

**A Business Case for
Monitoring, Control and Surveillance
(MCS) for the Yellowfin Tuna Fishery in
the Bay of Bengal**

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

2018

A. 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 Yellow Fin Tuna (YFT) monitoring, control and surveillance (MCS) within India's Exclusive Economic Zone (EEZ) in the Bay of Bengal, which might be attractive to either (or both) private or public investors. The work was undertaken in late 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

The business case development focused on three 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;*
- *A broad definition of MCS is adopted, consistent with Food and Agriculture Organisation expert reviews, which recognises MCS as being the set of control measures, monitoring systems and hardware and activities needed to effectively implement fisheries management. While traditional MCS considerations often focus on regulatory measures, this business case also considers private sector controls and activities that can contribute to fisheries management such as co-management and fish product traceability and certification systems. This approach is particularly important in the complex cultural, social and economic environment of India where top down regulatory approaches alone are unlikely be acceptable or effective.*

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 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, furthermore, 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 many different stakeholders in south India, in the Bay of Bengal 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

Three options for MCS investment in YFT were evaluated. These options were as follows:

- Option 1: The Baseline Case evaluated the current MCS framework which is limited in design in that it supports a rudimentary catch and vessel licensing system with no restriction on issue of licenses or catch;
- Option 2: The Value-Added Investment Case examined the consequences of increased investment in MCS within a regulatory framework that remains unchanged; and
- Option 3: The New Regulatory Approach Investment Case evaluated investment in a revised regulatory framework that restricts license numbers and develops a control system integrated between government MCS systems and private sector fish product traceability systems and certification. Option 3 also recognises that investment in co-management, detailed in Business Case 2 but scaled across the entire YFT fishery, will be critically important towards building trust and support for the new Regulatory Approach.

This Business Case adopts a risk assessment methodology to evaluate MCS rules in the YFT fishery and determine where investment is needed in improvements.

The Baseline Case results in significant economic loss and ongoing risk to sustainability of stocks. Moreover, Government of India obligations arising from a range of international agreements including the Indian Ocean Tuna Convention will not be met under the current approach.

The Value-Added Investment Case considers the potential for increased MCS investment under current fishery control rules and assuming that value added investment occurs. The current regime provides a poor framework for such investment given that the rules do not control vessel capacity and such investment will further reduce economic benefits and increase risk to sustainability.

The New Regulatory Approach Investment Case significantly increases sustainable economic returns recovered from YFT fishing in the India EEZ of the Bay of Bengal while meeting sustainability targets. The investment will provide a stable investment and operating environment for the profitable and sustainable use of YFT and implement measures to enable fishers and the Government of India to capture economic opportunities and increase fisher resilience against environmental and economic shocks. The MCS investment encompasses co-management initiatives and supports value chain development.

This opportunity is expected to attract interest and investment from the private sector, to develop improved product traceability systems to underpin high value sales into export markets, and public investment (government) to implement an effective fishery control system designed to enable capture of economic benefits and ensure sustainability of stocks within the context of Indian Ocean Tuna Commission rules applying to YFT.

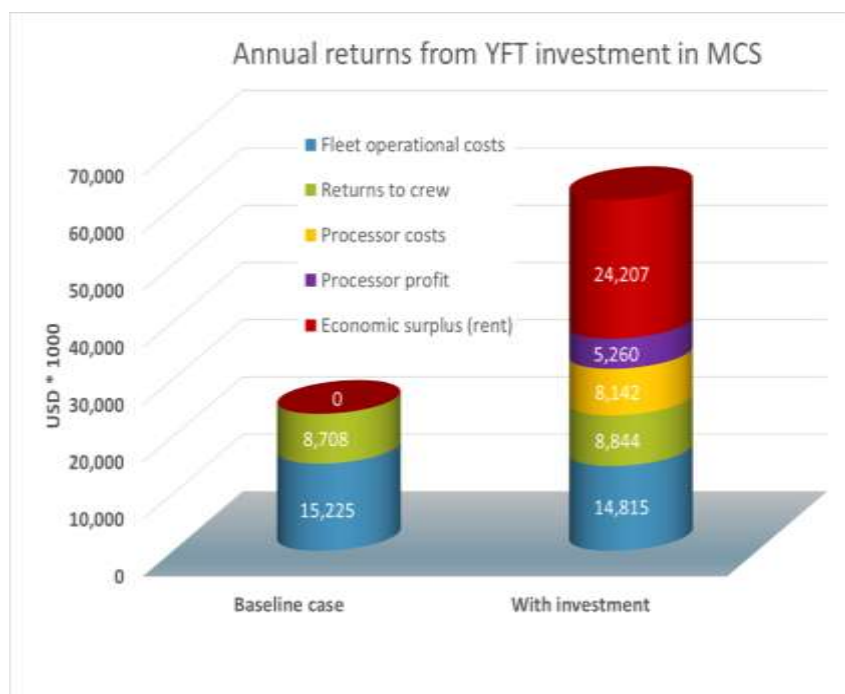
Increased and different approaches to MCS will be needed to implement the new approach. This will involve investment in both the private and public sectors and will encompass policy development in government, institutional development in the private sector, new hardware and monitoring systems, and training. Investment capital will be used to establish and enforce a revised fishery MCS approach to meet sustainability, fish traceability and quality requirements to attract high prices and ensure profitability.

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 the state and central government and a broader group of citizens (both within and outside the seafood sector).

Business case analysis - Main conclusions

[1] UNREALISED ECONOMIC POTENTIAL: India does not have a large yellow fin 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 ('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: Based on an investment appraisal exercise, investments in a revised MCS system – to enable the development of a sustainable and high value catch sector and the capture of economic benefits - showed a high level of performance with significant economic benefits, short payback periods, and both positive and large NPV and RoI scores. The option of establishing a revised control system performed better than both the baseline case 'without investment' (open access fishing fleet, no processing, 'business as usual' MCS) and the value-added case (open access fishing supplemented by value addition and enhanced MCS). The value-added case was shown to cause increased investment in non-productive capital such as vessels and gear at the expense of profitability.



[3] FISHERIES DEVELOPMENT: Assuming an annual catch of 17,500 mt of YFT, the investment in MCS in a new regulatory approach would enable capture of significant economic returns along with the establishment of a sustainable and profitable catching and processing sector. The 'with investment' YFT fishery would generate annual profit (rent) of over USD 24.2 million in addition to providing a normal return on capital invested in fishing and processing. These economic returns would have a capitalised value of USD 303 million at an interest rate (more accurately, a discount rate) of 8% per annum.

[4] RISKS AND ASSUMPTIONS: Sensitivity analysis revealed that two critical factors affected investment performance – vessel numbers (capacity) and price. The investment is fully costed encompassing co-management and ongoing MCS costs. Excluding ongoing MCS costs, on the basis that they are core government funding commitments needed in order to effectively implement the National Policy on Marine Fisheries, increased NPV returns significantly.

Recommendations:

[1] It is recommended that potential investors, both within and outside the seafood sector, should give serious consideration to future investment in the establishment of effective product traceability and sustainability MCS systems in the Bay of Bengal in 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 the regulatory regime adopted, as well as price (landed and wholesale), are critical factors. More robust data should be obtained to further evaluate price effects and the general enabling environment (policy, governance, economy) should also be examined carefully before committing to a definite investment.

B. TEAM OF INTERNATIONAL TECHNICAL CONSULTANTS (ITC)

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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.

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C. ACRONYMS AND ABBREVIATIONS

BC	Business Case
BOB	Bay of Bengal
BOBP-IGO	Bay of Bengal Programme Inter-Governmental Organisation
CPC	Contracting Party and Cooperating Non-Contracting Party
EEZ	Exclusive Economic Zone
EU	European Union
GEF	Global Environment Fund
GoI	Government of India
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
UK	United Kingdom
USA	United States of America
USD	United States Dollars
WB	World Bank
YFT	Yellowfin Tuna

D. CURRENCY AND EXCHANGE RATES

CURRENCY AND EXCHANGE RATES (November 2018, FT quoted)

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

USD 1 = INR 73.05

UNITS (SI)

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

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

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

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F. MAIN REPORT

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

Key points

- The objective of this business case is to identify and assess opportunities for investment in MCS in the Indian Exclusive Economic Zone of the Bay of Bengal, attractive to either (or both) private or public investors;
- India does not have a large tuna fishing or processing sector, despite the presence of large tuna stocks in the nearby Indian Ocean – this provides an opportunity to implement an effective MCS system aimed at enabling fishing and value chain investment that is high value and economically profitable.

The objective of this business case report is:

To identify and assess a clear opportunity, or opportunities, for investment in Monitoring and Control and Surveillance in the India Exclusive Economic Zone of the Bay of Bengal, 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 with 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 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. Given this undeveloped starting point, the YFT fishery provides a unique opportunity to develop an effective MCS system that will underpin harvesting and value-added investment that will ensure fishing remains sustainable and profitable.

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, a definition and outline methodology for the business case development is presented.
- Key steps in the business case methodology consist of:
 - Describing the setting and context;
 - Identifying and describing the opportunity for investment;
 - Identifying potential investors;
 - Analyzing the different options taken into account for the business case;
 - Describing the timescale and level of investment required;
 - Describing the expected performance of the investment;
 - Identifying the risks and assumptions underpinning the investment;
 - Laying out overall conclusions and recommendations.

To start, the business case methodology² 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 the following a set of steps:

1. 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;
2. The specific business case or opportunity for investment was identified and described;
3. The investors who are likely to be interested in the opportunity were also identified;
4. The development options for the business case opportunity were also identified and compared, and the most viable alternative was chosen to take forward;
5. The probable time-scale and level of investment required was considered, including a description of what the eventual utilization of invested funds;
6. 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. This analysis focuses on the role of this investment in underpinning the sustainability of other investments in the fisheries sector and the wider economic, social and environmental returns on an investment in fisheries co-management;
7. The assumptions and risks associated with the proposed investment opportunity were identified and then evaluated.
8. The overall conclusions and recommendations for the business case were summarized.

² 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.

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 institutions or entities involved.

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

Key points

- Yellowfin tuna resources in Bay of Bengal (BoB) are part of whole Indian Ocean stock and are currently considered to be overfished and subject to overfishing;
- The IOTC has set a target for YFT fishing at Bmsy of 421,00 mt of which India have estimated 80,000 mt can be sustainably taken from the India EEZ;
- For this Business Case, the sustainable yield for the BoB was established at 35,000 mt with an allowable catch for the business case of 17,500 mt. Most of the 24,770 mt of YFT currently fished in the BoB is taken by low value gill fishing methods;
- Fisheries management and MCS is rudimentary and does not constrain catch effectively either inside or outside the India EEZ;
- Defining the nature and extent of MCS services requires an assessment of risks to the management objectives set and compliance with the rules established to meet those objectives;
- Continuing with the current MCS regime will severely limit economic returns from the utilisation of the valuable YFT in the BoB.

3.1. Overview of the setting and context for MCS in the India EEZ of the Bay of Bengal

The YFT resources in the Bay of Bengal are considered to be part of the YFT stock of the entire Indian Ocean (see Appendix 1 for synopsis of the state of tuna resources in the Indian Ocean). The Indian Ocean Tuna Commission (IOTC) was established by Agreement amongst participating members in 1993 with a view to “ensuring, through appropriate management, the conservation and optimum utilization of [YFT] stocks ... and encouraging sustainable development of fisheries based on such stocks”. As signatory to this Agreement, India along with 31 other members, are bound by Conservation and Management Measures (CMMs) established under provisions of this Agreement. As of 2018, India has agreed to abide by 57 active CMMs applying to tuna and tuna like species within the Indian Ocean. Resolutions with direct application to YFT resources in the India EEZ of the Bay of Bengal detail a range reporting obligations and effort constraints for the most part binding on vessels greater 24 m in length. An overall constraint on YFT fishing is set at a target level of Bmsy but by and large there are no effective management measures binding catch to this target (see summary of Resolutions relevant to YFT in Appendix 2). In effect, the management of tuna catches within the EEZ of India remains at the discretion of India.

Looking to the future, agreement has been reached to move towards establishing CPC³ level quota limits (IOTC CMM 14/02). IOTC technical meetings held from 2011 onwards have canvassed a range of allocation criteria advanced by some IOTC member countries including key proponents; the European Union and Seychelles. These criteria are in large part based on a catch history formula linked to prior fishing years. Based on such an approach, initial proposals from the EU and Seychelles estimated that India would receive between 0.002 and 2.225% of the overall catch limit (IOTC-2011-SS4-inf01). Discussions are ongoing on the question of how to better reflect the interests of developing and coastal states and of new entrants under a catch history-based allocation approach (for example, see IOTC-2011-SS4-R[E] to, more recently, IOTC-2018-TCAC03-PropD[E] and IOTC-2018-TCAC04-PropA). At a meeting held to discuss regional cooperation on highly migratory stocks in the Bay of Bengal held in Chennai on 5-6 October 2018 prospects and potential rationale for moving away from a catch history-based allocation approach were also discussed.

