IFFO RS V2.0

FISHERY ASSESSMENT METHODOLOGY AND TEMPLATE REPORT

Fishery Under Assessment	**Indian Oil Sardine, Maharastra & Goa**
Date	**January 2018**
Assessor	**Sam Peacock**

IFFO RS Ltd, Unit C, Printworks, 22 Amelia Street, London, SE17 3BZ, United Kingdom

Application details and summary of the assessment outcome

Name: Omega Fishmeal and Oil Private Limited			
Address:			
Country:		**Zip:**	
Tel. No.		**Fax. No.**	
Email address:		**Applicant Code**	
Key Contact:		**Title:**	

Assessment Details

Name of Assessment Body:		RS Standards		
Assessor Name	**Peer Reviewer**	**Assessment Days**	**Initial/Surveillance/ Re-approval**	**Whole fish / By-product**
Sam Peacock			Improver Programme	Whole fish
Assessment Period	Jan 2018			

Scope Details

Management Authority (Country/State)	India; Maharastra & Goa
Main Species	Indian oil sardine (*Sardinella longiceps)* & lesser sardine (*Sardinella fimbriata*)
Fishery Location	Waters of Maharastra and Goa states and adjacent federal waters
Gear Type(s)	Purse seine
Outcome of Assessment	
Clauses with Gaps	M2, F1, F3, A1, A2, A3, A4

General Results

General Clause	Outcome (Pass/Gap)
M1 - Management Framework	Pass
M2 - Surveillance, Control and Enforcement	Gap
F1 - Impacts on ETP Species	Gap
F2 - Impacts on Habitats	Pass
F3 - Ecosystem Impacts	Gap

Note: This table should be completed for whole fish assessments only.

Species-Specific Results

Category	Species	% landings	Outcome (Pass/Gap)	
Category A	Indian Oil Sardine	44.43%	A1	Gap
			A2	Gap
			A3	Gap
			A4	Gap
Category B	Indian Oil Sardine (optional)	44.43%	Gap	
	Indian Mackerel (possible)	44.5%	Gap	
Category C	None		n/a	
Category D	Lesser Sardines (multiple species)	10.86%	Pass	
	Tunas (multiple species)	0.23%	Pass	
	Indian Mackerel (possible)	See notes	Pass	

[List all Category A and B species. List approximate total %age of landings which are Category C and D species; these do not need to be individually named here]

2

HOW TO COMPLETE THIS ASSESSMENT REPORT

This assessment template uses a modular approach to assessing fisheries against the IFFO RS standard.

Whole Fish

The process for completing the template for a **whole fish** assessment is as follows:

1. ALL ASSESSMENTS: Complete the Species Characterisation table, to determine which categories of species are present in the fishery.

2. ALL ASSESSMENTS: Complete clauses M1, M2, M3: Management.

3. IF THERE ARE CATEGORY A SPECIES IN THE FISHERY: Complete clauses A1, A2, A3, A4 for **each** Category A species.

4. IF THERE ARE CATEGORY B SPECIES IN THE FISHERY: Complete the Section B risk assessment for **each** Category B species.

5. IF THERE ARE CATEGORY C SPECIES IN THE FISHERY: Complete clause C1 for **each** Category C species.

6. IF THERE ARE CATEGORY D SPECIES IN THE FISHERY: Complete Section D.

7. ALL ASSESSMENTS: Complete clauses F1, F2, F3: Further Impacts.

A fishery must score a pass in **all applicable clauses** before approval may be recommended. To achieve a pass in a clause, the fishery/species must meet **all** of the minimum requirements.

By-products

The process for completing the template for **by-product raw material** is as follows:

1. ALL ASSESSMENTS: Complete the Species Characterisation table with the names of the by-product species and stocks under assessment. The '% landings' column can be left empty; all by-products are considered as Category C and D.

2. IF THERE ARE CATEGORY C BYPRODUCTS UNDER ASSESSMENT: Complete clause C1 for **each** Category C by-product.

3. IF THERE ARE CATEGORY D BYPRODUCTS UNDER ASSESSMENT: Complete Section D.

4. ALL OTHER SECTIONS CAN BE DELETED. Clauses M1 - M3, F1 - F3, and Sections A and B do not need to be completed for a by-product assessment.

By-product approval is awarded on a species-by-species basis. Each by-product species scoring a pass under the appropriate section may be approved against the IFFO RS Standard.

