

# **A Business Case for the Processing and Sale of High Quality Yellowfin Tuna Products from South India**



**A component of the  
World Bank and Global Environmental Fund (GEF)-funded  
Oceans Partnership Programme in the  
Bay of Bengal (OPP-BOB)**

**2018**

## EXECUTIVE SUMMARY

### ***Objective and context***

The objective of the following report is to present a business case focusing on the identification and assessment of opportunities for investment in tuna fishing and processing in south India, which might be attractive to either (or both) private or public investors. The work was undertaken in early 2018 as part of the World Bank/GEF-funded Oceans Partnership Programme in the Bay of Bengal (OPP-BOB), hosted by the Bay of Bengal Inter-Governmental Organisation (BOBP-IGO) in Chennai.

### ***Key definitions***

To start, the business case development focused on two key definitions, as follows:

- *A business case is a document which sets out the justification for the undertaking of a 'project' (or intervention) based on the estimated cost of development (investment) and the anticipated benefits to be gained (returns and outcomes);*
- *The business case is used to say why the forecasted effort and time will be worth the expenditure;*

### ***Methodology***

The methodology used consisted of the following set of steps. First, the setting and context were described and the key issues and factors relevant to the future design and implementation of the business case were examined. Second, the specific business case or opportunity for investment was identified and described. Third, the investors who are likely to be interested in the opportunity were also identified. Fourth, the development options for the business case opportunity were also identified and compared, and the most viable alternative was chosen to take forward. Fifth, the probable time-scale and level of investment required were considered. Sixth, crucially, for investors trying to decide whether they should invest their capital in the opportunity proposed, or in an alternative, the expected performance of the investment was assessed using standard metrics (e.g. return on investment, pay-back period, net present value). Seventh, the assumptions and risks associated with the proposed investment opportunity were identified and then evaluated (sensitivity analysis). Finally, eighth, the overall conclusions and recommendations were presented.

### ***Collaboration and information sources***

The methodology was implemented by a team of international consultants from IDDRA Ltd working in close collaboration with the BOBP-IGO staff, and a large number of different stakeholders in south India, in the BoB region and internationally. A wide range of official and informal information and data were collected and used to underpin the work involved.

### ***Business case (opportunity) identified - key features***

The business opportunity identified concerns the development of a new and innovative trade in high quality yellowfin tuna (YFT), from the Bay of Bengal, to markets in India and also to international markets in the UK, USA and elsewhere, producing a high level of profit and a high return on investment. It is also about achieving a sustainable business opportunity that will generate returns on investment, benefits for actors involved, and a model of sustainable resource exploitation based on low-volumes of high quality fish (the so-called 'three pillars' of sustainable development, which is highly relevant to India).

This opportunity is expected to attract interest and investment from the private sector in the first instance, although public investment (government) may also be relevant (e.g. fisheries development initiatives at the local level are commonly supported by public funds in India).

Investment will be required to develop appropriate systems and facilities to coordinate and operate a suitable supply chain – two options for investment (small- and large-scale) will be considered.

Investment capital will be used to improve the handling and delivery of high quality YFT (raw material) from local fishing vessels (technical capacity-building), and to establish appropriate fish processing facilities and onward trading systems to high-end domestic and international markets (infrastructure and human capacity-building), where YFT attracts high prices.

Benefits will include financial (profits and return on capital) for private firms and their shareholders, and wider economic impacts and benefits (employment, incomes, fiscal contributions and investments) for a broader group of citizens (both within and outside the seafood sector).

### ***Business case analysis - Main conclusions***

[1] **UNTAPPED POTENTIAL:** India does not have a large tuna fishing or processing sector, despite the presence of significant tuna stocks in the nearby Indian Ocean, including YFT, which is highly valued on international seafood markets. In fact, tuna landed from India is often characterized as low quality and low value, and does not reach high-end markets ('business as usual'). This situation represents a potential source of untapped opportunities for both private investors and beneficiaries (individuals or firms) and/or public investors (government and wider society).

[2] **BUSINESS CASE:** On the basis of an investment appraisal exercise (Tables ES1 and ES2), investments in both small- and large-scale processing operations for high quality YFT – forming the basis of a business case for the production and sale of high quality YFT operated by a private firm - showed a high level of performance with significant profits, short payback periods, and both positive and large NPV and RoI scores. Both options performed better than the baseline case 'without investment' (fishing fleet alone, no processing, 'business as usual' based on low quality YFT).

[3] **FISHERIES DEVELOPMENT:** At the fishery level, assuming a sustainable annual catch of 17,500 mt of YFT (with effective management), investment in processing of quality YFT would generate significant returns compared to the 'without investment' scenario (and no processing). The 'with investment' YFT fishery would generate nearly three times more revenue, at least four times more profit (rent), giving a fishery valued at over INR 21 billion (USD 308 million) (capitalised value).

[4] **RISKS AND ASSUMPTIONS:** Sensitivity analysis revealed that two critical factors affected investment performance - landed price and wholesale price. Others were less critical including - fishing boat profitability, investment costs and supply of YFT (fishery or factory sources).

### ***Recommendations:***

[1] It is recommended that potential investors, both within and outside the seafood sector, should give serious consideration to future investment in the production and sale of high quality YFT products from India. The business case appears to be worthwhile, with high levels of profitability and returns on investment, based on the best available data and information, and taking into account a number of assumptions and risks.

[2] It is also recommended, very strongly, that potential investors interested by the above business case should give added and careful consideration to the underlying assumptions and risks. The preliminary analysis has shown that price (landed and wholesale) is a critical factor, and further more robust data is probably required to further evaluate this aspect. Furthermore, the wider context – including considerations of fisheries management and MCS – and the general enabling environment (policy, governance, economy) – should also be examined carefully before committing to a definite investment.

<b>Table ES1. Small-scale investment in Catching, Processing and Sale of High Quality Yellowfin Tuna</b>	
Location	South India (Bay of Bengal coast)
Time horizon	0-20 years
<b>Total Investment</b>	<b>INR 38 million (USD 55,431)</b>
Capital utilization	Fishing boat upgrade (tuna handling/storage) + Onshore processing Plant
Plant capacity	72 tonnes
Financing cost	9.5% (Years 2-4)
Annual profits:	
Fleet	Increase from INR 1.44 million to 4.99 million (USD 20,976 to 72,659)
Processing Plant	Increase from INR 0 to 1.8 million (USD 0 to USD 26,163)
Payback period	3 years
NPV (8%)	INR 30 million (USD 437,406)
RoI	846%
Sensitivity analysis (level of impact on profitability)	Landed tuna price (+10%) and Wholesale tuna price (-10%)
Key assumptions	Effective fisheries management system, including MCS in place and fully operational; Skills capacity for tuna fishing and tuna processing at appropriate high level.

<b>Table ES2: Large-scale investment in Catching, Processing and Sale of High Quality Yellowfin Tuna</b>	
Location	South India (Bay of Bengal coast)
Time horizon	0-20 years
<b>Total Investment</b>	<b>INR 66 million (USD 964,773)</b>
Capital utilization	Fishing boat upgrade (tuna handling/storage) + Onshore processing Plant
Plant capacity	1,800 tonnes
Financing cost	9.5% (Years 2-5)
Annual profits:	
Fleet	Increase from INR 36 million to 125 million (USD 528,762 to 1,816,482)
Processing Plant	Increase from INR 0 to 43 million (USD 0 to USD 626,880)
Payback period	4 years
NPV (8%)	INR 277 million (USD 4,042,464)
RoI	1185%
Sensitivity analysis (level of impact on profitability)	Landed tuna price (+10%) and Wholesale tuna price (-10%)
Key assumptions	Effective fisheries management system, including MCS in place and fully operational; Skills capacity for tuna fishing and tuna processing at appropriate high level.

## **TEAM OF INTERNATIONAL TECHNICAL CONSULTANTS (ITC)**

Dr. Arthur E. Neiland (Team Leader)<sup>1</sup>

Mr. Michael Arbuckle

Dr. Steve Cunningham

Mr. Guillermo Gomez Sanchez

Mr. Philip Townsley

## **ACKNOWLEDGEMENTS AND DISCLAIMER**

The ITC team would like to thank Dr. Y.S. Yadava (Director) and the staff at the BOBP-IGO for their excellent collaboration, advice and support during the course of the work involved in producing this business case. In addition, we are grateful to all the stakeholders in India, within the fisheries sector and beyond, who provided information and who also gave so generously of their time during meetings and field-visits.

This disclaimer governs the use of this report. The information provided herein is a preliminary and first attempt to undertake an investment appraisal for tuna enterprises in India. You must not rely on the information in the report as an alternative to more detailed financial advice from an appropriately qualified professional.

Without prejudice to the generality of the foregoing paragraph, we do not represent, warrant, undertake or guarantee that the use of guidance in the report will lead to any particular outcome or result. We will not be liable to you in respect of any business losses, including without limitation loss of or damage to profits, income, revenue, use, production, anticipated savings, business, contracts, commercial opportunities or goodwill. The information provided and views expressed represent those of the ITC team alone, and not those of the BOBP-IGO or the many stakeholders interviewed and consulted.

## **PHOTOGRAPHS**

All of the photographs included in this report have been provided by Dr. Y.S. Yadava (Director, BOBP-IGO). Photo (1) Front page (left): Dish prepared by Raintree Hotel, Chennai using high quality yellowfin tuna from Puducherry. Photo (2) Front page (right): Small-scale fishing craft at Pudimadaka, Visakhapatnam district, Andhra Pradesh, India.

---

<sup>1</sup> Contact point : IDDRA Ltd, Endeavour Quay, Mumby Road, Gosport, Hants, United Kingdom PO12 1AH;  
Email: neiland@iddra.org

## ACRONYMS AND ABBEVIATIONS

BC	Business Case
BOB	Bay of Bengal
BOBP-IGO	Bay of Bengal Programme Inter-Governmental Organisation
EEZ	Exclusive Economic Zone
EU	European Union
FT	Financial Times
GEF	Global Environment Fund
INR	Indian Rupees
IO	Indian Ocean
IOTC	Indian Ocean Tuna Commission
MCS	Monitoring, Control and Surveillance
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yield
NPV	Net Present Value
OPP-BOB	Oceans Partnership Programme – Bay of Bengal
ROI	Return on Investment
SKJ	Skipjack Tuna
SI	International System of Units
UK	United Kingdom
USA	United States of America
USD	United States Dollars
WB	World Bank
YFT	Yellowfin Tuna

**CURRENCY AND EXCHANGE RATES (August 2018, FT quoted)**

Indian Rupee (INR) 1 = United States Dollar (USD) 0.014

USD 1 = INR 68.61

**UNITS (SI)**

Metric ton (or tonne) (mt) 1 = Kilogram (kg) 1,000

Million (M) = 1 million (1,000,000)

Billion = 1 thousand million (1,000,000,000)

## CONTENTS

		<b>Page</b>
	<b>Executive Summary</b>	ii
	<b>Study Team</b>	v
	<b>Acknowledgements and Disclaimer, Photographs</b>	v
	<b>Acronyms and Abbreviations</b>	vi
	<b>Currency and Exchange Rates, Units</b>	vii
	<b>Main Report</b>	
1.	What is the objective of this business case report?	1
2.	How is the business case developed and presented?	2
3.	What is the setting and context?	3
4.	What is the business opportunity?	4
5.	Who are the likely investors?	9
6.	What are the options considered?	10
7.	What is the time-scale and level of investment?	16
8.	What is the expected performance of the investment?	17
9.	What are the assumptions and risks?	21
10.	What the main conclusions and recommendations?	24
	<b>Appendices</b>	
1	Oceans Partnership Programme – Bay of Bengal (OPP-BOB): Four Business Cases	25
2	Tuna Resources and Landings in the Indian Ocean	28
3	Current Yellowfin Tuna Resources and Long-line and Hand-line Fisheries in the Bay of Bengal (including description of the base case/business as usual)	32
4	India’s Tuna Processing Sector	35
5	Market Considerations (Domestic and Export)	38
6	Yellowfin Tuna Fishing and Processing Operations – Investment Options	44
7	Yellowfin Tuna Fishing and Processing – Investment and Profit Schedule (Cashflow)	47
8	Yellowfin Tuna Fishing and Processing – Investment Performance Metrics	49
9	Yellowfin Tuna Fishery – Bay of Bengal - With and Without Investment – Performance Comparison	51
10	Yellowfin Tuna – Bay of Bengal - Small-scale Investment Case – Sensitivity Analysis	53
11	Yellowfin Tuna – Bay of Bengal - Large-scale Investment Case – Sensitivity Analysis	55
12	Yellowfin Tuna – Small-scale Investment Costs	57
13	Yellowfin Tuna - Large-scale Investment Costs	59
14	Risk Analysis	61
15	Bibliography	67



## 1. WHAT IS THE OBJECTIVE OF THIS BUSINESS CASE REPORT?

Key points
<ul style="list-style-type: none"><li>• This initial section sets the scene and defines the objective of the report;</li><li>• To identify and assess opportunities for investment in tuna fishing and processing in south India, attractive to either (or both) private or public investors, in the first instance;</li><li>• Particular attention will be given to tuna processing, with an emphasis on high quality and high value products targeted at both domestic and international markets, which might offer a high return on investments;</li><li>• India does not have a large tuna fishing or processing sector, despite the presence of large tuna stocks in the nearby Indian Ocean – this could represent a source of tapped potential for both private investors and beneficiaries (individuals or firms) and/or public investors (government and society).</li></ul>

The objective of this business case report is:

***To identify and assess a clear opportunity, or opportunities, for investment in tuna fishing or processing in south India, which might be taken up and implemented by private sector or government stakeholders, or both, leading to the generation of significant benefits.***

The work which underpins this business case has been undertaken as part of the World Bank and GEF-funded Oceans Partnership Programme for Bay of Bengal (OPP-BOB), implemented by the Bay of Bengal Inter-Governmental Organisation (BOBP-IGO) between 2016 and 2018.

From an early stage of the implementation of the OPP-BOB, and while working closely with a wide range of stakeholders, at local, national and international levels, it was recognized that the exploitable tuna resources of the Indian Ocean represent a hugely valuable form of renewable natural capital.

In turn, these IO tuna resources have the potential to underpin the development of a vibrant and profitable fisheries sector, including fishing, processing and trading operators and activities, leading to a positive impact on India's economy through the generation of wealth, taxable revenues, employment and traded goods and services.

On a global basis, tuna fisheries and tuna trade are amongst the most valuable within the overall seafood industry. Tuna products command high prices on both national and international markets in many locations. As a result, many countries have developed large and well-established tuna sectors.

However, India's large and diverse fishing and seafood industry does not focus on tuna or tuna products to any significant extent. Despite the close proximity of valuable tuna resources in the IO, there is little experience of tuna fishing and domestic fish markets have tended to favour other fish and other products.

Overall, therefore, from a preliminary review, tuna resources represent a source of untapped development potential for India. From the perspective of the private sector – investment in tuna fishing, processing and trading activities could generate a net return on this capital (profits), along with a return of capital. From the perspective of government – investment in the appropriate enabling mechanisms (infrastructure, institutions, services) would facilitate the investment and success of private investors leading to wider benefits for society in general.

It should be noted carefully that all investment carries some degree of risk, and there is no guarantee of a successful outcome. A careful identification and analysis of the risks involved will be a central part of the business case development approach.

## 2. HOW WAS THE BUSINESS CASE DEVELOPED AND THEN PRESENTED?

### Key points

- In this section, an outline methodology will be presented in eight steps;
- To start, a business case is defined (as a justification for an intervention or investment);
- Identifying and comparing options is crucial, taking forward the most viable choice;
- Time-scales for investment are described, followed by an assessment of performance;
- Standard metrics (NPV, RoI) calculated, followed by risk analysis;
- A summary should include recommendations and next steps

To start, the business case methodology<sup>2</sup> focused on two key definitions, as follows:

- *A business case is a document which sets out the justification for the undertaking of a 'project' (or intervention) based on the estimated cost of development (investment) and the anticipated benefits to be gained (returns and outcomes);*
- *The business case is used to say why the forecasted effort and time will be worth the expenditure;*

In the context of the OPP-BOB project, the methodology was implemented following a set of steps.

First, the setting and context were described and the key issues and factors relevant to the future design and implementation of the business case were examined.

Second, the specific business case or opportunity for investment was identified and described.

Third, the investors who are likely to be interested in the opportunity were also identified.

Fourth, the development options for the business case opportunity were also identified and compared, and the most viable alternative was chosen to take forward.

Fifth, the probable time-scale and level of investment required was considered.

Sixth, crucially, for investors trying to decide whether they should invest their capital in the opportunity proposed, or in an alternative, the expected performance of the investment was assessed using standard metrics (e.g. Return on Investment, Pay-back period, Net Present Value).

Seventh, furthermore, the assumptions and risks associated with the proposed investment opportunity were identified and then evaluated. Techniques such as sensitivity analyses were applied.

Finally, eighth, the overall conclusions and recommendations for the business case were summarized.

For potential investors who are interested in the business case presented here, the next step would be work with appropriate experts to develop a detailed *business plan*, with reference to the specific goals of the private business or entity involved.

---

<sup>2</sup> The methodology is coherent with the following set of guidelines: Viteri C., Yoshioka J., Castrejón M. (2016). Bankable Business Case Guidelines and Investment Criteria for Sustainable Production Seascapes. Conservation International's consulting report for the World Bank. pp.30.

### 3. WHAT IS THE SETTING AND CONTEXT OF THE BUSINESS CASE?

#### Key points

- In this section, the setting and context of the business case will be described;
- Yellowfin tuna (YFT) resources in Bay of Bengal are part of whole Indian Ocean stock;
- For this BC, MSY (BoB) was established at 35,000 mt (allowable catch at 50%);
- Range of perspectives provided including – Fishery characteristics (small-scale, rudimentary handling and storage procedures). Fishery development constraints (lack of landed, high quality YFT for incomes, processing and trade). Supply chains identified (5 main types, mainly local and bulk export of low quality YFT). Overview of YFT markets (domestic and export – potential for growth in Indian YFT trade is evident, with signs of increased demand for varied products).

#### 3.1. Indian Ocean - Tuna Resources, Landings and Value

The Indian Ocean (IO) accounts for 20% of global tuna landings (about 1 million metric tonnes per year); the Western Central Pacific Ocean region is the largest. IO yellowfin tuna (YFT) landings were 429,800 mt (2014). This represented a 6% increase since 2013, but 19% decline since the 2004 level, 530,000 mt. The MSY for IO YFT has been estimated at 421,000 mt, and stocks are currently considered overfished, and subject to overfishing. Management measures are being considered by the IOTC and its members. The potential sustainable gross annual landed value of YFT is estimated at USD 1 billion, with an annual economic value of over USD 400 million. These are significant values for the economies of the coastal states. Further information is provided in Appendix 2.