³ CPC represents any Contracting Party and Cooperating Non-Contracting Party under the IOTC Agreement

3.2. Indian Ocean - Tuna Resources, Landings and Value relative to Indian yield estimates

The Indian Ocean (IO) accounts for 20% of global tuna landings (about 1 million tonnes per year); the Western Central Pacific Ocean region is the largest. IO YFT landings were 429,800 (2014). This represented a 6% increase since 2013, but 19% decline since the 2004 level, 530,000 mt. The MSY for IO Yellowfin is estimated to be 421,000 mt, and stocks are currently considered overfished, and subject to overfishing. The potential sustainable gross annual landed value of yellowfin 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.

The Government of India has set a target yield for YFT in the India EEZ of 80,000 tonnes⁴ which represents about 19% of the estimated MSY for the IO. This target yield is more than double current catch levels in India reported to the IOTC which were around 33,427 mt in 2014 and about 8% of total Indian Ocean catch of yellowfin that year. Working towards a quota allocation framework within the context of an IOTC arrangement therefore creates some considerable challenges even if India decides to limit its harvests to target yields set for the India EEZ alone (i.e. and does not include opportunity to increase high seas catch under its flag). ***For the purpose of this business case, it is assumed that India will assert a share of the Indian Ocean MSY to be taken within its EEZ for YFT equivalent to the target yield of 80,000 tonnes.***

3.3. Bay of Bengal – YFT Tuna Resources and Fishery Characteristics

Within the target yield for the EEZ of India, the sustainable yield of YFT within the Bay of Bengal is estimated to be 35,000 metric tons (based on discussions with BOBP-IGO experts). The current catch in the Bay of Bengal is 24,770 mt of which about 55% of the catch is taken by motorised vessels and the remainder by mechanised gill net and hook and line boats. While overall vessel numbers have increased little based on most recent data available, there has been a significant change in fishing capacity with the number of larger mechanised vessels increasing by 60 % from 8,258 to 13,223 while motorised craft numbers have decreased by nearly 10% from 45,391 to 41,163 vessels.

The GoI currently offers a range of subsidies to both mechanised and motorised vessels and vessel crews including for out-board motor purchase, fuel, mechanised vessel construction and for conversion of trawlers from gill netting to long lining. Fishers, including crews, are also paid an allowance when fishing is prohibited by regulation during seasonal closures (associated with the monsoon season).

Most YFT is taken by mechanised vessels using gillnets (92%) as a bycatch of fishing for other species resulting in poor quality catch that is sold into the relatively low value tuna canning market or at local markets. Mechanised fishers maintain that longlining methods remain uneconomic for YFT fishing at current prices offered at landing (pers. comm. Mr Prithvi Raj, Priyansh Fisheries Pvt.). YFT catch by small scale (“motorised”) vessels is also taken largely as a bycatch of target fishing for higher value species such as sear-fish utilising hand lines, longlines and/or gill nets. The use of netting methods (which reduce the quality of fish caught due to soak times) and lack of adequate on-board handling and preservation practices particularly in the motorised fleet results in very poor-quality fish being landed and low prices received.

⁴ This estimate is in the process of being updated and is likely to increase to 88,000 tonnes.

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 to enter the canning value chain. Fishermen complain that the prices they get for their yellowfin tuna are low. Buyers, on the other hand, complain that the fish quality is poor due to inadequate on-board 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. Defining and costing MCS services through risk assessment

Monitoring, Control and Surveillance is (MCS) is described by FAO as i) monitoring – the collection, measurement and analysis of fishing activity including, but not limited to: catch, species composition, fishing effort, bycatch, discards, area of operations etc, ii) control – the implementation of appropriate management instruments in order to regulate the fishery or the fishery resource, and iii) surveillance – the observing, policing and enforcement of the implementation of management instruments (see BOBP/REP/105). MCS in practical terms is indistinguishable from the concept of fisheries management and the services provided for managing fisheries that are established to realise the objectives set for such management.

A broad definition of MCS is therefore adopted in this business which recognises MCS as being the set of control measures, monitoring systems and hardware and activities needed to effectively implement fisheries management. While traditional MCS considerations often focus on regulatory measures, this business case also considers private sector controls and activities that can contribute to fisheries management such as co-management and fish product traceability and certification systems

This business case adopts a risk assessment methodology to provide an, admittedly preliminary, analysis of MCS rules in the YFT to determine where investment is needed in improvements. Such an approach in determining the nature and extent of services that need to be provided to effectively manage fisheries is recommended best practice by the United Nation as Food and Agriculture Organisation (FAO 2007). The risk assessment methodology adopts international best practice for risk assessment as detailed under the ISO 31000:2018 Risk Management standard⁵

Risks are assessed broadly against the specific IOTC goals set for tuna fisheries in the Indian Ocean which is, in brief, to “ensure the conservation and optimum utilization of YFT stocks and their sustainable development”. This goal is considered to be consistent with the broader SDGs and the GoI National Policy. Risks to define specific MCS services are assessed for a given regulatory regime against the more specific objective of maximising fishery compliance with the control rules established.

A diagnostic framework was developed to inform the risk assessment analysis which is detailed in Appendix 5.

3.5. Bay of Bengal – MCS characteristics

⁵ See <https://www.iso.org/files/live/sites/isoorg/files/store/en/PUB100426.pdf>.

Management of the YFT fishery is rudimentary. Fishing for YFT within the Exclusive Economic Zone (EEZ) of occurs largely outside the 12 nm and within this zone is regulated only by seasonal closures and some method controls (e.g. mesh sizes). The Government of India (GoI) and relevant states are in the process of both registering and licencing all mechanised and motorised vessels. Harbour landing restrictions (allowing boats to only land fish at designated harbours) are in effect. There is catch monitoring at landing sites carried out by the Department of Fisheries for all mechanised vessels and periodic surveys are conducted by the Central Marine Fisheries Research Institute to determine motorised and non-motorised vessel catch and collect scientific data at landing. This information is used to meet reporting obligations to the IOTC and support national scientific analyses and management.

Given the rudimentary regulatory requirements, surveillance and enforcement activities are minimal and are often associated with more general maritime security operations such as border inspection and implementing safety at sea requirements. Such surveillance and enforcement activities that are carried out are implemented by a range of agencies including Port Authorities, Coastal Marine Police, with jurisdiction out to 12 nm, and the Indian Coast Guard (ICG), with jurisdiction outside 12 nm. Fisher associations also play an important role in defining and enforcing harbour landing restrictions.

The National and State governments of India are in the process of establishing a nationwide system of biometric card identification for fishers, linking subsidies payments to individual fishers, and the development of a vessel monitoring system⁶. Fish export quality assurance forms an important part of the regulatory environment to authorise export. Approval to export fish, including to the European Union, is provided by a GoI established certification body; the Export Inspection Council. The Marine Products Export Development Authority is responsible for assisting fishers in developing capacity to meet export standards.

3.6. Bay of Bengal – Constraints to tuna fisheries development

The continuation of the present situation, with rudimentary management, use of non-target and low quality fishing methods and limited and poor quality on-board tuna handling and preservation practices, has a number of serious implications, as follows:

- First, the open access entry regime promotes investment in fishing capacity and bulk fishing methods at the expense of fishing quality. As a consequence, the availability of landed high quality yellowfin tuna will remain low.
- Second, the limited availability of high quality yellowfin 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 yellowfin represents a major constraint for new investment in the development and expansion of processing operations and the development of trade with both domestic and export markets.

⁶ A Vessel Monitoring System is being introduced across the mechanised fishing fleet on the basis that fishers will be provided with a 50% subsidy on purchase of transponder equipment. States are currently collaborating on the development of specification for the VSM system which will include a monitoring system for the motorised fleet.

- Fourth, economic returns from the valuable yellowfin tuna resources found in the Bay of Bengal will continue to be severely limited as a result of suboptimal catches and inefficient and low quality fishing and process practices. The consequence is a minimal positive impact on and contribution to economic development in coastal regions in particular.

4. WHO ARE THE LIKELY INVESTORS?

Key points

- In the first instance, the business case is most likely to attract direct or indirect (e.g. international multilateral funding) government and / or philanthropic investment given the need to establish an effective regulatory regime and build new MCS systems and capability;
- Private sector investment in the fishing and processing / marketing sectors will become attractive once revised regulatory systems are adopted;
- Government (public) investors might also partner with private investors (e.g. to provide technical assistance and capital directly or through, public private partnership arrangements).

Public investment

Direct government (public investment) will be attracted to this business case for two reasons:

- i) The investment is coherent to national policy on fisheries development and management;
- ii) The investment will enable the GoI to meet its international obligation with the IOTC Agreement and more widely under obligations made under United Nations SDG resolutions;

The GoI National Policy on Marine Fisheries 2007 already contemplates a range of MCS initiatives aimed at improving management of fisheries more generally in fisheries. This investment will serve to implement those initiatives in a manner coherent with wider commitments made to conserve and optimally utilize the fishery to the benefit of fishers and the economy as a whole. It will also provide a useful exemplar for other fishery investments to meet the objectives of the National Policy on Marine Fisheries, 2017.

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 (international philanthropic organizations) – especially if the combination of likely financial and non-financial benefits have a recognizable development impact and linked to policy (e.g. rural development, economic development in coastal areas).

Private investment

The business case is most likely to attract private investors (at the level of the firm) in value addition and vessel improvement once a new regulatory approach is implemented. 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 private partnership

Given the nature of the investment it is also a potentially attractive proposition for the development of a public private partnership arrangement whereby a collective industry entity (perhaps made up of fish buyers or license holder cooperatives) enters into a partnership with state or central government encompassing investment to develop the vessel and processing value chain and a means to fund that investment through license holder and processing returns.

5. WHAT IS THE BUSINESS OPPORTUNITY?

Key Points

- The business opportunity concerns the development of a new and innovative MCS regime to stimulate and underpin the sustainable development and profitable utilization of the yellowfin tuna (YFT) fishery in the Bay of Bengal;
- Investment will be required in both the private and public sectors to implement an effective MCS regime aimed at ensuring sustainability and economic profitability of YFT harvests;
- Investment capital will be used to develop appropriate systems, provide hardware, and to coordinate and provide training and capacity development, in both government and private sector entities involved in YFT fishing, processing, management and certification for sale;
- Benefits will include financial (profits and return on capital) for fishers and private firm investors (and their shareholders) in the value chain, as well as significant wider economic impacts and benefits (employment, incomes, fiscal contributions and investments) for a broader group of citizens (both within and outside the seafood sector) and State and National governments.

The Goal

The business opportunity concerns the development of a new and innovative MCS regime to stimulate and underpin the sustainable development and profitable utilization of the yellowfin tuna (YFT) fishery in the Bay of Bengal.

The Kick-start Investment

To start, investment will be required to develop appropriate systems, provide hardware, and to coordinate and provide training and capacity development, in both government and private sector entities involved in YFT fishing, processing, management and certification for sale.

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. Good quality tuna attracts high prices in key markets. The Bay of Bengal YFT stocks form part of the Indian Ocean stock of YFT administered through the IOTC. The India catch history share of the sustainable yield set by the IOTC is less than 50% of the estimated sustainable yield available in the India EEZ.

The YFT stocks of the Bay of Bengal underpin a fishery distributed along the east coast of India. These stocks are underutilized when measured against the estimated sustainable yield that is available for harvest with the India EEZ and the Bay of Bengal.

The regulatory framework applying to YFT fishery is effectively open access in nature supporting an increase in mechanised fishing capacity and unspecialized fishing practices.

Most YFT catch in the Bay of Bengal is taken as a low quality bycatch of gillnet fishing operated by mechanised vessels or by motorised, small scale, vessels lacking rudimentary equipment 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.

At the level of the wider Indian economy, this means that 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 higher returns and earnings.

Current YFT fishing using high quality hook and line based fishing methods, such as it exists, is largely carried out by the small-scale fishing fleet. As fishing by small scale vessels is not constrained within the framework of the IOTC, and the estimated sustainable yield in the Bay of Bengal is under-caught, this offers a unique development opportunity that need not adversely impact current catch of YFT and will better position the GoI in IOTC discussions in the future.

Investment capital utilisation

Investment capital will be used in two ways as follows:

- i) To develop appropriate systems, provide hardware, and to coordinate and provide training and capacity development, in government agencies to develop an effective regulatory framework for YFT and to monitor and enforce this framework; and
- ii) To develop appropriate systems, provide hardware, and to coordinate and provide training and capacity development, in the private sector (including the establishment and operation of a buyer cooperative) to align and develop traceability and certifications schemes to support government MCS systems and the marketing of YFT products.

Potential benefits and beneficiaries

The potential benefits and the beneficiaries will be found at four levels, as follows:

- i) Foremost, the investment will provide small scale fishers with an opportunity to increase catch landed, price received and improve profit margins from investment in high quality fishing methods and fish handling procedures.
- ii) At the level of the firm, the investment will provide a foundation for the establishment of new private fish processing enterprises and / or marketing ventures that will generate significant financial benefits including revenues, profits, a return on investment capital and a return of the investment capital. The major beneficiaries will be the private investors and the shareholders of the companies involved.
- iii) More generally, the establishment of profitable and viable fishing and 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).

The major beneficiaries will include a broad range of actors – a stable, profitable and valuable seafood sector will offer direct employment opportunities in fishing and seafood companies (e.g. YFT fishing, processing and exporting), as well as in supporting and ancillary activities (e.g. suppliers of inputs and services, such as packaging and transportation). 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.