3

SPECIES CATEGORISATION

The following table should be completed as fully as the available information permits. Any species representing more than 0.1% of the annual catch should be listed, along with an estimate of the proportion of the catch each species represents. The species should then be divided into Type 1 and Type 2 as follows:

- **Type 1 Species** can be considered the 'target' or 'main' species in the fishery. They make up the bulk of annual landings and are subjected to a detailed assessment.

- **Type 2 Species** can be considered the 'bycatch' or 'minor' species in the fishery. They make up a small proportion of the annual landings and are subjected to relatively high-level assessment.

Type 1 Species must represent 95% of the total annual catch. Type 2 Species may represent a maximum of 5% of the annual catch (see Appendix B).

Species which make up less than 0.1% of landings do not need to be listed (NOTE: ETP species are considered separately). The table should be extended if more space is needed. Discarded species should be included when known.

The 'stock' column should be used to differentiate when there are multiple biological or management stocks of one species captured by the fishery. The 'management' column should be used to indicate whether there is an adequate management regime specifically aimed at the individual species/stock. In some cases it will be immediately clear whether there is a species-specific management regime in place (for example, if there is an annual TAC). In less clear circumstances, the rule of thumb should be that if the species meets the minimum requirements of clauses A1-A4, an adequate species-specific management regime is in place.

NOTE: If any species is categorised as Endangered or Critically Endangered on the IUCN Red List, or if it appears in the CITES appendices, it **cannot** be approved for use as an IFFO RS raw material. This applied to whole fish as well as by-products.

4

TYPE 1 SPECIES (Representing 95% of the catch or more)

Category A: Species-specific management regime in place.

Category B: No species-specific management regime in place.

TYPE 2 SPECIES (Representing 5% OF THE CATCH OR LESS)

Category C: Species-specific management regime in place.

Category D: No species-specific management regime in place.

Common name	Latin name	Stock	% of landings	Management	Category
Indian oil sardine (IOS)	*Sardinella longiceps*	Not defined	43.44% (2015) (or 86.88% without mackerel)	GAP	A or B
Lesser sardine (Fringescale sardinella)	*Sardinella fimbriata*	Multiple	10.86% (2015, total for all other sardines)	GAP	A or B
Mackerel	*Rastrelliger kanagurta*		44.5%		D (See Note 2)
Tunas			0.23%		C or D
Pomfrets			0.08%		n/a
Others			0.89% total		n/a

Improver Programme Note 1: The 'management' column of the table above is used as part of the species categorisation process. A fishery can be approved against the IFFO RS requirements whether or not the species assessed are subjected to species-specific management regimes, as long as they meet the requirements of the relevant Category. Fisheries applying to the Improver Programme therefore have a choice of whether to plan to develop species-specific management regimes (which is recommended) or whether to seek approval via the risk-based approach. For the purposes of this initial assessment, both options are considered to enable the applicant to make an informed decision.

Improver Programme Note 2: The above data was provided for purse seine vessels in general, rather than those specifically supplying the reduction industry. While mackerel represents 44.5% of purse seine landings, the applicant has listed only Indian Oil sardine (IOS) and lesser sardine as requiring an assessment. It is therefore possible, due to the targeted nature of the gear, that landings of IOS to reduction facilities contain substantially less than 44.5% mackerel. For this reason, mackerel has been subjected to an assessment under both Categories B and D, for the purposes of this initial Improver Programme report. It is important to recognise that if mackerel represents a substantial component of the catch landed by the IOS vessels during the same trips, mackerel will need to be subjected to a Category A or B assessment whether it is used for reduction purposes or not. The Category D assessment is only applicable if the sardine fishery has limited mackerel bycatch.

Improver Programme Note 3: The 'stock' section for IOS is listed as 'not defined' because there is considerable uncertainty as to the number and geographical distribution of IOS stocks in Indian waters. Some sources contend a single biological stock along the entire west coast; others that there are as many as four or five; and some stock assessment and management activities occur at the individual coastal state level. Whatever the most accurate definition, it is highly unlikely that the IOS is

naturally separated into stocks which correlate to state boundaries, and therefore any steps taken to ensure fishing effort is limited to an appropriate level must involve cooperation between multiple states. The foundation for this is already in place, with the Central Marine Fisheries Institute collecting catch data and assessing the species at multiple levels, and overall management policies directed by the national government's Department of Animal Husbandry, Dairying and Fisheries, via the National Policy on Marine Fisheries and similar documents. However, it is essential that any improvement plan for the fishery unit defined within this report is designed to take into account the fact that fishing activity in states outside the unit of assessment will have an impact on the IOS within Goa and Maharashtra waters. _Cooperation and coordination with other coastal states and the national government will be essential components of any effective plan_.

