent). The vessel owner costs were substantially lower with just 19 percent of the total operational costs. The vessel operating costs of gillnetters comprised in 2019 for 43 percent of running costs and 57 percent of labour costs. The labour wage costs ranged between USD 32 000 and USD 78 000, with an average of USD 50 000, and was the largest operational cost item in 2019 for gillnetters.

The reason behind a relatively high share of labour costs within the total operational cost of a gillnetter is due to the revenue sharing system used by gillnetters. In contrast, fixed wages with some labour incentives are provided by the trawlers. There is an increasing tendency towards having salaried employees on gillnetters, especially in the Chittagong region. However, in other regions of Bangladesh, the revenue sharing system is still in vogue.

There are different types of sharing systems in place, based on local customs and the relative bargaining power of the owner and the skipper. In most revenue-sharing systems, the skipper acts as the labour contractor and enters into an agreement with the vessel owner. In the most common arrangements, first, the vessel running costs and other variable costs (such as repair and maintenance costs) are deducted from the revenue, and then the balance is shared. The owner would take his personal share and shares for boat engine and nets; the skipper would take two shares and one share each is given to crewmembers. There are also sharing arrangements in place where the vessel owner and the skipper would share the costs and revenues equally.

Table 16 gives the average investment by vessels in the fleets surveyed while Figure 3 provides the percentile distribution of investment across categories by fleets surveyed. Table 17 presents the average revenues and expenditures for vessels in the surveyed fishing fleets in 2019.

TABLE 16
Investment costs and current values of surveyed fishing vessels (in USD)

Type of vessel / Investment item	Shrimp trawlers	Midwater trawlers	Bottom trawlers	Gillnetters
Vessel (hull)	539 000	1 141 333	231 000	50 160
Main engine(s)	299 020	273 907	173 000	11 232
Equipment on deck	138 196	148 128	21 945	-
Equipment below deck	199 750	177 467	-	-
Fishing gears	172 300	121 867	15 660	14 040
Electronic devices	23 820	25 800	5 150	336
Other	48 413	49 838	9 800	2 400
Total initial investment value	1 420 498	1 938 339	456 555	78 168
Depreciated value (book value)	978 297	887 113	141 456	32 785
Average age of the hull (years)	3	9	7	6

FIGURE 3
Pattern of investment in different types of vessels

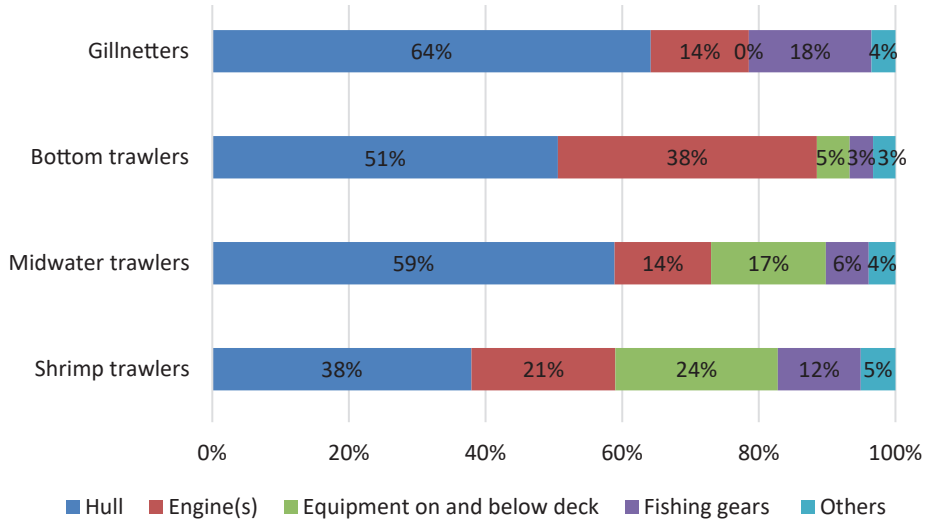


TABLE 17
Revenue and cost composition of the main fishing fleets in 2018-19 (in USD)

Category	Item	Shrimp trawlers	Fish trawlers	Wooden trawlers	Gill netters
I. Earnings	Fishing revenue (gross value of landings)	1 717 430	1 572 293	364 694	151 791
	Income from sale of fishing rights, licenses, permits and quotas	-	-	-	-
	Subsidies and grants	-	-	-	-
	Other vessel income (from tourism, charters, etc.)	-	-	-	-
	Total revenue/earnings	**1 717 430**	**1 572 293**	**364 694**	**151 791**
II. Running costs	Fuel	393 262	479 977	118 429	28 800
	Lubricants/oil/filters	18 809	11 550	-	1 206
	Harbour dues and levies	2 160	2 160	10 117	120
	Ice	-	-	18 619	5 232
	Bait	-	-	-	-
	Salt	-	-	-	-
	Fish selling costs	51 523	51 158	10 941	4 554
	Materials (packaging, boxes)	25 761	9 914	5 470	-
	Other operating costs	15 730	19 067	13 574	3 620
	Total running costs	**507 246**	**573 825**	**177 151**	**43 532**
III. Labour costs	Food, stores and other provisions	43 050	39 807	4 122	6 720
	Crew travel	-	-	416	100
	Labour (Labour share and wages (including social security contributions, life/accident and health insurance)	154 870	148 022	49 868	50 355
	Total labour costs	**197 920**	**187 829**	**54 406**	**57 175**
A. Total operating cost (II+III)		**705 166**	**761 654**	**231 557**	**100 707**
IV. Vessel costs	Fishing licenses, permits and quota (only annual costs and includes organization charges)	1 311	1 224	948	-
	Insurance (vessel, employees, equipment)	34 920	25 221	-	-
	Purchase fishing rights	-	-	-	-
	Gear replacements, repairs and maintenance	-	-	35 692	4 080
	Vessel repairs and maintenance	29 387	30 402	25 144	5 860
	Other fixed costs (accountancy, audit and legal fees, general expenses, subscriptions etc.)	38 500	28 267	3 747	-
	Total vessel costs	**104 118**	**85 113**	**65 531**	**9 940**
V. Capital costs	Depreciation (vessel, engine equipment and gears that last more than 3 years)	136 268	169 541	48 730	10 056
	Interests on investment	113 279	103 038	-	3 216
	Taxes on profit	-	-	-	-
	Total capital costs	**249 547**	**272 580**	**48 730**	**13 272**
B. Total vessel owner costs (IV+V)		**353 665**	**357 693**	**114 261**	**23 212**
	Total operational costs (A+B)	**1 058 831**	**1 119 347**	**345 817**	**123 919**

5. ECONOMIC AND FINANCIAL PERFORMANCE OF FISHING VESSELS

Key economic and financial indicators presented in Table 18 summarize the performance of the main fishing fleets in Bangladesh over the 2018-19 fishing season. All the fishing fleets surveyed showed positive net cash flows (total earnings minus total gross costs) and are thus generating investable surpluses. However, there are differences in relative fleet performances. Shrimp trawlers and midwater trawlers are most profitable as can be seen from their net profit margins (respectively 38 percent and 29 percent). Gillnetters who are relatively less capital intensive are also generating lucrative returns. This is shown in their high return on fixed tangible assets (ROFTA) of 85 percent. This explains the proliferation in the number of gillnetters, which could be a cause of concern for the future from a resource conservation and fisheries sustainability point of view.

TABLE 18
Financial and economic indicators per fishing fleet in 2019 (in USD)

	Code	Shrimp trawlers	Midwater trawlers	Bottom trawlers	Gillnetters
Revenue from landings	A	1 717 430	1 572 293	364 694	151 791
Total revenue	A2	1 717 430	1 572 293	364 694	151 791
Labour costs	B	197 920	187 829	54 406	57 175
Running costs	C	507 246	573 825	177 151	43 532
Vessel costs	D	104 118	85 113	65 531	9 940
Total gross cost (E) = B + C + D	E	809 284	846 768	297 088	110 647
Total costs (E2) = E + G + J + S	E2	1 058 831	1 119 347	345 817	123 919
Net cash flow (F) = A2 - E	F	908 146	725 526	67 606	41 144
Depreciation	G	136 268	169 541	48 730	10 056
Amortization	H	0	0	0	0
Gross profit (I) = F - G - H	I	771 877	555 984	18 877	31 088
Interest	J	113 279	103 038	0	3 216
Net profit before taxes (K) = I - J	K	658 599	452 946	18 877	27 872
Net profit margin (L) = K/A2	L	38%	29%	5%	18%
Value of tangible assets (2019)	M	978 297	887 113	141 456	32 785
ROFTA (N) = K/M	N	67%	51%	13%	85%
Value of intangible assets	O	0	0	0	0
ROI (P) = K/(T + O)	P	46%	23%	4%	36%
GVA (Q) = F + B	Q	1 106 066	913 355	122 012	98 319
GVA to revenue (R) = Q/A2	R	64%	58%	33%	65%
Taxes and extraordinary losses	S	0	0	0	0
Initial investment costs	T	1 420 498	1 938 339	456 555	78 168

5.1 Shrimp trawlers

The average gross profit of the shrimp trawlers in 2019 was around USD 772 000. The average net profit after adjusting for interest payment was USD 659 000. Given the initial investment cost of USD 1.4 million, vessels in this fleet generated a very good return on investment (ROI) of 46 percent, which was highest amongst the surveyed fishing fleets. The average gross value added by a shrimp trawler in 2019 was USD 1.1 million.

The ROFTA was 67 percent for an average shrimp trawler. ROFTA is a useful concept to measure performance over time. While it is not possible to compare here, considering the maturity of the shrimp-trawling sector in Bangladesh, a ROFTA of 67 percent is an indication of economically healthy fishing operations.

5.2 Midwater trawlers

The average gross profit of a midwater trawler in 2019 was around USD 556 000. The average net profit after adjusting for interest payment was USD 453 000. Applying an initial investment cost of USD 1.9 million, an average vessel in the midwater trawler fleet generated an ROI of 23 percent. The average gross value added by a vessel in this fleet was USD 913 000. The ROFTA was 51 percent, which indicates healthy operations.

5.3 Bottom trawlers

The average gross profit of a bottom trawler in 2019 was around USD 19 000. The vessels surveyed did not have loans and related interest payments, and therefore their net profits were the same as their gross profits. The relatively high initial investment cost of 456 000 in a vessel and related equipment of this fleet, compared to the small net profits in 2019, caused that the average ROI of a bottom trawler was just 4 percent.

The ROFTA was with 13 percent also relatively low. The average gross value added by a vessel in this fleet was USD 122 000 in 2019.

5.4 Gillnetters

The average gross profit of a gillnetter in 2019 was around USD 31 000. The average net profit after adjusting for interest payments was around USD 28 000. An average vessel in this fleet presented a net profit margin of 18 percent. Given the relatively low initial investment costs of USD 78 000, the average ROI of vessels in this fleet was high with 36 percent. The ROFTA of a vessel in this fleet was 85 percent, which indicates economically healthy fishing operations. The average gross value added by a gillnetter was USD 98 000 in 2019.

6. FINANCIAL SERVICES AVAILABLE TO THE FISHERIES SECTOR INCLUDING INSTITUTIONAL CREDIT PROGRAMMES

A stakeholder consultation was organized on 26 November 2019 at Chattogram to understand the financial support available to the sector. Ten fishing vessel owners, three fisheries input suppliers, and some representatives from the Marine Fisheries Office (MFO) participated in the meeting. The meeting outcomes showed a clear distinction in access to financial services depending on the ownership of the fishing vessels. Trawlers are mostly operated by multi-sectoral companies, while gillnetters are generally owned by individuals. The companies can access formal credit channels, which is often not possible for the owners of gillnetters.

There is no dedicated finance policy for the fisheries sector. The interest rates charged on loans to fishing vessel owners vary from 11 percent for an institutional credit to 60 percent per year for credit from informal sources. It was found that a slow process of aggregation is taking place in the gillnetter sub-sector where owners with single boats are finding it unprofitable to run a vessel. Owners generally prefer to operate 3 to 5 fishing vessels to spread risks and ensure sustainable profits.

While the gillnetters surveyed are profitable, risks of a bad fishing season or damage to the fishing vessels due to accidents may cause losses. In such a scenario, single boat owners are more at risk than those having a fleet of 3 to 5 vessels or more.

Multiple vessel owners and the trawler sector have also developed integrated fish and fishery products supply chains, ensuring better access to markets. They have more bargaining power and can be assured of timely supplies of inputs, such as ice and gears.

7. SUBSIDIES AND SUPPORT TO THE SECTOR

The fisheries sector does not enjoy any specific privileges. However, general export promotion incentives are applicable to companies in the fish and fisheries products value chain. The fishing vessel owners often do not benefit from such export-oriented initiatives. However, the Government provides support to fishers during the closed season in the form of food and support for alternative livelihood development (DoF, 2019).

8. TECHNOLOGICAL INNOVATIONS IN GEARS, EQUIPMENT AND VESSELS THAT IMPACT FISHING VESSEL ECONOMIC PERFORMANCE

The main technological innovations that have had an impact on the fishing fleet economic performance since 2000 in Bangladesh are presented in Table 19. The table also specifies how these changes impacted the economic fleet performance.

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

Major policy changes and development plans during the last decade affecting the fleet development in Bangladesh include the following:

TABLE 19
Technical innovations and their impacts on fishing fleet performance in Bangladesh

Category	Specific innovations	How these affected economic performance of the fleet
Cost reductions and energy savings	Use of GPS	Use of GPS by gillnetters is a recent phenomenon. Fishing vessels are using GPS equipment to plot their path and fishing spots. Its use is leading to fuel savings.
Increasing fishing efficiency	Introduction of resource-specific nets	During the last decade, there was a change in abundance of different species. The increasing availability of Indian salmon (locally known as Lakka) led to introduction of the Lakka net.
Reducing the environmental/ ecological impact of fishing operations	Prohibition of fine mesh size nets	From 2013, the Government has banned the use of fishing nets with small mesh sizes. Regular surveillance and enforcement operations are carried out to detect, seize and destroy illegal nets.
Improving safety at sea and working conditions of fishers	Use of sonar	Rather than for fishing purposes, the sonars and related instruments are being used by gillnetters to find the best spots for fishing and to avoid grounding.

- Introduction of midwater trawlers – midwater trawlers were introduced during 2003-04 to harvest fast-growing pelagic fish stocks in the EEZ of Bangladesh. This fleet was relatively modern, larger, and equipped with freezers.
- Conversion of bottom trawlers – in 2014, the Government instructed all bottom trawlers to convert to midwater trawling operations in line with the national marine resource conservation objectives. Subsequently, steel body bottom trawlers were converted to midwater trawlers. However, wooden trawlers were not fit for such conversion and continued bottom trawling. According to the general government policy, these wooden trawlers cannot be replaced at the end of their lifecycle. However, in the case of shrimp trawlers, replacement by new vessels is allowed.
- Conservation of Ilish fishery – Ilish is the national fish of Bangladesh, which is targeted by all types of fishing vessels and enjoys an insatiable demand. The large fishery for Ilish led to a decline in the Ilish stocks, despite it being a fast-growing species. In 2005, four important jatka (juvenile) nursery sites were declared Ilish sanctuaries under the amended Protection and Conservation of Fish Rules (1985) to improve Ilish fishery production. Another sanctuary was added in 2011. In another amendment of the Protection and Conservation of Fish Rules, fishing of any type is banned in these five sanctuaries at certain times of the year. Four Ilish spawning grounds have also been demarcated where fishing is banned for 11 days in October each year to allow the gravid Ilish (female Ilish carrying eggs) to spawn successfully. The amended Protection and Conservation of Fish Rules (1985) states that any fish caught by using any kind of gear in sanctuaries or spawning areas during the ban period may be seized and forfeited.
- An annual closed season was declared in 2015 from 20 May to 23 July (65 days) for all fishes and crustaceans by all type of fishing vessels under the Marine Fisheries Ordinance (1983). An amendment of the Protection and Conservation of Fish Act (1950) prohibits catch of Ilish during its breeding season (9 October to 30 October). Under the same Act, the catch, transportation, marketing, selling and having in possession of juvenile hilsa (up to 23.0 cm size) has been prohibited in the period 1 November to 31 May each year.
- Six Ilish sanctuaries were created, covering an area of 432 km^2, in the districts of Barishal, Bhola, Patuakhali, Lakshimipur, Chandpur, and Shariatpur, under the Protection and Conservation of Fish Rules (1985). Four sanctuaries were established in 2005 and the other two sanctuaries were declared in 2011 and 2018, respectively (Islam, Mohammed, & Ali, 2014).
- Bangladesh has also procured a survey vessel, RV Meen Sandhani in 2016 from Malaysia with funding support from the Islamic Development Bank, to assess and monitor the state of the fishery resources. Currently, the vessel is operating in a test phase and results are yet to be published. The Bay of Bengal Programme

Inter-Governmental Organisation is assisting the Government of Bangladesh to enhance capacity in a sea-based survey of fishery resources. The FAO in association with the Government of Norway is also implementing the EAF Nansen programme titled "*Supporting the Application of the Ecosystem Approach to Fisheries Management Considering Climate and Pollution Impacts*". Under this programme, the RV Dr Fridtjof Nansen conducted a research survey in the Bangladesh EEZ in August 2018 to collect data on distribution and abundance of fish stocks, biodiversity, environmental conditions, and occurrence of micro plastics.

- Bangladesh is working on improving its fisheries monitoring, control and surveillance under an on-going World Bank funded 'Sustainable Coastal and Marine Fisheries Project'. Currently, the Department of Fisheries is increasing its efforts to license fishing vessels and to provide photo identity cards to fishers.
- Promotion of longline fishing – the Bangladesh Government is promoting longline fishing to target tuna stocks in its EEZ. Bangladesh is now a full member of the Indian Ocean Tuna Commission (IOTC), although at present tuna landings are nominal. To harness tuna fishing capacity, Bangladesh has started implementing a pilot-scale project (2020-23) at the cost of USD 7.19 million.
- A multichannel slipway dockyard was constructed in 2019 in Chattogram to build and service fishing trawlers.