- iv) In terms of non-financial benefits (as opposed to financial and economic benefits) – the MCS investment will underpin a range of direct and indirect political, social and environmental benefits including – establishment of a robust management regime to protect fish stock sustainability and meet GoI international commitments (e.g. to the IOTC), 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 and revenues 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.

6. WHAT ARE THE INVESTMENT OPTIONS CONSIDERED?

Key points

- Three investment options in YFT MCS are evaluated;
- Option 1, the Baseline Case, which involves ongoing investment in MCS at a rudimentary level, results in significant economic loss and ongoing risk to sustainability of stocks. Moreover, GoI obligations arising from a range of international agreements, including the Indian Ocean Tuna Convention, will not be met under the current approach.
- Option 2, the Value-Added Investment Case, considers the potential for increased MCS investment under current fishery control rules assuming value added investment also occurs. The risk assessment identifies that increased MCS investment under such conditions will further reduce economic benefits and increase sustainability risks;
- Option 3, the New Regulatory Approach Investment Case, establishes a revised regulatory approach supported by investment in MCS in both the public and private sectors. This option provides high returns on investment in policy / institutional development, hardware, systems development, and training;
- For Options 2 and 3, value added investments are assumed to increase landed price received from 100 to 200 INR/kg (1.37 to 2.74. USD/kg).

Three investment options in YFT MCS are considered; Option 1 - the **Baseline Case** (no investment over and above current MCS commitments), Option 2 – the **Value Added Investment Case** where investment in value chain development occurs under current rules; and Option 3 – the **New Regulatory Approach Investment Case** where investment occurs in the development and application of a new MCS regime. These options are detailed below.

Option 1 Baseline Case (without investment)

The baseline case, against which this investment is assessed, is the current regulatory framework and associated monitoring, control and surveillance activities. These as discussed in the context section above and can be summarised as a regulated open access regime with no direct monitoring of YFT catch across the small scale fishing sector and little or no regulatory constraint on how much YFT can be taken each year. The current regime is also underpinned by subsidies on fishing *per se* and for promoting particular fishing methods. Under open access conditions these subsidies likely lead to marginally economic fishing activity (where profitability over and above costs of fishing and payment of crew is at or near zero). *On this basis it is assumed that current fishing costs, including vessel capital and operational costs and returns paid to crew, leave no economic surplus from revenues received from YFT caught and landed.*

The baseline case is costed for a motorized fishing fleet only (i.e. it does not include mechanized fishing) for comparison with the two investment options detailed below. Estimates of fishing costs are based on information secured from interviews with fishers and processors and assume small scale vessels catch (or could catch) 100 kg YFT per trip and that each boat undertakes 180 trips per year. The annual catch for baseline analysis is, therefore, assumed to be 18 mt per year per vessel. Investment performance is assessed relative to these baseline assumptions, but sensitivity analyses are carried out to test a broad range of catch scenarios.

The motorized 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 1.37/kg), giving an annual turnover of USD 24,617. The annual operating cost

per boat is INR 1,080,255 (USD 14,869). The small-scale operator does not process any of the YFT which is landed by this operation.

With investment options – common assumptions

Investment options 2 and 3 are considered in reference to the baseline. Both these investment options develop MCS requirements for investment through the application of a risk assessment methodology which examines risk associated with a given management scenario. Under Option 2, the Value-Added Investment Case, a risk assessment is carried out on the basis that the current management regime, including enhancements signaled in the GoI National Policy on Marine Fisheries, 2017 will be implemented and that value chain investments contemplated in Business Case 1 will also be adopted. Under Option 2, the New Regulatory Approach Investment Case, a risk assessment is carried out against a revised management regime whereby a limited license regime is constructed around the development of a small scale high value hook and line fishing sector.

In both cases, it is assumed that investment in fishing and processing, either as a direct government intervention (e.g. subsidies for building processing / marketing capacity) or through private sector enterprise, will occur in line with the expected financial returns detailed in Business Case 1. Under this approach the **landed price rises (INR 200/kg or USD 2.74/kg)** and the annual operation costs per boat rises (INR 1,114,255 or USD 15,239) to reflect increased costs and price associated with improved handling and refrigeration. Processing investment costs and returns are recovered from sales revenue after landed prices paid for fishers are deducted. The total processing costs are calculated multiplying the number of investments in processing operations needed (divided between large and small operations) to service the anticipated high value catch target of 50% of the Bay of Bengal sustainable yield or 17,500 mt.

Note that this approach assumes that 8 large and 43 small processing operations will be implemented. This assumption is used for the purpose of developing this business case and it is emphasized that other (potentially more cost effective) options for value chain development (such as through expansion of existing plants, secondary processing offshore (e.g. Sri Lanka)) are also likely. It is assumed that such initiatives will only be undertaken if they are more cost effective and therefore the implementation of 8 large and 43 small processing operations is assumed to be a worst case (in terms of cost) investment scenario. These operations are costed in Business Case 1.

Option 2 Value Added Investment Case

Following on from the Baseline Case (above), it is recognised that there is considerable opportunity to develop the YFT value chain and such development is likely to proceed, and indeed is already proceeding, regardless of whether there is investment in MCS. This case assumes that such value added improvements will be applied in line with Business Case 1 and that MCS investments will occur as outlined in the GoI National Policy on Marine Fisheries. The National Policy on Marine Fisheries, 2017 contemplates investment in improving a range of MCS systems and services, including the expansion of the vessel licensing system to motorized vessels, the continued implementation of a biometric card system at fisher level and the adoption of a vessel monitoring systems. It is acknowledged that the policy also contemplates the introduction of a revised regulatory framework to manage fishing capacity in the YFT fishery when needed although no framework or timeframe is set for such reform. This value added investment case assumes no such changes will be introduced.

A risk analysis was carried out to assess the risk of the current MCS framework applying to YFT management in the Bay of Bengal against the objectives established under the mandate of the IOTC (see Appendix 6). The risk assessment identified that the current framework carries a high level of risk that the IOTC objectives will not be met across all risk characteristics. This is because the current MCS framework does not control catch or fishing effort at regional, sub-regional, or national level. The risk to optimizing economic use is more urgent than the risk to sustainability because the current framework is leading to a dissipation of economic value as vessel numbers and capacity expands even though sustainable catch levels are yet to be realized in the India EEZ. In the medium term, the current MCS will also have little real impact on realising the IOTC objectives of ensuring conservation of YFT stocks in the Indian Ocean as a whole.

Option 3 *New Regulatory Approach Investment Case*

Following on from the baseline case (above), it is recognized that current catch of YFT in the Bay of Bengal is significantly less than the potential sustainable yield estimated available by the GoI in the India EEZ. Rather than maintaining the current regulatory framework, it is proposed that a limited licensing regime is introduced across 50% of the fishery for the method of hook and line fishing specifically - which is roughly equivalent to the untaken yield of YFT in the India EEZ of the BoB plus the catch taken by the existing hook and line fishery (see Table 1)⁷. This approach, if managed with care, has potential to be introduced without adversely impacting existing fishing operations. It offers a unique investment opportunity in a discrete part of the YFT fishery combining management with development.

Table 1: Estimated catch and yield of YFT

Bay of Bengal YFT method	Current catch	Mechanised	Motorised	Target harvest	Surplus / (over-catch)
All methods	24,770	11,115	13,655	35,000	10,230
Gillnet methods	18,770	10,729	8,041	17,500	(1,270)
Hook and Line methods	6,000**	386	5,614	17,500	6000

Source: IOTC data, ** scenario estimate (see footnote)

On this basis the target catch for hook and line vessels would be set at 17,500 mt which is half the estimated 35,000 mt estimated sustainable yield available from the India EEZ of the Bay of Bengal. In order to create a regulatory environment supportive of this MCS investment case the following new regulatory approach is proposed:

- i) A target catch limit for the hook and line fishery of 17,500 mt will be established. This target is considered sustainable within the current YFT yield estimates for the India EEZ of the Bay of Bengal given current estimated catch;
- ii) Licences for hook and line fishing will be limited to 1000 equivalent motorised vessels (by State and Federal law) whereby 1 mechanised licence will be equivalent to 10 motorised

⁷ Information is not available on the number of motorised vessels fishing YFT using hook and line method and it is acknowledged that current practice is often to swap from this to other methods such as gill net fishing on a regular basis. For purpose of this analysis it is estimated that these boats catch 6,000 mt of YFT.

licences. 1000 motorised vessel equivalents are assessed as capable of catch the 17,500 target limit at an optimal 100 kg per trip catch rate;

- iii) YFT fish buyers will be licenced as YFT Licenced Fish Receivers (YFT LFRs) and they will be the only buyers permitted to buy from YFT hook and line vessels at designated landing points;
- iv) The number of YFT LFRs will be limited and they will be required to belong to a producer cooperative with responsibility for overseeing and administering traceability systems and be consulted on the establishment of rules for fishing;
- v) Boat catch limits may be introduced if required to limit expansion of effort by mechanised vessels;
- vi) A moratorium on non-hook and line vessels catching YFT will be implemented and capacity managed to restrict harvesting to 17,500 mt if necessary. Given the low value of landed product there is evidence that expansion of fishing effort by these vessels will be unlikely;
- vii) Increases to the YFT hook and line catch limit will only be made if non-hook and line catch of YFT is retired or reduced;
- viii) Penalties for non-compliance with new rules will be established which may include loss of hook and line licence;
- ix) The subsidy on conversion of mechanised gill netters to hook and line will be removed immediately as it is no longer needed and works against the new regulatory regime;
- x) Consideration will be given to removing other subsidies in return for access to the hook and line fishery.

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

Key points
<ul style="list-style-type: none"> • A time horizon of 20 years is used for the investment and cash-flow schedule; • The investment is fully costed aligned to the timeframe needed to develop value chain profitability and co-management arrangements; • Initial MCS investments to implement new regulations and build systems, capacity and capability in both the private and public sectors are scheduled over a 5 year period followed by increased annual costs associated with implementing the more intensive regulatory regime; • Investment in vessel capital improvements are schedules at 5 year intervals reflecting the life of equipment provided; • Co-management arrangements are developed over a 6 year period, followed by ongoing operations, and costed accordingly; • Value chain development is costed over a 10 year period. Profitability improvements are linked to value chain development.

The rationale for, level of investment, and scheduling for MCS investments specifically and for the consolidated overall investment costs, incorporating vessel improvement, value chain development and co-management, are presented in detail in Appendix 9, including a cash-flow and profit schedule.

An investment time-horizon of 20 years is used. Given the long timescale and spread of investments over this period, costs are presented as total costs and as the NPV of costs (assuming a discount rate of 8% per annum). These are summarized in Table 2 below:

Table 2: Consolidated table of investments.

Investment component	Total cost over 20 years	NPV of costs (8% discount rate)
Value chain investments	8,241,874	5,530,365
Vessel upgrades	5,397,777	3,072,508
MCS investments	40,494,444	17,529,658
Co-management	24,682,778	15,604,855
Total investment costs	78,816,874	41,737,386

Value chain investments are based on costs provided in Business Case 1 and scaled across the 17,500 mt hook and line fishery. Value chain development is costed over a 10 year period and assumes 8 large and 43 small processing operations will be needed and the implementation of these investments will be evenly spread over 10 years. These costs are used for modelling purposes only and it is expected that value chain development will evolve in a more optimal way in practice combining existing and offshore processing and marketing activities. Total investment costs in value chain development are estimated at USD 8,241,874.

Investment in vessel upgrades (i.e. ice boxes and quality fish handling training) for 1000 motorised vessels are scheduled at 5 year intervals in Years, 1, 6, 11 and 16 reflecting the life of equipment provided. The total cost of these investments over 20 years is USD 5,397,777.

Initial MCS investments are based on estimates for implementing new regulations and building systems, capacity and capability in both the private and public sectors and are scheduled over a 5 year period (Total cost USD 4,494,444) followed by increased annual costs associated with implementing the more intensive regulatory regime over the next 15 years (Total cost USD 36 millions). Total MCS costs over 20 years associated with the new regulatory approach are USD 40,494,444. The net present value of the MCS investment, representing the investment value in today's dollars, is somewhat lower at 17,529,658 reflecting that the costs are spread throughout the investment period.

Co-management arrangements are developed over a 6 year period, followed by ongoing operations, and costed accordingly. Costs are scaled across the 1000 vessel fishery based on estimates provided for Business Case 2 for the Puducherry component of the fishery. Total costs are estimated at USD 24,682,778.

Profitability improvements are linked to the assumed 10 year sequence of value chain development. In practice this is likely to be a conservative approach as it is quite feasible that existing operations will expand quickly to secure higher quality fish if it is supplied and that prices will be higher than modeled given international benchmarks.

8. WHAT IS THE EXPECTED PERFORMANCE OF THE INVESTMENTS?

Key points

- On the basis of an investment appraisal exercise, investment in MCS to accompany value added investment has a negative return and is not recommended.
- MCS investment required to implement a new regulatory approach, and incorporating all costs of value chain and co-management, showed a high level of performance with significant profits, short payback periods, and both positive and large NPV and RoI scores.
- The ‘with investment’ YFT fishery would generate nearly three times more revenue and significant economic surplus giving a fishery valued at over USD 303 million (capital value);
- These appraisals are 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.