#### 3.2. Bay of Bengal (Coast of India) – Tuna Resources

The tuna resources in the Bay of Bengal are part of the YFT stock of the entire Indian Ocean. For the purpose of this analysis, the Maximum Sustainable Yield (MSY) for YFT in the Bay of Bengal has been estimated at 35,000 metric tons (based on discussions with BOBP-IGO experts). The current catch is 24,770 mt. It is proposed for the current business case that catches should be set at 17,500 mt (50% MSY). This catch limit would be subject to management within the IOTC framework, and national rules and regulations.

#### 3.3. Bay of Bengal (Coast of India) - Fishery Characteristics

Fishing for YFT in the Bay of Bengal is carried out near the coastline and within the Indian Exclusive Economic Zone (EEZ). A large proportion of the fleet consists of small-scale, open-deck fishing vessels that utilize hand-lines, long-lines and/or gillnets. Fishing trips range from 1 to 3 days (depending on the fishing region), with a crew of 4 to 5 fishermen. Most of the vessels have two outboard 9 horsepower (hp) engines (or equivalent inboard engine) and a sail (photographs below). The vessels carry no ice and have no onboard preservation equipment; catches are generally left on the open deck after capture. Other larger motorised vessels operate out of ports such as Puducherry, Chennai and Visakh (photographs below).

The lack of adequate onboard handling and preservation practices results in very poor quality fish and low prices (photographs below). Based on stakeholder consultations and interviews conducted with fishermen during field visits, the landed prices received for the fish currently ranges from 60 and 100 INR/kilo (US\$ 0.88 to US\$ 1.48/kg). The fish is sold to traders at these low prices, who in turn re-sell the fish to retailers for sale in local markets or directly ship the product (by truck) to processors located mainly in the Kochi (Kerala) region.

**Photograph (3): Pudimadaki – Small-scale fishing vessels (undecked, using outboards)**



**Photograph (4): Visakh - Motorised fishing vessels (decked, ice in fish hold)**





**Photograph (5): Kochi – Tuna in plastic boxes with minimal ice**



**Photograph (6): Kochi – Tuna catches on market hall floor with limited ice**



Fishermen complain that the prices they get for their YFT are low. Buyers, on the other hand, complain that the fish quality is poor due to inadequate onboard handling and preservation systems and hence they are not willing to pay higher prices. In addition, high levels of histamine in the fish (caused by lack of refrigeration shortly after the fish dies) represents a health hazard to consumers who may be sensitive to histamines and/or spoiled fish.

### ***3.4. Bay of Bengal (Coast of India) – Constraints to tuna fisheries development***

The continuation of the present situation, with limited and rudimentary onboard tuna handling and preservation practices, has a number of serious implications, as follows:

First, the availability of landed high quality YFT will remain low, and fishermen will continue to receive low prices and leading to low incomes (fishers are incentivised to maximise catch).

Second, the limited availability of high quality YFT will continue to represent a source of risk and uncertainty for existing fish processing operators (both financially and in terms of health hazards).

Third, the limited availability of high quality YFT represents a major constraint for the development and expansion of trade with both domestic and export markets, and an obstacle to new entrants and investment in the sector.

Fourth, economic returns from the valuable YFT resources found in the Bay of Bengal will continue to be severely limited, with a minimal positive impact on and contribution to economic development in coastal regions in particular.

### ***3.5. Bay of Bengal (Coast of India) - Tuna processing and utilization***

There are at least five main supply chains by which tuna landed from the Bay of Bengal are processed, marketed and utilized.

First, both YFT and skipjack (SKJ), and other tunas, usually of low quality are purchased by traders, who send them to freezing facilities in refrigerated or iced trucks. No other processing is undertaken, before the consignments of whole frozen fish are packed (sorted or in bulk) in 40' ocean refrigerated containers. These processors then sell the whole frozen fish to international buyers, who generally process the tuna into a canned product. Indian exporters' very low prices compared to other competitors allows for the buyers to assume a relatively high risk when buying tuna products which may have high histamine levels.

Second, the poor quality YFT caught by the small-scale vessels is also consumed in local coastal markets, as it has always done. There is a well-developed network of traders, often women carrying single cartons of fish, and using local buses, taxis and other transport. However, tuna is not a preferred fish variety in most of India so local consumption tends to be relatively limited.

Third, while tuna does not enter urban domestic market in significant volumes at the present time, some changes are evident. A number of major urban centres in India (New Delhi, Mumbai, Bangalore, Chennai and Kochi) seem to be developing new or expanded markets involving affluent consumers from the middle class, as well as expatriates and tourists.

Fourth, a limited number of tuna processors in India are producing value-added products (such as frozen, portion-controlled steaks and fillets) for international markets (U.S. and Europe). There have

been instances in the US market in which products originating from one of these facilities had to be recalled due to health hazards associated with salmonella and high histamines.

Fifth, a few tuna processing facilities in India produce canned tuna products and cooked tuna loins for canning. One of these facilities is located in the Kochi area and its canned tuna and cooked frozen loins products are mainly exported to Tunisia and the Middle East. Interestingly, this processing plant also custom packs canned tuna under strict specifications for India's armed forces.

As highlighted earlier, one of the main constraints faced by India's tuna processing industry in expanding both domestic and export markets is the poor quality of fish resulting from lack of adequate onboard handling and preservation of the fish prior to landing. In addition, there is a lack of an adequate and cost effective cold chain supply infrastructure at the large number of remote locations where the small-scale fishing vessels are landing their catches.

### ***3.6. Tuna markets – Domestic and Export***

#### *Domestic market*

The domestic market for tuna in India is poorly understood at present. A “ball park” estimate of the supply of fresh YFT (low quality) available for consumers in India on a yearly basis is 22,000 metric tons of landed tuna (9,900 mt finished product).

However, consumption of YFT in the metropolitan areas (away from local coastal consumption) seems to be growing, apparently driven by affluent consumers in the middle income class, demand from 5-star hotels and restaurants, and an emerging online market for seafood products. This is a recent trend emerging only in the past few years.

In addition, consumption by expatriate Japanese and Korean communities in major cities and the emergence of sushi style restaurants appear to be contributing to the growth of this market.

Furthermore, India expects to see median incomes per household increase by 90 percent in real terms from 2015 to 2030. This will not only bring discretionary spending power to large groups of new potential foodservice customers, but it will also help transition India from a “bottom of the pyramid” market towards a middle class consumer market with greater and more sophisticated dining-out demand.

Taking into account the data limitations, an educated estimate of the current size of the domestic market for fresh, high quality, YFT could range between 240 metric tons per year to up to 1,000 metric tons per year.

Growth of India's domestic market for fresh, high quality YFT will be dependent upon the growth patterns occurring in the hotel, restaurant, and institutional (HRI) service sector (all associated with both domestic and foreign tourism), and in the expansion of supermarket outlets in major Indian metropolitan areas, which are only starting to expand.

#### *Export trade*

In terms of exports, India's production of fresh, high quality YFT could potentially enter markets in Japan, the United States and many European countries, since there is a growing demand for this product in all three market regions.

The Japanese market usually represents the market where the highest prices are paid for the highest quality (Sashimi Grade A) tuna, when the required characteristics of the product (whole fish or processed loins) are met.

The USA and EU markets (inclusive of the UK), also demand high quality standards; YFT Sashimi Grade A and lower quality products are sold in both markets. Both markets have strict and ever-changing sanitary and labelling requirements for fresh and frozen tuna products. In the US, for instance, sale of frozen YFT treated with CO<sub>2</sub> is allowed, whereas in the UK market and other EU markets, that is not the case. Similarly, the use of other antioxidants is not allowed in the UK market.

For the purpose of this business case, the EU market has been identified as the main target market area, with specific emphasis on the UK market. The EU market, inclusive of the UK, is mainly supplied by both intra-EU and extra-EU imports. EU imports of fresh tunas increased 5.2% per year during the period 2012 to 2016. In 2016, the EU imported approximately 142 million euro of fresh tuna. YFT was the most imported species with a value of 70 million Euros.

The UK, the Netherlands and Belgium imported about 10 million Euros of tunas (mainly YFT), with the Netherlands being the main player (mostly for re-exporting intra-Europe). It is worth noting that the UK market has shown growth of tuna imports of about 23% over the period 2012 to 2015.

Spain, France, Greece, Ireland and Portugal are the main intra-EU suppliers of fresh tuna (80% of the total trade in 2014), with the remaining coming from the developing world with the Maldives, Sri-Lanka and Suriname as the main suppliers of extra-EU fresh tuna trade.

The Maldives is the most important supplier of yellowfin. The mostly hand-line caught fresh YFT from the Maldives accounts for about 7% of the total EU fresh tuna trade.

Prices for YFT in the EU and UK markets vary widely, depending on many factors such as the product presentation (steaks, loins, medallions and skewers), weight, origin, and whether or not the fish comes from a Marine Stewardship Council (MSC) certified fishery. The retail prices for fresh YFT can vary from 8 Euros per kilo (US\$ 9.40/kg) in Spain to up to 39 British pounds (US \$52) per kilogram in the UK market.

Margins at the retail level range between 18 to 25%, and at the wholesale distributor/importer margin may be close to a 100%. Therefore, a kilogram of high quality YFT priced at 600 Indian Rupees (US \$8.82), with an estimated air shipping cost of US\$ 4.00 to the UK (Chennai to London) could be offered to an importer/distributor at around US \$13 delivered.

Adding a 100% margin for the importer/processor would put the price to the retailer at US \$26 per kg. With a 25% margin to the retailer, the final consumer price would be in the neighbourhood of US \$32-33/kg).

UK consumption of chilled fish (all species) purchased at supermarkets represented about 151,700 metric tons in 2017. Tuna accounted for about 7,600 metric tons or about 5% of the total volume. Tuna constitutes the third species consumed in the UK after salmon and cod, ahead of haddock, and warm and cold-water prawns, which represent the top six chilled seafood items purchased by UK consumers.



#### 4. WHAT IS THE BUSINESS OPPORTUNITY?

##### Key Points

- The business opportunity concerns the development of a new and innovative trade in high quality yellowfin tuna (YFT), from the Bay of Bengal, to markets in India and also to international markets in the UK, USA and elsewhere, producing a high level of profit and a high return on investment;
- Also focused on a sustainable business opportunity that will not only generate returns on investment, but also benefits for actors involved, and a model of sustainable resource exploitation based on low-volumes of high quality fish;
- Investment will be required to develop appropriate systems and facilities to coordinate and operate a suitable supply chain;
- Investment capital will be used to improve the handling and delivery of high quality YFT (raw material) from local fishing vessels (technical capacity-building), and to establish appropriate fish processing facilities and onward trading systems to domestic and international markets (infrastructure and capacity-building);
- Benefits will include financial (profits and return on capital) for private firms and their shareholders, and wider economic impacts and benefits (employment, incomes, fiscal contributions and investments) for a broader group of citizens (both within and outside the seafood sector).

##### *The Goal*

The business opportunity, presented in this document, concerns the development of a new and innovative trade in high quality yellowfin tuna (YFT), from the Bay of Bengal, to markets in India and also to international markets in the UK, USA and elsewhere, producing a high level of profit. It is also about achieving a sustainable business opportunity that will generate returns on investment, benefits for actors involved, and a model of sustainable resource exploitation based on low-volumes of high quality fish.

##### *The Kick-start Investment*

To start, investment will be required to develop appropriate systems and facilities, to coordinate and operate a suitable supply chain, from buying and handling locally-caught landed YFT, and then onto processing, marketing, shipments and sales.

All of these arrangements will be centred on the establishment of a single private enterprise, or firm, as the basic unit of development.

Over time, it is expected that the successful establishment of one enterprise would also lead to further local and regional expansion of similar operations.

##### *The Context – A Reminder*

YFT is amongst the most commercially valuable and widely traded seafood commodities (and products in various forms) on a global basis.

The YFT stocks of the Bay of Bengal underpin a fishery distributed along the east coast of India, and operated by a fleet of small-scale, inshore fishing vessels, using rudimentary equipment (long-lines, hand-lines) and onboard facilities (non-refrigerated fish-holds).

The resulting landed catch of YFT is typically of low quality and sold for a low price. It enters a value-chain which is focused on the sale and distribution of this low value product to both domestic and international markets.

As a consequence, the prices realised by both fishermen (landed price) and fish buyers and processors (wholesale price) are relatively low. In turn, this translates into a relatively low return on investment and low earnings, compared to what could be achieved with high quality fish for sale and as raw

material for further processing and value addition. In other words, a relatively small proportion of the potential value of the YFT is realized, or captured, by the actors involved, either individual fishers, fishing firms or processing firms.

Furthermore, at the level of the wider economy, the potential contribution of YFT fishing, and the activities associated with the value chain, is relatively limited and sub-optimal compared to its full potential. By comparison, in other countries, including neighboring Sri Lanka and the Maldives, YFT fisheries, and the associated value chains, focus on high quality and high value products, traded mainly to international markets, offering the potential for relatively higher returns and earnings.

### ***Investment capital utilization***

Investment capital will be used in two ways, as follows: First, to support the establishment of a consistent supply of high quality landed fish (to be sold at a higher price than low quality fish). Second, to establish appropriate onshore processing facilities and operations to utilise this raw material (YFT) to produce, market, sell and ship high quality YFT seafood products to a range of domestic and international markets (high-end, where high quality attracts premium prices).

### ***Potential benefits and beneficiaries***

The potential benefits and the beneficiaries will be found at a number of levels, as follows: First, and fore-most, at the level of the firm, the new private fish processing enterprises established will generate significant financial benefits including revenues, profits, a return on investment capital and a return of the investment capital. Major beneficiaries will be the private investors and the share-holders of the companies involved.

Second, more generally, the establishment of profitable and viable fish processing enterprises will help to strengthen the YFT value chain, and contribute to the local, regional and national economies – through the generation of employment opportunities and incomes (economic impacts) – and through the generation of economic profits (a potential investable surplus in other parts of the economy) and also tax revenues (for use by government to invest in services and development activities).

Major beneficiaries will include a broad range of actors – a stable, profitable and valuable seafood sector will offer direct employment opportunities in seafood companies (e.g. yellowfin tuna processing and exporting), as well as in supporting and ancillary activities (e.g. suppliers of inputs and services, such as packaging and transportation). Fishers will benefit from higher earnings from fishing (for owners and crew) and improved livelihoods for them and their families (income, access to education and health care, and nutrition). The use of a potential economic profits (by the private sector) and tax revenues (by government) for investment in the economy is also likely to benefit a broad range of citizens.

Third, in terms of non-financial benefits (as opposed to financial and economic benefits) – well-established fish processing companies and a strong seafood sector will provide a range of social and environmental benefits including – a safe and assured supply of seafood to markets, employment at a local level to help stabilize and support prosperous rural and urban communities, and incentives to manage the underpinning fisheries on a productive and sustainable basis. The major beneficiaries will be citizens at a number of levels including – consumers who purchase seafood on a regular basis, people living in both urban and rural communities, and national citizens in general who will benefit either directly or indirectly through the contribution of well-managed fisheries to the country's activities and well-being.

## 5. WHO ARE THE LIKELY INVESTORS?

### Key points

- In the first instance, the business case is most likely to attract private investors (at the level of the firm), given the potentially high level of profitability and return on investment;
- Government (public) investors might also partner with private investors under some circumstances (e.g. provide technical assistance, specific lending facilities for communities), but they are better placed to strengthen the enabling environment and governance arrangements;
- International funds and support may be relevant in some situations (e.g. supporting development policy)

#### *Private investment*

In the first instance, the business case is most likely to attract private investors (at the level of the firm). With a potentially high level of profitability and a good return on investment (compared to other enterprises), investors from both within and also outside the seafood sectors are possible. This might also include national (Indian) and international investors.

For existing seafood sector actors – both fishers and fish processors – the proposed business case could represent a new venture, or there is also the possibility that the activities involved (YFT quality supply and processing and trading) could become an addition or enhancement to existing operations. For investors with no experience of the seafood industry, the potential returns are likely to be attractive, but careful investors will pay careful attention to the potential risks involved. The idea of partnering with other investors, with relevant experience, could be an option.

#### *Public investment*

Government (public investment) might also be attracted by the business case for three reasons – and largely because this could be coherent to national policy on fisheries development.

First, government funding for the fisheries sector in India might be made available to assist private firms to tackle technical constraints (e.g. onboard handling facilities and techniques). This could include ‘investment in kind’ through technical support schemes (e.g. government experts provided at low cost).

Second, government funding might be available for community investment in fish processing and trading enterprises and activities, where commercial loans are not accessible. In this case, government loans might be given at concessionary rates, and linked to ‘hand-holding’ conditionality for the planning and implementation of the investment in a specific operation. Once again, the provision of government support would probably be linked to specific policy targets.

Third, government investment in other related areas (e.g. FM and MCS services) may limit the availability of funds for investment in commercial seafood operations, through community groups or in partnership with dedicated commercial companies. In fact, there is a strong case (based on international experiences) that public funds should avoid near-market activities, since private firms have a comparative advantage, and the past performance tends to be low. Instead, government and public funds have a vital role in supporting an enabling environment for private investment activities, through establishing strong governance arrangements (policy, institutions, and processes).

#### *International bi-lateral and multi-lateral finance and impact investors*

The business case might also be attractive to international funding – either through bi-/multi-lateral organizations, or through impact investors – especially if the combination of likely financial and non-financial benefits have a recognizable development impact and are linked to policy (e.g. rural development, economic development in coastal areas).

## 6. WHAT ARE THE INVESTMENT OPTIONS CONSIDERED?

Key points
<ul style="list-style-type: none"><li>• Four options for investment in high-quality YFT processing are presented – the baseline option (no investment in small or large-scale operations), a small-scale investment and a large-scale investment;</li><li>• Investment in small-scale operation (4 boats) - fishing boat upgrade (INR 380,923 or USD 5,552) and a processing facility (INR 3,422,184 or USD 49,879). <b>A total investment of INR 3.8 M or USD 55,431.</b></li><li>• For large-scale operation (100 boats) - fishing boat upgrade (INR 9,523,068 or USD 138,800) and a processing facility (INR 56,670,000 or USD 825,973). <b>A total investment of INR 57 M or USD 965 K.</b></li><li>• In both cases, landed price (YFT) is expected to rise to INR 200/kg or USD 2.92/kg.</li></ul>

Four options for investment in YFT processing are presented – the baseline option (no investment in small or large-scale operations), a small-scale investment and a large-scale investment. A profile of each option is presented in detail in Appendix 6 (Table 6 below provides a summary).

### *Small-scale operator – baseline (without investment)*

To start, the baseline for the small-scale investment case considers an operator (individual fishermen or small firm) using 4 small inshore fishing boats. Each vessel catches 100 kg YFT per trip, and each boat undertakes 180 trips per year. The annual catch is, therefore, 72,000 kg per year. The vessels land low quality YFT (there is only basic handling practices and the vessels cannot preserve the catch, with limited ice and no refrigeration). The landed price of the fish is low (INR 100/kg or USD 1.46/kg), giving an annual turnover of INR 7.2 M (USD 105,120). The annual operating cost per boat is INR 1,080,424 (USD 15,747). The small-scale operator does not process any of the YFT which is landed by this operation.