Bangladesh envisions a blue economy in which the marine fisheries sector would play an important role. A major challenge identified in the seventh five-year plan of the country and vision 2021 of the department of Fisheries is the unsustainable exploitation of fishery resources. Illegal fishing by domestic and foreign vessels is a major concern. Considering this, Bangladesh has adopted a strategy of resource estimation, strengthening fisheries monitoring, control and surveillance and development of a National Plan of Action to prevent, deter and eliminate Illegal, Unreported and Unregulated Fishing. The Government also aims to control the fishing effort in the country by controlling the number of trawlers. In the past, such efforts were unsuccessful (MFO, 2016). However, during the last four years 2016-20, there is a decline in the number of trawlers.[7]

As the above analysis shows, marine fisheries in Bangladesh are economically profitable. With the adoption of better fishery management practices, the returns of fishing vessels can be optimized allowing the sector to generate rent, which can contribute to the economy and foster the socio-economic development of the country.

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National report of China

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1. GENERAL INFORMATION ABOUT MARINE CAPTURE FISHERIES IN THE PEOPLE'S REPUBLIC OF CHINA

In 2016, China produced approximately 15.2 million tonnes of fish, which accounted for 19 percent of the global capture fisheries production (FAO, 2018). China continuous to be the largest contributor to the global marine capture fisheries output. The average annual marine capture fisheries production of China over the period 2005–2014 was 13.1 million tonnes.

The economic performance of the main fishing fleets in China was analysed most recently in 1999 (FAO, 2001). The main fleets covered in the previous analysis included the following: squid jiggers, set netters, purse seiners, bottom pair trawlers, single boat bottom trawlers, and stow netters. The general background information presented in this analysis was collected, compiled and analysed in 2016 by the Bureau of Fisheries and the Fisheries Administration of Ministry of Agriculture and Rural Affairs of the People's Republic of China and FAO. The fishing vessel surveys were conducted in 2019.

2. SOCIO-ECONOMIC DATA

The population of China, which was 651 million in the 1960s, reached 1.39 billion people in 2017 with a 1 percent – 2 percent growth rate per year. Individuals in the working age range of 15 to 64 years account for 72 percent of the total population. In terms of geographical distribution of the population, 59 percent of people are living in urban centers.

In 2017, China's gross domestic product (GDP) was USD 12.2 trillion. The per capita GDP was USD 8 583 in the same year. The largest expense category of households is food, tobacco and alcoholic beverages, accounting for 29.3 percent of total household expenditures. Other important expenditure items consist of housing and rent (22.4 percent) and transportation (13.6 percent) (Tables 1 and 2).

TABLE 1
Demographic and socioeconomic data (2017)

Indicator/parameter	
Population size*	1 390 080 000
Age structure * (%)	
under 15,	16.8
15-64	71.8
over 65	11.4
Population growth rate (%)*	0.53
Percentage of urban population**	58.5
GDP (billion USD) *	11 759.7
Per capita GDP (based on purchasing power parity) (USD)*	8 482.2
Economic growth rate (%)***	6.9
Number of tourists visiting the country (million) *	139.5
Consumer price index*	101.6

*:http://data.stats.gov.cn/easyquery.htm?cn=C01
**:www.chyxx.com/industry/201801/605524.html
***:https://baijiahao.baidu.com/s?id=1589913614794871677&wfr=spider&for=pc

TABLE 2
Distribution of household consumption expenditures in 2017

Category	Share (%)
Housing and rent	22.4
Food, tobacco and alcoholic beverages	29.3
Transportation	13.6
Daily necessities and services	6.1
Education culture and entertainment	11.4
Clothing	6.8
Medical insurance	7.9
Others	2.4
Total	**100**

Source: National Bureau of Statistics.

According to the World Bank, China's rapid economic growth exceeded the pace of its institutional development, and there are important institutional and reform gaps that the country needs to address to ensure a sustainable growth path. Significant policy adjustments are required for China's growth to be sustainable. Managing structural reforms and related risks will not be straightforward given the complexity, size, and global importance of China's economy.[1]

China's 13th Five-Year Plan (2016–2020) addresses these issues. It highlights the development of services and measures to address environmental and social imbalances, setting targets to reduce pollution, to increase energy efficiency, to improve access to education and healthcare, and to expand social protection. The 13th Five-Year Plan's annual growth target is 6.5 percent, reflecting the rebalancing of the economy and a focus on the quality of growth, while maintaining the objective of realizing a "moderately prosperous society" by 2020 (doubling the GDP in the period 2010–2020).

3. OVERVIEW OF THE MAIN FISHING FLEETS

The marine capture fisheries production in China increased in the last 10 years from 12.4355 million tonnes in 2006 to 15.2702 million tonnes in 2016. The estimated number of "commercial" fishing vessels in 2016 were 179 688. The five economically most important semi-industrial and industrial fishing fleets in terms of volume of seafood landed are the following: gillnetters, single and pair bottom trawlers, stow netters and purse seiners.

The gillnetter fleet is the largest in terms of number of fishing vessels (see Table 3), followed by the bottom trawler and stow netter fleets. Most of the main fishing fleets are small-scale and fish in territorial waters. The main activities of the fleets take place in FAO fishing area 61 (Northwest Pacific). The main fishing harbours, where the seafood is landed, are Weihai Yuanyao fishing port, Weihai Center fishing port, Dayang fishing port, Lvsi fishing port, Haitou fishing port and Shenjiamen fishing port.

[1] www.worldbank.org/en/country/china (accessed on 4/11/2019).

TABLE 3
Overview of main fishing fleets (in 2016)

Fishing fleet	Number of vessels	Scale	FAO fishing area	Main fishing ports
Gill netters	96 315	Small-scale	61	Dayang fishing port, Lvsi fishing port, Haitou fishing port, Qingkou fishing port, Huangsha fishing port, Hankou fishing port, Bukou fishing port, Shenjiamen fishing port
Stow netters	18 281	Small-scale	61	Dayang fishing port, Lvsi fishing port
Single boat bottom trawlers	34 141	Small-scale	61	Lvsi fishing port, Weihai Yuanyao Fishing Port, Shidao fishing port, Mao Jia fishing port, Dayang fishing port, Shenjiamen fishing port
Pair trawlers		Small-scale	61	Weihai Yuanyao Fishing Port, Weihai Center Fishing Port, Haodangjia Fishing Port, Qifeng Wharf, Xiangshan Port, Shuangshan Wharf
Purse seiners	7 483	Small-scale	61	Haodangjia Fishing Port, Jiaojiang Wharf, Shenjiamen fishing port

Source: China Fisheries Statistical Yearbook 2017 Edition.

The main species targeted by each fleet are listed in Table 4.

The main species commonly caught by each fleet are listed in Table 5. In terms of commercial value generation, eel, big yellow croaker, silvery pomfret, and hairtail are key species to these fleets.

TABLE 4
Main species targeted by fishing fleet[2]

Fleets/species targeted	1	2	3	4	5
Gill netters	Silvery pomfret *(Pampus argenteus)*	Swimming crab *(Portunus trituberculatus)*	Small yellow croaker *(Pseudosciaena polyactis Bleeker)*		
Stow netters	Big yellow croaker *(Pseudosciaena amblyceps)*	Eel *(Anguilliformes)*	Hairtail *(Trichiurus haumela)*	Common Japanese mackerel *(Scomber japonicus)*	
Single boat bottom trawlers	Hairtail	Mantis Shrimp *(Oratosquilla oratoria)*	Octopus *(Octopoda)*	Anchovy *(Engraulis japonicus)*	Spanish mackerel *(Scomberomorus niphonius)*
Pair trawlers	Hairtail	Silvery pomfret	Anchovy *(Engraulis japonicus)*	Spanish mackerel	Squid
Purse seiners	Anchovy	Squid *(Ommastrephes bartrami)*			

TABLE 5
Main species commonly caught by fishing fleet[3]

Fleets/species targeted	1	2	3	4	5
Gill net	Silvery pomfret	Swimming crab	Small yellow croaker		
Stow net	Big yellow croaker	Angler fish *(Lophius americanus)*	Hairtail	Silvery pomfret	Common Japanese mackerel
Single boat bottom trawl	Hairtail	Spanish mackerel	Octopus	Anchovy	Mantis shrimp
Pair trawl	Hairtail	Silvery pomfret	Anchovy	Squid	
Purse seine	Anchovy	Squid			

[2] The species targeted are ranked from 1 (most important) to 5 (least important).
[3] The species caught are ranked from 1 (most frequently) to 5 (least frequently).

As can be seen from above tables, the targeted species by the surveyed fleets are also commonly caught. These fleets do not discard fish at sea. The operations of the fishing fleets are restricted by summer season moratoriums on marine fishing, i.e. closed seasons.

Table 6 provides an overview of the age structure of the vessels (hulls) in the main fishing fleets. Vessels in the gill netter and single boat bottom trawler fleet are relatively young with most in the category of below 5 years. In contrast, fourty percent of the vessel hulls in the stow netter fleet are older than 15 years. It further appears that investments in purse seine vessels were high about 10 to 15 years ago, and have since been reduced.

The vessels surveyed were rather young as well. The average age of the hull of the surveyed vessels was as follows: gillnetters (4 years), stownetters (5 years), single boat bottom trawlers (7 years), small pair trawlers (4 years), large pair trawlers (6 years), and purse seiners (8 years).

4. TECHNOLOGICAL AND OPERATIONAL CHARACTERISTICS OF INDIVIDUAL FISHING UNITS

Of each of the gillnetter, stow netter and bottom trawler (single and pair) fleets five vessels were surveyed in 2019. The fleet operational data in Table 7 represent the average vessel operations in 2018 by these fleets. The fleet survey also included three purse seine vessels, which are discussed separately, because of the wide variety in vessel sizes.

4.1 Gill netters

Eleven vessels in the gillnetter fleet were surveyed. Vessels in this fleet can be characterised by an average length overall (LOA) of 34 metres and a gross registered tonnage (GRT) of 169 tonnes. The power of the main engines ranges between 200 kW and 270 kW. On board storage space for fish is typically between 48 and 70 tonnes.

The main fishing gear carried are gill nets. Deck equipment available on-board generally includes cranes and winches. The average crew size is 10. The average number of days-at-sea per vessel in 2018 was 210 days. The average number of fishing trips in 2018 was 8.

4.2 Stow netters

The fleet can be characterised by an average LOA of 39 metres and a GRT of 189 tonnes. The power of the main engines ranges between 202 kW and 490 kW. On board storage space available for fish is typically between 50 and 112 tonnes.

The main fishing gear carried is stow nets. Deck equipment available on-board generally includes cranes and winches. The average crew size is 13. The number of days at sea per vessel ranges in 2018 from 170 to 300 days. The average number of fishing trips in 2018 was 11.

TABLE 6
Average age of fishing vessels by fleet in years (in percentages)

Fleets/average age of vessels in percentages of total fleet size (%)	0–5 years	5–10 years	10–15 years	15–20 years	more than 20 years
Gill netters	87.5	12.5			
Stow netters	30	30		20	20
Single boat bottom trawlers	80		20		
Pair trawlers	50	50			
Purse seiners	5	5	90		

4.3 Single boat bottom trawlers

The fleet can be characterised by an average LOA of 29 metres and a GRT of 50 tonnes. The size of the vessels in this fleet shows large variation, between 22 metres and 36 metres LOA. The power of the main engines ranges between 48 kW and 110 kW. On board storage space for fish ranges between 41 and 250 tonnes.

The main fishing gear carried are bottom trawls. Deck equipment available on-board generally includes cranes and winches. The average crew size is 6. In 2018, the number of days-at-sea per vessel ranged from 100 days to 240 days. The average number of fishing trips in 2018 was 11.

4.4 Pair bottom trawlers

The fleet can be characterised by an average LOA of 43 metres and a GRT of 337 tonnes. Of the five vessels surveyed, three were around 28 metres in length and two were 46 and 48 metres, and thus significantly longer. These two vessels had also a much larger tonnage (552 and 700 tonnes) than the other vessels and also a much larger engine power. The power of the main engines of the pair trawlers ranged between 330 and 706 kW. On board storage of fish of the vessels included in the survey was between 98 and 300 tonnes, with an average of 194 tonnes. The main fishing gears used are bottom trawl nets. Deck equipment available on-board generally includes cranes and winches.

The average crew size is 10. The number of days at sea per vessel ranged in 2018 from 150 days to 230 days, with an average of 204 days. The average number of fishing trips in 2018 was 10.

Table 7 below shows the average technological and operational characteristics of the vessels surveyed in 2019.

4.5 Purse seiners

The purse seine fleet can be characterised by an average length (LOA) of 46 metres and a GRT of 648 tonnes (Table 8). The power of the main engines ranged in 2018 between 330 kW and 1632 kW. Because of the large differences in the sizes of the three purse seiners surveyed, the characteristics of individual vessels are shown in Table 8 below, together with the averages. On-board storage of fish on the purse seine vessels surveyed is between 120 tonnes and 300 tonnes. The differences in on-board storage capacity are due to the different fishing areas. The smaller vessel (2) operated in 2018 in the coastal area and targeted Common Japanese mackerel. The larger vessels were operating in offshore areas and targeted anchovy and squid.

TABLE 7
Technological and operational characteristics of gillnetters, stow netters, single and pair bottom trawlers surveyed in 2019

Technological/operational characteristics	Gill netters	Stow netters	Single bottom trawlers	Pair bottom trawlers
LOA (metres)	34.02	39.32	29.46	43.18
GRT	168.6	189.2	116.2	337
Total power of main engines in kilowatts (kW)	236.8	382.6	161	466.8
On-board storage facilities (tonnes)	59.6	68.4	70.6	193.6
Fishing gear	gillnet	stow net	bottom trawl	bottom trawl
Crew size (persons)	10	12.8	6	12
Ownership	private	private	private	private
Total days fishing at sea	210	250	170	204
Number of fishing trips	7.6	11.4	11.2	10
Fishing season	March to May; August to December	September to May	September to May	September to May

TABLE 8
Technological and operational characteristics of purse seiners surveyed

Technological/operational characteristics	Vessel 1	Vessel 2	Vessel 3	Average
LOA (metres)	55	38	46	46.33
GRT	1 000	245	700	648.33
Total power of main engines in kilowatts (kW)	1 632	330	706	889.33
On-board storage facilities (tonnes)	200	120	300	206.67
Fishing gear	purse seine	purse seine	purse seine	purse seine
Crew size (persons)	16	10	8	11.33
Ownership (state, shared, chartered, company)	Company owned	Privately owned	Company owned	Company owned
Total days fishing at sea	180	92	180	151
Number of fishing trips	10	10	10	10
Fishing season (months)	September–May	September–January	September–May	September–May

The number of days at sea per purse seine vessel ranged in 2018 from 92 to 180 days. The average number of fishing trips in 2018 was 10. The main fishing gears carried are purse seine nets. Deck equipment available on-board generally included cranes, winches and power blocks. The average crew size is 11.

4.6 Labour employed on the surveyed fishing vessels

Most crew on the fishing vessels of the five fleets surveyed are part-time employed. All crew members are male. There were not any women employed on the vessels. Not much information is available on the age structure of the labour force of these fleets, but it is commonly observed that most crew are between 30 and 49 years of age. Table 9 provides the average age distribution of the fishing crews, using the information collected during the vessel surveys.

5. CAPITAL INVESTMENTS, COSTS AND REVENUES

5.1 Gill netters

Capital investments

The average initial investment in hull, engine and propulsion, equipment, gears and electronic devices for a gillnetter was USD 462 000. The current (2018) average book value[4] of the investment made in a vessel of this fleet and related equipment was estimated at USD 378 000, taking into account the depreciation[5] of the hull, engine and various equipment (Table 10).

The average age of the vessel hulls of the eleven vessels surveyed was 4 years. In terms of initial investment, the main investment (83 percent) was made on the vessel hull, followed by the investment in the engines (8 percent).

TABLE 9
Age distribution of fishers on the five fleets (in percentages)

Age distribution of fishers	Under 20	20–29	30–39	40–49	50–59
Percentage	0	10	45	40	5

[4] The information obtained on the vessel book values and insured values was incomplete and therefore the depreciated value was used as book value in this report.

[5] A linear depreciation method was applied, including annual depreciation of the hull with 4 percent, of the engine with 6.7 percent and other major equipment items with 12.5 percent.

TABLE 10
Investment costs and depreciated values of surveyed fishing vessels (in USD)

	Type of vessels					
Investment item	**Gillnetter**	**Stow netter**	**Single boat bottom trawler**	**Small pair bottom trawler**	**Large pair bottom trawler**	**Large purse seiner**
Vessel (hull)	382 755	565 971	241 400	340 800	930 100	1 817 600
Main engine(s)	35 188	35 906	18 460	9 940	19 880	71 000
Equipment on deck	5 049	4 260	6 745	497	none	72 420
Equipment below deck	None	5 893	1 065	none	none	14 200
Fishing gears	29 883	65 726	18 105	28 400	42 600	170 400
Electronic devices	9 314	11 366	4 686	4 899	8 321	52 540
Other	-	5 787	781	none	none	none
Total initial costs/value	462 188	694 908	291 242	384 536	1 000 901	2 198 160
Depreciated value (book value)	378 314	547 143	201 935	321 944	750 590	1 418 012
Average age of the hull	4	5	7	4	6	8

Operating and owner's costs

Among the gillnetter operating costs (composed of labour and running cost items), the labour share and wages were the highest in 2018, adding up to 69 percent of the operating costs. Other important operational costs were fuel costs (22 percent). Within the total vessel owner's costs the main cost items were depreciation (35 percent) and fishing license fees, permits and quota (22 percent).

The operating costs and owner's costs were 78 percent and 22 percent, respectively, of the total annual costs of an average vessel in this fleet.

Revenues

The average gillnetter realized a total revenue of USD 557 000 in 2018. The main revenue of the gillnetter fleet came from the sale of the landed fish, which accounted for approximately 97 percent of the total vessel earnings in 2018. The balance was coming from subsidies.