Baseline Case

The value added investment case and the new regulatory approach investment case are assessed against a baseline case as follows:

- 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);
- Under the ‘baseline case’, it is assumed that it would require 972 fishing boats to take the specified harvest above;
- Total fleet operational costs are USD 15,225,000;
- The total returns to the crew are USD 8,708,260;
- It is assumed that there is no processing of high quality YFT;
- Therefore, overall, the total fishery revenue for all operations would be USD 23,933,260;
- There would be no economic surplus generated;
- The total economic benefits (crew share and economic surplus) would be USD 8,708,260;
- On this basis, the fishery has no capital value.

With investment options

The two investment options were evaluated. Both investment options assume value chain and vessel upgrade investment will occur (as is currently happening in at a small scale in Puducherry with government and philanthropic investment) and that this would increase the price paid to fishers for each kg of YFT from 100 INR (USD 1.37) to 200 INR (USD 2.74) and market price (after processing) to 256 INR (USD 350). Performance of the Value Added Investment Case and the New Regulatory Approach Investment Case are compared in Figure 1 and 2 below and described in the following sections.

Figure 1: Comparison of annual returns from investment cases across all vessels (*USD 1000)

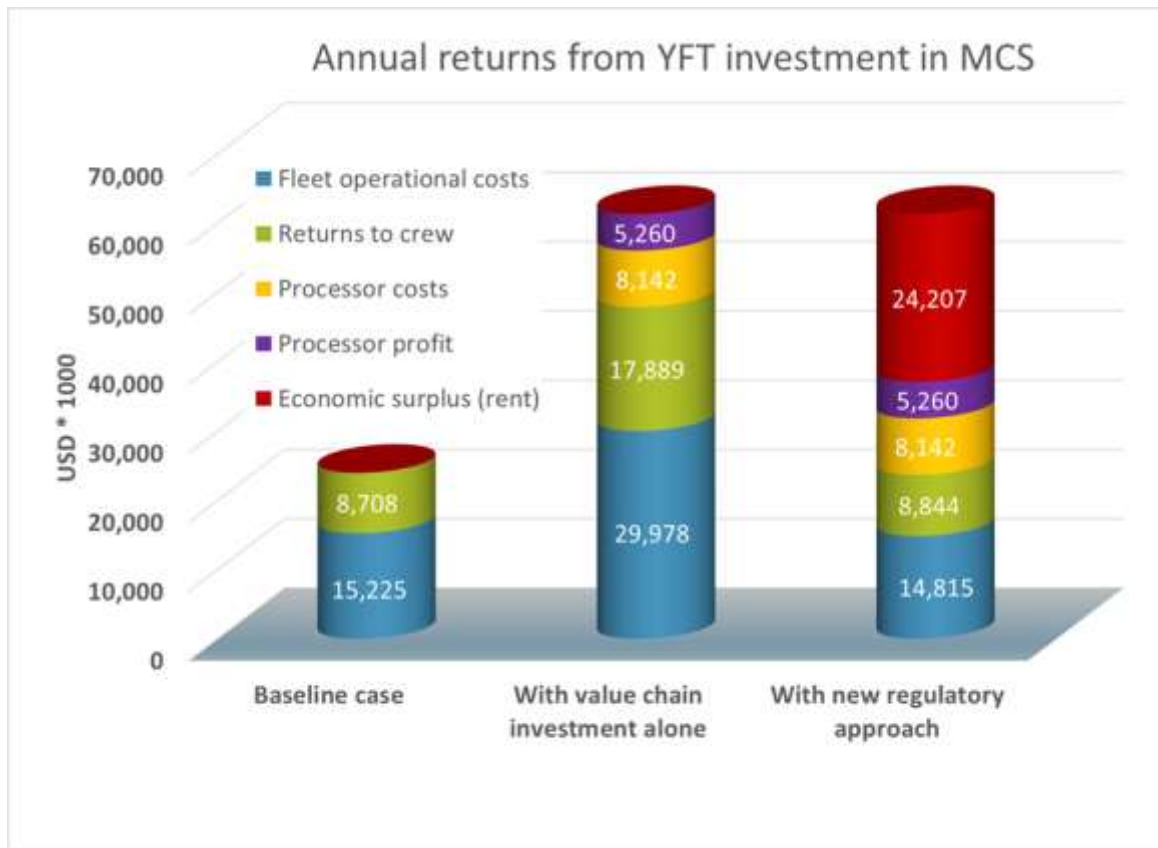
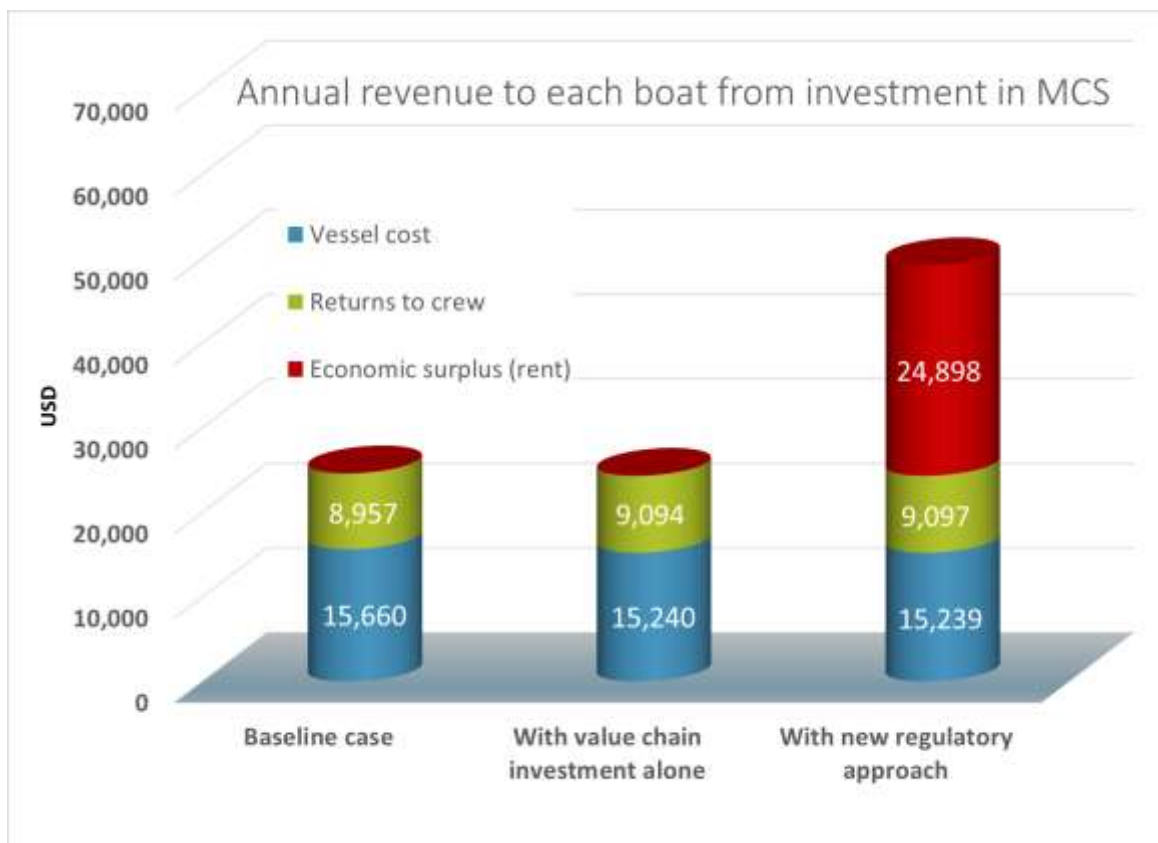


Figure 2: Comparison of annual returns from investment cases for each boat (USD)



[1] Investment appraisal – Option 1: Value Added Investment Case

It is assumed in this investment appraisal that the open access nature of the regulatory framework, which does not constrain vessel numbers or fishing effort, will provide fishers with an incentive to continue to enter the fishery retaining profitability at current estimated levels (i.e. marginally economic). Investment in value addition will consequently convert quickly into increased investment in fishing effort.

The consequence of this transfer of effort is that nearly 2000 vessels will be needed to harvest 17,500 mt of YFT assuming price increases associated with value added investment (i.e. hook and line, quality handling and processing). This is double the number of vessels in the Baseline Case. Catch per vessel under this scenario will reduce from 100 kg per trip to around 50 kg per trip on average. Fleet operational costs will double from USD 15.2 million to nearly USD 30 million. While total returns to crew will increase from USD 8,708,260 to USD 17,500,000 each year, the returns to each boat will stay at around USD 9,000 each year. Importantly there will be no economic surplus as any improvement in profitability will have been capitalized in increased vessel and labour costs.

On the basis of this investment appraisal exercise, increased investment in MCS under the current regulatory framework provides a negative return on investment and is not viable. There is no case for investment in MCS measured in terms of a return on investment.

The results of this analysis are presented in Figures 1 and 2 above and More detailed results are presented in Appendix 8.

[2] Investment appraisal – new regulatory approach

MCS investment required to implement a new regulatory approach, incorporating all costs of value chain development and co-management, showed a high level of performance with significant profits, short payback periods, and both positive and large NPV and RoI scores.

The annual fishery revenue for the 17,500 mt fishery would increase from the baseline case of about USD 24 million per annum to USD 61 million per annum. Annual economic surplus would increase from USD 0 to USD 24 million per annum (40% of revenues). The capital value of the fishery asset based on this economic surplus would be USD 303 million.

Total fishery revenues over the 20 year investment would be around USD 888 million with investment costs USD 79 million. The total profit (or rent) for the investment case, which provides for a scheduled increase in returns linked to investment effectiveness, would be about USD 351 million over the 20 year investment period. The economic surplus (cumulative) starts off at (-) USD 4,327,660 (Year 1) and reaches (+) USD 4,569,083 (Year 4). The economic surplus continues to increase in line with value chain development to optimum level after 10 years of USD 24,206,694 and remains at this level on into the future.

Table 3: Key investment metrics

Metric	Total cost / profit over 20 years	NPV (8% discount rate)
Total fishery revenues	888,402,626	349,586,382
Total investment costs	78,816,874	41,737,386

Total profit	350,997,064	138,117,324
Profit after costs are deducted	272,180,190	96,379,938
Internal Rate of Return (IRR)		22%
Return on Investment (RoI)		345%
Payback period in years		5
NPV of investment		96,379,938
Discount rate		0.08

The Net Present Value of the investment (calculated as the NPV of profits minus the NPV of investment costs using a discount rate of 8%) is significant at over USD 96 million with a return on investment of 365 % rate (calculated as the (sum of profits - sum of investment costs) / sum of investment costs) and an Internal Rate of Return of 22%. The Payback Period on this investment is 5 years.

9. WHAT ARE THE ASSUMPTIONS AND RISKS?

Key Points

- The Option 3 investment was assessed for sensitivity to changes in three key variables as follows: i) fishing boat numbers, ii) investment costs, iii) fish price (landed price)
- An increase in fishing boat numbers by 100% reduced investment performance to zero. Under such a scenario catch per vessel reduced to a marginally economic level at about 50 kgs per trip;
- MCS investment costs assume management and ongoing MCS costs after new systems and capacity is built. Relaxing these assumptions increased NPV returns significantly;
- The investments are highly sensitive to YFT price. The investments provide a negative return if landed price drops below 120 INR.

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 assessing the sensitivity of investment in Option 3 to changes in four key variables as follows:

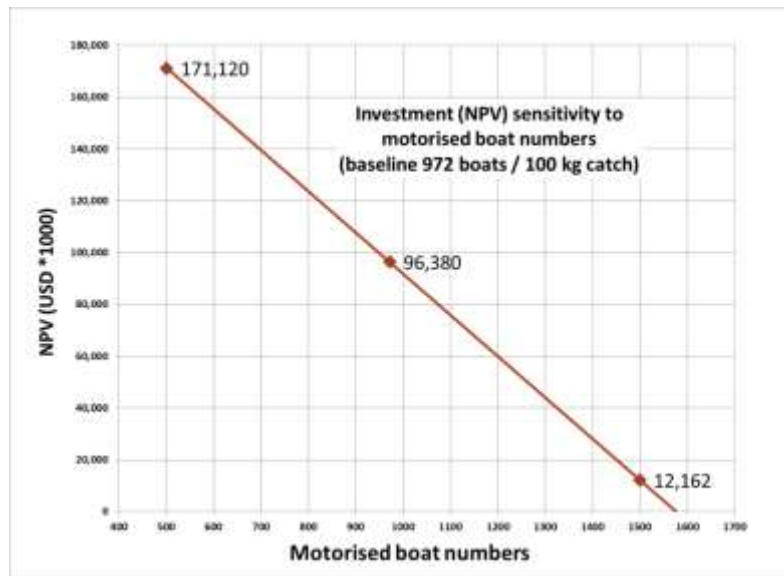
- Fishing boat numbers (profitability)
- Price of YFT
- Investment costs
- Supply of YFT (i.e. catch limits)

These four variables are considered in terms of the impact of % changes on the NPV of the investment.