### *Small-scale operator – investment case*

Following on from the baseline case (above), an investment is proposed in the small-scale operation (using 4 inshore fishing boats, 100 kg catch/trip, 180 trips per year) in two ways – first, to improve onboard handling and storage (ice) – and second, to construct and operate a small facility to process the high quality YFT (landed by the four boats). **The landed price has now risen (INR 200/kg or USD 2.92/kg)**. The annual operation costs per boat have also risen (INR 1,107,424 or USD 16,141). The new processing facility has a capacity of 72,000 kg per year. The processing costs per year (post investment) are INR 2,236,960 (or USD 32,604). As a result of the investment, the sale value of the YFT would be INR 256/kg (or USD 3.73/kg). Overall, the investment proposed would be a fishing boat upgrade (INR 380,923 or USD 5,552) (see Photograph 7), and a processing facility investment (INR 3,422,184 or USD 49,879). A total investment of INR 3.8 M or USD 55,431 (see Appendix 12 for full details).

### *Large-scale operator – baseline (without investment)*

The baseline for the large-scale investment considers an operator (a firm) using 100 inshore fishing boats. Each catches 100 kg YFT per trip, and each boat undertakes 180 trips per year. The annual catch is, therefore, 1,800 t per year. The vessels land low quality YFT (there is only basic handling practices and the vessels cannot preserve the catch, with limited ice and no refrigeration). The landed price of the fish is low (INR 100/kg or USD 1.46/kg), giving an annual turnover of INR 180 M (USD 2.63 M). The annual operating cost per boat is INR 1,080,424 (USD 15,747). This operator does not process any of the YFT which is landed by this operation.

### *Large-scale operator – investment case*

Following on from the baseline case (above), an investment is proposed in the large-scale operation in two ways – first, to improve onboard handling and storage (ice) – and second, to construct and operate

a facility to process the high quality YFT (landed by the 100 boats). **The landed price has now risen (INR 200/kg or USD 2.92/kg)**. The annual operation costs per boat have also risen (INR 1,107,424 or USD 16,141). The new processing facility has a capacity of 1,800,000 kg per year. The processing costs per year (post investment) are INR 57,789,791 (or USD 842,294). As a result of the investment, the sale value of the YFT would be INR 256/kg (or USD 3.73/kg). Overall, the investment proposed would be a fishing boat upgrade (INR 9,523,068 or USD 138,800) and a processing facility investment (INR 56,670,000 or USD 825,973) (see Photograph 8). A total investment of INR 66 M or USD 964,773 (see Appendix 13 for full details).

**Table 6.**

<b>Profile of Baseline and Investment Cases - Small-scale and Large-scale Tuna Operations</b>			
Line no.			
1	<b>NPV calculation discount rate</b>		<b>0.08</b>
2	<b>Xrate</b>		<b>68.61</b>
3	<b>Investment financing rate % (IMF lending rate to India )</b>		<b>9.5</b>
4	<b>Small investment baseline case</b>	INR	USD
5	Landed price to boat INR/ kg	100	1.46
6	Number of boats	4	4
7	Catch per trip / boat (kg)	100	100
8	Trips per year / boat	180	180
9	Annual operating cost per boat	1,080,424	15,747
10	Processing capacity per operation per year	72,000	72,000
11	Processing costs post investment per annum	0	0
12	Sale value post investment per kg g/w	256	3.73
13	Boat investment costs	0	0
14	Processor investment cost	0	0
15			
16	<b>Small investment case</b>		
17	Landed price to boat INR/ kg	200	2.92
18	Number of boats	4	4
19	Catch per trip / boat (kg)	100	100
20	Trips per year / boat	180	180
21	Annual operating cost per boat (includes boat capital costs)	1,107,424	16,141
22	Processing capacity per operation per year	72,000	72,000
23	Processing costs post investment per annum	2,236,960	32,604
24	Sale value post investment per kg g/w	256	3.73
25	Boat investment costs	380,923	5,552
26	Processor investment cost	3,422,184	49,879
27			
28	<b>Large investment baseline case</b>		
29	Landed price to boat INR/ kg	100	100.00
30	Number of boats	100	100
31	Catch per trip / boat (kg)	100	100
32	Trips per year / boat	180	180
33	Annual operating cost per boat (includes boat capital costs)	1,107,424	15,747
34	Processing capacity per operation per year	1,800,000	1,800,000
35	Processing costs post investment per annum	0	0
36	Sale value post investment per kg g/w	256	3.73
37	Boat investment cost	0	0
38	Processor investment cost	0	0
39			
40	<b>Large investment case</b>		
41	Landed price to boat INR/ kg	200	2.92
42	Number of boats	100	100
43	Catch per trip / boat (kg)	100	100
44	Trips per year / boat	180	180
45	Annual operating cost per boat (includes boat capital costs)	1,107,424	16,141
46	Processing capacity per operation per year	1,800,000	1,800,000
47	Processing costs post investment per annum	57,789,791	842,294
48	Sale value post investment per kg g/w	256	3.73
49	Boat investment costs	9,523,068	138,800
50	Processor investment cost	56,670,000	825,973



**Photograph 7: Vessel upgrade – use of insulated boxes for tuna storage**



**Photograph 8: Factory facility for processing high grade tuna**



**Photograph 10: High quality yellowfin tuna used to prepare sushi dish (Raintree Hotel, Chennai)**



**Photograph 10: High quality yellowfin tuna used in sushi dish (Raintree Hotel, Chennai)**



## 7. WHAT IS THE TIME-SCALE AND LEVEL OF INVESTMENT?

### Key points

- A time horizon of 20 years is used for the investment and cash-flow schedule;
- **For the small-scale investment (USD 55,431)**, boat investment (4 boats) occurs over 16 years (4 steps), and a single investment in the processing facility (year 1), reaching operating capacity by Year 3. Payback period is 3 years;
- **For the large-scale investment (USD 964,773)**, boat investment (100 boats) occurs over 16 years (4 steps), and a single investment in the processing facility (year 1), reaching operating capacity by Year 5. Payback period is 4 years.

The time-scale and level of investment for the both the small-scale operation and the large-scale operation are presented in detail in Appendix 7, including a cash-flow and profit schedule.

#### *Small-scale investment*

For the small-scale investment a time-horizon of 20 years is used. Investment (USD 1,388) in boats takes place in Years, 1, 6, 11 and 16 (Total USD 5,552). The number of boats is built up from 1 (Year 1) to 4 (by Year 3) while the total investment (USD 49,879) in the processing plant occurs in Year 1. The plant capacity is built up from 5% (Year 1) to its standard level of 40% or 72 tonnes per year (Year 3). The financing cost of the investment is 9.5% (based on the IMF lending rate to India) charged over Years 2-4. **Total investment equals USD 55,431.**

The net profit (cumulative) starts off at (-) USD 47,996 (Year 1) and reaches (+) USD 7,480 (Year 4). The Payback Period on this investment is therefore 3 years. The annual operating profit remains at USD 26,163 after Year 3.

#### *Large-scale investment*

For the large-scale investment a time-horizon of 20 years is also used. Investment (USD 34,700) in boats takes place in Years, 1, 6, 11 and 16. The number of boats is built up from 0 (Year 1) to 100 (by Year 5) while the total investment (USD 825,973) in the processing plant occurs in Year 1. The plant capacity is built up from 0% (Year 1) to its standard level of 100% or 1,800 tonnes per year (Year 5). The financing cost of the investment is 9.5% (based on the IMF lending rate to India) charged over Years 2-5. **Total investment equals USD 964,773.**

The net profit (cumulative) starts off at (-) USD 860,673 (Year 1) and reaches (+) USD 485,933 (Year 5). The Payback Period on this investment is therefore 4 years. The annual operating profit (processing plant) remains at USD 626,880 after Year 4.



## 8. WHAT IS THE EXPECTED PERFORMANCE OF THE INVESTMENTS?

### Key points

- On the basis of an investment appraisal exercise, investment in both small- and large-scale processing operations for high quality YFT showed a high level of performance with significant profits, short payback periods, and both positive and large NPV and RoI scores.
- Overall, investment in the large-scale operation showed greater returns than the small-scale unit;
- At the fishery level, assuming an annual catch of 17,500 mt of YFT, investment in processing of quality YFT would generate significant returns compared to the ‘without investment’ scenario (and no processing);
- The ‘with investment’ YFT fishery would generate nearly three times more revenue, at least four times more profit (rent), giving a fishery valued at over USD 308 million (capital value);
- This entire appraisal is based on a preliminary model, and careful consideration and analysis of likely assumptions and risks is required (next section) BEFORE any future investment is committed.

Two perspectives were used to examine the expected performance of the investments in YFT onboard handling and processing at small- and large-scale levels of operation (with associated small and large investments), as follows:

#### *[1] Investment appraisal – operational (firm) level*

The expected performance of each investment – for the small-scale operations and for the large-scale operations (compared against their respective baseline operations) – were determined and presented in the form of standard investment appraisal metrics including the following:

- Annual returns to crew
- Annual fleet profit
- Annual processor profit
- Payback Period (years)
- Net Present Value (NPV) of Investment (8%)
- Return on Investment (RoI)

The results of this analysis are presented in Table 8, and Fig. 8a and Fig.8b. A more detailed exposition of the results is also presented in Appendix 8.

#### *Small-scale operation*

In the case of the small-scale operation and investment, the results indicate that the investment in the fishing boat operations and the setting up and implementation of the fish processing unit for high quality YFT has a positive impact.

Total investment: USD 55,431.

The annual returns to the crew increase from USD 20,976 to USD 72,659.

The annual fleet (boat) profit also increases from USD 20,976 to USD 72,659.

The annual processor profit increases from USD 0 to USD 26,163.

The payback period for the investment is 3 years.

The NPV for the investment is USD 437,406. The return on investment (RoI) is 846%.

#### *Large-scale operation*

In the case of the large-scale operation and investment, the results indicate that the investment in the fishing boat operations and the setting up and implementation of the fish processing unit for high quality YFT also has a positive impact.

Total investment: USD 964,773.

The annual returns to the crew increase from USD 528,762 to USD 1,816,482.

The annual fleet (boat) profit also increases from USD 528,762 to USD 1,816,482.

The annual processor profit increases from USD 0 to USD 626,880.

The payback period for the investment is 4 years.

The NPV for the investment is USD 4,042,464. The return on investment (RoI) is 1185%.

## ***[2] Investment appraisal – fishery level***

A table which summarises the impact of the investments (small- and large-scale) at the fishery level in the Bay of Bengal is presented in Appendix 9. It is assumed that an annual harvest of 17,500 mt of YFT could be taken on a sustainable basis (using latest data and advice).

### ***Without investment scenario***

Under the ‘without investment’ baseline scenario, it would require 972 fishing boats to take the specified harvest above.

The total crew and fleet profits would amount to USD 5,140,743 each.

It is assumed that there is no processing of high quality YFT.

Therefore, overall, the total fishery revenue for all operations would be USD 25, 506,486.

The total profit (or rent) would be USD 5,140,743 (20% of fishery revenue).

The total economic benefits (crew share and profit) would be USD 10,281,486.

On this basis, the capital value of the fishery would be USD 64, 259,287.

### ***With investment scenario***

By comparison the ‘with investment’ scenario gives an improved level of fishery performance.

It is assumed that investments would be made in 43 small operations and 8 large operations.

Total processing capacity would be 17,500 mt.

The total investment (small and large operations) would be USD 8,775,342.

Therefore, overall, the total fishery revenue for all operations would be USD 65,296,604.

The total profit (or rent) would be USD 23,801,737 (36% of fishery revenue).

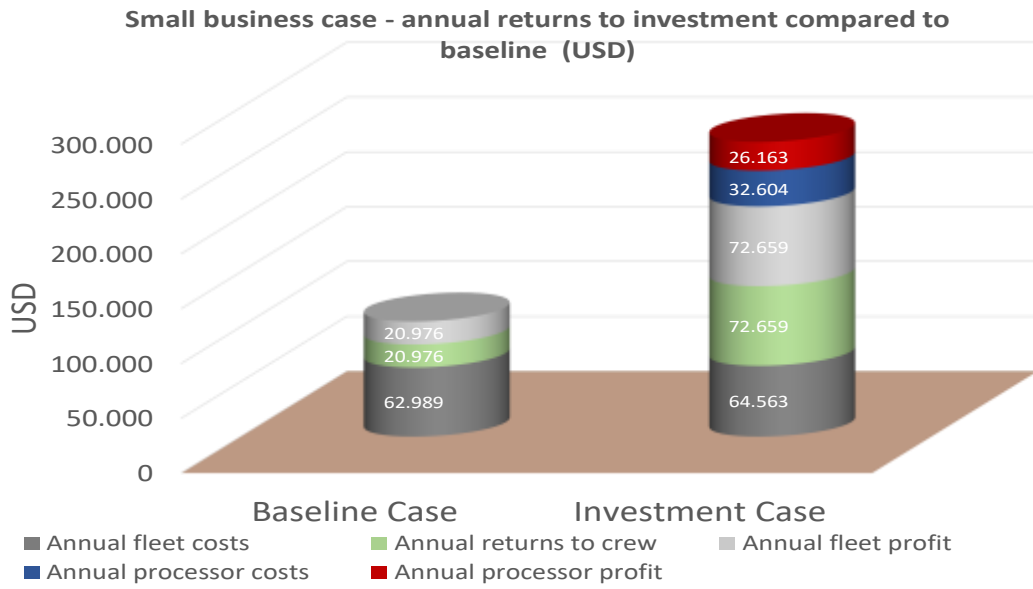
The total economic benefits (crew share and profit) would be USD 41,461,978.

On this basis, the capital value of the fishery would be USD 308,595,434.

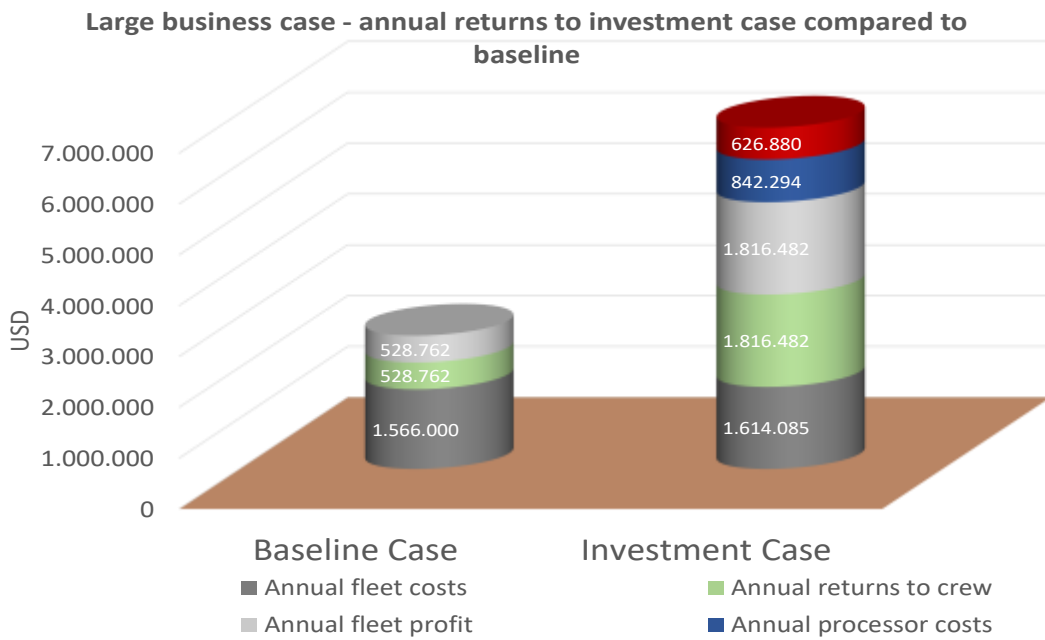
**Table 8: Investment appraisal**

<b>(A) Small processor investment compared to baseline (USD)</b>		
	<b>Baseline Case</b>	<b>Investment Case</b>
<b>Annual fleet catch (kg)</b>	72,000	72,000
<b>Number of boats</b>	4	4
<b>Annual fleet costs</b>	62,989	64,563
<b>Annual returns to crew</b>	20,976	72,659
<b>Annual fleet profit</b>	20,976	72,659
<b>Annual processor costs</b>	0	32,604
<b>Annual processor profit</b>	0	26,163
<b>Investment cost (boats)</b>	0	5,552
<b>Investment cost (processor)</b>	0	49,879
<b>Internal Rate of Return (IRR)</b>	0	#DIV/0!
<b>Return on Investment (RoI)</b>	0	846%
<b>Payback period (years)</b>	0	3
<b>NPV of investment</b>	0	437,406
<b>(B) Large processor investment compared to baseline (USD)</b>		
	<b>Baseline Case</b>	<b>Investment Case</b>
<b>Annual fleet catch</b>	1,800,000	1,800,000
<b>Number of boats</b>	100	100
<b>Annual fleet costs</b>	1,566,000	1,614,085
<b>Annual returns to crew</b>	528,762	1,816,482
<b>Annual fleet profit</b>	528,762	1,816,482
<b>Annual processor costs</b>	0	842,294
<b>Annual processor profit</b>	0	626,880
<b>Investment cost (boats)</b>	0	138,800
<b>Investment cost (processor)</b>	0	825,973
<b>Internal Rate of Return (IRR)</b>	0	#DIV/0!
<b>Return on Investment (RoI)</b>	0	1185%
<b>Payback period (years)</b>	0	4
<b>NPV of investment</b>	0	4,042,464

**Fig. 8 (a).**



**Fig. 8 (b)**



## 9. WHAT ARE THE ASSUMPTIONS AND RISKS?

Key Points
<ul style="list-style-type: none"><li>• Sensitivity analysis was used for each investment case to examine five key variables as follows: Fishing boat profitability, Landed price of YFT, Investment costs, Wholesale price of YFT, Supply of YFT product to market;</li><li>• For <u>fishing boat profitability</u>, an increase in landed price (to INR200/kg) is sufficient to allow the catch of YFT per boat to reduce from 100 kg to 40 kg (per trip per boat) without having much effect overall;</li><li>• Two critical factors for investment performance are <u>landed price</u> and <u>wholesale price</u> (10% change limits)</li><li>• <u>Investment costs</u> changes (20%) do not have a major impact;</li><li>• <u>Supply of YFT</u> (fishery or factory) is important, but secondary to price changes (above);</li></ul>

A critical step in investment appraisal is to examine the key assumptions which underpin the analysis, and to assess the risks involved.

A sensitivity analysis was used for each investment case to examine five key variables as follows:

- Fishing boat profitability
- Landed price of YFT
- Investment costs
- Wholesale price of YFT
- Supply of YFT product to market

The results for the small-scale investment are shown in Appendix 9. and Fig. 9(a).

The results for the large-scale investment are shown in Appendix 10 and Fig. 9(b).

### *Small-scale investment*

For fishing boat profitability, an increase in landed price (to INR200/kg) is sufficient to allow the catch of YFT per boat to reduce from 100 kg to 40 kg (per trip per boat) without having much effect overall. Of course, this outcome would not be optimal for vessel profitability.