5.2 Stow netters

Capital investments

The average initial investment in hull, engine and propulsion, equipment, gears and electronic devices for a stow netter was USD 695 000. The current average value of the investment made in a vessel and related equipment of this fleet was estimated at USD 547 000. The average age of the hull was 4.7 years in 2018.

In terms of original investment, the main investments were generally made in the hull (82 percent), followed by investment in fishing gears with a lifespan of 3 years or more (9 percent), and in the engines (5 percent).

Operating and owner's costs

Among the operating costs, the labour share and wages were the highest in 2018, adding up to 61 percent of the total operating costs. Other important operating costs were fuel costs (29 percent). The main owner's costs were depreciation, and gear replacements, repairs and maintenance of gears with a lifespan of less than 3 years. The operating costs and vessel owner's costs were respectively 81 percent and 19 percent of the average total annual costs of an average stownetter in this fleet.

Revenues

The average total earnings of a stownetter were USD 545 000 in 2018. The main source of revenue of a vessel in this fleet was the sale of the fish landings, which accounted for approximately 97 percent of the total earnings.

5.3 Single boat bottom trawlers

Capital investments

The average initial investment in hull, engine and propulsion, equipment, gears and electronic devices for a single boat bottom trawler was USD 291 000. The average value of the investment made in a bottom trawler hull and related equipment was estimated at USD 202 000 in 2018, taking into account depreciation. The average age of the hull was 7 years.

In terms of original investment, the main investments were generally made in the hull (83 percent), followed by the engines (6 percent) and fishing gears with a lifespan of 3 years or more (6 percent).

Operating and owner's costs

The total annual operational costs (composed of operating and vessel owner costs) of an average single boat bottom trawler in 2018 was USD 285 000. Among the operating costs, the fuel costs were the highest, adding up to 57 percent of the operating costs. Other important operating costs were labour share and wages (21 percent) and food for the crew (11 percent).

The total vessel owner's costs were USD 34 000, including USD 14 000 depreciation and USD 9 000 for vessel repairs and maintenance. Within the total operational costs of a vessel in this fleet in 2018, the vessel owner's costs were just 12 percent.

Revenues

The average single boat bottom trawlers realized USD 283 000 in total earnings in 2018. Ninety-three percent of these earnings were coming from the sale of the fish landings and the balance were some subsidies received in 2018.

5.4 Small pair bottom trawlers

Capital investments

The average initial investment in hull, engine and propulsion, equipment, gears and electronic devices for a small (38 metre LOA) pair bottom trawler was USD 385 000. The average depreciated value of the investment made in a vessel and related equipment of this fleet segment was estimated at USD 322 000 in 2018.[6] The average age of the hull was 4 years. In terms of original investment, the main investments were generally made in the hull (88 percent).

Operating and owner's costs

Among the operating costs, the fuel costs were the highest, adding up to nearly 42 percent of the operating costs. Other important operating costs were made in 2018 for the labour share and wages (41 percent). The average total vessel owner's costs for a vessel in this fleet segment were USD 51 000 and the depreciation costs added up to 36 percent of these owner's costs. The total operational costs of an average small pair bottom trawler was in 2018 just over USD 193 000. The operating costs and vessel owner's costs were respectively 73 percent and 27 percent, of the average total annual operational cost of a vessel in this fleet.

Revenues

The average total earnings of a small pair bottom trawler in 2018 were USD 129 000, of which 70 percent originated from the sale of fish landings. Nearly 30 percent of the total earnings were coming from subsidies in 2018.

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[6] Five pair bottom trawlers were surveyed and information from four vessels was found to be complete and reliable to use in the analysis. Given the large variation in investment, costs and earnings between the smaller pair bottom trawlers (of 38 metres) and the larger vessels (of 46–48 metre) it was considered appropriate to analyse these vessels separately. The analysis is based on two vessels of each pair bottom trawler fleet segment.

5.5 Large pair bottom trawlers

Capital investments

The average initial investment in hull, engine and propulsion, equipment, gears and electronic devices for a large (46–48 metre LOA) pair bottom trawler was USD 1 million; nearly three times as much as for a small pair bottom trawler. The average depreciated value of the investment made in a vessel and related equipment of this fleet segment was estimated at USD 750 000 in 2018. The average age of the hull was 6 years. In terms of original investment, the main investments were generally made in the hull (93 percent).

Operating and owner's costs

The operating costs (composed of running and labour costs) were nearly USD 603 000 in 2018. Within the operating costs, the fuel costs were the highest cost item, adding up to 72 percent of these operating costs. Other important operating costs were made in 2018 for the labour share and wages (24 percent). The average total vessel owner's costs for a large pair bottom trawler were USD 101 000 and the depreciation costs were 44 percent of these owner's costs. The total operational costs of an average large pair bottom trawler was USD 704 000. The operating costs and vessel owner's costs were respectively 86 percent and 14 percent, of the average total annual operational cost of a vessel in this fleet.

Revenues

The average total earnings of a large pair bottom trawler in 2018 were USD 803 000, of which 96 percent originated from the sale of fish landings.

5.6 Purse seiners

Capital investments

The initial investment in hull, engine and propulsion, equipment, gears and electronic devices for a purse seiner[7] of 55 metres (LOA) was nearly USD 2.2 million. The current (2018) value of the investment made in the vessel and related equipment was estimated at USD 1.4 million. The age of the hull was 8 years. In terms of original investment, the main investment item was the hull (83 percent), followed by fishing gears (8 percent).

Operating and owner's costs

The total operating costs of the purse seiner in 2018 were USD 567 000 and the highest cost item was the fuel (48 percent), followed by the labour share and wages (42 percent). The vessel owner's costs added up to USD 153 000. Depreciation was a major component of the owner's costs contributing 65 percent. The total operational costs (including operating and owner's costs) for the purse seine vessel were USD 720 000.

Revenues

The total earnings of the purse seiner were USD 796 000 in 2018 and 92 percent of these earnings were obtained from the sale of landed fish.

Table 11 provides an overview of the average annual costs and earnings of fishing vessels in the surveyed fleet segments.

[7] While three purse seine vessels were surveyed, only the information from a 55 metre vessel was completed and found sufficiently reliable to include in the financial analysis.

TABLE 11
Average annual costs and earnings of surveyed vessels in 2018[8] (in USD)

Category	Item	Gillnetter USD	Stow netter USD	Single boat bottom trawler USD	Small pair trawlers USD	Large pair trawler USD	Large purse seiner USD
Earnings	Revenue from fish sales	539 666	529 817	262 410	90 045	773 168	732 038
	Subsidies and grants	17 418	14 940	20 590	39 050	28 350	63 900
Total earnings		**557 084**	**544 758**	**283 000**	**129 095**	**801 518**	**795 938**
Running costs	Fuel	50 991	113 231	143 838	59 250	433 995	270 800
Running costs	Lubricants/ oil/filters	875	2 450	4 615	4 970	1 775	26 800
Running costs	Harbour dues and levies	1 678	1 128	667	1 079	533	213
Running costs	Ice	6 041	13 023	7 455	9 230	7 100	14 200
Labour costs	Food, stores and other provisions	7 229	5 830	28 369	7 810	12 690	7 100
Running costs	Fish selling costs	7 410	3 651	355		-	
Running costs	Materials (boxes)	2 517	10 751	1 953	1 950		7 100
Labour costs	Crew travel	-	-	2 203			
Running costs	Other operating costs	3 382	-	7 100			
Labour costs	Labor share and wages	156 200	238 343	53 844	57 500	146 700	240 800
Total operating costs		**236 324**	**388 408**	**250 398**	**141 789**	**602 793**	**567 013**
Vessel owner costs	Fishing license fees, permits and quota	14 605	258	-	4 970	355	2 840
Vessel owner costs	Insurance fees (vessel, employers, equipment)	2 195	4 554	6 873	1 420	7 810	7 100
Vessel owner costs	Purchase of fishing rights (quotas)	6 713	-	-	-	-	
Vessel owner costs	Gear replacements, repairs and maintenance of gears with a lifespan of less than 3 years	9 165	23 974	947	7 810	9 088	28 400
Vessel owner costs	Vessel repairs & maintenance	5 680	11 482	8 946	9 727	16 330	14 200
Vessel owner costs	Other fixed costs	2 375	-	-	-	-	-
Capital costs	Depreciation	23 198	36 673	14 718	18 522	44 901	98 761
Capital costs	Interest	1 115	16 286	3 000	9 000	22 700	1 600
Total vessel owner costs		**65 047**	**93 227**	**34 483**	**51 449**	**101 184**	**152 901**
Total annual operational costs		**301 370**	**481 635**	**284 881**	**193 239**	**703 977**	**719 914**

[8] Not any costs were reported for bait, salt, investments and taxes on profits.

6. ECONOMIC AND FINANCIAL PERFORMANCE OF FISHING VESSELS

The economic and financial performance of the fishing fleets covered in this national report is based on the average vessel costs and earnings information as presented above. This means that the information presented only reflects the average economic performance of vessels in the specific fleet segment. Individual vessels may have indicator values well above or below the figures presented in Table 12.

6.1 Gillnetters

The average gross profit of the 11 gillnetters surveyed in 2018 was USD 257 000. The average net profit of a vessel in this fleet was USD 256 000. The ratio of net profit to total revenue (net profit margin) was good with 46 percent. The return on fixed tangible assets (ROFTA) was high with 68 percent, which was caused by the good profits and low interest payments on loans for vessels in this fleet segment. The return on investment (ROI), calculated over the initial investment, was the highest of the fleet segments surveyed in China with 55 percent. The gross value added of a vessel in this fleet was nearly USD 443 000 in 2018.

TABLE 12
Financial and economic indicators per fleet segment in 2018 in USD

Financial indicators	Code	Gillnetter USD	Stow netter USD	Single boat bottom trawler USD	Small pair trawler USD	Large pair trawler USD	Large purse seiner USD
Revenue from landings	A	539 666	529 817	262 410	90 045	773 168	732 038
Total revenue	A2	557 084	544 758	283 000	129 095	801 518	795 938
Labour costs	B	163 429	244 173	84 415	65 310	159 390	247 900
Running costs	C	72 895	144 235	165 982	76 479	443 403	319 113
Vessel costs	D	40 733	40 268	16 765	23 927	33 583	52 540
Total gross cost (E) = B + C + D	E	277 057	428 676	267 163	165 716	636 376	619 553
Total costs (E2) = E + G + J + S	E2	301 370	481 635	284 881	193 239	703 977	719 914
Net cash flow (F) = A2 - E	F	280 027	116 082	15 837	- 36 621	165 142	176 385
Depreciation	G	23 198	36 673	14 718	18 522	44 901	98 761
Amortization	H	0	0	0	0	0	0
Gross profit (I) = F-G-H	I	256 829	79 408	1 119	- 55 144	120 241	77 624
Interest	J	1 115	16 286	3 000	9 000	22 700	1 600
Net profit before taxes (K) = I-J	K	255 713	63 123	- 1 881	- 64 144	97 541	76 024
Net profit margin (L) = K/A2	L	46%	12%	-1%	-50%	12%	10%
Value of tangible assets (2018)	M	378 314	547 143	201 935	321 944	750 590	1 418 012
ROFTA (N) = K/M	N	68%	12%	-1%	-20%	13%	5%
Value of intangible assets	O	0	0	0	0	0	0
ROI (P) = K/(T+O)[9]	P	55%	9%	-1%	-17%	10%	3%
GVA (Q) = F+B	Q	443 456	360 255	100 252	28 689	324 532	424 285
GVA to revenue (R) = Q/A2	R	80%	66%	35%	22%	40%	53%
Taxes	S	0	0	0	0	0	0
Initial investment costs	T	462 188	694 908	291 242	384 536	1 000 901	2 198 160

[9] The ROI in Table 12 is calculated based on the initial investment made in the fishing vessel hull, engine and its main equipment.

These results suggest that the gillnetter fleet had a good economic and financial performance in 2018. The fleet covered its costs of operation plus generated sufficient revenues for reinvestment in the fleet, while generating good returns on total assets and adding substantial gross value.

6.2 Stow netters

The average gross profit in 2018 of the seven vessels surveyed from the stownetter fleet was around USD 79 000. Net profit of a vessel in this fleet was estimated to be less than gross profit, as interest payments were some USD 16 000. The ratio of net profit to total revenue (net profit margin) was 12 percent. The ROFTA was also 12 percent and the ROI was 9 percent. The gross value added of a vessel in this fleet was in 2018 around USD 360 000. The stow netter fleet surveyed showed thus positive economic and financial results**.** The fleet covered its cost of operation and generated value added. However, it did not generate sufficient revenue to allow for reinvestments in the fleet.

6.3 Single boat bottom trawlers

The four vessels surveyed in the single boat bottom trawler fleet segment demonstrated diverse results in 2018. Overall, the average gross profit of vessels in this segment was very small (just over one thousand USD), while the net profit (after deduction of the paid interest) was slightly negative. The single boat bottom trawlers covered in the survey did thus not even fully cover their cost of operation. The net profit margin was also negative with minus one percent. The ROFTA and ROI indicators showed also slightly negative results. The GVA of vessels in this fleet was estimated at USD 100 000 in 2018.

6.4 Small pair bottom trawlers

The net cash flow (total revenue – total gross costs) of vessels in the small pair bottom trawler fleet segment was negative, which means that the average vessel in this fleet segment was in a loss making position in 2018. The net profit of a vessel in this fleet was estimated to be minus USD 64 000. The ROFTA and ROI indicators showed therefore also negative results. The GVA of vessels in this fleet was slightly positive, estimated at USD 29 000 in 2018.

6.5 Large pair bottom trawlers

The average gross profit of large pair bottom trawlers was much better than the smaller vessels in the pair bottom trawler fleet. Gross profit of an average vessel in this fleet segment was USD 120 000 and net profit (after deduction of interest) was USD 98 000. The ratio of net profit to total revenue (net profit margin) was reasonable with 12 percent. The ROFTA was 13 percent. The depreciated (book) value of the investment in 2018 was only USD 751 000 compared to an initial investment of USD 1 million. The ROI, calculated over the initial investment, was 10 percent. The gross value added of a vessel in this fleet was nearly USD 325 000 in 2018.

6.6 Purse seiners

The purse seiner fleet generally showed a good economic and financial performance in 2018. It covered its costs of operation, plus generated sufficient revenues to provide funds for reinvestment in the fleet while generating good returns of total assets and adding substantial gross value. However, as financial and cost information was incomplete for two of the purse seine vessels, the financial analysis only included data from one vessel. The gross profit of this 55 metre purse seiner was in 2018 around USD 78 000 and net profit was just over USD 76 000. The net profit margin was 10 percent

and the ROFTA was barely positive with five percent. The ROI, which was calculated over the initial investment of USD 2.2 million, was just three percent. The gross value added of the surveyed purse seiner was USD 424 000.

7. FINANCIAL SERVICES AVAILABLE TO THE FISHERIES SECTOR INCLUDING INSTITUTIONAL CREDIT PROGRAMMES

The fishing vessel owners in China have access to credit from rural credit cooperatives, banks and private sources. Most loans are taken for capital investments. The maximum loan size for capital investments is around USD 280 000 and lending periods are one year. Common interest rates charged by the credit providers were 5.5 percent annually in 2018.

8. SUBSIDIES AND SUPPORT TO THE SECTOR

Fishing vessel owners have access to subsidies for the purchase of fuel and navigation systems. There is also financial compensation in China for scrapping of fishing vessels to reduce the fishing capacity. Fishers can apply for the scrapping of their fishing vessels under a voluntary programme. The government will buy back these fishing vessels and arranges for their scrapping. The scrapping process is strictly implemented in accordance with the "Operating instruction on marine fishing boats scrapping".

9. TECHNOLOGICAL INNOVATIONS IN GEARS, EQUIPMENT AND VESSELS AFFECTING FISHING VESSEL ECONOMIC PERFORMANCE

The most important innovation in recent years was the introduction of the Beidou satellite navigation system. The system has greatly improved navigation, as well as safety of fishing vessels under all weather conditions. At the same time, the short message communication function, unique to the Beidou satellite navigation system, is expected to support the development of various other new services.

As far as improvements in fishing gears and methods are concerned, the catch rates of tuna longline fisheries have increased due to adoption of the super spool line system, deep longline setting, and increased use of circle hooks to reduce bycatch rates.

The catch rates of tuna purse seine vessels have also increased because of the use of drifting fish aggregating devices (FADs), with satellite tracking devices and echo sounders as well as introduction of rapid sinking speed gears. The purse seine vessels also use environmental forecasting imaging to reduce the searching time for fish on the fishing grounds.

10. SUMMARY DESCRIPTION OF NATIONAL PLANS AND POLICIES FOR ADJUSTMENT OF FLEET CAPACITIES

China is presently implementing the "National Fisheries Development Plan of the 13th Five – Year Period". The plan aims to reduce the fishing fleet by controlling fishing effort and capacity. The target is, to control fishing effort effectively by 2020. The results and achievements of the implementation of the plan have not been documented yet.

It is expected, that the domestic fish production will have reduced. It is further expected that the domestic marine capture fisheries production will be reduced in a controlled manner to below 10 million tonnes. The number of national marine fishing boats and their engine power is supposed to be reduced to 20 000 vessels with a combined engine power of 1.5 million kW. The implementation of the plan should halt the trend of declining fishery resources.

According to the National Fisheries Development Plan, these targets are to be achieved by:

1. Active promotion of a reduction in the number of fishing boats, combined with introducing other business and employment opportunities for fishermen. The priority is to reduce the number of old, wooden, marine fishing boats, large- and medium-sized fishing boats and fishing boats with fishing gears and methods that are destructive to fisheries resources and marine habitats.
2. Optimizing the marine fisheries industry structure and reducing the number of bottom pair trawlers, stow netters and surrounding netters with cod end.
3. Accelerating the modernization of fishing vessels, considering safety-at-sea aspects, energy saving, economic efficiency as well as, environmental and habitat protection.
4. Actively promoting to use the new materials, technologies, and equipment and energy sources for fishing vessels. Standardization of fishing vessel designs and construction methods and encouraging the use of standardized fishing gear.