Improver Programme Note 4: The National Policy on Marine Fisheries (NPMF) launched in 2017 is explicitly aimed at meeting the standards set out in the FAO's Code of Conduct for Responsible Fisheries (CCRF), on which the IFFO RS fisheries requirements are largely based. Many of the gaps highlighted by this report may be filled through the implementation of the NPMF over the coming years, and any fishery improvement plan for IOS should reference the NPMF extensively. Additionally, the Central Marine Fisheries Research Institute (CMFRI), in cooperation with the Central Institute of Fisheries Technology (CIFT), has produced guidance on a management model which would implement an adherence to the CCRF: the Indian Marine Fisheries Code (IMFC). This sets out, in detail, the methodology by which the CCRF would be met, including through the creation of three new bodies: the National Marine Fisheries Management Council (NMFMC), the Aquaculture Authority of India (AAI) and the National Aquatic Products Council (NAPC)[1].

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[1] IMFC overview, CMFRI and CIFT (presentation).
http://dahd.nic.in/sites/default/files/IMFC%20Oct%202017_7.pdf

Background Section

1.1 Overview of the fishery

Fishery Characterisation

Indian oil sardine is fished using a variety of gear types around the entire Indian coast. This assessment focusses on the components of the national fishery which are relevant to the applicant; namely, purse seine fishing within the state waters of Maharashtra and Goa, and the associated federal waters off each state. The assessment provided by this report, along with its conclusions for building a fishery improvement timeline to work towards IFFO RS approval, therefore apply only to this unit of assessment. It is particularly important to note that purse seining produces relatively low levels of bycatch. If the applicant organisation also wishes to develop a plan towards approval for other gear types (for example ring seines) these will need to be assessed separately, taking into account the greater range of species caught in those gears.

According to data provided by the applicant, the catch composition of purse seiners is 54.3% 'sardines', 44.5% mackerel, 0.23% tunas, 0.08% pomfrets, and 0.89% miscellaneous. An IFFO RS assessment requires a minimum of 95% of the total catch to be assessed as 'target' species, therefore sardines and mackerel would usually be considered under Category A or B. However, based on the species defined by the applicant as requiring assessment (see also "Improver Programme Note 2"), mackerel may represent a relatively small component of the reduction catch. For this reason it has been assessed within this IP report under Categories B and D, to cover both possibilities. In a full assessment, the proportion of mackerel landings would be known, and only one of these Categories would be used.

It is not necessary to assess any species representing less than 0.1% of the total catch, therefore pomfrets can be ignored. Tunas may need to be assessed as Category C or D 'bycatch' species, depending on the frequency of individual species in the catch. This assessment assumes that the 'miscellaneous' catch is made up of species occurring less frequently than pomfrets; however, if there are any other species which make up more than 0.1% of the catch then these should be assessed as Category C or D species.

All of the above is dependent on the provided purse seiner data being applicable to the reduction landings. If mackerel and sardine are independently targeted (i.e. if the sardine fishery catches minimal quantities of mackerel) then it may be possible to assess mackerel as a Category A or B species, or even omit it from the assessment entirely.
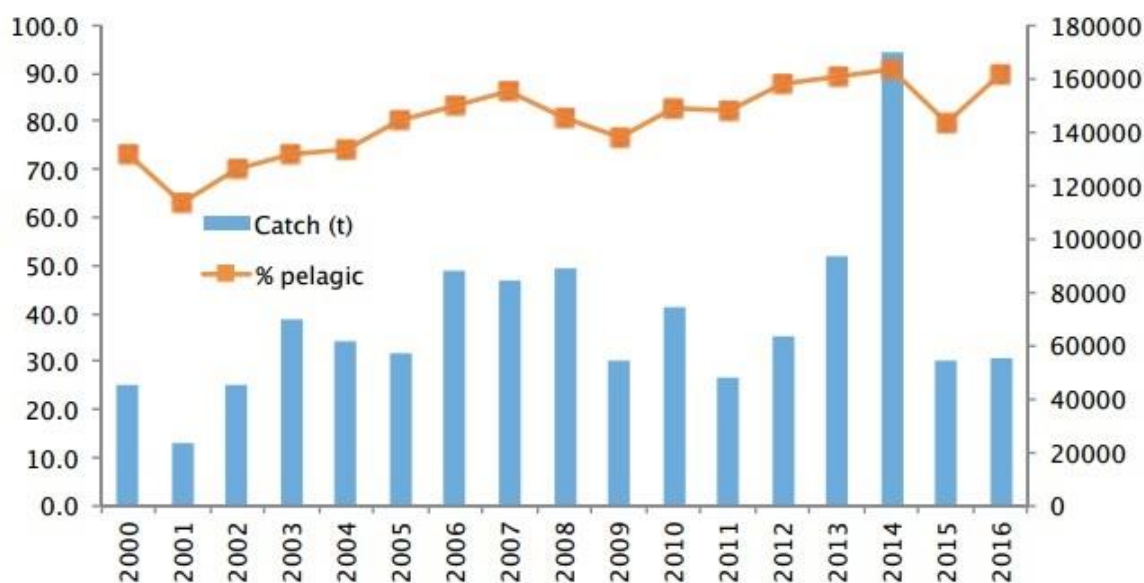
Indian Oil Sardine Fishery