The next four variables are considered in terms of the impact of % changes on the NPV of the investment (using the NPV of USD 437K, calculated originally, above, as the investment baseline).

Landed price of YFT appears to be critically important, and the analysis shows that NPV is highly sensitive to change (as revealed by the slope of the line, Fig. 9a). With a > 10-15% increase in landed price, the NPV becomes negative (- USD149K) and RoI is also negative (-113%). With price increases the investment is therefore risky and not worthwhile.

By comparison, the impact of investment costs appears to have limited impact on the NPV (as evidenced by the near-horizontal curve) and also on the other variables (for example, with a +/- 20% change in investment cost, the RoI remains high).

Wholesale price is also critically important (as shown by the steep slope of the curve). With a 10% drop in price the investment is put at high risk (with a negative NPV and RoI). The investment case at 600/400 INR for loins and bits (256 INR green weight) is unlikely to be competitive (for a start the estimated yield of 45% is well below other regional experiences).

Supply could also become an important factor (either driven by factory capacity or availability). This factor does become critical at certain points so, combined with price pressure, could be a key issue.

### ***Large-scale investment***

The results for the large-scale investment in YFT boat/handling and processing are also similar to that for the earlier small-scale option.

For fishing boat profitability, an increase in landed price (to INR200/kg) is sufficient to allow the catch of YFT per boat to reduce from 100 kg to 40 kg (per trip per boat) without having much effect overall. Similarly, this outcome would not be optimal for vessel profitability.

The next four variables are considered in terms of the impact of % changes on the NPV of the investment (using the NPV of USD 4 million calculated originally, above, as the investment baseline).

Landed price of YFT appears to be critically important, and the analysis shows that NPV is highly sensitive to change (as revealed by the slope of the line, Fig. 9b). With a > 10-15% increase in landed price, the NPV becomes negative (- USD1.99 million) and RoI is also negative (-104%). With price increases the investment is therefore risky and not worthwhile.

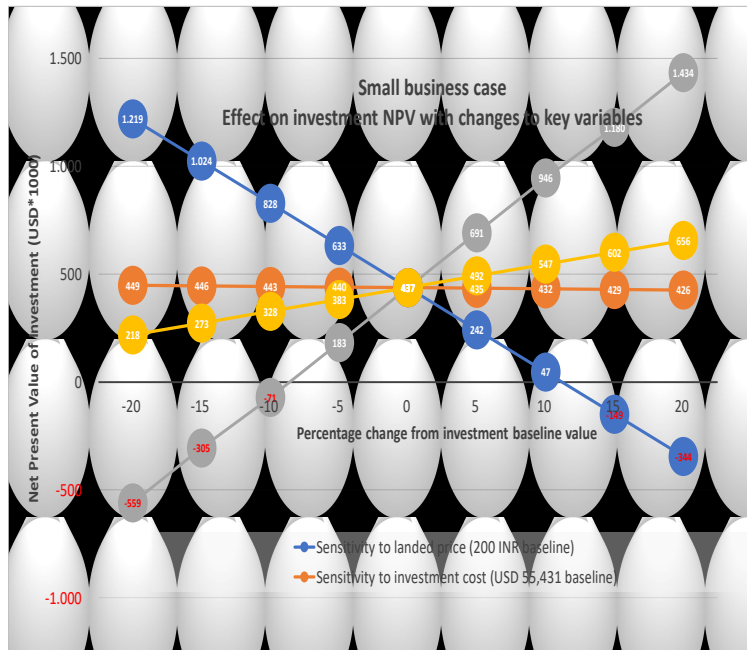
By comparison, the impact of investment costs appears to have limited impact on the NPV (as evidenced by the near-horizontal curve) and also on the other variables (for example, with a +/- 20% change in investment cost, the RoI remains high).

Wholesale price is also critically important (as shown by the steep slope of the curve). With a 10% drop in price the investment is put at high risk (with a negative NPV and RoI).

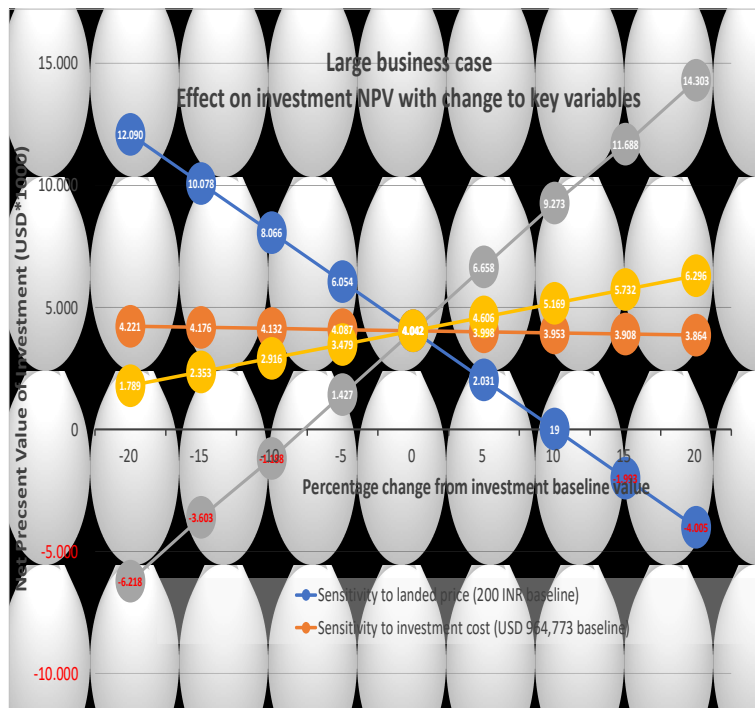
Supply could also become an important factor (either driven by factory capacity or availability). This factor does become critical at certain points so, combined with price pressure, could be a key issue.

A further detailed discussion of risks is provided in Appendix 14.

**Fig. 9(a)**



**Fig. 9 (b)**



## **10. WHAT ARE THE MAIN CONCLUSIONS AND RECOMMENDATIONS?**

### **Main conclusions**

[1] **UNTAPPED POTENTIAL:** India does not have a large tuna fishing or processing sector, despite the presence of significant tuna stocks in the nearby Indian Ocean, including yellowfin tuna (YFT), which is highly valued on international seafood markets. In fact, tuna landed from India is often characterized as low quality and low value, and does not reach high-end markets. This situation represents a potential source of untapped opportunities for both private investors and beneficiaries (individuals or firms) and/or public investors (government and society).

[2] **BUSINESS CASE:** On the basis of an investment appraisal exercise, investments in both small- and large-scale processing operations for high quality YFT – forming the basis of a business case for production and sale of high quality YFT aimed at private firms- showed a high level of performance with significant profits, short payback periods, and both positive and large NPV and RoI scores.

[3] **FISHERIES DEVELOPMENT:** At the fishery level, assuming an annual catch of 17,500 mt of YFT, investment in processing of quality YFT would generate significant returns compared to the ‘without investment’ scenario (and no processing). The ‘with investment’ YFT fishery would generate nearly three times more revenue, at least four times more profit (rent), giving a fishery valued at over USD 308 million (capital value).

[4] **RISKS AND ASSUMPTIONS:** Sensitivity analysis revealed that two critical factors affected investment performance - landed price and wholesale price. Others were less critical including - fishing boat profitability, investment costs and supply of YFT (fishery or factory sources).

### **Recommendations:**

[1] It is recommended that potential investors, both within and outside the seafood sector, should give serious consideration to future investment in the production and sale of high quality YFT products from India. The business case appears to be worthwhile, with high levels of profitability and returns on investment, based on the best available data and information, and taking into account a number of assumptions and risks.

[2] It is also recommended, very strongly, that potential investors interested by the above business case should give added and careful consideration to the underlying assumptions and risks. The preliminary analysis has shown that price (landed and wholesale) is a critical factor, and further more robust data is probably required to further evaluate this aspect. Furthermore, the wider context – including considerations of fisheries management and MCS – and the general enabling environment (policy, governance, economy) – should also be examined carefully before committing to a definite investment.



## **APPENDIX 1**

### **OCEANS PARTNERSHIP PROGRAMME – BAY OF BENGAL**

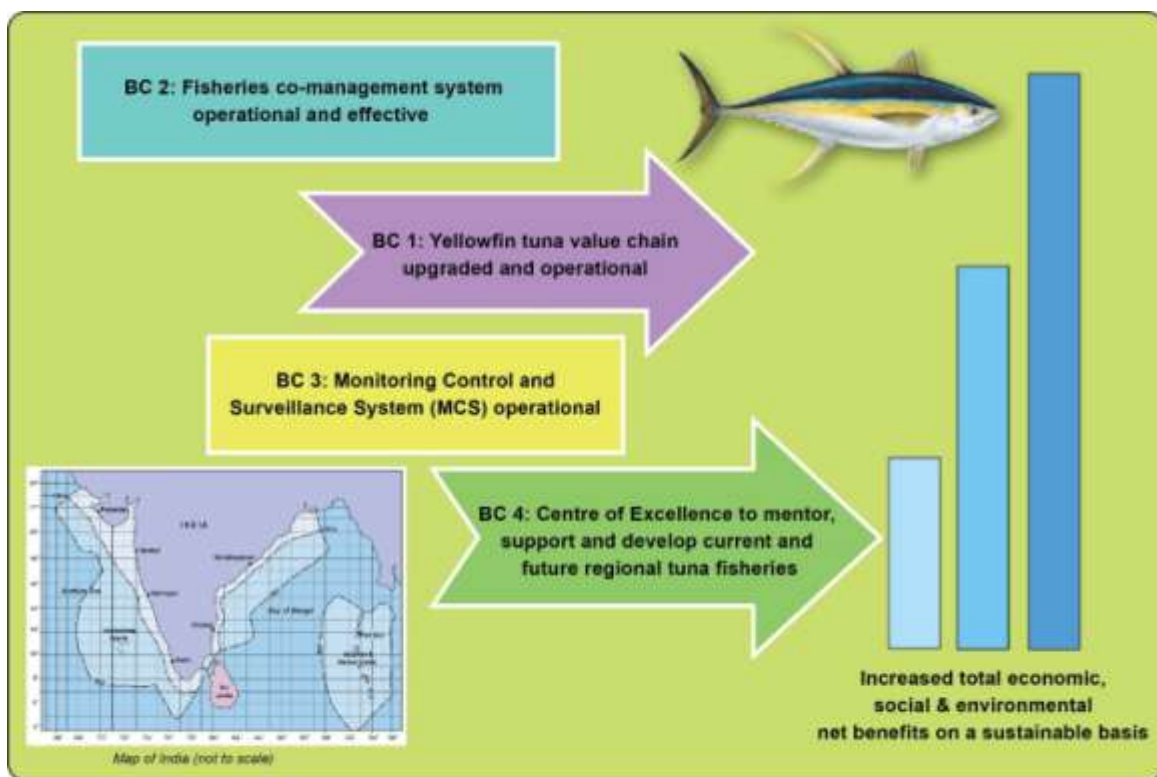
#### **FOUR BUSINESS CASES**

## BRIEFING NOTE: Oceans Partnership Project – Bay of Bengal (TF 018233)

Four business cases (BC) are currently under development, with a final delivery date of 31 December 2018.

The underlying process has involved widespread stakeholder consultations and detailed analysis in India and the Bay of Bengal (BoB) Region. The likely performance of the investments involved – with reference to triple bottom line outcomes (economic, social and environmental net benefits) – has been examined using a cost-benefit analysis framework. Furthermore, careful attention has been paid to possible investment opportunities from both national and international sources. The relationships between the BC, as part of an integrated approach to fisheries development, are illustrated below.

It should be noted that the upgrading and future operation of the **tuna value chain** will be dependent on the establishment and operation of an effective fisheries **co-management system** and an **MCS system**. In the long-run, it is planned that regional tuna fisheries and value chains will be supported, mentored and developed with the assistance of a **Regional Centre of Excellence** offering, in particular, a wide range of dedicated capacity-building opportunities and services for the institutions and stakeholders involved.



OPP-BOB: Inter-relationships between the Four Business Cases

### BC 1: Fish Quality Business Case for Yellowfin Tuna (YFT)

Increasing the supply of consistent high quality longline and handline caught YFT will provide a solid framework to support the sustainable development of existing and future YFT processing operations to meet current and future domestic and export market needs. Investments will result in strengthening the current value chains. The increased supply of high quality YFT will originate from the existing small-scale fishing vessels and will be supported via fishermen/

processor driven training programmes for improved onboard handling and fish preservation practices, accompanied by price premiums paid for high quality fish. Options for investment will be provided.

## **BC 2: Co-Management for Line Fisheries for Yellowfin Tuna (YFT) in Puducherry**

Investment in a co-management mechanism for line-caught fisheries for YFT in Puducherry will establish means for local actors in the YFT value chain to manage their fishery in close consultation with concerned institutions, researchers and local co-management committees. Supported by the other related business cases, this investment will establish an example of functioning co-management where the benefits from improved fishing activities are captured by producers and local handlers, as well as other actors further up the value chain. The sustainability of these fisheries activities will be ensured through a combination of incentives for quality production and traceability of product. This will provide an example of co-management in practice to support both the Government of India's National Policy on Marine Fisheries (NPMF), 2017 and the Government of the Union Territory of Puducherry in their efforts to establish co-management of fisheries. A positive example of alternative approaches to fisheries management could be extended to adjacent coastal areas where there are similar conditions and opportunities.

## **BC 3: MCS for Yellowfin Tuna (YFT) for the EEZ of India in the Bay of Bengal**

The Monitoring, Control and Surveillance (MCS) investment will increase sustainable economic returns recovered from YFT fishing in the Indian Exclusive Economic Zone (EEZ) of the BoB to 50% of their estimated potential value within ten years [to USD220 million]. The dedicated MCS investment in the YFT fishery will provide a stable investment and operating environment for the profitable and sustainable use of YFT and implement measures to improve fisher economic opportunities and resilience against environmental and economic shocks. The MCS investment will be designed to support value chain development and co-management initiatives. Building on the Government of India's NPMF, 2017, the investment will enhance new policy initiatives in MCS directly and through integration with value chain development programmes. Options for investment in the development of MCS systems for sub-regional application will also be provided. Target investors will encompass international and national government agencies as well as private sector interests. An investment of [USD 25 million] over 10 years will provide a high Return on Investment of [over 200%]. *(Figures in brackets may change based on on-going work during development of the BC)*

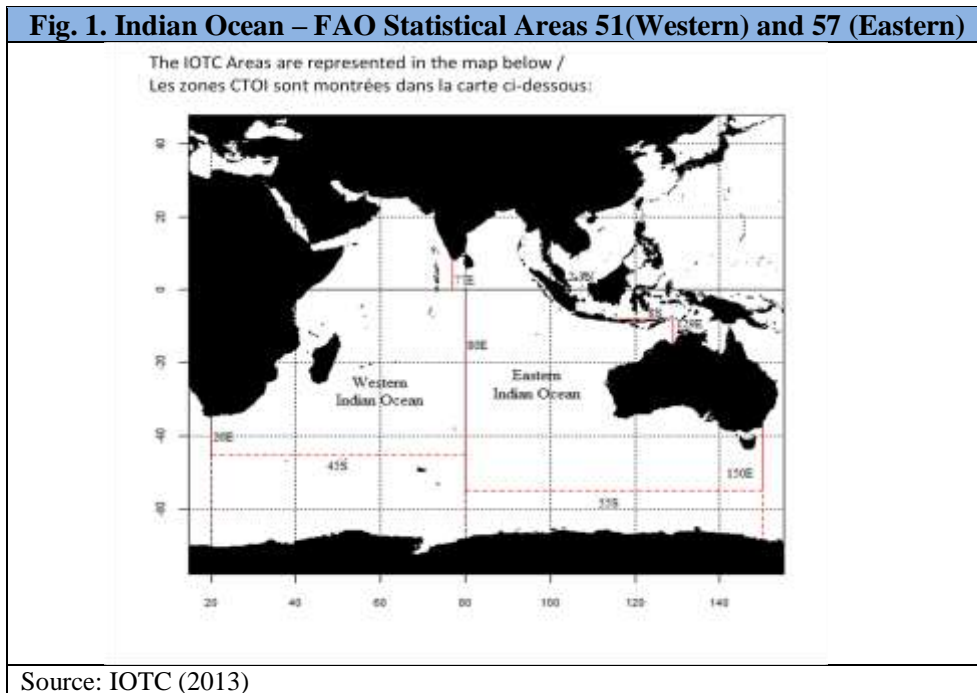
## **BC 4: Centre of Excellence for regional cooperation in sustainable management of SHMFS**

This final business case will draw upon project outputs and business cases (above) to propose the establishment of a new Centre of Excellence for fisheries management and development in the BoB region under the *aegis* of the BOBP-IGO. The business case will be underpinned by three key elements – the opportunity to build upon the high quality work of the OPP-BOB project, the strong and wide-ranging links forged by the project at all levels (local-national-regional-international) concerning Straddling and Highly Migratory Fish Stocks (SHMFS), and the solid and well-respected reputation and institutional base provided by the BOBP-IGO. A focus on 'capacity-building for future fisheries management and development' and 'knowledge management' will be the key themes. The target investors, in the first instance, will be the government and associated partners.

\*\*\*

**APPENDIX 2:**

**TUNA RESOURCES AND LANDINGS IN THE INDIAN OCEAN**



### **Tuna stocks:**

- Principal market species are [1]Yellowfin, [2] Bigeye, [3] Skipjack [4] Albacore and [5] Southern Bluefin
- Another important species – Southern Bluefin occurs mainly in the southerly IO Convention Area
- Other species of tuna and tuna-like fish include: Neritic tunas, Billfishes.
- Stock distribution: Based on catch distribution and catch-and release programmes
  - [1] Yellowfin: Western IO (Off Somalia, Area R2)
  - [2] Bigeye: Western IO (A1) and Eastern IO (A2)
  - [3] Skipjack: Western IO (R2) and Eastern IO (R1)
  - [4] Albacore: Mainly South of 10°S
  - [5] Southern Blue-fin: Southern waters between 30 and 50°S

### **Stock Assessment:**

- [1] Yellowfin: MSY: 421,000 - Overfished, overfishing (2015 stock assessments);
- [2] Bigeye: MSY: 132,000 t - Not overfished, no overfishing (2013 stock assessment);
- [3] Skipjack: MSY: 684, 000 - Not overfished, no overfishing (2014 stock assessment)
- [4] Albacore: MSY: 33,300 t - Not overfished, no overfishing (uncertainty relating to this assessment)(2014)
- [5] Southern Bluefin: MSY: 33,000 Heavily overfished, no overfishing (2014 stock assessment) (rebuilding plan in place).

### **Landings**

- Indian Ocean accounts for 20% of World tuna catch (2<sup>nd</sup> after WCPO)
- Total catch of four principal commercial species were 1,003,400 t (2014)(2% increase from 2013)
- Total catch has declined since a peak in 2005 (1.2 million tonnes)

- Total catch weight (2010-14): 915,000 t.