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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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1. GENERAL INFORMATION ABOUT MARINE CAPTURE FISHERIES IN INDONESIA

In 2016, marine capture fisheries in Indonesia produced 6 109 783 tonnes of fish, accounting for 7.7 percent of the global marine capture fisheries production. This made Indonesia the second largest marine capture fisheries producer after China. The average annual marine capture fisheries production between 2005 and 2014 was 5 074 932 tonnes. Indonesian capture fisheries production showed a 20 percent variation between years in this period (FAO, 2018).

At the same time, the estimated number of commercial, i.e. larger fishing vessels decreased from 4 487 in 2006/2007 to 3 677 in 2017; a reduction of 18 percent according to the official statistics of the Ministry of Marine Affairs and Fisheries (MMAF). The total number of vessels, both smaller artisanal vessels and larger commercial vessels, increased over the same period from 616 300 vessels in 2006 to 683 246 vessels in 2016.

The economic performance of fishing fleets in Indonesia was analyzed in 1999 by FAO. The main fleets covered in the previous analysis included the following: Java Sea purse seiners, Bali Strait purse seiners, Skipjack pole and liners, Tuna longliners, and gillnetters. (Lery, *et al.,* 1999). The objective of the techno-economic fleet performance assessments at the end of the 1990s was to estimate the economic and financial performance of marine capture fisheries in Indonesia, as part of a global assessment carried out by FAO and published in 2001 (Tietze *et al.,* 2001). Indonesia did not participate in the FAO global studies on techno-economic performance of the main fishing fleets in 2004–2005.

The current fleet assessment is part of the 2020 FAO Review of the techno-economic performance of the main global fishing fleets which aims to compare the financial and economic performance between fleets and over time within fleets. The information presented in this national report was collected and analysed between 2016 and 2019 by Umi Muawanah, fishery economist and researcher at the Ministry of Marine Affairs and Fisheries, Indonesia.

2. DEMOGRAPHIC AND SOCIO-ECONOMIC DATA

Indonesia is among the most populous countries after the Republic of China, India and the United States of America. The population census of 2017 showed an average annual population growth rate from 2010 to 2017 of 1.1 percent. In 2010, the total population of Indonesia was 246 million, and by 2017 the population had increased to 264 million people. The people in the active working age between 15 and 64 years accounted for 53 percent of the total population of the country. Indonesia's gross domestic product (GDP) was about USD 1 015 billion in 2017. The economic growth rate was 5.2 percent. Table 1 presents some key demographic and socio-economic indicators.

TABLE 1
Demographic and socio economic data of Indonesia in 2017[1]

Indicator	
Population size	264 million
Age structure (%)	
under 15,	21
15–64	53
over 65	25
Population growth rate (%)	1.1
Mean household size (people)	4.0
GDP (USD)	1 015 billion
Economic growth rate (%)	5.2
No. of tourists visiting the country (million)	14.04

3. OVERVIEW OF THE MAIN FISHING FLEETS IN INDONESIA

The economically most important semi-industrial and industrial fishing fleets in Indonesia, in terms of volume of seafood landed, are:

- Skip jack purse seiners
- Squid jiggers
- Pelagic gillnetters
- Castnetters
- Tuna longliners
- Tuna pole and liners.

The purse seiner fleet is the largest, in terms of number of fishing vessels (see Table 2), followed by the squid jigger and gillnetter fleets. The main fishing fleets are industrial and semi- industrial. However, there are also many small-scale fishing vessel that fish in territorial waters and in the Indonesian EEZ. The fishing takes place in FAO fishing areas 57 (Eastern Indian Ocean) and 71 (Western Central Pacific).

The main fishing harbours, where the seafood is landed, are:

- Muara Baru and Muara Angke (Jakarta) fishing ports for skipjack tuna purse seiners and pelagic gillnetters,
- Bali fishing port for the tuna long line fleet, and
- Ambon and Tual fishing ports, for the tuna pole and line fishing fleets.

The main species targeted by each fleet are listed in Table 3. Target species were determined using MMAF Decree Number 86 of 2016 on fishing vessel productivity. Each gear is associated with the class of fish species targeted.

TABLE 2
Overview of the main semi-industrial and industrial fishing fleets[2]

Rank	Gear	Number of boats > 30 GT	Target species	FAO fishing areas	Main fishing ports
1	**Purse seine**	1 374	Large pelagic fish	51 and 71	Jakarta, North Java, Papua
2	**Squid jigging**	470	Squid	52 and 71	Bali, Jakarta
3	**Gillnet**	491	Pelagic fish	53 and 71	Jakarta, Papua
4	**Castnet**	442	Pelagic fish, squid	54 and 71	Jakarta, North Java
5	**Longline**	351	Tuna	55 and 71	Bali
6	**Pole and line**	87	Tuna	56 and 71	Ternate, Ambon and Bitung

Source: MMAF, 2017.

[1] This information was provided by Bank Indonesia.
[2] The gillnetters will not be discussed in detail further in this report due to the limited information that could be collected on vessels of this fleet segment.

TABLE 3
Main species targeted by fishing fleet[3]

Fleets/species targeted	1	2	3	4
1. Purse seine	Skipjack or tuna *(Katsuwonus pelamis)*	Scad *(Decapterus macarellus)*	Neritic tuna *(Auxis thazard, Auxis rochei, Enthynnus affinis, Scomberomorus commerson)*	-
2. Squid jigging	Squid *(Decapodiformes)*	-	-	-
3. Gillnet	Skipjack *(Katsuwonus pelamis)*	Short bodied mackerel *(Rastrelliger brachysoma)*	Yellowfin tuna *(Thunnus albacares)*	-
4. Cast net	Scad *(Decapterus macarellus)*	Short bodied mackerel *(Rastrelliger brachysoma)*	Demersal fish Malabar snapper *(Lutjanus malabaricus)* Crimson snapper *(Lutjanus erythropterus)* Emperor snapper *(Lutjanus sebae)* Goldband snapper *(Pristipomoides multidens)* Spotted grouper *(Epinephelus coioides)* Areolate grouper *(Epinephelus areolatus)* Duskytail grouper *(Epinephelus bleekeri)*	Squid *(Decapodiformes)*
5. Tuna longline	Big eye tuna *(Thunnus obesus)*	Albacore *(Thunnus alalunga)*	Southern bluefin tuna *(Thunnus maccoyii)*	Yellowfin tuna *(Thunnus albacares)*
6. Pole and line	Big eye tuna *(Thunnus obesus)*	*Albacore (Thunnus alalunga)*	*Southern bluefin tuna (Thunnus maccoyii)*	Yellowfin tuna *(Thunnus albacares)*

Source: Survey interviews and MMAF statistics, 2016.

The main species commonly caught by each fleet are listed in Table 4. In terms of commercial value generation, species like tuna, skipjack, squid, as well as small pelagics, such as mackerel and scad are key to these fleets.

TABLE 4
Main species commonly caught by fleet

Fleets/species commonly caught	1	2	3
1. Purse seiners	Juvenile yellowfin *(Thunnus albacares)*	Juvenile bigeye *(Thunnus obesus)*	-
2. Squid jiggers	Squid *(Decapodiformes)*	-	-
3. Gillnetters	Scad *(Decapterus macarellus)*	Mullets *(Mugilidae/ Mugil cephalus)*	Flying fish *(Exocoitidae/ Cheilopogon katoptron)*
4. Cast netters	Sardines *(Sardina pilchardus)*	Mullets *(Mugilidae/Mugil cephalus)*	Squid *(Decapodiformes)*
5. Tuna longliners	Neritic tuna *(Auxis thazard, Auxis rochei, Enthynnus affinis, Scomberomorus commerson)*	-	-
6. Pole and line vessels	Neritic tuna *(Auxis thazard, Auxis rochei, Enthynnus affinis, Scomberomorus commerson)*	-	-

[3] The species targeted are ranked from 1 (most important) to 4 (less important).

The main species discarded at sea by fleet are presented in Table 5. The main reasons given for discarding these species are that they were accidently caught.

Table 6 provides an overview of the age structure of the vessels in the main fishing fleets. It is clear that the purse seiners and tuna longliners and castnetters are relatively old, with 40 percent or more of the vessels in these fleets having more than 20 years. In contrast, gillnetters and pole and line fishing vessels are generally younger.

One of the reasons for the difference in investments in fishing vessels between these fleets is the cost of fuel. In 2005, fuel costs increased substantially. This resulted in a move to purse seining to lower operating cost in the second part of the first decade of this millenium. However, in recent years the investments in purse seiners reduced. Another reason for shifting investment between fleets was Government Decree No. 75 of 2015. The Decree increased the resource rent based on fleet productivity and main species targeted. The gillnetter fleet has increased over the last 3 to 4 years in the context of an effort to replace foreign made/owned vessels with domestic fishing vessels. Foreign owned vessels cannot operate any longer in capture fisheries activities in Indonesia following the MMAF Decree No. 56 of 2014.

TABLE 5
Main species discarded at sea by fleet

Fleets/species discarded at sea	1	2	3
1. Purse seiners	Rainbow runner *(Elagatis bipinnulata)*	Dolphin *(Delphinus/Tursiops truncatus)*	Shark *(Carcharhinus melanopterus, Carcharhinus limbatus, Triaenodon obesus)*
2. Squid jiggers	Rainbow runner *(Elagatis bipinnulata)*	-	-
3. Gillnetters	Sharks *(Carcharhinus melanopterus, Carcharhinus limbatus, Triaenodon obesus)*	Marlins *(Makaira indica, Makaira mazara, Tetrapturus audax)*	-
4. Cast netters	Marlins *(Makaira indica, Makaira mazara, Tetrapturus audax)*	-	-
5. Tuna longliners	Sharks *(Carcharhinus melanopterus, Carcharhinus limbatus, Triaenodon obesus)*	Seabirds *(Phaethon rubricauda, Phaethon lepturus)*	Turtles *(Cheloniidae)*
6. Pole and line vessels	Sharks *(Carcharhinus melanopterus, Carcharhinus limbatus, Triaenodon obesus)*	Dolphins *(Delphinus/ Tursiops truncatus)*	-

TABLE 6
Average age of fishing vessels in the main fishing fleets

Fleets/average age of vessels in percentages of total fleet size	0–5 years	6–10 years	11–20 years	more than 20 years
Purse seiners	3%	15%	32%	50%
Squid jiggers	10%	30%	30%	10%
Gillnetters	20%	20%	50%	10%
Cast netters	10%	20%	30%	40%
Tuna longliners	10%	20%	30%	40%
Pole and line vessels	20%	40%	20%	20%

Source: Office of Fishing Licenses, Directorate General of Capture Fisheries (DGCF), Ministry of Marine Affairs and Fisheries (MMAF), 2018.

Recent changes and plans for future development of the fishing fleet include the procurement of small-scale fishing boats of 3 GTs for small-scale fishers, which was approved by the Government in 2017. Plans for future development also recognize the potential for development of new fishing areas, the potential for exploitation of underexploited fisheries resources, the need for replacement of fishing vessels and the need to reduce fishing effort and fleet size.

4. TECHNOLOGICAL AND OPERATIONAL CHARACTERISTICS OF FISHING VESSELS

4.1 Purse seine fleet

The purse seine fleet can be characterized by a vessel length (LOA) of 25 metres to 29 metres and an average gross tonnage (GT) of 147 tonnes. The power of the main engines ranges between 530 kW and 630 kW. On board storage of fish is typically between 60 m^3 and 72 m^3. The main fishing gear carried is purse seines. The average crew size is 36 persons.

In 2018/2019, the number of days-at- sea per vessel ranged from 182 to 313 days, with an average of 198 days. The number of fishing trips in 2018/2019 was 6 to 9 trips. The number of days per fishing trip was about 30 days.

4.2 Squid jigger fleet

The squid jigger fleet can be characterized by a vessel length (LOA) of 20 metres to 30 metres, with an average of 27 metres and an average gross tonnage (GT) of 121 tonnes. The power of the main engines ranges between 500 kW and 650 kW. On board storage of fish is typically between 48 and 53 m^3. The main fishing gear carried is hook and line. Deck equipment available on-board generally includes lamps and ropes. The average crew size is 31 persons. In 2018/2019, the average number of days-at-sea per vessel was 224 days.

4.3 Cast net fleet

The cast net fleet can be characterized by a vessel length (LOA) of 20 metres to 30 metres (with an average of 23 metres) and a gross tonnage of 47 tonnes to 75 tonnes. The power of the main engines ranges between 280 kW and 500 kW. On board storage of fish varies greatly. The storage available is typically between 24 m^3 and 50 m^3, with an average value of 37 m^3.

The fishing gear used are cast nets. In 2018/2019, the average number of days-at-sea per vessel was 45 days. The average number of fishing trips per year in 2018/2019 was 4.5.

4.4 Longliner fleet

The longliner fleet can be characterised by a vessel length (LOA) of 19 to 27 metres and a gross tonnage of 60 tonnes to 100 tonnes. The power of the main engines ranges between 300 kW and 500 kW, with an average of 383 kW. On board storage capacity for fish is typically between 25 m^3 and 35 m^3.

The main fishing gear carried is longlines. Deck equipment available on-board generally includes line haulers and small winches. The average crew size is 15 persons.

In 2018/2019, the number of days-at-sea per vessel ranged from 167 to 239 days per year. The number of fishing trips of the in 2018/2019 of the vessels surveyed 1 to 5.

4.5 Pole and line fleet

The pole and line fleet can be characterised by an average vessel length (LOA) of 30 metres and a gross tonnage of 80 tonnes. The power of the main engines ranges between 530 kW and 630 kW. On board storage capacity for fish is typically between 34 and 44 m^3. The main fishing gear carried is pole and line. Deck equipment available on-board generally includes small winches. The average crew size is 45 to 60 persons.

In 2018/2019, the average number of days-at-sea per vessel was 308 and fishing trips were generally nearly a week at sea. The average number of fishing trips per month in 2018/2019 was 4. The fishing season was 11 month per year.

Table 7 shows the average technological and operational characteristics of the Indonesian fishing vessels surveyed.

Gender, age structure and full-time versus part-time employment

As far as full-time/part time employment, gender and age structure of the labour force on the vessels surveyed is concerned, most crewmembers on the vessels surveyed are full-time employed. No female crew were observed on the vessels. Not much information is available on the age structure of the labour force of these fleets, but they are typically 20 years to 50 years of age.

5. CAPITAL INVESTMENTS, COSTS AND REVENUES

5.1 Purse seiner fleet

Capital investment

The average initial investment in hull, engine and propulsion, equipment, gears and electronic devices for purse seine vessels was nearly USD 184 000 (Table 8). The average age of the hull was 5 years.

Operating and owner costs

Among the running costs, the fuel costs were highest, accounting for up to 58 percent of the total operating costs (Table 9). Other important operating costs were labour related costs (wages, shares, food and crew travel), accounting for up to 27 percent. The main owner costs were incurred for vessel repair and maintenance. The average operating costs (including running and labour costs) and owner costs were respectively USD 193 000 and nearly USD 5 000.

Almost 100 percent of the revenue of this fleet came from the sale of fish landings. The average annual revenue of the surveyed purse seine vessels was nearly USD 262 000 in 2018.

Table 8 provides an overview of the average initial investment costs and book values (or depreciated values) of the surveyed fishing vessels.

TABLE 7
Technological and operational characteristics of Indonesian fishing vessels surveyed[4]

Characteristics	Purse seiners	Squid jiggers	Cast netters	Longliners	Pole and line vessels
Length overall (LOA) (in metres)	27	27	23	22	30
Gross tonnage (GT)	147	121	61	75	80
Total power of main engines in kilowatts (kW)	590	570	390	383	586
On-board storage facilities (m^3)	66	50	37	28	40
Fishing gear	Purse seine	Hook and lines	Cast net (BoukeAmi)	Longlines	Poles and lines
Crew size (persons)	36	31	10	15	49
Ownership	Company owned	Company owned	Company owned	Company owned	Company owned
Total days fishing at sea per year	198	224	45	215	308
Number of fishing trips per year	9	unknown	4.5	3	40+
Fishing season (months)	Variable	7.5	7	Variable	11

[4] The figures presented in this table are averages for the vessels surveyed.

TABLE 8
Initial investment costs and book/current value of Indonesian fishing vessels surveyed (in USD)[5]

Type of vessel / Investment item	Purse seiners	Cast netters	Tuna long liners	Pole and line vessels	Squid jiggers
Vessel (hull)	183 566	28 333	121 212	92 857	101 706
Main engine(s)	NI[6]	NI	5 594	4 196	NI
Equipment on deck	NI	NI	NI	NI	NI
Equipment below deck	NI	NI	NI	NI	NI
Fishing gears	NI	1 329	11 000	Owned by crew	NI
Electronic devices	NI	568	NI	1 286	NI
Total initial costs/value	183 566	30 798	137 807	98 339	101 706
Book value	151 442[7]	18 797	78 326	47 106	54 253
Hull age in 2018	5 years	8 years	13 years	15 years	15.5 years

TABLE 9
Annual costs and earnings of Indonesian Fishing Vessels (in USD)[8]

		Purse seiners	Cast netters	Tuna longliners	Pole and Liners	Squid jiggers
Category	**Item**	**USD**				
Earnings (=Revenue)	Total fishing revenue	261 721	141 000	72 767	10 651	272 979
Total earnings		261 721	141 000	72 767	10 651	272 979
Running costs	Fuel	111 268	63 077	97 366	5 286	91 608
Running costs	Lubricants/oil/filters	2 140	473	1 678	0	21 818
Running costs	Freezer	-	3 127	-	316	0
Running costs	Bait	-	0	-	1 950	0
Labour costs	Food, stores and other provisions	5 480	7 975	3 985	286	9 808
Running costs	Fish selling costs	28 556	0	-	0	15 222
Running costs	Materials (packaging)	-	750	-	0	0
Labour costs	Crew travel	7 406	68	2 433	0	420
Running costs	Other operating costs	-	0	-	25	0
Labour costs	Labor share and wages	38 420	1 590	23 056	0[9]	55 944
Total operating costs		193 269	77 061	128 518	7 862	194 820
Vessel owner costs	Fishing license fees & permits	-	875	9 510	0	19 352
Vessel owner costs	Insurance fees	-	379	0	0	0
Vessel owner costs	Gear replacements & repairs	2 972	5 150	1 399	0	2 040
Vessel owner costs	Vessel repairs & maintenance	1 748	5 250	991	1 065	4 398
Vessel owner costs	Other fixed costs	-	1 150	0	0	1 761
Total vessel owner costs		4 720	12 804	11 900	1 065	27 551
Total costs in 2018		197 989	89 865	140 418	8 927	222 370

5 The figures presented in the table are averages of three to five vessels surveyed per fleet segment. The information available was very limited, as investments were made years ago.
6 NI = no reliable information was provided on the investments in these items.
7 For the purse seiner vessels surveyed not any book values were provided. The figure presented in Table 8 is the depreciated value calculated at 3.5 percent/year (linear depreciation) assuming a lifespan of the hull of 30 years.
8 The figures are averages of the three to five vessels surveyed per fleet segment.
9 The pole and line fishing vessels reported that the crew received payment in the form of a share of the catches. The catch share taken by the crew was subtracted from the catch reported by these vessels, thus from the vessel earnings. The crew did thus not get a wage and therefore this costs line is zero in this table.