Fishing boat numbers (profitability)

The number of vessels fishing, and the catch rate of the vessels, has a major impact on the viability of the investment. An increase in fishing boat numbers by 50% from 1000 to around 1600 will reduce the NPV of the investment to zero, which is the expected outcome under open access. Under such a scenario catch per vessel is reduced to about 62 kgs per trip. On the other hand, if catch rates per vessel are increased and the number of vessels halved then the NPV will nearly double to \$171 million. Fishers can achieve results like these, provided that the MCS framework provides the right incentives. Therein lies the challenge and the interest in this business case.

Figure 4: Investment sensitivity to vessel numbers.



Investment sensitivity is calculated by relaxing some investment cost assumptions. The Option 3 investment is fully costed to include co-management and ongoing MCS costs once the systems and capacity of government and the private sector are built. It however might be the case that ongoing MCS costs will be fully paid for by the GoI within the framework of the National Policy on Marine Fisheries and can be considered as costs not attributable to the investment. Table 4 shows the impact of removing these costs which would improve the performance of the investment significantly.

The investment provides for the establishment of a buyer cooperative that can coordinate and discipline fisher engagement and it therefore might be argued that this will lessen the need for associated co-management investments. It should be noted however that the removal of co-management activities would significantly raise the risk of investment failure as these activities are aimed at engaging fishers and potentially communities in the management process and in sharing the economic surplus gained from the investment. ***Co-management investments are therefore critically important for building legitimacy and providing incentives for fishers to comply with the new regulatory framework.***

Table 4: Investment costs sensitivity

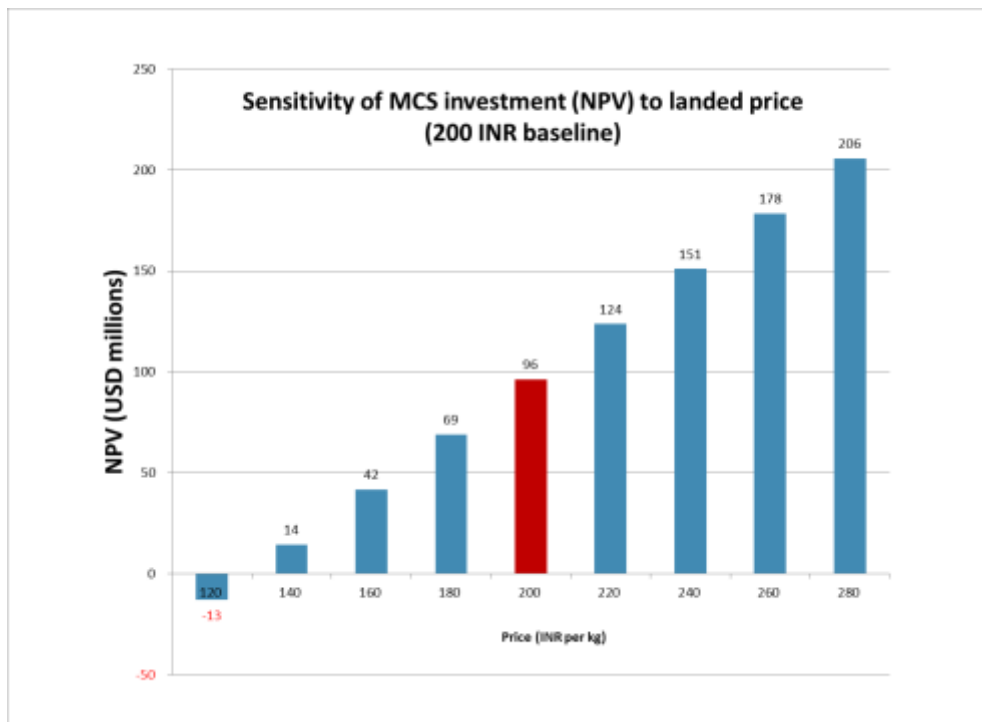
Investment scenarios	IRR	ROI	Payback	NPV
Without ongoing MCS costs included	28%	720%	5	110,360,988
With ongoing MCS costs included	22%	345%	5	96,379,938

Sensitivity to landed price

The sensitivity of the investment was tested by holding the margin between the landed price and wholesale price constant (this approach assumes any increased benefit or loss in profitability will accrue within the landed price and not to the processor). Landed price of YFT appears to be critically important, and the analysis shows that NPV is sensitive to change. With a 30-40% decrease

in landed price (to 120-140 INR per kg), the NPV becomes negative meaning that a greater than 30% reduction in price renders the investment as not viable.

Figure 5: Investment sensitivity to landed price



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.

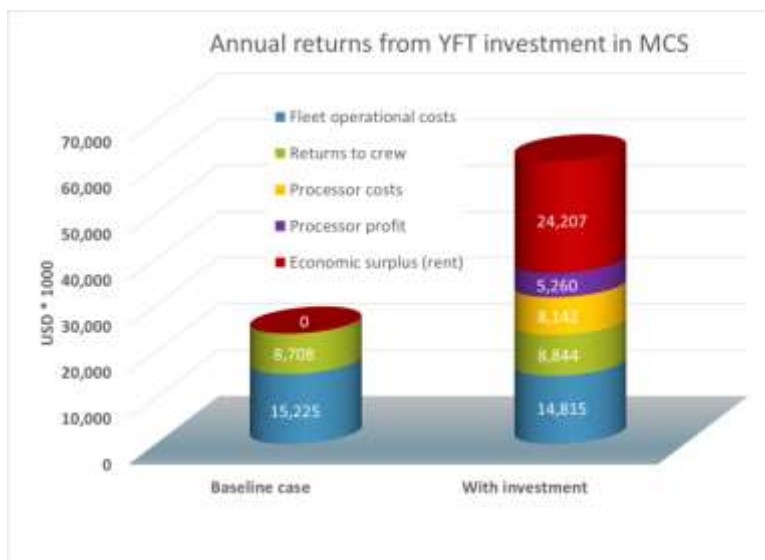
10. WHAT ARE THE MAIN CONCLUSIONS AND RECOMMENDATIONS?

Main conclusions

[1] UNREALISED ECONOMIC POTENTIAL: India does not have a large yellow fin 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 ('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, investments in a revised Control and Monitoring system – to enable the development of a sustainable and high value catch sector and the capture of economic benefits - showed a high level of performance with significant economic benefits, short payback periods, and both positive and large NPV and RoI scores. The option of establishing a revised control system performed better than both the baseline case 'without investment' (open access fishing fleet, no processing, 'business as usual' MCS) and the value-added case (open access fishing supplemented by value addition and enhanced MCS). The value added case was shown to cause increased investment in non-productive capital such as vessels and gear at the expense of profitability.

Figure 6: Annual returns of the preferred investment



[3] FISHERIES DEVELOPMENT: Assuming an annual catch of 17,500 mt of YFT, the investment in MCS would enable capture of significant economic returns along with the establishment of a sustainable and profitable catching and processing sector. The 'with investment' YFT fishery would generate annual profit (rent) of over USD 24.2 million in addition to providing a normal return on capital invested in fishing and processing. Economic returns would have a capital value of USD 303 million.

[4] RISKS AND ASSUMPTIONS: Sensitivity analysis revealed that two critical factors affected investment performance – vessel numbers (capacity) and price. The investment is fully costed encompassing ongoing MCS costs (after new systems and capacity are built) and co-management costs. Relaxing these assumptions on the basis that ongoing MCS costs are core government funding commitments needed in order to effectively implement the National Policy on Marine Fisheries would increase NPV returns significantly.

Recommendations:

[1] It is recommended that potential investors, both within and outside the seafood sector, should give serious consideration to future investment in the establishment of effective product traceability and sustainability MCS systems in the Bay of Bengal in 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 the regulatory regime adopted, as well as price (landed and wholesale), are critical factors. More robust data should be obtained to further evaluate price effects and the general enabling environment (policy, governance, economy) should also be examined carefully before committing to a definite investment.

G. APPENDICES

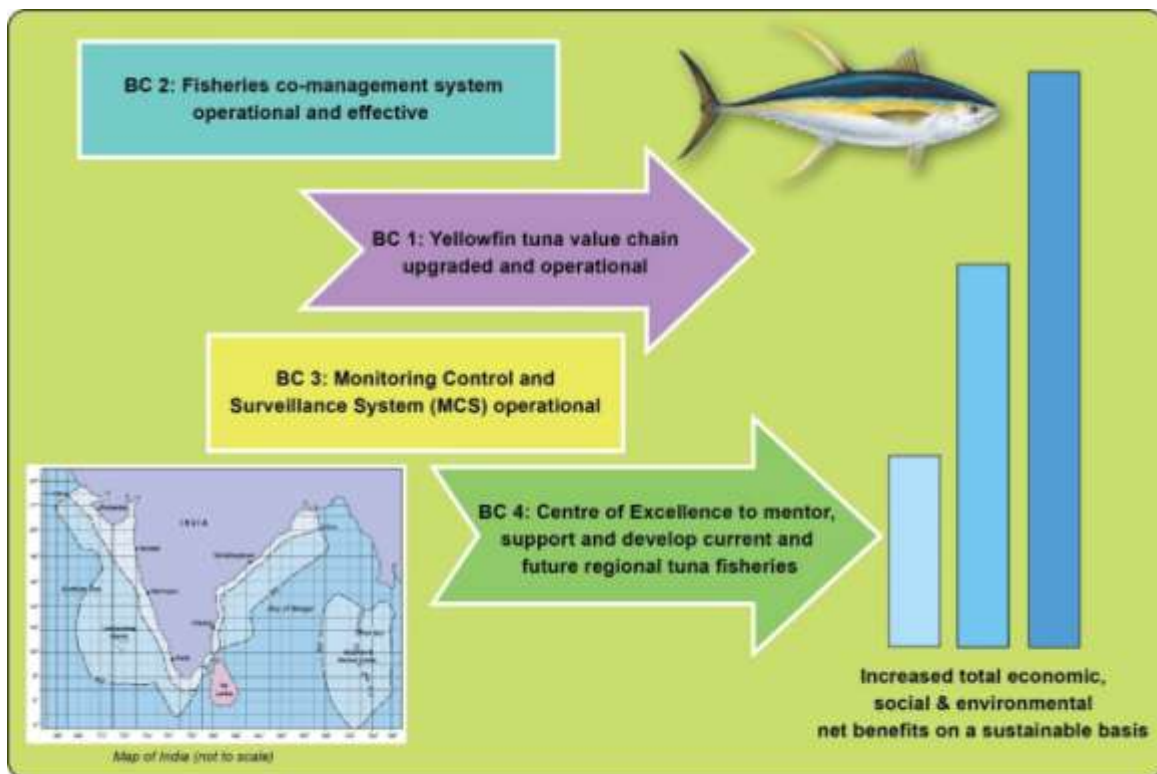
APPENDIX 1: Oceans Partnership Programme– Bay of Bengal Four Business Cases

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 USD 303 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 in MCS of USD 40 million over 20 years will provide a high Return on Investment of over 345%.

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: IOTC Conservation and Management Measures

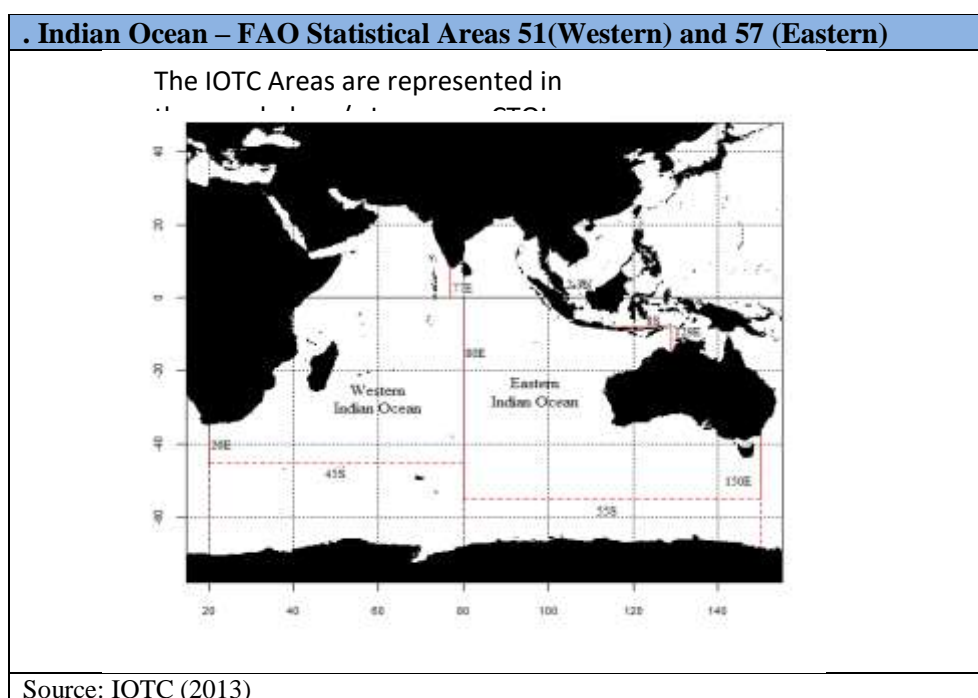
Summary of IOTC Conservation and Management Measures applicable to the Bay of Bengal YFT fishery.