### **Catch Composition and regulation**

- Total catch composition by weight (2010-14): Skipjack (44%), Yellowfin (41%), Bigeye (11%), Albacore (4%)

[1] Yellowfin catch: 429,800 (2014) (6% increase since 2013)(but 19% decline since 2004 level, 530,000 t)

[2] Bigeye catch: 100,200 t (2014) (12% decrease since 2013);

[3] Skipjack catch: 432,500 t (2014) (similar level to 2013);

Management: IOTC has not established conservation measures for these species (above), or quota allocation (despite advice from the Scientific Committee, Resolution 14/02); (Resolution 15/06 discard ban by purse-seine vessels)(some other mitigation measure, but monitoring is weak);

[4] Albacore catch: 49,900 t (2014) (22% decrease since 2013)

Management: There are no conservation and management measures adopted by IOTC for albacore.

[5] Southern Blue-fin catch: 11,900 t (2014) (1% increase since 2013)

Management: Annual TAC (to rebuild stock to 20% of unfished level by 2035) est. 2011; 2015-2017 TAC is 14,647t

### **Catch by nation**

- There are some 50 countries which currently record some landings of tuna and tuna-like species from the IO
- Largest annual catch (2014): Indonesia, Iran, the EU (Spain, France and others), India, Sri Lanka and the Maldives. All of these countries have shown an increased level of annual catch since the early 1980s.

### **Catch by gear types**

- Total catch by gear (2010-14): Purse-seine vessels (36%), longline (19%), gillnets (18%), pole-and-line (11%)
- [1] Yellowfin catch: Purse-seine (35%), longline (20%), gillnet (15%), Misc. (24%), Pole-and-line (5%)  
Gillnet and Misc. Gears increasingly important (purse-seine and longline decreasing, pole-and-line stable);
- [2] Bigeye catch: Longline (55%) (decreasing catch overall, pirate areas avoided recently), purse-seine (28%)(stable);
- [3] Skipjack catch: Purse-seine (41%), gillnets (25%), pole-and-line (20%) (all catches falling since 2000);
- [4] Albacore catch: Drifting longlines (almost 100%);
- [5] Southern Blue-fin: Longlines (60%) and purse-seine (40%) (currently at 15% of peak in 1961);

### **Small-scale fishing**

High diversity of coastal tuna fisheries involving neritic tunas (Longtail, Frigate, Bullet, Kawakawa, Spanish Mackerels), wide range of gears involved, both target and by-catch species. Most significant for Indonesia, and India.

### **Economic valuation – preliminary results – Indian Ocean tuna fisheries**

- The estimated *potential* sustainable economic value of both the principal and neritic tuna stocks in the Indian Ocean is **USD 2.06 billion** (therefore, the capitalised asset value of the fish stocks @ 8% [reasonable return, long term] is **USD 26 billion**).
- By comparison: India GDP (USD 2, 067 billion), Tamil Nadu (USD 167 billion), Kerala (USD 77 billion), Sri Lanka (67 billion), Maldives (2.3 billion).
- The actual (current) economic value of the tuna stocks in the IO is not known (in terms of the current levels of resource rent being generated). However, it seems unlikely any of the fisheries involved is generating economic rents at a level close to the potential value (above) under current management arrangements.
- Improved economic performance in the future could come from three routes: (1) critically from improved management at the harvesting level, (2) from increased catch up to MSY and (3) from improved performance throughout the value chain (but 2 and 3 depend on 1 of course). It should be noted that these results are at the resource level, but the results at country level will depend on how the resources or the economic benefits from their exploitation are shared.

Reference: Neiland (2016)

**APPENDIX 3:**

**CURRENT YELLOWFIN TUNA RESOURCES AND LONGLINE/HANDLINE FISHERIES IN THE BAY OF BENGAL (INCLUDING DESCRIPTION OF THE BASE CASE/BUSINESS AS USUAL)**



## **Yellowfin Tuna (YFT) Resources in the Bay of Bengal**

The tuna resources in the Bay of Bengal are part of the YFT stock of the entire Indian Ocean. The Indian Ocean Tuna Commission (IOTC), the regional international tuna management organization for the Indian Ocean, has indicated that the YFT stock may be fully exploited already. For the purpose of this analysis, the Maximum Sustainable Yield (MSY) for YFT in the Bay of Bengal has been estimated at 35,000 metric tons (based on discussions with BOBP-IGO experts). The current catch is 24,770 mt. It is proposed for the current BC that catches should be set at 17,500 mt (50% MSY). This catch limit would be subject to management within the IOTC framework, and national rules and regulations.

### **The Small-scale Longline and Handline Yellowfin Tuna (YFT) Fishery**

Fishing for YFT in the Bay of Bengal is carried out near the coastline and within the Indian Exclusive Economic Zone (EEZ). The fleet is composed of small-scale, open-deck fishing vessels that utilize hand-lines, long-lines and/or gillnets. These vessels engage in fishing trips that range anywhere from 1 to 3 days (depending on the fishing region), with a crew of 4 to 5 fishermen. Most of the fishing vessels have two outboard 9 horsepower (hp) engines (or equivalent inboard engine) and a sail. The vessels carry no ice and have no onboard preservation equipment; catches are generally left on the open deck after capture.

The typical one-day fishing trip entails leaving in the late afternoon/early evening, catching bait (which is kept alive in a special well with circulating sea water) and then travelling to the fishing grounds in the early hours of the morning. The vessels travel approximately 35 miles (but occasionally up to 60 miles) to the fishing grounds, where they set the long-lines. Once the long-line is recovered and the catch retrieved, the vessel heads back home to arrive while there is still daylight. The catches of these vessels average about 100 kilograms of fish (not only YFT but other tunas and tuna-like species (i.e. skipjack, billfishes, seer fish). The size of YFT caught by these vessels vary and could range from a few kilograms up to 35 kg per fish.

While tuna is present throughout the year in the Bay of Bengal, the small-scale hand-line/long-line fleet operates for about 9 months (270 days) a year, due to weather and other factors. Of this period, these vessels tend to focus on tuna about 180 days per year (i.e., an average of 180 one-day trips per year), while also potentially catching other commercial varieties of fish, such as seer fish, mahi mahi, sail fish and groupers.

The approximate capital cost of the typical fishing vessel is US\$ 5,000 for the vessel, US\$ 6,000 for two 9hp outboard engines (or US\$ 2500) and US\$ 2,000 for the fishing gear. The main operating costs are as follows:

- Fuel (estimated at US\$ 60.66 per one-day trip),
- Provisions (estimated at US\$ 14.71 per one-day trip),
- Water (estimated at US\$ 4.41 per one-day trip), and
- Crew costs.

The 4 to 5-member crew split the crew share, which is equal to 50% of the total value of ex-vessel sales after the above operating costs have been subtracted. The remaining 50% goes to the boat owner, who is responsible for the original investment/depreciation, and maintenance.

The majority of the fish is landed in the local fishing communities, because the local fishermen do not allow boats from other regions to land their catch (except in Kochi, Kerala on the southwest coast of India, where local customs allow fishermen from other regions to land their fish in the harbour). The vessels' lack of adequate onboard handling and preservation practices results in very poor quality fish and low prices. Based on stakeholder consultations and interviews conducted with fishermen during field visits, the landed prices received for the fish currently ranges between about 60 and 100 INR/kg (US\$ 0.88 to US\$ 1.48/kg). The fish is sold to traders at these low prices, who in turn re-sell the fish to retailers for sale in local markets or directly ship the product (by truck) to processors located mainly in the Kochi (Kerala) region.

Fishermen complain that the prices they get for their YFT are low. Buyers, on the other hand, complain that the fish quality is poor due to inadequate onboard handling and preservation systems and hence they are not willing to pay higher prices. An unknown volume of the YFT catch may be wasted due to poor quality (although it is suspected that, in fact, all landed fish is sold). In addition, high levels of histamine in the fish (caused by lack of refrigeration shortly after the fish dies) can result in a health hazard to consumers who may be sensitive to histamines and/or spoiled fish.

The continuation of the present situation (inappropriate onboard handling and preservation practices) would not result in improvements in the quality of long-line and hand-line YFT caught, which would limit the availability of appropriate quality raw material for processing. This constitutes a significant risk to YFT processors, from both economic and health hazard perspectives. This also represents a major constraint for the expansion of domestic and/or export markets. If current onboard and preservations practices persist in the fishery, economic returns from the valuable YFT resources found in the Bay of Bengal will continue to be severely limited.

**APPENDIX 4:**  
**INDIA'S TUNA PROCESSING SECTOR**

In addition to the small-scale hand-line/long-line fishery discussed in Annex 3, gillnet fisheries produce the majority of India's tuna catches. The production of YFT (and sometimes skipjack) tunas caught by the small-scale hand-line/long-line fishing vessels, as well as the gillnet tuna catches (primarily skipjack tunas), find their way into tuna processing facilities located on the South and Southwest coast of India, in particular, in Kochi, Kerala.

The long-line/hand-line catches of generally low quality tunas obtained by the small-scale vessels (which lack onboard refrigeration or preservation systems) are purchased at low prices by traders (buyers or agents) who, in turn, send them to freezing processing facilities in refrigerated or iced trucks. The tunas are hung or placed in racks to be frozen as whole fish. No further processing is done to the tunas at these freezing plants. Sometimes, the frozen fish are sorted by size and species before placing in the 40' ocean refrigerated containers; at other times the fish is placed in bulk inside the refrigerated container. These processors then sell the whole frozen fish to international buyers, who generally process the tuna into a canned product. India's tuna processors currently sell this frozen tuna directly or through traders to canning facilities located in the Middle East (Oman, Iran), North Africa (Tunisia and Turkey) and Thailand.

Because the processors pay a low price for the fish and do not have significant processing costs for freezing the tuna, they can sell their frozen YFT and skipjack tunas in international markets at very competitive prices (i.e. US \$1,200 per mt at the Indian plant), while other producers of YFT and skipjack tuna offer somewhat similar products for US \$1,800 per mt delivered.

Therefore, even accounting for containerized ocean freight costs and traders' commissions of up to US \$400 per mt, there appears to be room for India's tuna processors (exporters) of whole frozen tuna to obtain important margins. Indian exporters' very low prices compared to other competitors allows for the buyers to assume a relatively high risk when buying tuna products which may have high histamine levels. These buyers purchase the fish from India's processors subject to final adjustments in the payments after the fish has been processed at its overseas destination, and the final quality of the product has been determined.

The poor quality YFT caught by the small-scale vessels is consumed in local coastal markets and does not appear to be entering into the urban domestic market in significant volumes at the present time. This situation appears to be shifting, as some major urban centres in India (New Delhi, Mumbai, Bangalore, Chennai and Kochi) seem to be developing new or expanded markets involving affluent consumers from the middle class, as well as expatriates and tourists. A few tuna processors in India are producing value-added products (such as frozen, portion-controlled steaks and fillets) to be sold in developing domestic markets, as well as in international markets (USA and Europe). This is the case of a processor located in North Thamarai Kulam, Tamil Nadu. This processor and others located in the Kochi area are also exporting fresh tuna loins to the European and USA markets, although the volumes appear to be limited. There have been instances in the USA market in which products originating from one of these facilities had to be recalled due to health hazards associated with salmonella and high histamines.

Finally, a few tuna processing facilities in India produce canned tuna products and cooked tuna loins for canning. One of these facilities is located in the Kochi area and its canned tuna and cooked frozen loins products are mainly exported to Tunisia and the Middle East. Interestingly, this processing plant also custom packs canned tuna under strict specifications for India's armed forces.

It is worth noting that new processing facilities to process fresh YFT to be sold in the domestic and export markets are emerging. Two facilities, one located in Puducherry and the other near Visakhapatnam, appear ready to commence operations within the next six months if not sooner. One of these facilities is aiming its production to the domestic market while the other is expecting to export the product to the UK market.

As highlighted earlier, one of the main constraints faced by India's tuna processing industry in expanding both domestic and export markets is the poor quality of fish resulting from lack of adequate onboard handling and preservation of the fish prior to landing. In addition, there is a lack of an adequate and cost effective cold chain supply infrastructure at the large number of remote locations where the small-scale fishing vessels are landing their catches. However, even if the cold chain supply infrastructure were to be developed, it would not likely solve the problem of the low quality of the fish landed. This can only be accomplished by addressing the root problem; that is, by improving how the fishermen handle the fish onboard and providing them with the ability to preserve the quality of the fish on board until it is landed.

**APPENDIX 5:**  
**MARKET CONSIDERATIONS (DOMESTIC AND EXPORT)**

## India's Domestic Market for High Quality Yellowfin Tuna (YFT)

The volume of India's current consumption of high quality fresh YFT is not known at the present time and the limited understanding of the potential market size<sup>3</sup> represents a source of risk and uncertainty for potential investors in the seafood sector.

Indian consumers do not have a particular liking for tuna; in general, they prefer other fish species like seer fish and groupers instead of tunas. Consumers in local coastal markets eat low quality YFT and the size of this market is also unknown. A "ball park" estimate of the supply of fresh YFT (low quality) available for consumers in India on a yearly basis may be approximately 22,000 metric tons of landed tuna (9,900 finished product).<sup>4</sup> In the absence of real data on the size and characteristics of these markets (low and high quality YFT markets), only qualitative information can be utilized to assess the opportunities for the proposed processing plant to sell high quality YFT in the domestic market.

Consumption of YFT in the metropolitan areas (away from local coastal consumption) seems to be growing, apparently driven by affluent consumers in the middle income class, demand from 5-star hotels and restaurants, and an emerging online market for seafood products. This is a recent trend of only the past few years. In addition, consumption by expatriate Japanese and Korean communities in major cities and the emergence of sushi style restaurants appear to be contributing to the growth of this market.

Some indicators suggest there is an emerging market for high quality tuna in the large metropolitan areas such as New Delhi, Mumbai, Kolkata, Bangalore and Chennai, as represented by the needs of 5-star hotels and high end restaurants that utilize imported YFT to cater for their customers. According to a limited survey conducted for the Chennai and Bangalore area, these hotels often are required to import high quality tuna to meet their customer needs. The imported fish is expensive and there are logistical problems, at times, associated with ensuring the quality of the imported product, as characterized by anecdotal information expressed by chefs of 5-star hotels.<sup>5</sup>

Furthermore, India expects to see median incomes per household increase by 90 percent in real terms from 2015 to 2030. This will not only bring discretionary spending power to large groups of new potential foodservice customers, but it will also help transition India from a "bottom of the pyramid"

---

<sup>3</sup> Since most fresh yellowfin tuna available in the India is of poor quality, the size of the country's existing market for high quality fresh yellowfin tuna is zero or close to zero.

<sup>4</sup> A "ball park" estimate of India's current domestic consumption of yellowfin tuna suggests that the domestic usage (low quality yellowfin tuna) may be around 22,000 mt per year (raw weight). This is based on the following rationale. According to the IOTC, India's yellowfin tuna production has been around 35,000 mt per year in recent years. Exports of frozen yellowfin tuna (low quality for canning markets) in the past 5 years is estimated at 9 thousand tons per year. Deducting the 9,000 mt of exports of frozen whole yellowfin tuna from the IOTC catch estimate of 35,000 mt would leave an available supply of yellowfin of about 26,000 mt per year. If we apply a 15% factor to the available supply due to spoilage (bad quality) and wastage (~4000 mt), the actual available supply of yellowfin tuna (low quality) for the domestic market may be 22,100 mt per year. Applying a 45% processing yield, domestic consumption of finished yellowfin tuna product is estimated at 9,900 mt per year.

<sup>5</sup> Divya Karnad. BOBP-IGO Draft Report of Markets and Trade Opportunities for India's Tuna Fisheries, June 24, 2018.

market towards a middle class consumer market with greater and more sophisticated dining-out demand.

	Five Star Hotels	Restaurants (20+ tables)	Specialty Seafood Retailers*	Online Retailers *	Total
Total No. of Modern Establishments	576	100,000	50	20	100,646
% of Universe of Establishments Captured*	30%	7%	16%	25%	-
No. Establishments carrying HQ YFT	172.8	7,000	8	5	7,186
Avg. Usage per week/kg	10	5	20	5	40
Total Kilograms per week	520	260	1040	260	2,080
Total Kilograms per Year/Establishment	27,040	13,520	54,080	13,520	108,160
Total Metric tons Finished Product	27.04	13.52	54.08	13.52	108
Total Metric Tons Raw Material (45% Conversion Factor)	60	25	120	30	240

\* ITC Team estimate (2018)

HQ YFT = High Quality Yellowfin Tuna

<sup>6</sup>Taking into account the data limitations, an educated estimate of the current size of the domestic market for **fresh, high quality, yellowfin tuna** could range between 240 mt per year to up to 1,000 mt per year. The lower estimate is a best estimate base on an approximate weekly consumption YFT using preliminary data from a survey contracted by BOBP-IGO (Divya Karnad 2018). The above table illustrates how this estimate was arrived at.

The upper range of 1,000 mt is based on the fact that the survey mentioned did not capture information on potential buyers (retailers) of YFT in other major urban areas besides Bangalore and Chennai. In addition, this upper range may include online sales of fresh YFT from companies such as

---

<sup>6</sup> Dhruv Sood and Shubhi Mishra. India Food Service - Hotel Restaurant Institutional: India's foodservice sector continues growing as restaurant dining and tourist numbers climb. GAIN Report No. IN6165, Dec 2016. U.S.A. Department of Agriculture, Foreign Agriculture Service.  
[https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Food%20Service%20-%20Hotel%20Restaurant%20Institutional\\_New%20Delhi\\_India\\_12-29-2016.pdf](https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Food%20Service%20-%20Hotel%20Restaurant%20Institutional_New%20Delhi_India_12-29-2016.pdf)



PescaFresh, West Fine Foods and others, which may be selling higher-than-average quality YFT products directly to consumers via e-markets.<sup>7</sup>

Growth of India's domestic market for fresh high quality YFT will be dependent upon the growth patterns occurring in the hotel, restaurant, and institutional (HRI) service sector (all associated with both domestic and foreign tourism), and in the expansion of supermarket outlets in major Indian metropolitan areas, which are only starting to expand. According to one study, the following list outlines some of the factors expected to facilitate growth over the long term.

- “Chefs working in the HRI sector are keen to introduce new cuisines and culinary practices;
- Restaurants and hotels are “Indianizing” their services and foods to better meet Indian preferences;
- The modern segment of the HRI sector is striving to match standards of quality and service;
- Government of India with its safe food initiative (Surakshit Khadya Abhiyan) is intending to ensure quality food at all the levels;
- International hotel chains are penetrating the Indian market;
- The increasing number of shopping centres and shopping destinations make food service through retail a more preferred location;
- The growing trend for convenience in food courts and full-service restaurants in shopping centres;
- Dine-in locations expanding inside hypermarkets and supermarkets for easy access to attract consumers;
- Low-fare domestic airlines providing improved and more frequent travel service;
- Rising numbers of working women, increased urbanization and a very young population are all expected to lead to lifestyle and eating pattern changes;
- Strong growth in casual dining and fast food sectors from both domestic and foreign chains, which are introducing new dining options and foods;
- Increased competition is keeping costs “in check” and ensuring that firms are delivering value for money;
- Slowdown in global economy has led to an increase of domestic travellers opting for leisure destinations within India; and,
- Stable political scenario is expected to act as a catalyst in increased number of business and leisure travellers.”<sup>8</sup>

### **Export Market Considerations for High Quality Yellowfin Tuna (YFT)**

India's production of fresh, high quality YFT could potentially enter markets in Japan, the United States and many European countries, since there is a growing demand for this product in all three market regions. The Japanese market usually represents the market where the highest prices are paid for the highest quality (Sashimi Grade A) tuna, when the required characteristics of the product (whole fish or processed loins) are met.