5.2 Squid jigger fleet

Capital investment

The average initial investment in hull, engine and propulsion, equipment, gears and electronic devices for a squid jigging vessel surveyed was USD 102 000. The depreciated or book value of a vessel of this fleet is estimated at USD 54 000. The average age of the hull of surveyed vessels was 15.5 years in 2018.

Operating and owner's costs

Among the operating costs, the fuel costs were highest, accounting for up to 47 percent of the total operating costs. Other important operating costs were labour costs (mainly catch shares and wages and food for the crew), accounting for up to 34 percent of the total operating costs.

The main owner costs were related to licenses, which added up to 70 percent of owner costs. The average operating costs (consisting of running and labour costs) and vessel owner costs were respectively USD 195 000 and nearly USD 28 000.

Total annual revenue from the sale of catch of the surveyed squid jigging vessels was around USD 273 000. No other revenues were reported by the vessels in this fleet segment.

5.3 Cast netter fleet

Capital investment

The average initial investment in hull, engine and propulsion, equipment, gears and electronic devices for a pole and line vessel was nearly USD 31 000. The depreciated or book value of a vessel in this fleet segment was estimated at USD 19 000. The average age of the hull was 8 years in 2018.

Operating and owner costs

Among the operating costs, fuel costs were highest, accounting for up to 82 percent of the total operating costs. Other important operational costs were the provision of food for the crew (9 percent) and crew wages/catch shares (4 percent).

The main owner costs were vessel and gear repair and maintenance, together adding up to 81 percent of the vessel owner costs. The operating costs and vessel owner costs were USD 77 000 and USD 13 000, respectively.

Revenues

Total annual revenue of the cast netters surveyed from the sale of catch was USD 141 000. No other revenues were reported by the vessels in this fleet segment.

5.4 Tuna long liners

Capital investment

The average initial investment in hull, engine and propulsion, equipment, gears and electronic devices for the long liners surveyed was USD 138 000. This cost includes the electronic and deck equipment. The depreciated value of the investment made in a vessel and related equipment of this fleet was estimated at USD 78 000. The average age of the hull of the vessels surveyed was 13 years in 2018.

Operating and vessel owner's costs

Among the operating costs, the fuel costs were highest, accounting for up to 76 percent of the total costs. Other important operating costs were the labour related costs (wages/catch shares, food for the crew and crew travel costs), accounting for 23 percent.

The main vessel owner costs were incurred for licenses and permits (80 percent) and gear gear repair and replacement (12 percent). The operating costs (including running and labour costs) and owner costs were respectively USD 129 000 and USD 12 000.

Revenues

Total average annual revenue in 2019 of the surveyed tuna long liners was USD 73 000, originating solely from the sale of fish landed.

5.5 Pole and line fleet

Capital investment

The average initial investment in hull, engine and propulsion, equipment, gears and electronic devices for a pole and line vessel surveyed was USD 98 000. The depreciated value of the investment made in a vessel and related equipment of this fleet was estimated at USD 47 000. The average age of the hull was 15 years in 2018.

In terms of original investment, the main investments are generally made in the hull (94 percent), followed by investment in the engines (4 percent) and deck equipment (2 percent). The poles and lines used are owned by the crew.

Operating and vessel owner's costs

Among the operating costs, fuel costs were highest, accounting for up to 67 percent of the total operating costs in 2018. Other important operating costs were the cost of bait, which added up to 25 percent. The main owner costs incurred for vessel repair and maintenance. The operating costs and owner costs accounted for 88 percent and 12 percent, respectively, of the average total annual operational costs of a vessel in this fleet. The operating costs (including mainly running and labour costs) and owner costs were around USD 8 000 and USD 1 000 respectively.

Total average annual revenue in 2018 of the surveyed pole and line fishing vessels was nearly USD 11 000 coming from the sale of fish only.

Table 9 provides an overview of annual costs and earnings of the selected fishing fleet segments.

The vessel owners and operators interviewed for the vessel survey did not report any harbour dues or levies paid, costs for purchase of fishing rights, interest payments, amortization and/or taxes paid. The depreciation costs of the vessels and their on-board equipment could not be provided either and were therefore not included in the calculations in Table 9 above.

6. ECONOMIC AND FINANCIAL PERFORMANCE OF FISHING VESSELS

6.1 Economic and financial indicators used

The economic and financial performance assessment of the five major Indonesian fishing fleet segments in this national report is based on the average vessel earnings and cost information presented above. This implies that the financial and economic performance indicators in this chapter also reflects the averages of data reported over 2018, and that individual vessels in these fleet segments may show much better or worse figures than those presented in Table 10 below.

6.2 Results

6.2.1 Skip Jack purse seiners

The economic and financial performance of the skip jack purse seiners surveyed was very favourable. Not only did they generate net profits, thereby allowing for reinvestments in the fleet, but they also substantial gross values and a good return on total assets.

TABLE 10
Financial and economic indicators (averages) of vessels in the five fleet segments (in USD)

Indicator	Purse seiners	Cast netters	Tuna longliner	Pole and line vessels	Squid jiggers	Code	Calculation
Revenue from landings	261 721	141 000	72 767	10 651	272 979	A	
Labour costs	51 306	9 634	29 474	286	66 171	B	
Running costs	141 964	67 427	99 044	7 576	128 648	C	
Vessel costs	4 720	12 804	11 900	1 065	27 551	D	
Total gross cost	197 989	89 864	140 418	8 927	222 370	E	B + C + D
Net cash flow	63 732	51 135	-67 651	1 724	50 609	F	A - E
Depreciation	6 425	1 078	4 823	3 442	3 560	G	[10]
Amortization	-	-	-	-	-	H	No information
Gross profit	57 307	50 057	-72 474	-1 718	47 049	I	F – G - H
Interest	-	-	-	-	-	J	No information
Net profit before taxes	57 307	50 057	-72 474	-1 718	47 049	K	I - J
Net profit margin	22%	36%	-100%	-16%	17%	L	K/A
Value of tangible assets	151 442	18 797	78 326	47 106	54 253	M	[11]
Return on fixed tangible assets	38%	266%	-93%	-4%	87%	N	K/M
Value of intangible assets	-	-	-	-	-	O	No information
Return on investment[12]	31%	163%	-53%	-2%	46%	P	K/(S+O)
Gross value added	115 037	60 769	-38 177	2 010	116 780	Q	F + B
Gross value added to revenue	44%	43%	-52%	19%	43%	R	Q/A
Initial investment costs	183 566	30 798	137 807	98 339	101 706	S	

The average gross profit for vessels in this fleet in 2018 was USD 57 000. The average net profit of a vessel in this fleet was estimated to be equal to gross profit as interest payments were not reported. The ratio of net profit to total revenue (net profit margin) was 22 percent, which is good. The return to fixed tangible assets (ROFTA) was high with 38 percent and the return on investment was 31 percent. The gross value added of a vessel in this fleet was USD 115 000.

6.2.2 Cast netters

The average gross profit for vessels in this fleet in 2018 was USD 50 000. The ratio of net profit to total revenue (the net profit margin) was 36 percent, which is very good. The ROFTA was very good with 266 percent, which is exceptional and largely due to the low book value of the vessels. The ROI was 163 percent in the same year; the latter being calculated over the initial investment costs. The cast netter vessels appeared to have had highly profitable fishing operations in 2016. The gross value added was nearly USD 61 000.

[10] Annual depreciation was estimated as being 3.5 percent of the initial investment in the vessel (assuming the vessel lifespan would be around 30 years).
[11] The value applied for the purse seiner vessels is the depreciated value; for the other vessels the book values of Table 8 are inserted here.
[12] Return on investment (ROI) was calculated over the initial investment costs, to differentiate in the table from the ROFTA, in view of the non-availability of information on the value of intangible assets.

6.2.3 Tuna longliners

The tuna longliners surveyed showed a substantial gross loss of USD 72 000 in 2018. The prohibition on transshipments at sea, which was issued through Ministerial Decree No. 57 of 2014, caused that the tuna longliners could not sell fresh high-value tuna anymore to other fleets at sea. Instead they had to land all tuna in Indonesian ports. Due to the large distances from the landing ports, the tuna longliners turned to landing of tuna in frozen form, which value was on average one-third of the fresh tuna ex-vessel value. As a consequence the average tuna longliner revenues were substantially lower in recent years compared to before 2014. However, since April 2020, the collector vessels were allowed to operate again with strict monitoring of the catches. This would help and ease the losses from this fleet segment. In addition, some of the surveyed tuna longliners did not make the number of fishing trips they had planned to undertake in 2018/2019, due to technical problems and the time needed for repairs.

6.2.4 Pole and line vessels

While the pole and line vessels covered their cost of operation with the sale of fish landed, they did not generate sufficient revenue to allow for reinvestment in the fleet. The average gross profit for vessels in this fleet was slightly negative, with a minus of USD 1 700. The net profit margin, ROFTA and ROI were therefore also negative. The gross value added of a vessel in this fleet was approximately USD 2 000 in 2018.

6.2.5 Squid jiggers[13]

The squid jiggers surveyed showed a gross profit of USD 47 000 and a net profit margin of 17 percent. The ROFTA and ROI for an average vessel in this fleet segment were respectively 87 percent and 46 percent in 2018. The gross value added was USD 117 000.

7. FINANCIAL SERVICES AVAILABLE TO THE FISHERIES SECTOR

Fishing vessel owners and fishing cooperatives in Indonesia have access to credit from local banks and other financial institutions. However, the respondents in the surveys generally utilized their savings and/or borrowed from relatives to purchase a used vessel rather than borrowing money from the banks.

However, in northern Java, many fishermen borrow money from banks. The loans issued are mainly for the purchase of vessel engines, equipment, fishing gears and to cover the operational costs. The maximum loan sizes available are around USD 70 000, depending on the fisher's ability to manage and repay the loans. Lending periods are typically between 5 and 10 years. Common interest rates, charged by the local banks and other formal credit providers, range from 10 to 12 percent per year.

8. SUBSIDIES AND SUPPORT TO THE SECTOR

Fishing vessel owners and fishing cooperatives can benefit from some available subsidies for the purchase of vessels, engines, gears, fuel/lubricants and ice:

- Vessels under 10 GT may be eligible to receive financial assistance for the purchase of small boats (3 GT, 5 GT or 10 GT) and for the purchase of fishing gears and engines as long as they form or are member of a cooperative.
- Vessels larger than 30 GT do not have access to subsidized fuel.

There are no import tax exemptions or duty free exemptions for Indonesian vessels.

Indonesia does not have a system of financial compensation for reduction of fishing fleet capacity, such as for the scrapping of fishing vessels. However, there was a

[13] This information is based on information provided by two vessels only.

compensation programme in operation for some years that facilitated gear replacement for those small vessels that were using mini trawls on the north Java coast. These trawl nets were replaced with gillnets by the fisheries administration.

9. TECHNOLOGICAL INNOVATIONS IN GEARS, EQUIPMENT AND VESSELS

The main technological innovations that have had an impact on the fishing fleet economic performance since 2000 in Indonesia are presented in Table 11. The table also specifies how these changes impacted the economic fleet performance.

10. SUMMARY DESCRIPTION OF NATIONAL PLANS AND POLICIES FOR ADJUSTMENT OF THE FISHING FLEET CAPACITY

The following recent fisheries regulations and decrees are governing the operations and developments of the fishing fleets in Indonesia.

1. Government Regulation No. 75 of 2015 on Non Tax Revenue. This regulation has increased the license fee that fishing vessel owners need to pay. The license fee is based on the gear used and the total gross tonnage (GT) of the vessel.
2. MMAF Decree No. 56 of 2014 on the moratorium on fishing by foreign made and owned vessels. This regulation reduced the share of large-scale industrial vessels to 35 percent of the total fishing fleet capacity. The reduction in large-scale vessels was mainly among vessels, owned and operated by foreign entities, that did not get licences to fish in Indonesian waters. This regulation also impacted the average size of Indonesian fishing vessels. The currently active fishing vessels are mostly below 200 GT.
3. MMAF Decree No. 57 of 2014 on the ban of transshipments. This decree was intended to stop transshipments to other countries of fishes caught by illegal fishing activities in the Indonesian EEZ. However, the decree also increased the cost of some capture fisheries operations, because fishing vessels are not any longer allowed to use the services of collector vessels, unless these vessels belong to the same fishing company as the catcher vessel.
4. MMAF Decree No. 2 of 2015 on the nationwide ban of large-scale trawling, including pair trawling. This decree has changed the fleet composition in Indonesia as large trawlers are not allowed to operate any longer. The regulation has led to the abondonment of large shrimp and fish trawlers that used to fish in the Banda and Arafura Sea. Instead of large trawl nets, three layer gillnets or trammel nets (locally called Ciker), designed to catch shrimp in Fishery Management Area (FMA) No. 718 around the Aru and Arafura Sea, are now being promoted and extensively used.

Apart from the above listed regulations and decrees, Indonesia has presently (2019) no plans for limiting or reducing the fishing fleet capacity. However, the Government of Indonesia is initiating a programme for fishing capacity allocation based on scientific recommendations carried out by the National Committee for Fisheries Stock Assessment.

TABLE 11
Technological innovations

Category	Specific innovations	How these affected economic performance of the fleet
1. Cost reductions and energy savings	Introduction of onboard deep freezer systems. Use of net haulers.	Reduced the energy needed for the freezing of fish. Reduced the number of crew needed on board.
2. Increasing fishing efficiency	Use of more efficient line-handling methods.	
3. Improving fish handling, product quality and food safety	Use of ice and improved onboard handling/cleaning and fish bleeding practices.	Better fish quality, resulting in higher market prices.

Scientific recommendations for nine groups of species per fisheries management area have been endorsed as an MMAF Ministerial Decree in 2017; these recommendations are based on the estimated maximum sustainable yields for these groups of species. The nine species groups include large pelagics, small pelagics, demersal species, reef fishes, shrimps, lobsters, blue swimming crab, and mud crabs (Ministerial Decree No. 50 of 2017).

The Government of Indonesia has also submitted its Fleet Development Plan to the Indian Ocean Tuna Commission (IOTC) in compliance with IOTC resolution number 15/11 on the implementation of a limitation of fishing capacity of contracting parties and cooperating non-contracting parties. The banning of foreign made and owned vessels has resulted in some of Indonesia's tuna quota not being used. The tuna Fleet Development Plan includes the increase of the tuna fishing fleet with 690 additional vessels, consisting of purse seiners, long liners and pole and liners to fish in Indonesia's EEZ (Muawanah U., Dewita Y., 2019).

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Report of Japan

National report of Japan

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1. OBJECTIVES AND CONTEXT

The economic performance of fishing fleets in Japan has not been analysed in recent years. The main fleets in terms of volume of fish landed are the following: purse seine for sardine, mackerel, purse seine for bonito, longline for tuna, and offshore trawl for cod and pollock.

This techno-economic fleet assessment is part of a global review study conducted by FAO, which aims to compare the financial and economic performance between fleets and over time within fleets. Japan did not participate in the past FAO global studies on techno-economic performance of the main fishing fleets.

Japan produced approximately 3.56 percent of the global capture fisheries production in 2016, and is therefore included in this global fishing fleet performance assessment of FAO.

The information presented in this analysis was collected, compiled and analysed in 2019 by Hiroki Wakamatsu.

2. CHARACTERISTICS OF FISHING FLEETS OPERATING IN JAPAN

The marine capture fisheries production in Japan decreased in the last 10 years from 4 451 205 tonnes in 2006/2007 to 3 275 262 tonnes in 2016/2017. The number of commercial fishing vessels decreased from 128 534 in 2003/2004 to 91 475 in 2013/2014, a change of 28.8 percent. The five economically most important semi-industrial and industrial fishing fleets in terms of volume of seafood landed are the following: purse seine for sardine, mackerel, purse seine for bonito tuna, offshore trawl for cod and pollock, and longline for tuna.

The purse seine fleet is the largest in terms of volume of catch landed (Table 1), followed by the offshore trawl and longline fleets. Most of the main fishing fleets can be characterized as semi-industrial or industrial and operate in territorial waters or the Exclusive Economic Zone (EEZ) of Japan. The main activities of the purse seine and offshore trawl fleets take place in FAO fishing area 61 (Northwest Pacific Ocean), while the longliners and bonito purse seine vessels also fish in other parts of the Pacific Ocean, as well as in the Atlantic and Indian Oceans. The main fishing harbours where the seafood is landed are: Choshi, Yaizu, Kushiro, Oinaoshi, Makurazaki, Hachinohe, Ishinomaki, and Kesen-numa.