CMM Resolution	Purpose	Relevance to YFT in the Bay of Bengal EEZ
18/01	On an interim plan for rebuilding Indian Ocean YFT stocks	Only applies to vessel greater than 24 meters fishing within flag state EEZs and less than 24 meters if fishing outside EEZs. CPCs ⁸ are to reduce purse seine catch by 15% if catch over 5000MT, restrict use of FADs per vessel, reduce supply vessels, report information on FAD catch, reduce gill net catch by 10% if catch over 2000MT, reduce longline catch by 10% if catch over 5000MT, evaluate catch information and take appropriate measures on the management of artisanal YFT fishery where required
15/01	On recording of catch and effort data by fishing vessel in the IOTC	CPCs are to subject all fishing vessels to a data recording system and report catch for MCS activities. Applies to all vessels although data recordings systems for developing CPCs are to be implemented progressively from 2016. Reporting specifications are defined.
15/02	Mandatory statistical reporting requirements for IOTC CPCs	Mandatory reporting of YFT catch, catch and effort data, and fish size on an annual basis.
15/03	On VMS programme	CPCs shall adopt a VMS programme for all vessels fishing outside the EEZ and all vessels > 24 m in length.
15/04	Concerning the IOTC record of vessels authorised to operate	CPCs shall maintain a record of all vessels fishing outside the EEZ and all vessels > 24 m in length
15/10	On target and limit reference points and a decision framework	Establishes a Target Reference Point for YFT as Bmsy and a Limit Reference Point for YFT as 0.4 Bmsy
18/04	On BIOFAD experimental project	Project to reduce the amount of synthetic marine debris arising from FADs
18/03	On establishing a list of vessels presumed to have carried out IUU fishing	CPCs to provide IOTC with list of IUU vessels.
18/06	On establishing a programme for transshipment by large scale fishing vessels	CPCs to report transshipment from large scale longline tuna vessels (>24 m)
18/07	On measures applicable in case of non-fulfilment of reporting obligations	CPCs may be prohibited from retaining species where non-compliance with reporting obligations occurs.
18/08	Procedures on a FAD management plan	Applies to purse seine vessels only. Establishes procedures for management of FADs to minimise bycatch of juvenile YFT
18/10	On vessel chartering	CPCs to report charter arrangements to IOTC

⁸ CPC represents any Contracting Party and Cooperating Non-Contracting Party under the IOTC Agreement

17/04	On a ban on discards of YFT caught by purse seine vessels	Illegal to discard YFT caught in purse seine. All dead YFT to be retained by all methods unless unfit for human consumption.
17/07	On the prohibition of large-scale drift nets	Gill nets use of more than 2.5 km in length prohibited.
16/07	On the use of artificial lights to attract fish	Applies outside territorial waters. Prohibition on using artificial lights to attract YFT
16/08	On the prohibition of use of aircraft and unmanned aerial vehicles as fishing aids	Use of aircraft and unmanned aerial vehicles prohibited as fishing aids.
16/10	To promote implementation of CMMs	A special fund for capacity building to be maintained from 2017-21 to promote implementation of CMMs
16/11	On port state measures to prevent IUU fishing	Port state measures to be applied for non-India flagged vessels applying to land YFT except for neighbouring state artisanal subsistence fishers
14/02	For the conservation and management of tropical tuna stocks	CPCs shall establish an allocation system (quota) or any other relevant measures for YFT
14/05	Concerning a record of licenced foreign vessels	CPCs shall keep a record of licenced foreign vessels and report to IOTC
12/06	On reducing the incidental bycatch of seabirds in longline fisheries	CPCs to keep a record of seabird incidental bycatch and take measures to reduce bycatch
11/04	On a regional observer scheme	CPCs shall implement observer programme on 5% of vessels fishing outside the EEZ and all vessels > 24 m in length. The number of artisanal fishing vessel landings shall also be monitored by samplers (5% coverage).
10/10	Concerning market related measures	CFCs to record, examine and report imported tuna data.
10/08	Concerning a record of active vessels fishing for YFT	CPCs shall submit a list of vessels fishing YFT outside the EEZ and all vessels > 24 m in length fishing YFT
07/01	To promote compliance with CMMs	CPCs to investigate IUU fishing.
05/07	Concerning a management standard	CPCs to take measures to implement management standards for tuna fishing
03/01	On the limitation of fishing capacity	CPCs with more than 50 vessels on 2003 register to limit vessels and draw up fleet development plans.

APPENDIX 3: Tuna Resources in the Indian Ocean relative to India



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 (2nd 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 4: Determining MCS costs

Risk assessment

Monitoring, Control and Surveillance is (MCS) is described by FAO as i) monitoring – the collection, measurement and analysis of fishing activity including, but not limited to: catch, species composition, fishing effort, bycatch, discards, area of operations etc, ii) control – the implementation of appropriate management instruments in order to regulate the fishery or the fishery resource, and iii) surveillance – the observing, policing and enforcement of the implementation of management instruments (see BOBP/REP/105). MCS in practical terms is indistinguishable from the concept of fisheries management and the services provided for managing fisheries that are established to realise the objectives set for such management. Thus, when considering investment in the services needed to implement MCS it is important to first consider how the various MCS rules contribute (or not) to the management objectives set and to determine what benefit investment in those services might provide.

In this respect it is neither robust nor wise to assume an existing control rule, monitoring approach or indeed enforcement procedure (or combination of such factors) necessarily contributes to the objectives set for a fishery at all or in any significant way. This is particularly the case where MCS rules and services have been introduced as a generic response to international agreements and / or assumptions about the type of services that may be needed in the future or, as is plainly the case in India, for purposes other than management of the fishery such as subsidy management or safety at sea requirements. This current situation in the YFT fishery in the India EEZ of the Bay of Bengal is that no specific objectives have been set and no fishery plan has been developed that defines MCS services needed to manage the YFT fishery⁹.

In order to bridge this gap, this business case has adopted a risk assessment methodology to provide an, admittedly preliminary, analysis of MCS rules in the YFT to determine where investment is needed in improvements. Such an approach in determining the nature and extent of services that need to be provided to effectively manage fisheries is recommended best practice by the United Nations Food and Agriculture Organisation (FAO 2007). The risk assessment methodology adopts international best practice for risk assessment as detailed under the ISO 31000:2018 Risk Management standard¹⁰. This global risk management standard was designed to provide organisations with guiding principles and a generic framework and process for management of risk at differing levels of organisational engagement (from overall strategy such as company profitability to specific operational functionality such as operation of a fish processing line). It is therefore a useful tool that can be applied at two levels in the YFT fishery; first to assess the risk that the current (or proposed) management system has to the high level objectives set for the fishery; and, second, to assess the risks associated with complying with the particular rules themselves and define mitigation strategies or services needed to address these risks.

There are a number of particular advantages for adopting a risk-based framework for identifying and quantifying MCS investment in YFT. These include the following: i) efficiency of spend – the MCS

⁹ It is in the work plan of CMFRI to develop scientific strategies for sustaining tuna fisheries and yield at optimum levels but these strategies as yet unavailable and are unlikely to be designed to provide an evaluation of the nature and extent of services needed to manage the fishery. See <http://www.cmfri.org.in/division/pelagic-fisheries-division>

¹⁰ See <https://www.iso.org/files/live/sites/isoorg/files/store/en/PUB100426.pdf>.

investment can be directed in a way that best mitigates risk, ii) justification of spend – it provides an analytical basis for allocation of scarce MCS resources, and iii) basis for investment discussions – it provides a degree of transparency with respect to the approach and investment risks faced.

MCS objectives

At a fishery level, no explicit objectives are set for the Yellowfin tuna fishery by the GoI, but a range of wider policies and international commitments are relevant. Chief amongst these is the mandate of the Indian Ocean Tuna Commission (IOTC), of which the GoI is a signatory, along with the GoI National Policy on Marine Fisheries 2017. In addition, a recent Bay of Bengal regional coastal state workshop on MCS agreed that MCS objectives should more generally address country obligations made to meet the Sustainable Development Goals set the United Nation under Nations Resolution 70/1. Given this background, this Business Case adopts the specific IOTC goal set for tuna fisheries in the Indian Ocean which is, in brief, to “ensure the conservation and optimum utilization of YFT stocks and their sustainable development”. This goal is considered to be consistent with the broader SDGs and the GoI National Policy.

At a lower organisational level, it is also appropriate to consider what the objective of implementing MCS activities might be on the assumption that the control rules established for the fishery are fit for purpose to realise the overall objectives for the fishery. In this respect, international best practice is that the MCS systems and services should be designed and implemented in a way that *maximises compliance* with those rules. This approach opens the door for a broad range of responses and investments associated with MCS which might include: i) policy responses to change the regulatory framework to improve incentives for compliance (such as establishing effective co-management arrangements), ii) education to improve understanding of rules and buy into the rules, iii) monitoring and surveillance activities to identify non-compliance activity (these may relate to a wide range of activities including voluntary reporting and dockside vessel monitoring systems); iv) investigations around particular high risk activities or where suspected non-compliance is occurring; v) prosecution activity to make penalties effective; and vi) setting the right type and level of penalty (these might encompass civil, administrative and criminal arrangements).

In determining the correct mix of MCS activities and services to support compliance consideration needs to be given to how an individual fisher, or other actor in the fisheries value chain, is likely to respond when confronted with a particular rule or set of rules. This involves assessing three factors relevant to that fisher’s decision making as follows:

- i) The *personal moral obligation* that fisher has to comply with the rule or rules in question – an example of a rule with a high level of personal moral obligation in society more broadly is the rule against stealing other people’s personal property (e.g. their car). In most societies individuals are brought up to believe that such stealing is wrong and have a strong personal commitment not to do so.
- ii) The *social pressure* that a fisher faces from his or her peers – an example where high levels of social pressure might apply is where rules are agreed amongst communities of interest or have long standing through traditional and customary practices.
- iii) The risk of *economic loss* that a fisher faces if they do not comply. Economic incentives faced by fishers come in a number of forms and are most associated with penalties that are applied and enforced through civil (including customary), administrative or criminal law. Economic loss may also relate to indirect economic incentives where, for example,

levies or taxes are applied but even in such cases they will necessarily be underpinned by some kind of sanction to ensure compliance.

The expected balance between the factors faced by a fisher or group of fishers, and with other value chain actors, helps identify the type and extent of MCS services needed to maximise compliance with fisheries rules. For example, where personal obligation and social pressure to comply with a particular rule is thought to be low, it might be important to increase the risk of economic loss to compensate. This in turn will involve balancing the levels of penalties applied with the amount effort spent on monitoring, surveillance, enforcement and prosecution or litigation. Alternatively, it might be an option to redefine the rules to promote greater fisher and community commitment to the rules or simply increase understanding of the importance of the rule through education. Whatever balance that is struck might change over time wherein initial investment in ensuring compliance may need to be high to educate fishers and modify established behaviours but ongoing MCS investment will lessen. A risk analysis can help identify priorities in this regard.

APPENDIX 5: ISO3100:2018 Risk Management steps and diagnostics

The IS31000:2017 Risk Management standard identifies six key steps that are to be followed in carrying out a risk assessment. These are identified in the following table along with a series of diagnostic questions that might be applied in the specific context of an MCS risk assessment in the YFT fishery.

Risk assessment steps	Diagnostic questions
Specify the scope	What are the species or stocks or sub-stocks covered by the MCS regime?
Establish Objectives	What specific objectives or standards apply to the MCS regime for YFT?
Describe the MCS framework	<ul style="list-style-type: none"> What input / output controls apply? What economic incentives / controls apply (i.e. subsidies, taxes)? What quality controls apply (e.g. traceability, certification)? What monitoring regime is in place? What level of enforcement is applied? What administrative services are provided? What stakeholder organizations exist and what role do stakeholders play?
Summarise current performance measures	<ul style="list-style-type: none"> What is the current level of target fishing activity on the stock? Are the stocks caught as a bycatch? What are the historical catch levels? What is the level of compliance with existing rules? What is the current health of the stocks (biomass vs MSY)? What is the current economic profitability of the fishery? What is the current level of employment in the sector?
Identify risks and opportunities	<ul style="list-style-type: none"> Are the objectives identified satisfied currently? Are the performance standards being met? Is sufficient information available to adequately assess performance against objectives? Are all elements of the existing framework contributing to the objectives – how? Is there opportunity to relax constraints? Is there opportunity to increase stakeholder participation in management?
Analyse each risk (high, medium, low)	<ul style="list-style-type: none"> What is the priority of the risks relative to the objectives? How risk adverse is manager to failure of the objective at risk? How severe is the consequence of the risk if it eventuates? What is the likelihood of the risk occurring? In what timescale is the risk likely to eventuate (high = immediately)? How certain is each risk characterization?
Develop mitigation strategies	<ul style="list-style-type: none"> Which risks should be mitigated assuming a cost-effective mitigation strategy can be identified? Which risks should be monitored on an ongoing basis? Which risks require no further action? What options are available to mitigate the risk? What is the probably of success of each mitigation option? What are the services required to implement each mitigation option?
Evaluate risks and opportunities (High, Medium, Low)	<ul style="list-style-type: none"> How effective is the mitigation strategy likely to be, such that the benefits of avoiding the adverse consequence are likely to exceed the costs of action? How likely is the mitigation strategy likely to succeed in addressing risks? How quickly will the mitigation strategy be in effect (high = immediately)?
Address risks and opportunities	<ul style="list-style-type: none"> What specific actions are required to action risk mitigation options? What MCS services are required to support the MCS arrangements for the fishery?