---

<sup>7</sup> See for instance: <http://www.pescafresh.com/>; <https://www.indiamart.com/westcoast-finefoods/>; <https://www.cambaytiger.com/sea-water>; <https://www.alibaba.com/showroom/fresh-tuna-india.html>; <http://www.freshfishmumbai.com/>

<sup>8</sup> Op.Cit. (see footnote 4)

The USA and EU markets (inclusive of the UK), also demand high quality standards; YFT Sashimi Grade A and lower quality products are sold in both markets. Both markets have strict and ever-changing sanitary and labelling requirements for fresh and frozen tuna products. In the USA, for instance, sale of frozen YFT treated with CO<sub>2</sub> is allowed, whereas in the UK market and other EU markets, that is not the case. Similarly, the use of other antioxidants is not allowed in the UK market.<sup>9</sup>

For the purpose of this Business Case, the EU market has been identified as the main target market area, with specific emphasis on the UK market.

### Exports of Fresh Tuna to the EU Market

The EU market, inclusive of the UK, is mainly supplied by both intra-EU and extra-EU imports. EU imports of fresh tuna increased 5.2% per year during the period 2012 to 2016. In 2016, the EU imported approximately 142 million euro of fresh tuna. YFT was the most imported species with a value of 70 million Euros, followed by albacore 35 million euro and bluefin tuna 30 million euro. Italy also represents an important player in the importing of fresh tuna, mainly YFT.

France and Spain are the main importers of tuna, with about 35 and 36 million euro each respectively in 2016. France is the main importer of YFT, and Spain is the main importer of albacore and bluefin tuna.

The UK, the Netherlands and Belgium imported about 10 million euro of tunas (mainly YFT), with the Netherlands being the main player (mostly for re-exporting intra-Europe). It is worth noting that the UK market has shown growth of tuna imports of about 23% over the period 2012 to 2015. According to one UK importer, the market in the UK has declined recently to 10,000 kg per week or less (wholesale), because catches have been very low (and prices have been correspondingly high).<sup>10</sup>

Spain, France, Greece, Ireland and Portugal are the main intra-EU suppliers of fresh tuna (80% of the total trade in 2014), with the remaining coming from the developing world with the Maldives, Sri-Lanka and Suriname as the main suppliers of extra-EU fresh tuna trade. The Maldives is the most important supplier of YFT. The mostly hand-line caught fresh YFT from the Maldives accounts for about 7% of the total EU fresh tuna trade.

Up until 2014, Sri-Lanka accounted for about 6.4 % of the overall fresh tuna trade. That position dropped to 0.4% due to non-compliance with EU regulations on IUU (Illegal, Unreported and Unregistered) fishing.

### EU/UK Prices for Fresh Yellowfin Tuna (YFT)

Prices for YFT in the EU and UK markets vary widely, depending on many factors such as the product presentation (steaks, loins, medallions, skewers), weight, origin, and whether or not the fish comes from a Marine Stewardship Council (MSC) certified fishery. The retail prices for fresh YFT can vary from 8 euro per kg (US\$ 9.40/kg) in Spain to up to 39 GB (US \$52) per kg in the UK market.

---

<sup>9</sup> Source: <https://www.cbi.eu/market-information/fish-seafood/fresh-tuna/> and <https://www.cbi.eu/market-information/fish-seafood/frozen-tuna-products/europe/>

<sup>10</sup> Confidential personal communication of British seafood buyer, July 28, 2018

Margins at the retail level range between 18 to 25%, and at the wholesale distributor/importer the margin may be close to a 100%. Therefore, a kilogram of high quality yellowfin priced at 600 Indian Rupees (US \$8.82), with an estimated air shipping cost of US\$ 4.00 to the UK (Chennai to London) could be offered to an importer/distributor at around US \$13 delivered. [Assuming this equates to a FOB of US 8.82 in India which compares to a FOB price of US \$ 16 (almost double). This would suggest that there is a major risk that all high quality product from BoB will be diverted into the Sri Lanka value chain for export unless the local processors access these markets – noting also that the local market (at USD 8.8) would not stay competitive].

Adding a 100% margin for the importer/processor would put the price to the retailer at US \$26 per kg. With a 25% margin to the retailer, the final consumer price would be about US \$32-33 per kg).<sup>11</sup>

The following table<sup>12</sup> shows some indicative prices for YFT products in the EU/UK market:

Product/Species	Price US/kg	Market
Yellowfin Tuna Fillet/ 1/4/loin (fish counter)	US \$23 to US \$ 52	Spain, UK, France
Tuna Steak in Tray	US \$20 to US \$ 34	Spain, UK, France, Belgium
Tuna Steak in Vacuum Package	US \$ 27	Spain
Two Tuna Medallions (240 grs/each.)	US \$35.45	UK

It should be noted that, according to at least one UK seafood buyer, current (summer 2018) procurement prices are quite high, because of poor catches in the Indian Ocean. For instance, current FOB prices (at the processing plant) in Colombo, Sri-Lanka and Male, Maldives are about US \$16.00, which is very high, compared to typical prices at those locations of about US \$10.50.<sup>13</sup>

#### Estimated Size of UK Market for Fresh Yellowfin Tuna (YFT)

UK consumption of chilled fish (all species) purchased at supermarkets represented about 151,700 metric tons in 2017. Tuna accounted for about 7,600 mt or about 5% of the total volume. Tuna constitutes the third species consumed in the UK after salmon and cod, ahead of haddock, and warm and cold-water prawns, which represent the top six chilled seafood items purchased by UK consumers.<sup>14</sup>

<sup>11</sup> Sources: For example: UK, <https://www.sainsburys.co.uk/shop/gb/groceries/sainsburys-tuna-steaks--taste-the-difference-240g>; Spain <https://www.missupermercados.com/comprar/lomos-de-atun-elaborado-al-corte-en-filetes-pid-82581854.html>; Belgium, <https://www.ah.be/>.

<sup>12</sup> Based on data in <https://www.cbi.eu/market-information/fish-seafood/fresh-tuna/> and <https://www.cbi.eu/market-information/fish-seafood/frozen-tuna-products/europe/>

<sup>13</sup> Confidential personal communication of British seafood buyer, July 28, 2018

<sup>14</sup> <http://www.seafish.org/research-economics/uk-seafood-industry-overview>

**APPENDIX 6**

**YELLOWFIN TUNA FISHING AND PROCESSING OPERATIONS –  
INVESTMENT OPTIONS**

Profile of Baseline and Investment Cases - Small-scale and Large-scale Tuna Operations			
Line no.			
1	NPV calculation discount rate	0.08	
2	Xrate	68.61	
3	Investment financing rate % (IMF lending rate to India )	9.5	
4	<b>Small investment baseline case</b>	INR	USD
5	Landed price to boat INR/ kg	100	1.46
6	Number of boats	4	4
7	Catch per trip / boat (kg)	100	100
8	Trips per year / boat	180	180
9	Annual operating cost per boat	1,080,424	15,747
10	Processing capacity per operation per year	72,000	72,000
11	Processing costs post investment per annum	0	0
12	Sale value post investment per kg g/w	256	3.73
13	Boat investment costs	0	0
14	Processor investment cost	0	0
15			
16	<b>Small investment case</b>		
17	Landed price to boat INR/ kg	200	2.92
18	Number of boats	4	4
19	Catch per trip / boat (kg)	100	100
20	Trips per year / boat	180	180
21	Annual operating cost per boat (includes boat capital costs)	1,107,424	16,141
22	Processing capacity per operation per year	72,000	72,000
23	Processing costs post investment per annum	2,236,960	32,604
24	Sale value post investment per kg g/w	256	3.73
25	Boat investment costs	380,923	5,552
26	Processor investment cost	3,422,184	49,879
27			
28	<b>Large investment baseline case</b>		
29	Landed price to boat INR/ kg	100	100.00
30	Number of boats	100	100
31	Catch per trip / boat (kg)	100	100
32	Trips per year / boat	180	180
33	Annual operating cost per boat (includes boat capital costs)	1,107,424	15,747
34	Processing capacity per operation per year	1,800,000	1,800,000
35	Processing costs post investment per annum	0	0
36	Sale value post investment per kg g/w	256	3.73
37	Boat investment cost	0	0
38	Processor investment cost	0	0
39			
40	<b>Large investment case</b>		
41	Landed price to boat INR/ kg	200	2.92
42	Number of boats	100	100
43	Catch per trip / boat (kg)	100	100
44	Trips per year / boat	180	180
45	Annual operating cost per boat (includes boat capital costs)	1,107,424	16,141
46	Processing capacity per operation per year	1,800,000	1,800,000
47	Processing costs post investment per annum	57,789,791	842,294
48	Sale value post investment per kg g/w	256	3.73
49	Boat investment costs	9,523,068	138,800
50	Processor investment cost	56,670,000	825,973

**Notes and references**

Line no.	
1	Discount rate used across all calculations
2	Exchange rate used across all calculations
3	
4	Notes
5	Estimated landed price for poor quality fish
6	Computed from processor capacity and catch per boat (for comparison with investment case)
7	Estimated catch per trip
8	Estimated trips per year
9	Input from 'Boat Costs' spreadsheet
10	No processing in base case
11	No processing costs in base case
12	Calculated at 600 INR for loins and 400 for other cuts at 38% and 7% recovery per kg greenweight
13	No investment in base case
14	No investment in base case
15	
16	
17	Estimated landed price for high quality fish
18	Computed from processor capacity and catch per boat
19	Estimated catch per trip
20	Estimated trips per year
21	Input from 'Boat Costs' spreadsheet (note slight operational increase due to ongoing cost of Ice not in base case)
22	Processing capacity (at 40% of capacity)
23	Estimated costs not detailed (excludes plant depreciation as investment costs are expensed)
24	Calculated at 600 INR for loins and 400 for other cuts at 38% and 7% recovery per kg greenweight
25	Input from 'Boat Costs' spreadsheet (multiplied by number of boats in investment)
26	Input from 'Small case investment' spreadsheet'
27	
28	
29	Estimated landed price for poor quality fish
30	Computed from processor capacity and catch per boat (for comparison with investment case)
31	Estimated catch per trip
32	Estimated trips per year
33	Input from 'Boat Costs' spreadsheet
34	No processing in base case
35	No processing costs in base case
36	Calculated at 600 INR for loins and 400 for other cuts at 38% and 7% recovery per kg greenweight
37	No investment in base case
38	No investment in base case
39	
40	
41	Estimated landed price for high quality fish
42	Computed from processor capacity and catch per boat
43	Estimated catch per trip
44	Estimated trips per year
45	Input from 'Boat Costs' spreadsheet (note slight operational increase due to ongoing cost of Ice not in base case)
46	Processing capacity (at 100% of capacity)
47	Estimated costs not detailed (excludes plant depreciation as plant investment costs are expensed)
48	Calculated at 600 INR for loins and 400 for other cuts at 38% and 7% recovery per kg greenweight
49	Input from 'Boat costs' spreadsheet (multiplied by number of boats in investment)
50	Input from 'Large case investment' spreadsheet (includes financing costs)

**APPENDIX 7**  
**YELLOWFIN TUNA FISHING AND PROCESSING –**  
**INVESTMENT AND PROFIT SCHEDULE (CASHFLOW)**

## Investment and profit schedule

<b>SMALL INVESTMENT CASE</b>	Rate	Y-1	Y-2	Y-3	Y-4	Y-5	Y-6	Y-7	Y-8	Y-9	Y-10	Y-11	Y-12	Y-13	Y-14	Y-15	Y-16	Y-17	Y-18	Y-19	Y-20
Investment schedule (boats)		-\$1,388					-\$1,388					-\$1,388					-\$1,388				
Investment schedule (processor)		-49,879	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum plant capacity		180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000
Plant capacity used %		5	20	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Plant capacity used tonnes		9,000	36,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000
Financing costs of investment	9.5		-4,560	-3,750	-1,621	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Profit	-\$49,879	3,270	13,081	26,163	26,163	26,163	26,163	26,163	26,163	26,163	26,163	26,163	26,163	26,163	26,163	26,163	26,163	26,163	26,163	26,163	26,163
Number of boats supplying		1	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Net profit (Cumulative)		-47,996	-39,475	-17,062	7,480	33,643	58,418	84,581	110,744	136,907	163,070	187,845	214,008	240,171	266,334	292,497	317,272	343,435	369,598	395,760	421,923

Internal Rate of Return (IRR)	#DIV/0!
Return on Investment (RoI)	846%
Payback period (years)	3
NPV of investment	\$437,406
NPV discount rate	0

<b>LARGE INVESTMENT CASE</b>	Rate	Y-1	Y-2	Y-3	Y-4	Y-5	Y-6	Y-7	Y-8	Y-9	Y-10	Y-11	Y-12	Y-13	Y-14	Y-15	Y-16	Y-17	Y-18	Y-19	Y-20
Investment schedule (boats)		-\$34,700					-\$34,700					-\$34,700					-\$34,700				
Investment schedule (processors)		-825,973	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum plant capacity		1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000
Plant capacity used %		0	25	50	75	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Plant capacity used tonnes		0	450,000	900,000	1,350,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000
Financing costs of investment	9.5	0	-81,764	-74,643	-51,957	-12,228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual profit / loss	-\$825,973	0	156,720	313,440	470,160	626,880	626,880	626,880	626,880	626,880	626,880	626,880	626,880	626,880	626,880	626,880	626,880	626,880	626,880	626,880	626,880
Number of boats supplying		0	25	50	75	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Net profit (Cumulative)		-860,673	-785,717	-546,920	-128,718	485,933	1,078,113	1,704,993	2,331,872	2,958,752	3,585,631	4,177,811	4,804,691	5,431,570	6,058,450	6,685,329	7,277,509	7,904,389	8,531,268	9,158,148	9,785,027

Internal Rate of Return (IRR)	#DIV/0!
Return on Investment (RoI)	1185%
Payback period	4
NPV of investment	\$4,042,464
Discount rate	0.08



**APPENDIX 8**  
**YELLOWFIN TUNA FISHING AND PROCESSING –**  
**INVESTMENT PERFORMANCE METRICS**

SMALL INVESTMENT BASELINE METRICS		
Annual fleet catch (kg)	72,000	72,000
Number of boats	4	4
Annual fleet costs	4,321,694	62,989
Annual returns to crew	1,439,153	20,976
Annual fleet profit	1,439,153	20,976
Annual processor costs	0	0
Annual processor profit	0	0
Investment cost (boats)	0	0
Investment cost (processor)	0	0
Internal Rate of Return (IRR)		0%
Return on Investment (RoI)		0%
Payback period (years)		0
NPV of investment		0

LARGE INVESTMENT BASELINE METRICS		
Annual fleet catch	1,800,000	1,800,000
Number of boats	100	100
Annual fleet costs	107,443,260	1,566,000
Annual returns to crew	36,278,370	528,762
Annual fleet profit	36,278,370	528,762
Annual processor costs	0	0
Annual processor profit	0	0
Investment cost (boats)		
Investment cost (processor)	0	0
Internal Rate of Return (IRR)		0%
Return on Investment (RoI)		0%
Payback period (years)		0
NPV of investment		0

SMALL INVESTMENT METRICS		
Annual fleet catch (kg)	72,000	72,000
Number of boats	4	4
Annual fleet costs	4,429,694	64,563
Annual returns to crew	4,985,153	72,659
Annual fleet profit	4,985,153	72,659
Annual processor costs	2,236,960	32,604
Annual processor profit	1,795,040	26,163
Investment cost (boats)	380,923	5,552
Investment cost (processor)	3,422,184	49,879
Internal Rate of Return (IRR)		#DIV/0!
Return on Investment (RoI)		846%
Payback period (years)		3
NPV of investment		437,406

LARGE INVESTMENT METRICS		
Annual fleet catch	1,800,000	1,800,000
Number of boats	100	100
Annual fleet costs	110,742,357	1,614,085
Annual returns to crew	124,628,822	1,816,482
Annual fleet profit	124,628,822	1,816,482
Annual processor costs	57,789,791	842,294
Annual processor profit	43,010,209	626,880
Investment cost (boats)	9,523,068	138,800
Investment cost (processor)	56,670,000	825,973
Internal Rate of Return (IRR)		#DIV/0!
Return on Investment (RoI)		1185%
Payback period (years)		4
NPV of investment	0.08	4,042,464

**APPENDIX 9**

**YELLOWFIN TUNA FISHERY – BAY OF BENGAL**

**WITH AND WITHOUT INVESTMENT – PERFORMANCE COMPARISON**

WITHOUT INVESTMENT			WITH INVESTMENT			
ANNUAL FISHERY PROJECTION (17,500 tonne harvest)		Total return	ANNUAL FISHERY PROJECTION (17,500 tonne harvest)	Small investments	Large investments	Total return
Number of operations needed to process 17,500 tonne catch			Number of operations needed to process 17,500 tonne catch	43	8	51
Number of boats needed to catch 17,500 tonnes		972	Number of boats needed to catch 17,500 tonnes	172	800	972
Processing capacity all operations / year		0	Processing capacity all operations / year	3,100,000	14,400,000	17,500,000
Investment cost		0	Investment cost (not timetabled)	2,147,559	6,607,783	8,755,342
Total fleet operational costs		15,225,000	Total fleet operational costs	2,779,813	12,912,678	15,692,491
Total crew share		5,140,743	Total crew share	3,128,385	14,531,855	17,660,240
Total fleet profit all operations		5,140,743	Total fleet profit all operations	3,128,385	14,531,855	17,660,240
Total processor costs		0	Total processor costs	1,403,783	6,738,352	8,142,135
Total processor profit all operations		0	Total processor profit all operations	1,126,460	5,015,037	6,141,497
<b>Total fishery revenue all operations</b>		<b>25,506,486</b>	<b>Total fishery revenue all operations</b>	<b>11,566,827</b>	<b>53,729,777</b>	<b>65,296,604</b>
<b>Total profit (rent)</b>		<b>5,140,743</b>	<b>Total profit (rent)</b>	<b>4,254,846</b>	<b>19,546,892</b>	<b>23,801,737</b>
<b>Rent as % of fishery revenue</b>		<b>20%</b>	<b>Rent as % of fishery revenue</b>	<b>37%</b>	<b>36%</b>	<b>36%</b>
<b>Total economic benefits (crew share and profit)</b>		<b>10,281,486</b>	<b>Total economic benefits (crew share and profit)</b>	<b>7,383,231</b>	<b>34,078,747</b>	<b>41,461,978</b>
<b>Capital value of fishery (NPV interest rate)</b>		<b>64,259,287</b>	<b>Capital value of fishery (NPV interest rate)</b>		<b>244,336,147</b>	<b>308,595,434</b>