TABLE 1
Overview of main fishing fleets

Fishing fleet Listed by gear name	Number of vessels	Scale[1]	FAO fishing area	Main fishing ports
1. Purse seine	60	Semi-industrial	61	Hachinohe, Ishinomaki, Kesennuma
2. Purse seine (bonito)	35	Industrial	61, 71, 81, 67	Yaizu, Makurazaki
3. Offshore trawl (pollock, cod)	268	Semi-industrial	61	Oinaoshi, Kushiro
4. Longline (Bigeye tuna, yellowfin tuna)	198	Industrial	88, 87, 77, 71, 58, 57, 51, 47, 34, 27, 21	Yaizu, Choshi

[1] The scale categories applied within the FAO global fleet review are: Industrial, semi-industrial, or artisanal/small-scale.

The main species targeted by each fleet are listed in Table 2.

The main species commonly caught by each fleet are listed in Table 3. In terms of commercial value generation sardine, mackerel, bonito tuna, cod and pollock are key to these fleets.

None of these fleets discards species at sea, because most of the fish species caught are utilized in Japan. Moreover, the law prohibits discarding fish at sea.

Under the Fisheries Act of Japan, all of the fishing fleets are governed and regulated by the Minister for fisheries, because the fisheries activities impact on the stock status of the target species and fish is considered of high importance to Japan's economy. Input control regulations are used in the management of these fisheries, which determine the vessel size, target species, vessel operations, fishing gears that can be used, fishing grounds, and fishing seasons. Besides the input controls, output controls have been implemented for some fisheries, including Total Allowable Catch (TAC) and Individual Quota (IQ). TAC measures are applied for most of the target species of the fishing fleets covered in this report, except for cod and sharks.

Table 4 provides an overview of the age structure of the main fishing fleets. It is clear that a majority of the vessels were constructed over 20 years ago. The entry of new fishing vessels showed a decreasing trend in recent years in Japan.

The Government of Japan recently (2018) revised the Fisheries Act and restructured its fishery policy. The Fisheries Agency of the Ministry of Agriculture, Forestry and Fisheries decided to shift its fishery management policy from input controls to output controls, and applies increasingly TAC limits with individual quota.

Considering the recent rapid decrease in the fisheries labour force in Japan, the Fisheries Agency has tried to optimize the fishing grounds utilization by re-distributing abandoned fishing grounds to more productive fishers, including private fishing companies.

TABLE 2
Main species targeted by fishing fleet

Fleets/species targeted	1	2	3	4	5
1. Purse seine	Sardine	Mackerel	Yellow tail	Flying squid	Bluefin tuna
2. Purse seine (bonito)	Bonito tuna	Bigeye tuna	Yellowfin tuna		
3. Offshore trawl	Pollock	Cod			
4. Longline	Bigeye tuna	Yellowfin tuna	Sharks	Albacore tuna	Swordfish

TABLE 3
Main species commonly caught by fleet

Fleets/species commonly caught	1	2	3	4	5
1. Purse seine	Sardine	Mackerel	Yellow tail	Flying squid	Bluefin tuna
2. Purse seine (bonito)	Bonito tuna	Bigeye tuna	Yellowfin tuna		
3. Offshore trawl	Pollock	Cod			
4. Longline	Bigeye tuna	Yellowfin tuna	Sharks	Albacore tuna	Swordfish

TABLE 4
Average age of fishing vessels by fleet in 2012 (in percentages)

Fleets/average age of vessels in percentages of total fleet size (%)	0–5 years	5–10 years	10–15 years	15–20 years	More than 20 years
1. Purse seine	11%	8%	11%	7%	63%
2. Purse seine (bonito)	11%	14%	11%	9%	54%
3. Offshore trawl	10%	9%	9%	9%	63%
4. Longline	7%	7%	14%	17%	54%

3. TECHNO-ECONOMIC AND OPERATIONAL CHARACTERISTICS OF INDIVIDUAL FISHING UNITS

Japan applies a different measuring system for length overall (LOA) and gross tonnage (GT) of fishing vessels. Gross tonnage (GT) is generally estimated by $(0.2 + 0.02*\log_{10} *V) *V$, where V is the gross cubic metres of the vessel. However, Japanese gross tonnage (JGT) is estimated by $GT* k_1* k_2$, where k_1 is coefficient less than one, k_2 is between 0.45 and 0.65. These coefficients are set by the Transfer Ministry Ordinance in Japan. The numbers of JGT are replaced by GT using the correlation outlined in Table A of the Appendix.

In Japan, fishing vessels are officially categorized and regulated by weight (in tonnes) and not by length, like other many countries. Accordingly, LOA in Japan does not reflect global LOA standards. For example, there is a 130 GT vessel in Japan with a LOA of 38 metre, which is usually equivalent to 400 GT vessels in the world. The LOA is converted using a transfer function in FAO Fishery Technical Paper 267 (1985) "Definition and classification of fishery vessel types".

3.1 Large and medium-scale purse seine for sardine and mackerel

In Japan, purse seine fishing vessels of more than 65 GT are categorized as large and medium-scale purse seine fleet. This fleet can be characterised by an average length overall (LOA) of 30 metres and a gross tonnage of 199 tonnes (GT) (Table 5). In total, 60 vessels were registered in 2017 in this purse seine fleet category. The power of the main engine of vessels in this fleet ranges between 809 kW and 2 900 kW. When horsepower (HP) is used to describe an engine, then the HP is multiplied with 0.7457 to obtain kW. One purse seiner fleet consists of one net ship and two carrier ships, with on board storage spaces. The specification of the purse seine vessels varies greatly between vessels in a purse seine fleet.

The main fishing gear used is the purse seine net. Equipment available on-board generally includes nets, winches, net haulers, cranes, radio devices, sonars and radars.

The average number of fishing crew members is 37.3 for vessels of 317–742 GT, 50 for vessels of 742 1 360 GT, and 119.5 for vessels over 1 360 GT.

The number of days at sea per purse seine vessel in 2016–17 ranged around 171 days for vessels of 317–742 GT, 282 days for vessels of 742–1 360 GT, and 785 days for purse seine vessels over 1 360 GT. The average number of fishing trips was 150. The average number of fishing trips in 2016/2017 depended on the size of vessels. Most medium-scale vessels in the purse seine fleet make one day or two-day trips, while some large-scale purse seine vessels can stay out at sea for a fishing trip of more than one year.

TABLE 5
Basic information of the purse seine vessels surveyed

	Vessel 1	Vessel 2	Vessel 3
Length overall (LOA) (m)	37	40	44
Gross tonnage (GT)	316	390	465
Total power of main engines in kilowatts (KW)	2 360	1 838	2 900
On-board storage facilities (m^3)	-	-	669
Fishing gear	Net	Carrier	Carrier
Crew size (persons)	22	10	22
Ownership (state, shared, chartered, company)	Company	Company	Company
Total days fishing at sea	-	-	-
Number of fishing trips	-	-	-
Fishing season (months)	6	6	6

3.2 Large and medium-scale purse seine for bonito tuna

The purse seine vessels in this fleet are also categorized in Japan as large and medium-scale purse seiners, but all of the fishing vessels should be regarded as large scale industrial vessels. The 35 vessels in this fleet can be further characterised by an average length (LOA) of 56 metres and a gross tonnage of 886 tonnes (GT) (see Table 6). The power of the main engines range between 1 912 kW and 2 942 kW. On board storage of fish is generally between 700 and 1 200 tonnes. Since one fishing trip takes on average 30 to 40 days, the freezer capacity is often the same as fish storage to freeze all fish caught.

The only fishing gear applied is the purse seine net. Equipment available on-board generally includes: purse seine nets, winches, net haulers, cranes, a helicopter, radio devices, sonars and radars. The average crew size distribution for these vessels is similar as for the other purse seine vessels and is largely dependent on the size of the vessel. The number of days at sea per vessel in 2016/2017 ranged from 273 to 312 days. The average number of fishing trips in 2016/2017 was 7 to 8 trips per bonito purse seine vessel.

TABLE 6
Basic information of bonito purse seine vessels surveyed

	Vessel 1	Vessel 2	Vessel 3
Length overall (LOA) (m)	62	46	62
Gross tonnage (GT)	1 080	500	1 080
Total power of main engines in kilowatts (kW)	2 942	1 912	2 942
On-board storage facilities (m^3 or metric tonnes)	1 929 m^3	800 t	1 200 t
Fishing gear – purse seine net	net	net	net
Crew size (persons)	30	23	28
Ownership (state, shared, chartered, company)	Company	Company	Company
Total days fishing at sea	273–312	273–312	273–312
Number of fishing trips	7–8	7–8	7–8
Fishing season (months)	12	12	12

3.3 Offshore trawlers for cod and pollock

The offshore trawl fleet for cod and pollock consisted in 2017 can be characterised by an average length overall (LOA) of 29.3 metres and a gross tonnage of 215 tonnes (see Table 7). The power of the main engines ranged between 809 kW and 1 029 kW. Average on board storage space for fish is 127 m^3 on these vessels. The main fishing gears carried are trawl nets. The main fishing methods employed are roughly 70 percent beam trawling and 30 percent pelagic trawling. Deck equipment available on-board generally includes the trawl winches, cargo winches, hoists and steering gears. The average crew size on these offshore trawlers is 9.8 persons for vessels of 83–163 GT and 16 persons for vessels of 163–318 GT. The number of days at sea per vessel ranged in 2016/2017 from 180 to 242 days. Most of the fishing trips were one-day trips.

3.4 Longline for tuna

The longline fleet for tuna can be characterised by an average length (LOA) of 40 metres and a gross tonnage of 427 tonnes (see Table 8). The power of the main engines is generally around 736 kW. On-board storage space for fish is often around 734 m^3, mainly available as freezer space.

The only fishing gears carried by these vessels are longlines. Deck equipment available on-board generally includes freezers, winches, hoist, stabilizer, radio devices, sonars and radars. The average crew size is 7 persons for vessels smaller than 33 GT and 43 persons for vessels of 742–1 360 GT.

TABLE 7
Basic information of the surveyed offshore trawlers

	Vessel 1	Vessel 2	Vessel 3
Length overall (LOA) (m)	37	30	21
Gross tonnage (GT)	290	230	125
Total power of main engines in kilowatts (kW)	1 029	1 029	735
On-board storage facilities (m^3 or metric tonnes)	128 m^3	106 m^3	32 t
Fishing gear	trawl	trawl	trawl
Crew size (persons)	18	14	6
Ownership (state, shared, chartered, company)	Company	Company	Company
Total days fishing at sea	180	180	187
Number of fishing trips	-	-	187
Fishing season (months)	10	10	10

TABLE 8
Basic information of long line tuna vessels surveyed

	Vessel 1	Vessel 2	Vessel 3
Length overall (LOA) (m)	51	49	21
Gross tonnage (GT)	650	600	33
Total power of main engines in kilowatts (kW)	736	736	736
On-board storage facilities (tonnes)	-	331 t	
Fishing gear	Longline	Longline	Longline
Crew size (persons)	23	24	7.5
Ownership (state, shared, chartered, company)	Company	Company	Sole proprietor
Total days fishing at sea	-	-	-
Number of fishing trips	250	248	254
Fishing season (months)	11	11	11

The number of days at sea per vessel in 2016/2017 was 243 days for vessels smaller than 33 GT. The large vessels of 742–1 360 GT stayed on average 460 days at sea over a two-year period. The average number of fishing trips in 2016/2017 depended mainly on the size of the vessels. Small size vessels made several trips per year; middle size vessels made generally one trip per year, very large size vessels made fishing trips of more than one year.

Employment

Table 9 presents the age distribution of the fishing crew on vessels of the four fleet segments surveyed. All crew on these vessels were full-time employed. There were not any part-time crew on these vessels in 2017. Moreover, all crewmembers were male. It was mentioned that there are very few female workers on vessels of these fleets. Not much information is available on the age structure of the labour force of these fleets, but it is clear that the majority of the crew on the longliners and offshore trawlers is over 50 years. The age distribution of the crew on the bonito purse seiners seems balanced. However, for the other three surveyed fishing fleets it is clear that the fisher labour force is aging.

4. FINANCIAL AND ECONOMIC CHARACTERISTICS OF INDIVIDUAL FISHING UNITS

Table B of the Appendix provides a general overview of the financial performance across the corresponding fishing fleet categories applied by the Fisheries Agency of Japan. The average fishing vessels in each of the categories showed positive net profit figures in 2017. Although the fishing companies generate most of their revenues from their fishing operations, they also obtained non-fishing revenues.

4.1 Large and medium-scale purse seiners for sardine and mackerel

Capital investments

The average initial investment in the hull, engine and propulsion, equipment, gears, electronic devices for a fishing vessel in this fleet segment of large and medium-scale purse seiners for sardine and mackerel of 465 GT was USD 17 million. The current average value of a vessel and related equipment in this fleet segment is estimated at USD 4.9 million for 318–742 GT purse seine vessels. The average age of the hull was 18.66 years (in 2012).

Revenues

The main revenue of vessels in this fishing fleet segment was generated by the sale of fish landed, which was approximately 93 percent of their total revenue in 2017. An average vessel in the sardine and mackerel purse seine fleet segment obtained a revenue of around USD 8.1 million in 2017 from fish sales and more than USD 600 000 from other activities.

TABLE 9
Age distribution in years of crew on the surveyed vessels (2017)

Age distribution of fishers (%)	Under 20	20–29	30–39	40–49	50–59	Over 60
Purse seiner	2%	4%	30%	18%	14%	32%
Purse seiner (bonito)	0%	21%	29%	25%	21%	4%
Offshore trawler	2%	10%	19%	17%	25%	27%
Longliner (tuna)	5%			8%	50%	37%

Operating and owner costs

Among the operating costs, the labour share and wages were the highest cost category in 2017, adding up to 47 percent of the operating costs. Other important operational costs were fuel (13 percent), labour benefits (10 percent), ice and other operating costs (26 percent) and fish selling cost (4 percent). The total labour related costs for an average vessel in this segment amounted to nearly USD 3 million. The vessel owner costs, which also include the capital costs and taxes in Table 10, added up to USD 3.3 million in 2017. The main vessel owner costs categories were depreciation cost (50 percent), followed by gear replacements (28 percent) and vessel maintenance costs (7 percent).

The operating costs (consisting of running and labour costs) and owner costs (costs to the owner, capital costs and tax payments) were respectively 61 percent and 39 percent of the average total annual operational costs of a vessel in this fleet segment.

TABLE 10
Average revenues and costs of vessels in the four fishing fleet segments in 2017 (in USD)

Category	Item	Purse seiner for sardine and mackerel	Purse seiner for bonito	Offshore trawler for cod and pollock	Longliner for tuna
Earnings (=Revenue)	Total fishing revenue	8 121 830	11 680 013	3 411 010	5 225 865
	Income other than fishing revenue	265 197	534 237	209 942	244 304
	Extra ordinary gain	4 039	19 586	158 296	197 476
	Other vessel income	349 146	766 550	217 814	79 184
Total earnings		8 740 212	13 000 385	3 997 063	5 746 830
Running costs	Fuel and lubricants	696 670	1 422 759	349 755	838 059
Running costs	Bait	-	92 429	-	340 629
Running costs	Fish selling costs	201 891	594 632	160 016	80 706
Labour costs	Other labour benefit	524 251	573 318	295 789	223 286
Running costs	Other operating costs (incl. ice, harbor dues, packing materials)	1 384 699	1 154 848	216 757	328 557
Labour costs	Labor share and wages	2 454 981	3 975 086	1 332 739	1 635 048
Total operating costs		5 262 493	7 813 073	2 355 056	3 446 285
Vessel owner costs	Other owner costs	314 864	498 290	106 525	130 400
Vessel owner costs	Insurance fees	-	-	26 920	-
Vessel owner costs	Gear replacements, repairs and maintenance of gears	927 174	334 656	157 007	149 323
Vessel owner costs	Vessel repairs & maintenance	245 289	1 062 500	319 629	599 952
Capital costs	Depreciation	1 663 535	1 576 999	263 979	214 375
Capital costs	Interest	106 014	169 759	137 761	103 731
	Extra ordinary loss	9 797	130 920	16 308	169 697
	Taxes on profits	32 607	240 982	116 233	59 679
	Corporate taxes	40 631	234 624	98 107	240 606
Total vessel owner costs		**3 339 913**	**4 248 728**	**1 242 468**	**1 667 762**
Total annual operational costs		**8 602 405**	**12 061 801**	**3 597 525**	**5 114 047**

4.2 Large and medium-scale purse seiners for bonito tuna

Capital investments

In the official statistical data the purse seiners for sardine, mackerel and bonito are considered as one category. The estimated average initial investment in these bonito purse seiners was therefore similar as for the sardine purse seine vessels, being USD 17 million. The current value of purse seine vessels for bonito tuna is however lower than the value of vessels for sardine, probably because of the higher average age of vessels fishing for bonito tuna. The current average value of the investment made in bonito purse seine vessels and related equipment is estimated at USD 3.3 million for vessels in the 742–1 360 GT category.

Revenues

The sale of landed fish contributes 90 percent to the revenue generated by vessels in this main fishing fleet segment. The average annual revenue from fish sales was in 2017 around USD 13 million, including USD 11.7 million from fish and USD 1.3 million from other businesses of the fishing company.

Operating and owner costs

Among the operating costs the labour share and wages presented the highest cost item, adding up to 51 percent of these costs. Other labour related benefits costs were up to another 7 percent of the operating costs. The total labour costs in 2017 of an average vessel in this fleet segment were USD 4 million. Other important operational (running) costs items were fuel (18 percent), ice and other operating costs (15 percent) and fish selling costs (7 percent).

The vessel owner costs (including also capital costs and taxes) added up to USD 4.2 million in 2017. The highest owner costs were vessel and equipment depreciation (37 percent), followed by vessel repairs and maintenance (25 percent), gear replacements, repairs and maintenance (8 percent), and taxes (6 percent).

The operating costs and owner costs were respectively 65 percent and 35 percent of the average total annual operational costs of a bonito purse seine vessel in this fleet segment.

4.3 Offshore trawlers for cod and pollock

Capital investments

The average initial investment in hull, engine and propulsion, equipment, gears and electronic devices for a 130 GT offshore trawler was USD 9 million. The current average value of the investment made in vessels and related equipment of this fleet segment of vessels in the 83 GT to 318 GT category is estimated at USD 513 000. The average age of the hull of vessels in this category was 19.88 years (in 2012).