APPENDIX 6: Application of risk assessment methodology to existing MCS framework

The ISO31000:2018 Risk management standard is applied to the current MCS framework to assess risk against overall management objectives defined as the IOTC objectives set for the fishery.

Risk assessment steps	Diagnostic questions
Specify the scope	The scope of the risk assessment is the Yellowfin tuna fishery within the India EEZ of the Bay of Bengal.
Establish Objectives	This analysis adopts the IOTC goal which is, in brief, to ensure the <i>conservation and optimum utilization of YFT stocks and their sustainable development.</i>
Describe the MCS framework	Management of the YFT fishery is rudimentary. Fishing for YFT within the Exclusive Economic Zone (EEZ) of occurs largely outside the 12 nm and within this zone is regulated only by seasonal closures and some method controls (e.g. mesh sizes). The GoI and relevant states are in the process of both registering and licencing all mechanised and motorised vessels (only mechanised vessels are licenced currently). Harbour landing restrictions (allowing boats to only land fish at designated harbours) are in effect. There is catch monitoring at landing sites carried out by the Department of Fisheries for all mechanised vessels and periodic surveys are conducted by the Central Marine Fisheries Research Institute to determine motorised and non-motorised vessel catch and collect scientific data at landing. This information is used to meet reporting obligations to the IOTC and support national scientific analyses and management. Surveillance and enforcement activities are minimal and are often associated with more general maritime security operations such as border inspection and implementing safety at sea requirements. Such surveillance and enforcement activities that are carried out are implemented by a range of agencies including Port Authorities, Coastal Marine Police, with jurisdiction out to 12 nm, and the Indian Coast Guard (ICG), with jurisdiction outside 12 nm. Fisher associations also play an important role in defining and enforcing harbour landing restrictions
Summarise current performance measures	An overall constraint on YFT fishing is set at a target level of Bmsy but by and large there are no effective management measures binding catch to this target. In effect, the management of tuna catches within the EEZ of India remains at the discretion of India. The Indian Ocean (IO) accounts for 20% of global tuna landings (about 1 million mts per year); the Western Central Pacific Ocean region is the largest. IO YFT landings were 429,800 (2014). This represented a 6% increase since 2013, but 19% decline since the 2004 level, 530,000 mts. The MSY for IO Yellowfin is estimated to be 421,000 mts, and stocks are currently considered overfished, and subject to overfishing. The potential sustainable gross annual landed value of yellowfin 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. The Government of India has set a target yield for YFT in the India EEZ of 80,000 tonnes ¹¹ which represents about 19% of the estimated MSY for the IO. This target yield is more than double current catch levels in India reported to the IOTC which were around 33,427 mts in 2014 and about 8% of total Indian Ocean catch of yellowfin that year.

¹¹ This estimate is in the process of being updated and is likely to increase to 88,000 mt.

Identify risk	Risk analysis	Mitigation strategy	Evaluation
Risk of control rules to conservation and sustainability of stocks	High priority, High averseness, High severity, High likelihood, Medium immediacy	Output controls to be developed.	High effectiveness, high likelihood, high immediacy
		Sub-regional MCS coordination.	Medium effectiveness, medium likelihood, low immediacy
		IOTC IO wide catch and effort constraints.	Low effectiveness, low likelihood, low immediacy
Risk of management approach to optimal use of stocks	High priority, High averseness, High severity, High likelihood, High immediacy	Vessel licences limited	High effectiveness, high likelihood, high immediacy
		Individual catch limited	High effectiveness, high likelihood, medium immediacy
		Subsidies removed	Medium effectiveness, low likelihood, low immediacy

APPENDIX 7: Application of risk assessment to the new regulatory approach

The ISO31000:2018 Risk management standard is applied to the new regulatory approach risk of compliance with new rules and help identify the type of MCS services needed for investment in ensuring such compliance.

Risk assessment steps	Diagnostic questions
Specify the scope	The scope of the risk assessment is the Yellowfin tuna fishery within the India EEZ of the Bay of Bengal
Establish Objectives	This analysis adopts the IOTC goal which is, in brief, to ensure the <i>conservation and optimum utilization of YFT stocks and their sustainable development.</i>
Describe the MCS framework	A target catch limit for the hook and line fishery of 17,500 mt will be established. This target is considered sustainable within the current YFT yield estimates for the India EEZ of the Bay of Bengal given current estimated catch; Licences for hook and line fishing will be limited to 1000 equivalent motorised vessels (by State and Federal law) whereby 1 mechanised licence will be equivalent to 10 motorised licences. 1000 motorised vessel equivalents are assessed as capable of catch the 17,500 mt target limit at an optimal 100 kg per trip catch rate; YFT fish buyers will be licenced as YFT Licenced Fish Receivers (YFT LFRs) and they will be the only buyers permitted to buy from YFT hook and line vessels at designated landing points. The number of YFT LFRs will be limited and they will be required to belong to a producer cooperative with responsibility for overseeing and administering traceability systems and be consulted on the establishment of rules for fishing; Boat catch limits may be introduced if required to limit expansion of effort by mechanised vessels. A moratorium on non-hook and line vessels catching YFT will be implemented and capacity managed to restrict harvesting to 17,500 mt if necessary. Given the low value of landed product there is evidence that expansion of fishing effort by these vessels will be unlikely. Increases to the YFT hook and line catch limit will only be made if non-hook and line catch of YFT is retired or reduced. Penalties for non-compliance with new rules will be established will be loss of licence. The subsidy on conversion of mechanised gill netters to hook and line will be removed immediately as it is no longer needed and works against the new regulatory regime. Consideration will be given to removing other subsidies in return for access to the hook and line fishery.
Summarise current performance measures	An overall constraint on YFT fishing is set at a target level of Bmsy but by and large there are no effective management measures binding catch to this target. In effect, the management of tuna catches within the EEZ of India remains at the discretion of India. The Government of India has set a target yield for YFT in the India EEZ of 80,000 tonnes ¹² which represents about 19% of the estimated MSY for the IO. This target yield is more than double current catch levels in India reported to the IOTC which were around 33,427 mt in 2014 and about 8% of total Indian Ocean catch of yellowfin that year. The YFT Bay of Bengal hook and line fishery will be the first fully fishery effectively constrained by a catch limit set as part of the estimated India EEZ sustainable yield.

¹² This estimate is in the process of being updated and is likely to increase to 88,000 tonnes.

Identify risk	Risk analysis	Mitigation strategy	Evaluation	MCS services required to mitigate risks
Current control rules will not ensure conservation and sustainability of YFT stocks	High priority, High averseness, High severity, High likelihood, Medium immediacy	Output controls to be developed.	High effectiveness, high likelihood, high immediacy	Policy capacity support, stakeholder level consultation and engagement
		Vessel licences limited – all licences capped, YFT hook and line limited to 1000 motorised equivalent units	High effectiveness, high likelihood, high immediacy	Policy capacity support, systems development, stakeholder level consultation and engagement, systems development
		YFT buyers from hook and line licenced and limited	High effectiveness, high likelihood, high immediacy	Policy capacity support, systems development, stakeholder level consultation and engagement
		YFT buyer collective formed and traceability systems developed	High effectiveness, high likelihood, high immediacy	Policy capacity support, systems development, stakeholder level consultation and engagement, collective management structure and capacity development
		Individual catch limits established	High effectiveness, high likelihood, medium immediacy	Policy capacity support, stakeholder level consultation and engagement, catch and vessel monitoring and registry systems development
		Subsidies removed	Medium effectiveness, low likelihood, low immediacy	Policy capacity support, stakeholder level consultation and engagement, important to link subsidy removal with limited licencing system to mitigate economic impact (i.e. licence beneficiaries do not get subsidies as they gain from licencing arrangements)
		Sub-regional MCS coordination.	Medium effectiveness, medium likelihood, low immediacy	Develop coastal state coordination mechanism to build sub-regional MCS capability, capacity and rules.
		IOTC IO wide catch and effort constraints.	Low effectiveness, low likelihood, low immediacy	Develop coastal state coordination mechanism to build sub-regional MCS capacity and collective authority to assert coastal state management measures

New management regime risks	Risk analysis	Mitigation strategy	Evaluation	MCS services required to mitigate risks
IOTC will not recognise GoI sustainable yield estimates	High priority, High averseness, High severity, High likelihood, Medium immediacy	IOTC IO wide catch and effort constraints.	Low effectiveness, low likelihood, low immediacy	Develop coastal state coordination mechanism to build sub-regional MCS capacity and collective authority to assert coastal state management measures
Poor Regional compliance with country allocations	High priority, High averseness, High severity, High likelihood, Medium immediacy	Sub-regional MCS coordination.	Medium effectiveness, medium likelihood, low immediacy	Develop coastal state coordination mechanism to build sub-regional MCS capability, capacity and rules.
Permitted fishers will misreport catch	High priority, High averseness, High severity, High likelihood, High immediacy	Product traceability linked to market access Dockside monitoring system Electronic reporting	High effectiveness, high likelihood, high immediacy	Provide hardware for electronic monitoring at landing point. Enhance Department of Fisheries (DoF) capacity to monitor. Enforcement of landing rules by Coastal Police. Penalty for loss of licence will be loss of Hook and Line licence privilege and loss of buyer licence.
Gill net fishers will tranship catch to H&L	High priority, High averseness, High severity, low likelihood, High immediacy	Product traceability systems and certification At sea enforcement	High effectiveness, high likelihood, high immediacy	Training for ICG. Training for buyer collective. Penalty loss of buyer licence.
Gill net fishers will convert to H&L	High priority, High averseness, High severity, High likelihood, High immediacy	Requires enhanced level of licence enforcement at wharf At sea enforcement	High effectiveness, high likelihood, high immediacy	Stakeholder education. Enforcement of landing rules by Coastal Police. Penalty will be loss of licence. Training / coordination with ICG
Mechanised gill net fishers will convert to H&L	High priority, High averseness, High severity, High likelihood, High immediacy	Remove subsidies Requires enhanced level of licence enforcement at wharf At sea enforcement	High effectiveness, high likelihood, medium immediacy	Stakeholder education. Enforcement of landing rules by Coastal Police. Penalty will be loss of licence. Training / coordination with ICG
Mechanised fishers will expand effort and catch	High priority, High averseness, High severity, High likelihood, High	Policy response – e.g. cap catch Requires enhanced level of licence enforcement at wharf	High effectiveness, high likelihood, medium immediacy	Stakeholder education. Enhance DoF capacity to monitor. Training for ICG. Enforcement of landing rules by Coastal Police.

	immediacy	At sea enforcement		Penalty for loss of licence will be loss of Hook and Line licence privilege and loss of buyer licence.
YFT LFR will take fish from non-licensed H&L YFT	High priority, High averseness, High severity, High likelihood, High immediacy	Product traceability systems Dockside monitoring system Electronic reporting	Medium effectiveness, medium likelihood, low immediacy	Provide hardware for electronic monitoring at landing point. Enhance DoF capacity to monitor. Enforcement of landing rules by Coastal Police. Penalty for loss of licence will be loss of buyer licence.
Non-YFT LFR will buy H&L YFT	High priority, High averseness, High severity, High	Improved capacity of Marine Police to check at landing point Traceability systems and certification	Medium effectiveness, medium likelihood, low immediacy	Provide hardware for electronic monitoring at landing point. Enhance DoF capacity to monitor. Enforcement of landing rules by Coastal Police.

APPENDIX 8: Investment Performance Metrics

Summary of performance metrics for the three business case options: i) the baseline case, ii) the value added investment case and iii) the new regulatory approach investment case.