**APPENDIX 10**

**YELLOWFIN TUNA – BAY OF BENGAL**

**SMALL-SCALE INVESTMENT CASE – SENSITIVITY ANALYSIS**

<b>Small investment case</b>									
	<b>Baseline</b>	100							
% increase / decrease	80	85	90	95	100	105	110	115	120
<b>Boat profitability at 200 INR / kg</b>	<b>Baseline</b>	<b>100 kgs</b>							
Catch per trip per boat (kg)	20	40	60	80	100	120	140	160	180
Number of boats needed supply operation	20.0	10.0	6.7	5.0	4.0	3.3	2.9	2.5	2.2
Per boat profit	<b>-2,823</b>	2,424	7,671	12,918	18,165	23,412	28,659	33,906	39,153
	<b>Baseline</b>	<b>200 INR</b>							
<b>Sensitivity to landed price (USD)</b>	160	170	180	190	200	210	220	230	240
IRR	71%	63%	55%	45%	35%	23%	7%		
RoI	2423%	2029%	1636%	1243%	846%	443%	-113%	-1094%	-2076%
Payback (years)	2	2	2	2	3	5	20	20	20
NPV (USD)	1,219,216	1,023,764	828,311	632,859	437,406	241,953	46,501	<b>-148,952</b>	<b>-344,404</b>
	<b>Baseline</b>	<b>55,431 USD</b>							
<b>Sensitivity to investment cost (USD)</b>	44345	47116	49888	52659	55431	58203	60974	63746	66517
IRR	43%	41%	39%	37%	35%	34%	33%	31%	30%
RoI	1127%	1041%	968%	903%	846%	794%	748%	706%	667%
Payback (years)	3	3	3	3	3	3	3	4	4
NPV (USD)	448,548	445,721	442,949	440,178	437,406	434,634	431,863	429,091	426,320
	<b>Baseline</b>	<b>256 INR</b>							
<b>Sensitivity to wholesale price (USD)</b>	205	218	230	243	256	269	282	294	307
IRR				19%	35%	48%	60%	69%	79%
RoI	-3155%	-1879%	-702%	317%	846%	1361%	1872%	2344%	2855%
Payback (years)	20	20	20	7	3	2	2	2	2
NPV (USD)	<b>-559,402</b>	<b>-305,314</b>	<b>-70,771</b>	183,318	437,406	691,494	945,583	1,180,126	1,434,214
	<b>Baseline</b>	<b>72,000 kgs</b>							
<b>Sensitivity to supply (USD)</b>	57600	61200	64800	68400	72000	75600	79200	82800	86400
IRR	22%	25%	29%	32%	35%	38%	41%	44%	47%
RoI	396%	511%	623%	735%	846%	956%	1067%	1177%	1287%
Payback (years)	6	5	4	4	3	3	3	3	2
NPV (USD)	218,499	273,226	327,953	382,679	437,406	492,133	546,859	601,586	656,313
<b>Summary</b>									
% increase / decrease	<b>-20</b>	<b>-15</b>	<b>-10</b>	<b>-5</b>	0	5	10	15	20
Sensitivity to landed price (200 INR baseline)	1,219	1,024	828	633	437	242	47	<b>-149</b>	<b>-344</b>
Sensitivity to investment cost (USD 55,431 baseline)	449	446	443	440	437	435	432	429	426
Sensitivity to wholesale price (256 INR baseline)	<b>-559</b>	<b>-305</b>	<b>-71</b>	183	437	691	946	1,180	1,434
Sensitivity to supply (72,000 kgs baseline)	218	273	328	383	437	492	547	602	656

**APPENDIX 11**

**YELLOWFIN TUNA – BAY OF BENGAL**

**LARGE-SCALE INVESTMENT CASE – SENSITIVITY ANALYSIS**



	<b>Baseline</b>	<b>100</b>							
% increase / decrease	80	85	90	95	100	105	110	115	120
<b>Boat profitability at 200 INR / kg</b>	<b>Baseline</b>	<b>100</b>	<b>kgs</b>						
Catch per trip per boat (kg)	20	40	60	80	100	120	140	160	180
Number of boats needed supply op	500	250	167	125	100	83	71	63	56
Per boat profit	<b>-2,823</b>	2,424	7,671	12,918	18,165	23412	28,659	33,906	39,153
	<b>Baseline</b>	<b>200</b>	<b>INR</b>						
<b>Sensitivity to landed price (USD)</b>	160	170	180	190	200	210	220	230	240
<b>IRR</b>	66%	60%	53%	46%	37%	25%	7%		
<b>RoI</b>	3419%	2862%	2304%	1745%	1185%	618%	-104%	-1415%	-2726%
<b>Payback (years)</b>	2	2	3	3	4	5	20	20	20
<b>NPV (USD)</b>	12,089,908	10,078,047	8,066,186	6,054,325	4,042,464	2,030,603	18,742	<b>-1,993,119</b>	<b>-4,004,980</b>
	<b>Baseline</b>	<b>964,773</b>	<b>USD</b>						
<b>Sensitivity to investment cost (USD)</b>	771818	820057	868296	916534	964773	1013012	1061250	1109489	1157727
<b>IRR</b>	43%	42%	40%	38%	37%	35%	34%	33%	32%
<b>RoI</b>	1588%	1466%	1360%	1267%	1185%	1111%	1046%	987%	933%
<b>Payback (years)</b>	3	3	4	4	4	4	4	4	4
<b>NPV (USD)</b>	4,221,126	4,176,460	4,131,794	4,087,130	4,042,464	3,997,798	3,953,133	3,908,467	3,863,802
	<b>Baseline</b>	<b>256</b>	<b>INR</b>						
<b>Sensitivity to wholesale price (USD)</b>	205	218	230	243	256	269	282	294	307
<b>IRR</b>				21%	37%	48%	58%	65%	73%
<b>RoI</b>	-4168%	-2464%	-891%	444%	1185%	1913%	2639%	3308%	4031%
<b>Payback (years)</b>	20	20	20	6	4	3	3	2	2
<b>NPV (USD)</b>	<b>-6,218,028</b>	<b>-3,602,608</b>	<b>-1,188,375</b>	1,427,044	4,042,464	6,657,883	9,273,303	11,687,536	14,302,955
	<b>Baseline</b>	<b>1,800,000</b>	<b>kgs</b>						
<b>Sensitivity to supply (USD)</b>	1440000	1530000	1620000	1710000	1800000	1890000	1980000	2070000	2160000
<b>IRR</b>	24%	27%	31%	34%	37%	39%	42%	44%	47%
<b>RoI</b>	553%	713%	871%	1028%	1185%	1342%	1497%	1653%	1809%
<b>Payback (years)</b>	6	5	4	4	4	4	3	3	3
<b>NPV (USD)</b>	1,789,179	2,352,501	2,915,822	3,479,143	4,042,464	4,605,785	5,169,106	5,732,427	6,295,748
<b>Summary</b>									
% increase / decrease	<b>-20</b>	<b>-15</b>	<b>-10</b>	<b>-5</b>	0	5	10	15	20
Sensitivity to landed price (200 INR	12,090	10,078	8,066	6,054	4,042	2,031	19	<b>-1,993</b>	<b>-4,005</b>
Sensitivity to investment cost (USD	4,221	4,176	4,132	4,087	4,042	3,998	3,953	3,908	3,864
Sensitivity to wholesale price (256	<b>-6,218</b>	<b>-3,603</b>	<b>-1,188</b>	1,427	4,042	6,658	9,273	11,688	14,303
Sensitivity to supply (1,800,000 kgs	1,789	2,353	2,916	3,479	4,042	4,606	5,169	5,732	6,296

**APPENDIX 12**  
**YELLOWFIN TUNA**  
**SMALL CASE INVESTMENT COSTS**

		ExR 68.61		
#	Items	Quotation	USD	Procurement
1	Air-conditioner (2 + 1)	77,500	1,130	Aurofish
2	Exhaust fans (4)	7,200	105	Aurofish
3	Ceiling fan (3)	8,850	129	Aurofish
4	Fly catcher (3)	11,289	165	Aurofish
5	Generator (Honda)	190,885	2,782	Aurofish
6	Weighing Machine	13,824	201	Aurofish
7	Delivery / Chill pack box	9,442	138	Aurofish
8	Contact with Sushi	25,000	364	Aurofish
9	Improvements in	10,000	146	Aurofish
10	RPN stall monthly	48,000	700	Aurofish
11	Trademark registration	4,000	58	Aurofish
12	Advertising/Market	25,000	364	Aurofish
13	Laptop	63,000	918	Aurofish
14	Printer	10,800	157	Aurofish
15	Barcode printer	15,000	219	Aurofish
16	Scanner	2,800	41	Aurofish
17	Stainless steel table (1)	48,000	700	BOBP
18	Stainless steel table	124,500	1,815	BOBP
19	Packing table (2)	88,000	1,283	BOBP
20	Tuna tubs (Sintex IR	-	-	BOBP
21	Vacuum packing	195,000	2,842	BOBP
22	Table top vacuum	95,000	1,385	BOBP
23	Reach-in-chiller (1300	152,000	2,215	BOBP
24	On-board handling and	30,000	437	BOBP
25	Insulated fish boxes	250,000	3,644	BOBP
26	Sea safety jacket,	300,000	4,373	BOBP
27	Cutting Board	42,244	616	BOBP
28	Trainer/ Facilitator fee	45,000	656	BOBP
29	Civil works+roofing	843,750	12,298	TATA
30	Land	686,100	10,000	Aurofish
	<b>Total investment cost</b>	<b>3,422,184</b>	<b>49,879</b>	
<b>Contributors</b>				
	<b>Aurofish (land)</b>	<b>686,100.00</b>	<b>10,000</b>	
	<b>Aurofish</b>	<b>522,590.00</b>	<b>7,617</b>	
	<b>BOBP</b>	<b>1,369,744.00</b>	<b>19,964</b>	
	<b>TATA</b>	<b>843,750.00</b>	<b>12,298</b>	

Based on pilot work-programmes: Mrs Anitha Muthuvel & Mr M Muthuvel, Aurofish, Puducherry and BOBP-IGO

**APPENDIX 13**  
**YELLOWFIN TUNA**  
**LARGE-SCALE INVESTMENT COSTS**

Item	Description	INR (lakh)	USD
<b>LAND &amp; BUILDING</b>			
1	Land purchase	100	145,751
2	Construction of the main building, raw material receiving and handling area, pre-processing, processing and packing area chill storage with puff panels, delivery area, lab building, toilets, canteen, Effluent treatment unit	331	482,437
<b>PLANT AND MACHINERY</b>			
3	Chill room	17	24,778
4	Flake ice machine 10 t/day	23	33,523
5	R. O Plant with sand filter, carbon filter, pump, etc.	5.5	8,016
6	Stainless Steel Processing tables- 8 nos.	2.4	3,498
7	Air curtains	1	1,458
8	Electronic balance	0.4	583
9	Vacuum packing machines- 2 nos.	8.2	11,952
10	Water supply- bore well, pump, storage tank, distribution pipelines, etc.	6	8,745
11	Electricity supply including transformer, panel, meter box, breaker switch etc. including lighting	9.5	13,846
12	Standby generator	12	17,490
13	Air conditioners- 3 nos.	1.6	2,332
14	Fly catchers- 8 nos.	0.5	729
15	Fork lift Manual	1.5	2,186
16	Processing equipment	1	1,458
17	Wooden and plastic pallets	0.7	1,020
18	Fish bins (insulated fish boxes) 1000 ml-6/ 200 ml-6	3.3	4,810
19	Freezers (to store at around 0° C)- 2 nos.	3.1	4,518
<b>OFFICE EQUIPMENT</b>			
20	Computers, printers, etc.	2	2,915
21	Furniture	2	2,915
<b>VEHICLES</b>			
22	Vehicles-3T/2no & 1 t/2	25	36,438
<b>LABORATORY</b>			
23	Laboratory equipment	10	14,575
		Grand total	566.7 825,973

**APPENDIX 14**  
**RISK ANALYSIS**

The financial metrics for the investment value added propositions for the Small and Large Operations look positive, based on existing data and assumptions; however, there are a number of variables that could negatively impact the expected outcomes. This business case analysis relies on a number of assumptions, some of which are within the project's control, while others are not. If, in reality, at the time of implementation, these factors differ from the assumed value, business results may differ from those presented in this report.

In general, key assumptions/risks that are completely out of this project's control include the following:

- Overall status of the tuna stocks (resource availability, Potential management measures and limitation on catches)
- Competitors' actions, including fishing activities of neighbouring countries or districts fishing on the same tuna stocks
- Foreign currency exchange rates
- The rate of inflation
- Demand/supply and prices in domestic and international tuna markets
- The price of fuel
- Availability of bait resources
- Natural disasters and acts of war
- Government regulation.

These factors should be watched carefully during the analysis period because changes in these values would change expected results.

Key assumptions/risks that may be influenced or controlled to some degree (perhaps through additional investment) include the following:

- Insufficient supply of quality yellowfin tuna and other species to the plant (including diversion of the supply of high quality yellowfin by other buyers)
- Tuna traceability
- Procurement organization and logistics
- Reliability of third party suppliers

In general, these risks may be reduced through good planning and management, maintenance of relationships with suppliers, and/or additional investments.

The major specific, tuna-related risks to the investment scenarios are discussed in more detail below.

- **Resource Availability and Fisheries Management Issues.** Global tuna fisheries are very dynamic and volatile, in part because they depend on a changing natural marine environment, which affects the availability and abundance of the tuna resource base (i.e. the tuna stocks that support the fisheries). They are also volatile due to their interaction with the resource users (i.e. the fishermen) that harvest these resources under open access, first come-first serve common property access conditions. Furthermore, because the tuna resources are highly migratory and travel through both the high seas and many areas of national jurisdiction, and are pursued by fishermen from many nations, the effects of fishing activities in one area may



have an impact on the availability of the resource in another region and/or EEZ of a particular country.

This is the case for the yellowfin tuna resources found within the EEZ of India and the Bay of Bengal. These resources constitute a portion of a tuna stock of the entire Indian Ocean and therefore, the fishing operations of large industrial fleets of countries like Spain, France, the Seychelles, etc., in areas outside India's EEZ, could have an important impact on the resource availability for the small-scale handline/longline fishery operating within India's EEZ, including the Bay of Bengal.

Lack of effective fisheries management measures implemented by the IOTC to effectively monitor, control and surveillance (MCS) fishing effort over the tuna stocks in the region also contributes to increased risks of the health of the stocks; this, in turn, poses a risk to the current and future availability of tuna in the Indian Ocean, including the yellowfin tuna resources found within the Bay of Bengal.

As a consequence of the intrinsic nature of tuna fisheries, investments in fishing and/or processing operations probably have much higher risks than other types of investments not associated with the utilization of a natural resource harvested under open access conditions.

- **Bait Shortages.** The small-scale handline/longline vessels utilize live bait to catch yellowfin tuna, attaching the live bait to the hooks. The main species used for bait are scad (*Decaprerus russelli*), flying fish (*Exocoetidae*) and, occasionally, sardines and squid. The abundance and availability of these bait resources is not known, but clearly, if the fishermen (as they sometime do) cannot find and catch the bait before they head further out to set their fishing gear, the entire supply chain into the processing plants could be compromised.
- **Insufficient Supply of Quality Yellowfin Tuna to the Plant.** It is possible that, despite the implementation of training programmes for onboard handling, the provisioning the fishing vessels with appropriate ice boxes, and the adoption of a higher price to entice fishermen to produce high quality tuna, insufficient tuna catches could occur. Factors such as the lack of availability of live bait, bad weather, or recurrent low catches of yellowfin tuna (due to vagaries in tuna availability in the Bay of Bengal as a result of temperature changes / overfishing elsewhere, or other factors), could discourage fishermen from fishing for this species, and tempt them to switch to other, more easily available, valuable species (e.g., seer fish), again causing limitations in the supply to the processing plant and increasing the investment risk.
- **Diversion of the Supply of High Quality Yellowfin by Other Buyers.** India's yellowfin tuna does not enjoy a good reputation, due to current quality issues. As the supply of high quality landed tuna becomes available, other potential buyers (outside of the designated value chain) may attempt to acquire these increased volumes of higher quality yellowfin tuna (e.g., Japanese tuna traders may try to divert landings for sashimi-quality tuna). The potential prices that these "newcomers" could pay for high quality tuna could potentially be significantly higher than what the processors can afford, therefore limiting their ability to ensure sufficient supply of high quality yellowfin tuna for their processing operation.
- **Domestic Market Limitations.** High quality yellowfin tuna in the domestic market is very limited and no reliable information is available as to the current size of this market. Our best

estimate is that the present market for **fresh, high quality yellowfin** ranges from 240 to 1000 metric tons per year. India expects to see median incomes per household increase by 90 percent in real terms between 2015 and 2030, which will bring discretionary spending power to large groups of new potential foodservice customers, including those who may consume yellowfin tuna. Nevertheless, consumers in India have marked preferences for other non-tuna species such as seer fish, which could affect the domestic market demand. (See Appendix 5, *Market Considerations [Domestic and Export]*)

- **Export Market Limitations.** The yellowfin tuna export market constitutes a very dynamic and changing competitive global market landscape. Consumption of fresh yellowfin tuna in the US and European (EU) markets has expanded in the past 15 years. Demand for fresh and frozen yellowfin tuna by Japanese-style sushi restaurants and by the introduction of grilled and seared yellowfin tuna steaks at white tablecloth restaurants have contributed to this growth. Households are also increasing their purchases of fresh tuna steaks and loins at seafood counters in supermarkets in the US and EU markets. Suppliers from around the world, from the Philippines and Indonesia, to the Maldives, Sri-Lanka, and Suriname are competitively supplying these markets, having to meet ever-changing, stricter sanitary, labelling, trade and environmental conditions (such as IUU fishing). In addition, suppliers are constantly confronted with pricing strategies from new entrants into these markets trying to capture market shares. Indian fresh high quality yellowfin tuna would not be exempted from this situation and hence, there are risks which could negatively impact India's export opportunities. (See Appendix 5, *Market Considerations [Domestic and Export]*)
  
- **Tuna traceability.** India's current small-scale handline/longline yellowfin tuna fisheries lack traceability, a major issue associated with processing this product if it is to be exported. The key example of this issue is the case of Sri-Lanka. This country was the second yellowfin tuna supplier after the Maldives to the UK market, with a market share of 6.4% in 2014. Non-compliance with EU regulations regarding IUU fishing resulted in an EU "red card" for Sri-Lanka tuna entering into the European market. When Sri-Lanka resumed exporting tuna to the EU (2017), its market share had dropped to 0.4%. Therefore, it is of utmost importance that India's small-scale handline/longline yellowfin fishery is capable of documenting and tracing the origin of its fish exports, and that they ensure that fishing operations are compliance with management measures implemented by the IOTC. While this is critical for the processing operations oriented to export markets, it is not as critical (although it would be very useful) to implement in the fishery supplying high quality tuna for the domestic market.
  