Revenues

The main revenue of the vessels in this offshore trawler fleet segment comes from the sale of landed fish, which was approximately 85 percent of the total revenue in 2017. The total revenue of an average vessel in this fleet segment was USD 4 million in 2017.

Operating and owner costs

Among the operating costs (compiled by running and labour costs) the labour share and wages were highest, adding up to 70 percent of these costs. Other important operating costs were fuel (15 percent), ice and other operation costs (9 percent), and fish selling cost (7 percent). The highest vessel owner attributed costs categories were vessel repairs and maintenance cost (26 percent), followed by depreciation cost (21 percent), taxes (17 percent) and gear replacement and maintenance (13 percent).

The average total annual operational costs of an offshore trawler in this fleet segment were USD 3.6 million in 2017. The operating costs and owner costs were respectively 65 percent and 35 percent of the average total annual operational costs of a vessel in this fleet.

4.4 Longliners for tuna

Capital investments

The average initial investment in hull, engine and propulsion, equipment, gears and electronic devices for a tuna longline vessel was USD 6.3 million. The average value of investments made in a tuna longline vessel and related equipment in 2017 was estimated at USD 1.7 million. The average age of the hull of vessels in this fleet segment was 19.47 years in 2012.

Revenues

The main revenue of the tuna longline vessels is coming from the sale of landed fish. The sale of landed fish contributed approximately 91 percent (USD 5.2 million) to the total revenue of a vessel in this fleet in 2017.

Operating and owner costs

The operating costs of an average tuna longliner amounted to USD 3.4 million in 2017. The labour share, wages and other labour benefits of the crew were together the highest cost component and added up to 53 percent of the total operating costs in 2017. Other important operating cost items were fuel (24 percent), bait (10 percent), and the category ice and other operating costs (10 percent). The most important vessel owner cost items (including also capital costs and taxes) were vessel repairs and maintenance (36 percent), followed by taxes (18 percent), depreciation (13 percent), and gear replacement, repairs and maintenance (9 percent).

The operating costs and owner costs were respectively 67 percent and 33 percent of the average total annual operational costs of a tuna longliner in 2017.

Economic and financial performance of fishing vessels

The economic and financial performance of the fishing fleets covered in this national report is based on the average vessel costs and earnings information as presented above. This means that the information presented only reflects the average economic performance of the specific fleet, and that individual vessels might have indicator values well above or below the figures presented in Table 11.

Large and medium scale purse seiners for sardine and mackerel

The average gross profit of vessels in the sardine and mackerel purse seine fleet in 2017 was around USD 3.7 million. Net profit of a vessel in this fleet was estimated to be slightly less than gross profit as interest payments were limited to USD 106 000. The ratio of net profit to total revenue (net profit margin) was higher for this fleet segment, with 41 percent, than for the other three fleet segments covered in this study. The return on fixed tangible assets (ROFTA) was 71 percent and the return on investment (ROI)[2] was 21 percent. The gross value added of a vessel in this fleet was in 2017 nearly USD 5 million.

[2] The ROI in Table 11 is calculated based on the initial investment made in the fishing vessel and main equipment.

Large and medium scale purse seiners for bonito tuna

The average gross profit of vessels in the bonito tuna purse seine fleet in 2017 was nearly USD 4.9 million. Net profit of a vessel in this fleet was estimated to be around USD 4.7 million. The ratio of net profit to total revenue (net profit margin) was high with 36 percent. This means that for every dollar made by the fishing operations some 36 cents was kept as profit. The ROFTA was very high with 143 percent and the ROI was 28 percent. The very high ROFTA was caused by the relatively low depreciated value of the vessels. The book value of the investment in 2017 was USD 3.3 million compared to the USD 17 million investment initially made. The gross value added of a vessel in this fleet was more than USD 7.8 million in 2017. This fleet segment showed thus very good financial and economic results in 2017.

Offshore trawlers for cod and pollock

The average gross profit of vessels in the offshore trawler fleet for cod and pollock was around USD 1.3 million in 2017. Net profit of a vessel in this fleet was estimated to be around USD 1.2 million. The ratio of net profit to total revenue (net profit margin) was good with 29 percent. The ROFTA was very high with 226 percent, which was caused by the low depreciated value of the vessels in this fleet. The book value of the investment in 2017 was only USD 513 000 compared to an initial investment of nearly USD 9 million. The ROI, calculated over the initial investment, was average with 13 percent. The gross value added of a vessel in this fleet was nearly USD 2.7 million in 2017.

TABLE 11
Financial and economic indicators per fleet segment in 2017 in USD

	Code	Purse seiners for sardine and mackerel	Bonito purse seiner	Offshore trawler for cod and pollock	Tuna longliner
Revenue from landings	A	8 121 830	11 680 013	3 411 010	5 225 865
Total revenue	A2	8 740 212	13 000 385	3 997 063	5 746 830
Labour costs	B	2 979 232	4 548 404	1 628 528	1 858 334
Running costs	C	2 283 260	3 264 669	726 528	1 587 951
Vessel costs	D	1 487 328	1 895 445	610 080	879 675
Total gross cost (E) = B + C + D	E	6 749 821	9 708 518	2 965 136	4 325 960
Total costs (E2) = E + G + J + S	E2	8 602 405	12 061 801	3 597 525	5 114 047
Net cash flow (F) = A2 - E	F	1 990 391	3 291 867	1 031 926	1 420 870
Depreciation	G	1 663 535	1 576 999	263 979	214 375
Amortization	H	0	0	0	0
Gross profit (I) = F - G - H	I	3 653 926	4 868 866	1 295 906	1 635 245
Interest	J	106 014	169 759	137 761	103 731
Net profit before taxes (K) = I - J	K	3 547 912	4 699 106	1 158 144	1 531 514
Net profit margin (L) = K/A2	L	41%	36%	29%	27%
Value of intangible assets (2017)	M	4 986 000	3 294 000	513 000	1 732 000
ROFTA (N) = K/M	N	71%	143%	226%	88%
Value of intangible assets	O	0	0	0	0
ROI (P) = K/(T + O)	P	21%	28%	13%	24%
GVA (Q) = F + B	Q	4 969 623	7 840 271	2 660 455	3 279 204
GVA to revenue (R) = Q/A2	R	57%	60%	67%	57%
Taxes & extraordinary losses	S	83 035	606 525	230 647	469 981
Initial investment costs	T	17 015 331	17 015 331	8 955 000	6 268 806

Tuna longliners

The average gross profit of vessels in the tuna longline fleet was around USD 1.6 million in 2017. Net profit of a vessel in this fleet was estimated to be around USD 1.5 million, as interest payments were just USD 103 000 in 2017. The ratio of net profit to total revenue (net profit margin) was good with 27 percent. The ROFTA was 88 percent. The ROI, calculated over the initial investment, was good with 24 percent. The gross value added of a vessel in this fleet was nearly USD 3.3 million in 2017.

5. FINANCIAL SERVICES AVAILABLE TO THE FISHERIES SECTOR INCLUDING INSTITUTIONAL CREDIT PROGRAMMES

The fishing vessel owners and fishery cooperatives in Japan have access to credit from the Japan Finance Corporation.[3] The purpose of the loans is mainly for the purchase of vessels, engines, equipment, gears and to cover operational costs. The maximum loan sizes are around USD 7.6–10 million for purse seine vessels, USD 4.8–6.4 million for tuna longline vessels, USD 4.0 million for other fishing vessels, and around USD 900 000 for fishing gears. The loan periods applied are often 15 years. The common interest rate charged by the governmental credit provider is 0.2 percent per year.

6. SUBSIDIES AND SUPPORT TO THE SECTOR

In 2011, various strong earthquakes hit the east coast of Japan's main island. The earthquakes caused tsunamis, which damaged 20 out of 121 large and medium-scale purse seine vessels. These vessels stranded on land, sunk, capsized, or went missing. The economic loss due to the natural disasters was not limited to the fishing fleet losses and damages, but also affected processing, distribution chains and retailers. The Japanese government established the Reconstruction Agency and made a variety of reconstruction plans for infrastructure, various affected industries (including fisheries), and for residences of the affected people. The Fisheries Agency also provided support for rehabilitation of infrastructure and production capacity in the order of USD 12 million for three years. For general-use fishing vessels, subsidies were available, which covered more than one third of the expenses for rehabilitation. For those fishers and companies affected by the tsunamis, which submitted recovery plans, the authority subsidized 90 percent, two thirds, or half of the investments needed to restart their fishing operations.

Fishing vessels owners and fishery cooperatives can benefit from a system of subsidies for the development of new technology for fisheries, to support sustainable fishing operations, to promote women participation in fisheries, for value addition to fishery products and to increase exports of domestic fisheries products.

TABLE 12
Major technological innovations introduced in the Japanese fishing fleets since 2000

Category	Specific innovations	How these affected economic performance of the fleet
Cost reductions and energy savings	Rationalization of the use of vessels in the purse seine fleet; reducing the number of vessels used in purse seine operations	Saved 9% in fuel used
Improving fish handling, product quality and food safety	Introduction of brine freezing systems in the large scale fishing vessels	Increased ex-vessel value of the fish, due to higher quality products
Improving safety at sea and working conditions of fishers	Introduced new ILO criteria for crew accommodation on fishing vessels	Improved the quality of the on-board accommodation for the crew and contributed to safe working conditions on the vessels

[3] For more information, please visit: www.jfc.go.jp/n/english/

There is also a system in Japan that provides financial compensation for reduction of fishing effort, such as scrapping of fishing vessels. The Fisheries Agency had recently a budget of USD 886 000 for a fleet capacity reduction project. The Fisheries Agency of Japan also developed the Fishery Reconstruction Master Plan, which supports the domestic fisheries sector to introduce new technologies, such as energy- and cost-saving technology, in the fishing fleet.

7. TECHNOLOGICAL INNOVATIONS IN GEARS, EQUIPMENT AND VESSELS THAT IMPACT FISHING VESSEL ECONOMIC PERFORMANCE

The main technological innovations that have had an impact on the economic performance of the Japanese fishing fleet since 2000 are presented in Table 12. The table also specifies how these changes impacted the economic fleet performance.

8. SUMMARY DESCRIPTION OF NATIONAL PLANS AND POLICIES FOR ADJUSTMENT OF FLEET CAPACITIES

Japan has plans in place that limit or reduce the fleet capacity, especially of vessels fishing for highly migratory species (e.g. tunas, sharks). The restructure support plan (2014-16) aimed to reduce the fishing fleet capacity. If the fishing vessel owners submitted a vessel reduction plan, they could receive subsidies of one-third to five-ninths of the expenses to remove their vessels depending on the type of fisheries.

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Appendix

TABLE A
Correlation table between gross tonnage and japanese gross tonnage

Cubic metres	GT	JGT	Cubic metres	GT	JGT
32.159	7.3	4.9	1 887.005	500	325
32.566	7.4	5	2 609.019	699	468
32.986	7.5	5	2 612.746	700	469
135.97	32	19	2 760.416	741	499
139.975	33	19	2 764.136	742	500
143.914	34	20	3 685.956	999	699
203.086	49	29	3 689.642	1 000	700
207.064	50	30	3 693.328	1 001	700
327.606	81	49	4 961.664	1 358	999
331.469	82	49	4 965.315	1 359	1 000
335.329	83	50	4 968.966	1 360	1 000
396.825	99	60	5 811.841	1 599	1 215
400.634	100	61	5 815.474	1 600	1 216
632.812	161	99	7 215.007	1 999	1 599
636.47	162	99	7 218.614	2 000	1 600
640.374	163	100	8 561.176	2 385	1 999
775.795	199	123	8 564.764	2 386	2 000
779.674	200	124	10 691.375	2 999	2 698
1 148.545	299	188	10 694.939	3 000	2 700
1 152.373	300	189	11 539.829	3 244	2 998
1 121.31	316	199	11 543.385	3 245	3 000
1 215.131	317	200	14 134.275	3 999	3 998
1 218.952	318	200	14 137.809	4 000	4 000
1 751.604	463	299	17 550.017	4 999	4 999
1 755.379	464	299	17 553.527	5 000	5 000
1 759.154	465	300	34 399.724	9 999	9 999
1 883.239	499	324	34 403.164	10 000	10 000

Source: Practical Guide for Tonnage Act (in Japanese), Tonnage Study Group Ed., 1985, Kaibundo, Tokyo.

TABLE B
Financial performance of fishing fleet categories in Japan in 2017 in USD[4]

(Unit: USD)	Off-shore trawl		Large and medium-scale purse seine				Longline for tuna (Distant and nearby water)			
	83~163 GT	163~318 GT	318 ~742 GT	Over 742 GT	742~1 360 GT	Over 1 360 GT	Less than 34 GT	Over 742 GT	742 ~ 1 360 GT	Over 1 360 GT
Revenues	1 678 634	3 628 824	8 470 975	34 729 814	12 446 563	57 013 075	855 808	10 059 679	5 305 049	13 229 438
Operational cost	1 275 389	2 733 289	7 248 290	29 205 814	9 724 173	48 687 473	629 111	8 426 359	4 151 302	11 276 383
Selling cost and general expense	230 925	691 190	1 182 055	3 722 543	1 942 264	5 502 857	175 885	1 073 748	457 677	1 484 453
Non-operating revenue	39 323	209 942	265 197	1 000 090	534 237	1 465 942	11 329	311 210	244 304	355 808
Non-operating expense	12 744	137 761	106 014	217 841	169 759	265 932	4 173	205 294	103 731	273 007
Current net profit	180 774	320 408	153 425	1 865 328	798 646	2 931 957	43 837	560 100	623 818	517 642

Source: Fisheries Agency, 2018, Fisheries Business Management Inquiry Report in 2017, Tokyo.

[4] The original table from the Fisheries Business Management Inquiry Report in 2017 contains figures in Japanese Yen. The exchange rate between JPY and USD applied in this table is 111.664 JPY = 1 USD (official exchange rate of 1 April 2017).

Report of the Republic of Korea

National report of the Republic of Korea

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1. OBJECTIVES AND CONTEXT

The economic performance of fishing fleets of the Republic of Korea (South Korea) was presented in previous FAO global reviews in 1999, 2001 and most recently in 2005. The main fishing fleets covered in the previous analyses included the following: Offshore stow netter, offshore squid jigger, eastern sea trawler, large otter board trawler, large pair trawler, large Danish seiner, west south sea medium Danish seiner, eastern sea medium Danish seiner, large purse seiner, and anchovy drag netter (pair).

The current fleet assessment is part of the 4th FAO global assessment of the techno-economic performance of the main fishing fleets in the world, and aims to compare the financial and economic performance between fleets and over time within fleets.

The Republic of Korea participated again in the FAO global studies on techno-economic performance of the main fishing fleets with data and information from 2017. The country produced approximately 1.52 percent of the global capture fisheries production in 2017, and was therefore included in this global fishing fleet performance assessment of FAO. The information presented in this national report was collected and analysed by Dr. Bong Jin Cha of the National Institute of Fisheries Science (NIFS).

2. CHARACTERISTICS OF FISHING FLEETS OPERATING IN THE REPUBLIC OF KOREA

The marine capture fisheries production in the Republic of Korea decreased in the last 10 years from 1 888 362 tonnes in 2007 to 1 408 936 tonnes in 2017. At the same time the estimated number of commercial fishing vessels decreased from 85 627 in 2007 to 66 736 in 2017; a reduction of 24 percent. The three economically most important semi-industrial and industrial fishing fleets in terms of volume of seafood landed in 2017 were the following: large trawl, offshore jigging, large purse seine.

The offshore jigging fleet is the largest in terms of number of fishing vessels (Table 1), followed by the large otter trawl, and large purse seine fleets. Most of the main fishing fleets are of an industrial (large otter trawl, large purse seine) or semi industrial (offshore jigging) scale and fish in territorial waters and the South Korean Exclusive Economic Zone (EEZ). The main activities of the fleets take place in FAO fishing area 61 (Northwest Pacific). The main fishing harbour where seafood is landed is Busan.

TABLE 1
Overview of the main fishing fleets in 2017

Fishing fleet Listed by gear name	Number of vessels	Scale	FAO fishing area	Main fishing ports
1. Offshore jigging	588	Industrial	61	Pohang (36°01'20.6"N 129°24'00.3"E)
2. Large otter trawl	34	Industrial	61	Busan (35°05'20.3"N 129°01'30.9"E)
3. Large purse seine	25	Industrial	61	Busan (35°05'20.3"N 129°01'30.9"E)

The main species targeted and caught by each fleet are listed in Table 2.

In terms of commercial value, squid and mackerel are the most important target species for these fleets. Information on discards at sea from these fleets was not available.

The following fisheries legislation and regulations are governing the operations and developments of these fishing fleets:

- **Fisheries Act (2007)**
  The purpose of this Act is to establish the fundamental system for fisheries, to promote the development of fisheries and fishery business by improving the comprehensive utilization of fishery resources and waters and consequently enhancing the productivity of fisheries.

- **Fishery Resources Management Act (2009)**
  The purpose of this Act is to contribute to the sustainable development of fisheries and to the income growth of fishers by establishing plans for the management of fishery resources and the efficient management of the fishery resources, through the prescription of measures that are necessary for the protection, recovery and development of fishery resources.

- **Fishing Vessels Act (2016)**
  The purpose of this Act is to prescribe the requirements concerning the construction, registration, equipment, inspection, trade and investigations of, and research carried out on fishing vessels.

Table 3 provides an overview of the age structure of the vessels in the three main fishing fleets that are the focus of this national report. It is clear that the offshore jigging vessels are relatively young with many vessels in the category of less than 20 years. In contrast the vessels in the large purse seine fleet are generally older. The main reason for the difference in investments in fishing vessels between these fleets is the construction costs of a vessel, which are much higher for large purse seine vessels.