BASELINE CASE WITHOUT INVESTMENT			
ANNUAL FISHERY PROJECTION (17,500 tonne harvest)			Total return
Number of operations needed to process 17,500 tonne catch			
Number of boats needed to catch 17,500 tonnes			972
Processing capacity all operations / year			0
Investment cost			0
Fleet operational costs			15,225,000
Returns to crew			8,708,260
Economic surplus (rent)			0
Processor costs			0
Processor profit			0
Total fishery revenue all operations			23,933,260
Total profit (rent)			0
Rent as % of fishery revenue			0%
Total economic benefits (crew share and profit)			8,708,260
Capital value of fishery (NPV interest rate)			0

WITH INVESTMENT IN VALUE ADDED			
ANNUAL FISHERY PROJECTION (17,500 tonne harvest)	Small investments	Large investments	Total return
Number of operations needed to process 17,500 tonne catch	43	8	51
Number of boats needed to catch 17,500 tonnes	339	1,628	1,967
Processing capacity all operations / year	3,100,000	14,400,000	17,500,000
Fleet operational costs	5,171,321	24,806,457	29,977,778
Returns to crew	3,307,891	14,580,830	17,888,722
Economic surplus (rent)	0	0	0
Total processor costs	1,403,783	6,738,352	8,142,135
Total processor profit all operations	970,396	4,290,094	5,260,490
Total fishery revenue all operations	10,853,392	50,415,755	61,269,147
Total profit (rent)	0	0	0
Rent as % of fishery revenue	0%	0%	0%
Total economic benefits (crew share and profit)	4,278,287	18,870,946	23,149,233
Capital value of fishery (NPV interest rate)			0

WITH INVESTMENT UNDER A NEW REGULATORY APPROACH			
ANNUAL FISHERY PROJECTION (17,500 tonne harvest)	Small investments	Large investments	Total return
Number of operations needed to process 17,500 tonne catch	43	8	51
Number of boats needed to catch 17,500 tonnes	172	800	972
Processing capacity all operations / year	3,100,000	14,400,000	17,500,000
Fleet operational costs	2,624,445	12,190,972	14,815,418
Returns to crew	1,678,755	7,165,654	8,844,409
Economic surplus (rent)	4,176,012	20,030,682	24,206,694
Total processor costs	1,403,783	6,738,352	8,142,135
Total processor profit all operations	970,396	4,290,094	5,260,490
Total fishery revenue all operations	10,853,392	50,415,755	61,269,147
Total profit (rent)	4,176,012	20,030,682	24,206,694
Rent as % of fishery revenue	38%	40%	40%
Total economic benefits (crew share and profit)	6,825,163	31,486,431	38,311,594
Capital value of fishery (NPV interest rate)			302,583,676

APPENDIX 9: Investment Costs

This report this Business Case is designed to *set 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)*. It is expected that any detailed project would carry out a comprehensive risk assessment process to determine the nature and extent of fisheries services needed for effective MCS in the YFT fishery. In the absence of such analysis, and in order to properly inform this report, global benchmarks MCS for costs associated with particular fisheries management approaches are used as inputs into the financial analysis.

While few comprehensive studies of fisheries costs have been carried out, a United Nations Food and Agriculture Organisation Expert Consultation on Low Cost Fisheries Management and Cost Recovery (FAO 2007) provides information, guidance and recommendations on fisheries management funding arrangements. Based on a 2003 OECD study, costs of fisheries management within OECD countries were estimated under three categories: i) research costs, ii) management costs and iii) enforcement costs and presented for comparative purposes as percentage of the landed value the fisheries in each country.

While these categories are difficult to apply consistently across countries, they do broadly allow the separation of MCS costs, encompassed within category ii) and category iii) of the analysis from research activities. Taking this approach, the costs of MCS services (i.e. category ii) and iii) services) range between 4.3 and 11.4 % of the landed value of fish caught in key OECD countries (See Table 5). Developing country fisheries costs, where fisheries management systems are less developed or non-existent, are typically much less. For, example, FAO 2007 report that total fisheries management costs in Nicaragua were about 0.5% of export value of fish caught, in Ghana they were 0.08% at that time.

Table 5: Costs of fisheries management and MCS as % of landed value

OECD Country	Total costs	MCS costs
Australia	8.5	4.3
Canada	14.1	9.6
European Union	10.0	6.2
Korea	9.5	8.7
New Zealand**	8.0	5.6
Norway	9.7	7.3
USA	17.0	11.4

Calculated from OECD 2003.

In calculating MCS costs for the Option 3 New Regulatory Approach Investment Case provision is made for ongoing increased MCS costs associated with this regime after year 5. For the purpose of this analysis it is assumed that the timeframe for the investment analysis is 20 years and costs will be consistent with global costs of management although at the lower end of these costs given that the approach adopted is to adopt a high level of stakeholder engagement and an efficient delivery approach. For this reason, ongoing MCS costs are set at 5% of estimated landed value or about USD2.4 million per annum as noted in Table 6. These costs are assumed to apply fully from year 6 of the investment after an initial five-year period which is costed around the business of building the new management systems and capacity to implement the revised regulatory framework.

Table 6: Ongoing MCS managements costs

	Landed value (USD)*	Ongoing MCS cost (%)	Ongoing MCS cost (USD)
Post investment	47,866,521	5	2,400,000

Investment costs during the first five years of the 20-year investment are broken into five investment categories distilled from the risk assessment analysis are budgeted separately as follows:

- i) Government policy development capacity (policy advice, training, consultation)
- ii) Integrated vessel monitoring and chain of custody systems (software, training)
- iii) Vessel monitoring and dockside monitoring hardware (tracking units, computers / iPads for monitoring)
- iv) Sub-regional coordination and capacity
- v) Buyer cooperative institution, capacity building and ongoing operational costs
- vi) Coastal police monitoring and surveillance training and coordination
- vii) Indian Coast Guard training and coordination

An investment schedule for these MCS costs is provided in Appendix 10.

The MCS investment case is fully costed incorporating value chain investment identified as needed in Business Case 1 where investment and value chain development is applied sequentially over a ten-year period. The MCS investment case also assumes the implementation of a supporting co-management regime developed at fisher level. Co-management costs are scaled from Business Case 2 across the whole YFT hook and line fishery in the Bay of Bengal and are sequenced over a 6-year period. Profitability is assumed to improve in line with value chain investment.

The above approach to costing the Option 3 investment is considered to be conservative for the following reasons:

- i) The new regime is designed to be effective without fisher level co-management (through the administrations of the buyer coop) although it is clear that the risks to the successful implementation of this new system will increase if fishers are not fully engaged in setting the rules and able to capture a fair share of the benefits created;
- ii) The establishment of a new regulatory framework will likely attract immediate private sector investment in YFT processing and marketing and increase profitability more quickly than assumed;
- iii) The costs to estimate MCS investment do not take into consideration existing aligned MCS activity that could arguably be offset against the future MCS investment costs;
- iv) Profitability is calculated based on an assumed future landed price of around USD 2.74 per kilogram which is considerably below landed price being realised in other countries landing high value YFT.

A consolidated schedule of investment costs across all value chain improvements and co-management is provided in Appendix 11

APPENDIX 10: MCS investment schedule.

MCS	Total	Y-1	Y-2	Y-3	Y-4	Y-5	Y-6	Y-7	Y-8	Y-9	Y-10
Government policy development capacity	-\$3,100,000	-\$100,000	-\$150,000	-\$250,000	-\$250,000	-\$250,000					
Integrated vessel monitoring and chain of custody sys	-\$2,877,778	-\$200,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000
Vessel minoring and dockside monitoring hardware	-\$3,727,778	-\$194,444					-\$194,444				
Buyer cooperative institutions / capacity building	-\$3,450,000	-\$50,000	-\$100,000	-\$350,000	-\$350,000	-\$350,000	-\$350,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000
Sub-regional training and MCS capacity	-\$1,000,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000					
Coastal police monitoring training	-\$1,000,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000					
Indian Coast Guard training and coordination	-\$32,666,667	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000					
Ongoing MCS operational costs	-\$72,661,111						-\$1,755,556	-\$2,200,000	-\$2,200,000	-\$2,200,000	-\$2,200,000
Total investment costs	-\$40,494,444	-\$844,444	-\$650,000	-\$1,000,000	-\$1,000,000	-\$1,000,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000

MCS	Total	Y-11	Y-12	Y-13	Y-14	Y-15	Y-16	Y-17	Y-18	Y-19	Y-20
Government policy development capacity	-\$3,100,000										
Integrated vessel monitoring and chain of custody sys	-\$2,877,778	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000
Vessel minoring and dockside monitoring hardware	-\$3,727,778	-\$194,444					-\$194,444				
Buyer cooperative institutions / capacity building	-\$3,450,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000	-\$100,000
Sub-regional training and MCS capacity	-\$1,000,000										
Coastal police monitoring training	-\$1,000,000										
Indian Coast Guard training and coordination	-\$32,666,667										
Ongoing MCS operational costs	-\$72,661,111	-\$2,005,556	-\$2,200,000	-\$2,200,000	-\$2,200,000	-\$2,200,000	-\$2,005,556	-\$2,200,000	-\$2,200,000	-\$2,200,000	-\$2,200,000
Total investment costs	-\$40,494,444	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000

APPENDIX 11: Consolidated schedule of investment costs.

Consolidated investment schedule	Total	Y-1	Y-2	Y-3	Y-4	Y-5	Y-6	Y-7	Y-8	Y-9	Y-10
Boat upgrade and training	-\$5,397,778	-\$1,349,444	\$0	\$0	\$0	\$0	-\$1,349,444	\$0	\$0	\$0	\$0
Value chain investments	-\$8,241,874	-\$824,187	-\$824,187	-\$824,187	-\$824,187	-\$824,187	-\$824,187	-\$824,187	-\$824,187	-\$824,187	-\$824,187
Co-management	-\$24,682,778	-\$1,309,583	-\$1,620,370	-\$3,888,889	-\$3,888,889	-\$3,888,889	-\$2,605,880	-\$486,111	-\$486,111	-\$486,111	-\$486,111
MCS investments	-\$40,494,444	-\$844,444	-\$650,000	-\$1,000,000	-\$1,000,000	-\$1,000,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000
Total investment costs	-\$78,816,874	-\$4,327,660	-\$3,094,558	-\$5,713,076	-\$5,713,076	-\$5,713,076	-\$7,179,511	-\$3,710,299	-\$3,710,299	-\$3,710,299	-\$3,710,299
Annual profit / loss before investment costs	\$350,997,064	\$0	\$2,420,669	\$4,841,339	\$7,262,008	\$9,682,678	\$12,103,347	\$14,524,016	\$16,944,686	\$19,365,355	\$21,786,025
Profit after investment	\$272,180,190	-\$4,327,660	-\$673,888	-\$871,737	\$1,548,932	\$3,969,601	\$4,923,836	\$10,813,718	\$13,234,387	\$15,655,057	\$18,075,726
Cummulative profit / loss after investment		-\$4,327,660	-\$5,001,548	-\$5,873,286	-\$4,324,354	-\$354,752	\$4,569,083	\$15,382,801	\$28,617,188	\$44,272,245	\$62,347,971

Consolidated investment schedule	Total	Y-11	Y-12	Y-13	Y-14	Y-15	Y-16	Y-17	Y-18	Y-19	Y-20
Boat upgrade and training	-\$5,397,778	-\$1,349,444	\$0	\$0	\$0	\$0	-\$1,349,444	\$0	\$0	\$0	\$0
Value chain investments	-\$8,241,874	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Co-management	-\$24,682,778	-\$823,472	-\$486,111	-\$486,111	-\$486,111	-\$486,111	-\$823,472	-\$486,111	-\$486,111	-\$486,111	-\$486,111
MCS investments	-\$40,494,444	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000	-\$2,400,000
Total investment costs	-\$78,816,874	-\$4,572,917	-\$2,886,111	-\$2,886,111	-\$2,886,111	-\$2,886,111	-\$4,572,917	-\$2,886,111	-\$2,886,111	-\$2,886,111	-\$2,886,111
Annual profit / loss before investment costs	\$350,997,064	\$24,206,694	\$24,206,694	\$24,206,694	\$24,206,694	\$24,206,694	\$24,206,694	\$24,206,694	\$24,206,694	\$24,206,694	\$24,206,694
Profit after investment	\$272,180,190	\$19,633,777	\$21,320,583	\$21,320,583	\$21,320,583	\$21,320,583	\$19,633,777	\$21,320,583	\$21,320,583	\$21,320,583	\$21,320,583
Cummulative profit / loss after investment		\$81,981,749	\$103,302,332	\$124,622,915	\$145,943,497	\$167,264,080	\$186,897,858	\$208,218,441	\$229,539,024	\$250,859,607	\$272,180,190

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Business Case 3: A Business Case for Monitoring, Control and Surveillance (MCS) for the Yellowfin Tuna Fishery in the Bay of Bengal

Annex 12: 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 Business Case of MCS is a critical element in addressing the environmental risks associated with investment in the yellowfin tuna (YFT) fishery in the Bay of Bengal. The exact nature of the mechanism developed will inevitably evolve based on discussion and negotiations between the key parties concerned, including private sector operators in the value chain and mandated government departments.

No single model of MCS arrangements is likely to be appropriate across all settings. However, some key elements that would characterize any MCS arrangement for YFT include:

- Mechanisms for assessing catches and the health of fish stocks. The relative level of sophistication of such methods will depend on capacities within the sector and how they develop;
- Mechanisms for negotiating and setting agreed controls on catches based on assessments of the health of fish stocks. Within a co-management framework these mechanisms would involve fish harvesters, processors and market actors, mandated government institutions and community-based organisations and decision-making institutions;
- Arrangements for surveillance and control of fishing activities to ensure compliance with both arrangements for assessment of catches and fish stocks, and the controls agreed upon by co-management bodies; and
- The supporting legislative framework required to ensure that these arrangements are legally binding and legitimate.

4.0 Specific social risks and their management

The business case should be implemented through a thorough consultation with all stakeholders as exclusion from the system for any particular group may hurt their economic well-being. In this case, the business case should be guided by the National Policy on Marine Fisheries, 2017 of the Government of India which calls for an inclusive management process.

Stakeholder participation in the decision-making process is an accepted norm in policy making in India and each new law or management measures pass through a public hearing process, which also gives the marginal stakeholders to raise their voice and register it.

The co-management guidelines issued in the states of Tamil Nadu and Kerala and the Union Territory of Puducherry should be adhered to. The implementation will also be guided by the 1995 Code of Conduct for Responsible Fisheries and its operational guidelines on MCS measures to ensure that the international best practices are adopted.