- **Procurement Organization and Logistics.** One additional risk for the investment in the Large Operation has to do with the necessary organization and logistics associated with procuring the raw material requirements. Organizing and coordinating the unloading and transporting operations of a large number of small fishing vessels (each one potentially bringing only 50 kg of high quality tuna) would require major organizational, communication and logistical support. There would be the following needs:
  - To have the necessary trucks ice and tubs to receive the fish at the landing sites;
  - To ensure good traceability to know which fish were caught by which boat;
  - To have sufficient appropriate personnel to grade the fish, if this occurs at the landing site;

- To keep a clear accounting system for payment of all the fish deliveries; and
- To have clear communications systems with the fishermen to know their schedules, landing times, volumes caught, etc., since all 150 to 200 day boats may or may not be fishing on the same day

All these may add to the overall total cost of the fish. Lack of an efficient procurement system could risk having the plant operating much below desirable capacity, affecting the financial bottom line. The plant operators can and should work to manage this risk by implementing effective systems, which could require additional investments.

- **Reliability of Third Party Suppliers**

- **Ice.** There may be instances in which the processing plants (especially the small operation type of plants) do not have their own ice making machines and are required to depend upon a third party ice making supplier. Since providing ice to the fishermen before they leave is critical, as is the need to have ice at the time the fish arrives, ensuring availability of this input at all times is of critical importance. Therefore, a close collaboration with the ice-making supplier and having alternate suppliers could reduce a potential risk that could result in raw material procurement problems to the plant.
- **Packaging Material.** Just as ice is critical, the same is true for packaging material like insulated boxes, plastic liners and gel ice. Inadequate supplies of these packaging materials when dealing with a highly perishable commodity such a fresh yellowfin tuna could be critical to the entire operation. Having adequate inventories and reliable third party suppliers of these materials is very important.
- **Airfreight, Transportation Logistics and Availability of Chilled Areas at Airports.** For both processing plants (small and large operations) easy access to an airport and direct airlines connections to the target markets is critical. Airlines need to have experience in handling perishable cargo and should also be reliable in guaranteeing the spaces booked by the processors and their schedules. The last thing a processor of high quality yellowfin tuna needs is to have the product sit at an airport, not being loaded onto a plane due to last minute changes by the airline or because the desirable cargo space for the intended product was not properly booked. Some airports have designated areas that have temperature control for perishable products, while others do not. Therefore, timing the logistic for delivering the product to the cargo areas of the airlines may also require close coordination between the processor and the airline, to minimize the staging of the product and still allow for sufficient time to prepare all necessary documentation that would accompany the product. At the receiving end, coordination with the buyer to organize pickup and delivery of the products sold is as important as organizing the original shipping. The perishability of the product is such that unnecessary delays could result in decreasing the quality of the product to the detriment of both the supplier and the buyer.
- **Insurance.** For fresh tuna processing operations, it is highly desirable to have good product insurance to protect the value of the product, and also to protect the processor

against potential liabilities that could result from a health hazard issue arising from the sold fish itself (i.e. salmonella, histamines, food poisoning)

**APPENDIX 15**  
**BIBLIOGRAPHY**

## BIBLIOGRAPHY

Indian Ocean Tuna Commission (IOTC). Stock Status. [www.iotc.org/science/status-summary-species-tuna-and-tuna-species-under-iotc-mandate-well-other-species-impacted-iotc](http://www.iotc.org/science/status-summary-species-tuna-and-tuna-species-under-iotc-mandate-well-other-species-impacted-iotc)

Karnad, D. (2018) Report of Markets and Trade Opportunities for India's Tuna Fisheries. BOBP-IGO, Chennai June 24, 2018

Neiland, A.E. (2017) Characterisation of the Fisheries Sector in the Indian Ocean: With Particular Reference to Tuna Fisheries in the Bay of Bengal: (i) Environmental and Economic Aspects. Report for the World Bank/GEF-funded Oceans Partnership Project (OPP) – Bay of Bengal implemented by the Bay of Bengal Programme Inter-Government Organisation (BOBP-IGO), Chennai, India.

Sood, D. and Mishra, S (2016). India Food Service - Hotel Restaurant Institutional: India's foodservice sector continues growing as restaurant dining and tourist numbers climb. GAIN Report No. IN6165, Dec 2016. U.S.A. Department of Agriculture, Foreign Agriculture Service.

[https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Food%20Service%20-%20Hotel%20Restaurant%20Institutional\\_New%20Delhi\\_India\\_12-29-2016.pdf](https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Food%20Service%20-%20Hotel%20Restaurant%20Institutional_New%20Delhi_India_12-29-2016.pdf)

Viteri C., Yoshioka J., Castrejón M. (2016). Bankable Business Case Guidelines and Investment Criteria for Sustainable Production Seascapes. Conservation International's consulting report for the World Bank. pp.30.

# Business Case 1: A Business Case for the Processing and Sale of High-Quality Yellow fin Tuna Products from South India

## Annex 15: Environmental and Social Safeguards

### 1.0 Overarching environmental risks

Addressing the need for proper management of yellowfin tuna resources in the Bay of Bengal is the principle objective of the 4 Business Cases developed under the ‘Ocean Partnerships for Sustainable Fisheries and Biodiversity Conservation – Models for Innovation and Reform Project (OPP-BOB)’ by the Implementing Agency, the Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO). Any investment in the yellowfin tuna (YFT) fishing sub-sector, including the investment in improved value chains for high-quality, high-value YFT in South India proposed in Business Case No.1, creates the potential for encouraging increased fishing effort that could, without effective management, lead to the degradation of the resources on which these investments depend.

The OPP-BOB has addressed this issue by supporting the Business Case 1 with 3 other Business Cases, the principle purpose of which is to ensure that investment in improved YFT value chains are nested within improved measures and institutional arrangements for the proper management of YFT resources. These include:

- Investment in the development of co-management arrangements for YFT fisheries in the Union Territory of Puducherry, with a view to creating a model for fisheries co-management that could be adapted and developed upon in other areas of the east coast of India. A key feature of this investment includes the engagement of all stakeholders in YFT value chains in the management process, including private sector producers and operators in processing and marketing, community-based mechanisms for decision-making and distribution of benefits generated from improved management of the resource, inclusion of existing community actors such as the caste, Panchayat and community-based decision-making structures in the process, engagement with existing government institutions, and the development of a third-party intermediary organization(s) to facilitate the long-term process of hand-holding and developing appropriate management arrangements;
- Investment in a Monitoring, Control and Surveillance (MCS) mechanisms that will provide essential support to the implementation of more effective management arrangements at the local, state and, eventually, national levels; and
- Investment in a Centre of Excellence in International Fisheries Development to provide long-term support to the process of developing effective fisheries management for YFT resources in the Bay of Bengal as well as advice and direction to institutions in the region regarding future investment and development of YFT fisheries.

The four OPP-BOB business cases are presented separately as they each deal with distinct levels of intervention, involving different scales of investment that are likely to be of interest for different types of investors. However, the OPP-BOB has emphasized that these four investments are highly **interdependent** and should **not** be considered in isolation from one another and the dangers involved in considering any of these investments in isolation are highlighted.

Investment in improved YFT value chains (Business Case No.1) must be nested within wider investments in the development of the management arrangements (Business Cases 2, 3 and 4) that would ensure a sustainable environmental and institutional framework that would underpin the sustainability, and positive economic returns, from Business Case No.1.

The focus of investment in Business Case No.1 on low-volume, high-quality landings of YFT tuna, with close attention to the monitoring of quality and sustainability in fishing methods would also serve, within a framework of better management arrangements, to limit the potential for overexploitation of the resource.

## 2.0 Overarching social risks

The introduction of new fisheries management arrangements, particularly in a context of *de facto* open-access fisheries with limited effective regulation of fishing activity, may generate short-term risks for the livelihoods of those currently involved in fisheries. This is certainly the case with regard to fisheries for YFT on the Bay of Bengal coast of India. Currently, access to these fisheries is effectively open with no limitations imposed on fishing effort by the mostly small-scale fishing fleet beyond the access of fishers to the technology and skills required to exploit this fishery. Currently, specific targeting of YFT by small-scale fishers is limited to a few operations such as those that are identified as having potential for development in Business Case No.1. As a result, YFT catches are largely limited to YFT harvested by drift gillnets by small-scale operations operating in coastal waters and along the edge of the continental shelf that land mixed tuna catches (mostly skipjack tuna) of low quality and generating low returns.

The proposed investments in improved value chains for high-quality YFT in Business Case No.1 would be underpinned by management arrangements proposed in the Business Cases 2 and 3 that would place limits on the fishing operations, specifically targeting YFT while capturing a proportion of the added value generated by these fisheries through improved handling and marketing. An important feature of the co-management arrangements proposed in Business Case No.2 would be to establish mechanisms by which a part of this added value would be channeled to the wider fishing community to compensate for the limitations imposed on the numbers of fishing operations targeting this particular resource. The MCS arrangements proposed in Business Case No.3 would ensure that these limitations, that would be essential for ensuring the sustainability of the investments, are enforced.

As with any set of new fisheries management arrangements, the OPP-BOB proposals recognize the social issues involved and lay out a long-term, inclusive process of consultation, negotiation and community-based monitoring and control that would serve to identify and deal with potential social risks associated with these arrangements. The proposal of an independent, third-party institution in Business Case No.2 to take the lead in mediating and negotiating arrangements that satisfy all the stakeholders involved is important in this respect. All the proposals foresee key roles for key mandated government institutions in supporting the process and overseeing its implementation and ensuring that they are aligned with government's social development and distributive priorities.

The long-term time-frames envisaged for all the proposed Business Cases recognize that the processes involved in establishing fisheries management arrangements are complex and require a long-term perspective. Recognition of this is essential in order to develop inclusive arrangements that accommodate the concerns and priorities of different stakeholders while ensuring the sustainability of the resource base on which fisheries livelihoods depend.

In addition to these overarching social and environmental concerns, specific risks associated with each of the OPP-BOB Business Cases are addressed below.

## 3.0 Specific environmental risks and their management

The risks associated with potential over-fishing of yellowfin tuna (YFT) resources as a result of increased demand for an improved YFT value chain along the Bay of Bengal coast of India has been addressed in the discussion of overarching environmental risks above.

Key features that specifically relate to this Business Case include:

- A focus within the improved value-chain on low volumes of high-value YFT with strict monitoring and enforcement of quality standards;
- A recognition of the primary role of value-chain actors in enforcing these quality standards as this would underpin the economic returns that they would recognize from the investments;
- The nesting of investments in value chains within a framework of improved management arrangements, including Community-Based Fisheries Management (Business Case No.2) and Monitoring, Control and Surveillance arrangements (Business Case No.3); and



- The development of a Centre of Excellence (Business Case No.4) to maintain a long-term focus on sustainability in the development of YFT fisheries. This would include addressing future uncertainties generated by climate-change related impacts on fisheries.

Other environmental concerns relate to eventual construction works, whether of small-scale or larger-scale processing units. All the states where these investments are proposed in Business Case No.1 have comprehensive systems, supported by legislation and enforcement mechanisms, for addressing these risks and these would provide a secure framework for the management of construction-related environmental hazards.

Key legislation covering these aspects includes:

- **2019 Coastal Regulation Zone (CRZ) Notification under the Environment (Protection) Act of 1986:** the law is promulgated to ensure livelihood security of fisher communities, and other local communities, living in the coastal areas; to conserve and protect coastal stretches, its unique environment and its marine area; and to promote development through sustainable manner based on scientific principles taking into account the dangers of natural hazards in the coastal areas and sea level rise due to global warming. It shall restrict the setting up and expansion of any industry, operations or processes and manufacture or handling or storage or disposal of hazardous substances.
- **Construction and Demolition Waste Management Rules, 2016:** The rules shall apply to every one who generates construction and demolition waste such as building materials, debris, rubble waste resulting from construction, re-modelling, repair and demolition of any civil structure of individual or organisation or authority. Every waste generator shall be responsible for collection, segregation of concrete, soil and others and storage of construction and demolition waste generated separately, deposit at collection centre so made by the local body or handover it to the authorised processing facilities, ensure that there is no littering or deposition so as to prevent obstruction to the traffic or the public or drains.

New processing facilities would also pose potential risks for waste management, including waste from fish processing and handling of packaging material. All the states where these investments are proposed in Business Case No.1 have comprehensive systems, supported by legislation and enforcement mechanisms, for addressing these risks and these would provide a secure framework for the management of waste and the promotion of recyclable packaging materials. Key legislation covering these aspects include:

- **The Water (Prevention and Control of Pollution) Act, 1974:** An Act to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water, for the establishment, with a view to carrying out the purposes aforesaid, of Boards for the prevention and control of water pollution, for conferring on and assigning to such Boards powers and functions relating thereto and for matters connected therewith.
- **Solid Waste Management Rules, 2016:** The Rules are now applicable beyond municipal areas and extend to urban agglomerations, census towns, notified industrial townships, areas under the control of Indian Railways, airports, airbase, Port and harbour, defence establishments, special economic zones, State and Central government organizations, places of pilgrims, religious & historical importance. The source segregation of waste has been mandated to channelize the waste to wealth by recovery, reuse and recycle. Responsibilities of generators have been introduced to segregate waste in to three streams, Wet (Biodegradable), Dry (Plastic, Paper, metal, wood, etc.) and domestic hazardous wastes (empty containers of cleaning agents, mosquito repellents, etc.) and handover segregated wastes to authorized rag-pickers or waste collectors or local bodies.

The setting up of any food processing facility is fully regulated and the key legislations governing the process include:

- **FSSAI Food Safety and Standards Authority License:** The FSSAI license, also known as the Food License is one of the most important licenses required and is obtained from the FSSAI (Food Safety and Standard Authority Of India). It serves as an approval by the Authority that the food affirms to the food safety standards of India. This license is necessarily a unique 14-digit registration number that is given to manufacturers, traders, and restaurants which should mandatorily be printed on food packages.

- **Health/Trade License:** The 11th schedule of the Municipal Corporation Act (1957) is about Health Trade License. It came into existence from the concern that public health must be given supreme importance. This license is generated by the local civil authorities like the State's Municipal Corporation or the Health Department.
- **Certificate of Environmental Clearance:** The Environmental Clearance Certificate is mandatory requirement for the project activities included in the Schedule of EIA notification dated 14th September 2006 {under Environment (Protection) Act 1986}, before initiating any project related activities on the site.

### Minimum Legal Size of Fish

The Government of Kerala through a notification in 2015 under the Kerala Marine Fishing Regulation Act of 1980 has banned catching of juvenile fish for 58 commercially important species, including tunas by setting a minimum legal size (MLS). MLS is seen as a fisheries management tool with the ability 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. MLS could be used to protect immature fish ensuring that enough fish survive to grow and spawn, control the numbers and sizes of fish landed, maximize marketing and economic benefits and promote the aesthetic values of fish. The species and sizes were suggested by the Central Marine Fisheries Research Institute (CMFRI). This measure is now considered by other coastal states for implementation. It is proposed that while developing a tuna fishery, the harvesters and processors will follow the minimum legal size as prescribed below. **Fork length (FL)** is the **length** of a fish measured from the tip of the snout to the end of the middle caudal fin rays. During the implementation of the business case, the officials from the Department of Fisheries will ensure that suitable gear are being used so that the following guidelines can be adhere to.

Scientific Name	English Name	Recommended MLS (cm)
<i>Euthynnus affinis</i>	Little tuna	31 FL
<i>Auxis thazard</i>	Frigate tuna	25 FL
<i>Katsuwonus pelamis</i>	Skipjack tuna	35 FL
<i>Thunnus albacares</i>	Yellowfin tuna	50 FL
<i>Auxis rochei</i>	Bullet tuna	18 FL
<i>Sarda orientalis</i>	Bonito	35 FL
<i>Thunnus tonggol</i>	Longtail tuna	44 FL
<i>Gymnosarda unicolor</i>	Dogtooth tuna	50 FL

### 4.0 Specific social risks and their management

The financial viability of Business Case No.1 is underpinned by the recognition that much of the potential value of YFT catches on the Bay of Bengal coast of India is currently being lost through the poor quality of catches and poor handling and marketing. In the Business Case, the focus on supporting value chain actors, from production through handling and processing to marketing, to generate low volumes of high-quality product would encourage the actors involved to seek out means of maximising the value of their product. There is potential in the future, both in domestic markets and export market, for enhancing the value proposition by obtaining certification of both environmental sustainability and social sustainability. The relationships between Business Case No.1 and the other Business Cases proposed by OPP-BOB would be particularly important in this regard.

Risks relating to occupational health and safety for those working within improved YFT value chains would be addressed under existing legislation and monitoring mechanisms of the states where the investments are proposed.

Relevant legislation in place to ensure that standards are maintained includes:

- The Fatal Accidents Act, 1855
- The Workmen's Compensation Act, 1923

- The Weekly Holiday Act, 1942
- The Personal Injuries (Emergency) Provisions Act, 1962
- The Personal Injuries (Compensation Insurance) Act, 1963

The rights and conditions of labour involved in improved YFT value chains would likewise be fully covered under existing legislation and mechanisms including the following:

- The Child Labour (Prohibition and Regulation) Act, 1986
- Equal Remuneration Act, 1976
- The Unorganised Workers' Social Security Act 2008
- The Payment of Wages (AMENDMENT) Act, 2005
- The Minimum Wages Act, 1948
- The Maternity Benefit Act, 1961
- The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013

The proposals for better organisation and representation of value chain stakeholders, both at the production level and in processing and marketing, would ensure that robust mechanisms with recognised legitimacy among key stakeholders would be in place to deal with grievances and redress among those directly involved in improved YFT marketing.

New high-value YFT value chains cannot be inclusive of everyone in the fishing sector if they are to be sustainable. There is, therefore, potential for grievances being raised by those who might feel excluded from these new opportunities. To address this, the nesting of Business Case No.1 within a wider framework of improved management, as proposed in Business Cases 2 and 3, becomes particularly important. A significant part of Business Case No.2 on 'co-management arrangements' would aim to establish robust and sustainable institutional arrangements through which the **benefits** generated from improved YFT value chains can be extended to those in the fisheries sector not directly involved in these targeted tuna fisheries. Community-level co-management committees and supervision by mandated government departments and facilitated by non-governmental actors would play a key role in ensuring that these mechanisms respond to grievances raised within the sector.

For dealing with grievances among other parties, such as those whose land might be acquired for the construction of new processing facilities, or those whose livelihoods and incomes are perceived as being negatively affected by the new investments, the states involved and the Government of India have in-place well-tried mechanisms and legislation for addressing these grievances, Key legislation in this regard includes:

- Environmental Impact Assessment Notification, 2006
- The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013

Construction activities under Business Case No.1 might involve private sector operators investing in either small-scale or larger-scale processing facilities and the associated services and transport facilities. As with all private investments in India, these would be subject to existing legislation and monitoring mechanisms that would ensure the registration of any market transactions involved, the compensation of all affected persons, the transparency of all transactions undertaken and compliance with appropriate approval processes.

\*\*\*