TABLE 2
Main species targeted and caught by fishing fleet

Fleets/species targeted	1	2	3	4	5
1. Offshore jigging	Japanese common squid (*Todarodes pacificus*)	Largehead hairtail, (*Trichiurus lepturus*)	Mitra squid (*Loligo chinesis*)	Pufferfishes and toadfishes (*Tetraodontidae*)	Small yellow croaker (*Larimichthys polyactis*)
2. Large otter trawl	Japanese Common squid (*Todarodes pacificus*)	Largehead hairtail, (*Trichiurus lepturus*)	Brown croaker (*Miichthys miiuy*)	Common mackerel (*Scomber japonicas*)	Spanish mackerel (*Scomberomorus niphonius*)
3. Large purse seine	Common mackerel (*Scomber japonicus*)	Horse mackerel (*Trachurus japonicas*)	Spotted mackerel (*Scomber australasicus*)	Largehead hairtail, (*Trichiurus lepturus*)	Yellow tail (*Seriola quinqueradiata*)

TABLE 3
Average age of fishing vessels by fleet in years (in percentages)

Fleets/average age of vessels in percentages of total fleet size (%)	0–5 years	5–10 years	10–20 years	more than 20 years
1. Offshore jigging	12.4	9.2	48.1	30.3
2. Large otter trawl	5.9	2.0	19.6	72.5
3. Large purse seine	0.0	0.0	2.8	97.2

3. TECHNO-ECONOMIC AND OPERATIONAL CHARACTERISTICS OF INDIVIDUAL FISHING VESSELS

The **offshore jigging fleet** can be characterised by an average length (LOA) of 22.7 metres and an average gross tonnage of 50 tonnes (see Table 4). The power of the main engines is generally around 547 kW. The average on board storage capacity of fish is 92 m^3. The fishery operations are split in two distinct types. One group of vessels generally carries out fishing trips of more than 10 days and stocks the fish caught in the on-board freezer. The other group of vessels is fishing carries out day-trips, as possible, and these vessels are equipped with water tanks/basins to keep the catch alive, instead of freezers.

The average numbers of fishing days, and storage space and freezer capacity information, as presented in Table 4, originate from the yearbook of the Ministry of Oceans and Fisheries of Korea. The large difference in fishing operations between the two groups of offshore jigging vessels is therefore not reflected in the single figure presented in this table. Deck equipment available on-board generally includes jigging machines with lines and hooks, fish gathering lamps, sea anchors and rollers. The average crew size on the offshore jigging vessels is 10. Those vessels that do day trips go out almost every day and their fishing activities highly depend on the weather.

The **large otter trawl fleet** can be characterised by an average length (LOA) of 34.9 metres and a gross tonnage of 139 tonnes (see Table 4). The power of the main engines is 1 480 kW on average. On board storage space for fish is generally around 180 m^3. The volume of the fish holds is generally adequate for 45 tonnes and freezer capacity is often 135 m^3.

Deck equipment available on-board generally includes winches, trawl gears with wing nets and bag net (cod end), main ropes, and otter boards. The average crew size is 14.

The average number of days at sea per vessel was in 2017 some 182 days. The average number of fishing trips per vessel in 2017 was 43.

A **large purse seine fleet** consist generally of six vessels, one main boat, 2 light boats and 3 carrier boats. The main boat can be characterised by an average length (LOA) of 38.1 metres and a gross tonnage of 129 tonnes (see Table 4). The average power of the main engines is 547 kW. The main fishing gears used are purse seine gear. Deck equipment available on-board generally includes power blocks and pursing winches.

TABLE 4
Basic information of each fishing vessel surveyed

	Offshore jigging	Large otter trawl	Large purse seine
Length overall (LOA) (m)	22.7	34.9	38.1
Gross tonnage (GT)	50	139	129
Total power of main engines in kilowatts (kW)	547	1 480	1 368
On-board storage facilities (m^3)	92	78	-
Fishing gear used	1. Fishing lines with hooks 2. Fish gathering lamp 3. Sea anchor Roller	1. Trawl gears with wings net and bag net (cod end) 2. Float 3. Otter board (Alongside ship) 4. Sweep line	1. Purse seine gear 2. Power block 3. Traction roller
Crew size (persons)	10	14	27 (main vessel)
Ownership (state, shared, chartered, company)	Individual	Individual	Individual
Total days fishing at sea	125	139	240
Number of fishing trips	57	43	12
Fishing season (months)	12	12	11

The average crew size is 27.

The average number of days at sea per vessel in 2017 was 240 days. The average number of fishing trips in 2017 was 12, indicating that a fishing trip takes around 3 weeks.

The vessel owners and operators of the large purse seiners have agreed to not fish between 1 April and 9 May each year. Moreover, they do not operate during the two days before and after full moon.

Table 5 presents the average number of full-time crew on vessels of each of the three main fleets. All fishing crew on these vessels work full-time and are male. There are not any part-time employed crew or women working on the vessels. The structure of crew ages throughout the three fleets was very similar, even though number of crew on the vessels is different (see Table 5). The older fishermen (older than 40) are all Korean, but the younger workers in the three fleets are generally foreigners, because most young Korean men do not want to work on board.

4. FINANCIAL AND ECONOMIC CHARACTERISTICS OF INDIVIDUAL FISHING VESSELS

Capital investments

The initial investments in the fishing vessels (hull, main engine, propulsion, equipment, gears and electronic devices) were a challenge to investigate, because most of the vessels were built long ago and their ownership has often changed. Moreover, some vessels replaced the engines and/or propulsion systems and have seen various gear replacements.

The **offshore jigging** vessels were built (on average) some 20 years ago. The initial investment in a vessel (hull, engine, and equipment) was nearly USD 700 000. The hull investment was generally approximately 58 percent and the engine was 14 percent of the total investment. The cranes/winches and other on deck equipment cost another 15 percent of the initial investment. These type of vessels are expected to operate for approximately 33 years, hence a depreciation rate of 3 percent is applied on the combined investments in the hull, engine and major deck equipment.

The current average value of the investment made in a **large otter trawler** and related equipment of vessels in this fleet is estimated at USD 2.1 million. The average age of the hull, engine and main on-board equipment is 22 years. The main investments in large otter trawlers were generally made in the hull (68 percent), followed by investment in the engines (12 percent). A large otter trawler is expected to be in operation for approximately 35 years.

The **large purse seine** vessels in use in the Republic of Korea accounted with initial investments of around USD 6.2 million. The largest investment items were respectively the hull, on-deck equipment and the engines, with respectively 78 percent, 12 percent and 4 percent of the total initial investment. The annual depreciation of the vessel and its equipment is estimated at USD 370 000, which would be 6 percent of the initial investment. This would generally mean that a vessel of this type is expected to be in operation for some 17 years, but in reality, the average age of vessels in this fleet is around 30 years. The relatively high depreciation rate is caused by the fishing gear that is very expensive and need frequent replacement.

TABLE 5
Fishing crew distribution by age group

Age distribution of fishers	Number of crew per vessel	Under 20	20–29	30–39	40–49	50–59	60 and over
Offshore jigging vessel	10	0%	0%	30%	10%	20%	40%
Large otter trawl vessel	14	0%	14%	14%	0%	50%	22%
Large purse seine vessel	27	0%	19%	19%	11%	26%	25%

The average initial investment costs in vessels of these three fleets are presented in Table 6.

Revenues

The main revenue of the offshore jigging fleet comes from the sale of the fish landings, which is approximately 98 percent of the total revenue. Total revenue of the fleet is not only coming from the sales of fish, but also from other vessel income, such as leisure fishing or charters. The average annual total revenue of an offshore jigging vessel in 2017 added up to some USD 370 000.

Large otter trawlers generated in 2017 an annual revenue of around USD 4 million and the large purse seine vessels realized around USD 9.4 million in revenues from sales of fish in the same year. Another source of income for the large purse seiners is the income obtained from financial investment by the fisheries cooperatives. The fishing vessel owners, who are member of a cooperative receive annually dividend on their investment in the cooperative and its business. This income was over USD 800 000 in 2017 and contributed about 8 percent to the total earnings by these vessels.

The average annual revenues and costs of the three vessel categories covered in this report, based on data from 2017, are presented in Table 7.

Operating and owner costs

The annual operating costs of an average **offshore jigging vessel** added up in 2017 to USD 277 000. Around 53 percent of these costs were made for the wages and labour share of the crew. Fuel was other important cost item accounting for 31 percent of the operating costs.

For vessels in the **large otter trawl** fleet the annual operating costs were nearly USD 2.3 million, of which 43 percent was used to cover wages and labour shares of the crew. Fuel and auction/selling costs were with 19 percent and 14 percent other important operating cost items in 2017.

The annual operating costs of a **large purse seine** vessel were larger than the initial investment in the vessel. The average annual operating costs added up to nearly USD 7.7 million in 2017. The wages and crew share amounted to some 45 percent of these costs, and the fuel costs were another 23 percent of the operating costs.

The vessel owner costs of an **offshore jigging vessel** owner added up to some USD 42 000. The vessel maintenance and repair costs for the owner were on average 36 percent, while gear repairs and replacements contributed another 44 percent of the owner costs.

TABLE 6
Average initial investments made in the three types of fishing vessels

Investment item	Offshore jigging USD	Large otter trawl USD	Large purse seine USD
Vessel (hull)	399 449	1 476 965	4 848 569
Main engine(s)	96 943	262 295	242 446
Equipment on deck (e.g. cranes, beams) and fishing gears (BRDs, FADs)	100 389 (not including fishing gears)	111 106	737 366
Equipment below deck (e.g. cold storage, ice making, freezers)	-	159 504	-
Electronic devices (navigation, fish finding and communication)	88 613	150 642	372 175
Other	-	-	-
Total	**685 394**	**2 160 512**	**6 200 556**

TABLE 7
Average revenues and costs of vessels in the three fishing fleets in 2017

		Offshore jigging	Large otter trawl	Large purse seine
Category	**Item**	**USD**	**USD**	**USD**
Earnings (=Revenue)	Total fishing revenue	362 748	4 073 972	9 350 025
	Other vessel income	7 796	0	835 835
Total earnings		370 544	4 073 972	10 185 860
Running costs	Fuel	84 999	434 340	1 773 322
Labour costs	Food, stores and other provisions	20 494	321 546	423 081
Running costs	Fish selling costs	14 689	318 731	542 302
Running costs	Materials	4 579	44 558	272 482
Labour costs	Crew travel	0	0	0
Running costs	Other operating costs	610	91243	319771
Labour costs	Labor share and wages	147 883	989 329	3 445 528
Total operating costs		277 312	2 265 656	7 656 838
Vessel owner costs	Insurance and license fees	13 396	65 870	442 442
Vessel owner costs	Gear replacements, repairs and maintenance	11 074	313 200	447 913
Vessel owner costs	Vessel repairs & maintenance	15 419	232 988	1 050 182
Vessel owner costs	Other fixed costs (interest, accountancy, legal fees)	1 668	87 698	1 249 158
Capital costs	Depreciation	20 894	59 386	370 849
	Taxes on profits	1 343	52 634	48 686
Total costs in 2017		**341 106**	**3 077 432**	**11 266 068**

The costs that attribute to the vessel owner of a **large otter trawler** were on average USD 700 000 in 2017. The gear repairs and maintenance costs were the highest cost category within the vessel owner costs with 45 percent, followed by vessel repair and maintenance with 33 percent.

The annual vessel owner costs of a **large purse seiner** were nearly USD 3.2 million in 2017. The accountants, legal fees and general expenses were the highest within the vessel owner costs with 39 percent, followed by vessel repairs and maintenance costs with 33 percent. The vessel insurance premiums were also above 10 percent of the total owner costs with common expenditure on these cost items of above USD 400 000.

Economic and financial performance of fishing vessels

The economic and financial performance of the fishing fleets covered in this national report is based on the average vessel costs and earnings information as presented above. This means that the information presented only reflects the average economic performance of the specific fleet, and that individual vessels might have indicator values well above or below the figures presented in Table 8.

Offshore squid jigging vessel

The average gross profit of vessels in the offshore squid jigger fleet in 2017 was just over USD 30 000. Net profit of a vessel in this fleet was estimated to be equal to gross profit as interest payments were not reported. The ratio of net profit to total revenue (net profit margin) was 8 percent. This means that for every dollar made by the fishing operations some 8 cents is kept as profit. The return on fixed tangible assets (ROFTA) was 14 percent and the ROI was four percent. The gross value added of a vessel in this fleet was more than USD 220 000.

TABLE 8
Financial and economic indicators per fleet segment in 2017 in USD

	Code	Offshore jigger	Large otter trawler	Large purse seiner
Revenue from fish landings	A	362 748	4 073 972	9 350 025
Total revenue	A2	370 545	4 073 972	10 185 859
Labour costs	B	168 377	1 310 875	3 868 609
Running costs	C	108 935	954 781	3 788 229
Vessel costs	D	41 557	699 756	3 189 695
Total gross cost (E) = B + C + D	**E**	**318 869**	**2 965 412**	**10 846 533**
Total costs (E2) = E + G + S	**E2**	**341 106**	**3 077 432**	**11 266 068**
Net cash flow (F) = A2 - E	F	51 676	1 108 560	-660 674
Depreciation	G	20 894	59 386	370 849
Amortization	H	0	0	0
Gross profit (I) = F - G - H	I	30 782	1 049 174	-1 031 523
Interest	J	0	0	0
Net profit before taxes (K) = I - J	K	30 782	1 049 174	-1 031 523
Net profit margin (L) = K/A2	L	8%	26%	-10%
Value of tangible assets	M	217 211	417 990	591 988
ROFTA (N) = K/M	N	14%	251%	-174%
Value of intangible assets	O	0	0	0
ROI (P) = K/(T + O)	P	4%	49%	-17%
GVA (Q) = F + B	Q	220 053	2 419 435	3 207 935
GVA to revenue (R) = Q/A2	R	59%	59%	31%
Taxes on profits	S	1 343	52 634	48 686
Initial investment costs	T	685 394	2 160 512	6 200 556

Large otter trawler

The average gross profit of vessels in the large otter trawler fleet in 2017 was just over USD 1 million. Net profit of a vessel in this fleet was estimated to be equal to gross profit as interest payments were not reported. The ratio of net profit to total revenue (net profit margin) was 26 percent. The ROFTA was very high with 251 percent, which is largely caused by the low depreciated value of vessels in this fleet. Their depreciated value was estimated at just 19 percent of the initial investment cost in vessel and main on-board equipment. The ROI was very good as well with 49 percent. The gross value added of a vessel in this fleet was more than USD 2.4 million.

Large purse seiner

The average large purse seine vessel ended 2017 with a loss. The costs made were larger than the earnings generated. However, as these large vessels operated in groups with smaller purse seine vessels and fish carriers, it may be that the profits made by the other vessels compensated for the losses by the large purse seiners. The net loss by an average large purse seiner in 2017 was just over one million USD. The financial indicators were also negative in 2017 for these vessels. The gross value added of a vessel in this fleet was more than USD 3.2 million in 2017.

5. FINANCIAL SERVICES AVAILABLE TO THE FISHERIES SECTOR INCLUDING INSTITUTIONAL CREDIT PROGRAMMES

The fishing vessel owners and fishing companies in the Republic of Korea have access to credit from fishing cooperatives and commercial banks. The loans are mainly used for procurement of vessels and equipment, as well as to cover the operational costs of the business. Common interest rates charged in 2017 by the credit providers ranged from 3 percent to 6 percent per year.

6. TECHNOLOGICAL INNOVATIONS IN GEARS, EQUIPMENT AND VESSELS THAT IMPACT FISHING VESSEL ECONOMIC PERFORMANCE

The main technological innovations that have had an impact on the fishing fleets' economic performance since 2000 in the Republic of Korea are presented in the following table.

7. SUMMARY DESCRIPTION OF NATIONAL PLANS AND POLICIES FOR ADJUSTMENT OF FLEET CAPACITIES

The Government of the Republic of Korea supports the long-term sustainable use of fisheries resources and enhancement of fishery competitiveness by reducing the number of coastal fishing vessels to maintain fishery resources at sustainable levels. The Ministry of Oceans and Fisheries (MOF) manages the fishing fleet capacity reduction programme. Over the period 1994–2017 the fishing fleet of the Republic of Korea was reduced with 2 674 vessels. The cost of the buy-back and fishing fleet reduction programme over this period was USD 924 million. The reduction efforts focused on fishing fleets that target depleted fisheries resources and aimed to support the recovery of these fishery resources. The Government has initiated a project to modernize the fishing fleet, through development of new types of fishing vessels.

TABLE 9
Technological innovations that have had an impact on the fishing fleet economic performance since 2000

Category	Specific innovations
1. Cost reductions and energy savings	Development and introduction of energy saving fishing gear for large otter trawlers. A few offshore jigging vessels changed their lights for attraction of squid from metal halide lamps to LED lamps. Most vessels in the three fleets covered in this report changed the lights for work on the deck to LED lamps.
2. Increasing fishing efficiency	Improved fish finders were introduced in all three fleets. Improved otter boards are being used by the otter trawlers.
3. Reducing the environmental/ecological impact	Eco-friendly fish boxes are used by all three fleets.
4. Improving fish handling, product quality and food safety	All large otter trawlers were equipped with cold storage and/or freezers. Many jigging vessels were also equipped with cold storage/freezers, and/or tanks with oxygen generators to maintain live catch.
5. Improving safety at sea and working conditions of fishers	Education for crew on safety and the use of personal safety gear are more common on the vessels. Fishing boat position identification devices (e.g. AIS, V-pass, VHS-DSC) have been installed on the vessels.

This techno-economic performance review of selected fishing fleets in Asia presents the findings of six country level studies of fishing fleets in Bangladesh, China, India, Indonesia, Japan and the Republic of Korea. The review includes financial and economic information of 27 major fishing fleet segments, including trawlers, gillnetters, long liners, jiggers, purse seiners, as well as pole and line fishing vessels.

An analysis of the costs and earnings data of these important fishing fleet segments in Asia was carried out using national statistics of 2017 for the Japanese and the Korean fleet segments and 2018-19 survey data for the other countries. 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 theirs 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. It generates usually enough income to cover depreciation costs, interest and loan repayments, and provides 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 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.

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