India is the second largest fish producing nation in the world, with landings in 2015/16 estimated to be 10.8 million tonnes[2]. Of this, around 265,000t was Indian Oil Sardine (IOS), and a further 256,000t other sardine species[3]. This assessment covers the IOS purse seine reduction fishery off the coasts of Goa (around 104km of coast) and Maharashtra (720km)[2]. In 2015, these two states produced 69,276t of IOS and 13,759t of other sardines, primarily through purse seine gears[3]. Pelagic fishing represents 41% of the total marine catch in Maharashtra, with IOS making up around 4% of the total marine

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[2] DADF annual report, 2016-17. http://dahd.nic.in/sites/default/files/Annual%20Report%202016-17.pdf
[3] Summarised catch data provided by applicant, based on CMFRI annual reports, e.g. 2016-17 http://eprints.cmfri.org.in/11964/

catch. In Goa pelagic gears are much more important, representing 90% of the total marine catch, with IOS around 41% of the total marine catch[4].

Pelagic landings and contribution of pelagic landings to total catch in Goa, 2000-2016. Indian oil sardine represented around 40% of the total catch in 2016, and around 45% of pelagic landings. From the CMFRI 2016/17 annual report[5].

1.2 Management system

Management of the Indian oil sardine fishery falls under the jurisdiction of a number of different authorities. The over-arching federal authority is the Department of Animal Husbandry, Dairying and Fisheries (DADF) within the Ministry of Agriculture and Farmers Welfare, which has primary jurisdiction over fishing activities conducted in the EEZ waters beyond 12nm from shore. Fisheries active within 12nm of shore fall under the jurisdiction of state governments; for the purposes of this assessment, the relevant primary authorities are the Directorate of Fisheries in Goa and the Department of Fisheries in Maharastra. At both the national and state levels of governance there are also other authorities with some degree of influence, including the Ministries of Defence; Science and Technology; Food and Processing Industries; Earth Sciences; and Environment, Forests and Climate Change[6].

The Central Marine Fisheries Research Institute (CMFRI) was created by the Indian government in 1947 and is the primary national research organisation for marine wild capture fisheries and mariculture[7]. The CMFRI collects landings data using a sampling methodology referred to as a Stratified Multistage Random Sampling Scheme, and also conducts rapid stock assessments for 28 of

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[4] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/
[5] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/
[6] Sriramachandra Murty, V (2015). The status of fisheries science in India – Including results of certain field developments, the results of application of innovations resulting from fisheries science work. Fishing Chimes, V.34 No. 11 pp.9-31
[7] CMFRI website, "About Us". http://www.cmfri.org.in/about-us

the most economically important species groups caught in Indian fisheries, including oil sardine[8]. Data collected and analysed by the CMFRI is used by the state governments to inform their management decisions; rather than state-level research organisations, the CMFRI maintains a regional presence, with centres in Mandapam, Visakhapatnam and Veraval, and research centres in Mangalore, Kozhikode, Mumbai, Vizhinjam, Karwar, Tuticorin and Chennai[9].

1.3 Target species

The primary target species is Indian oil sardine (*Sardinella longiceps*). Indian oil sardine (IOS) is a small pelagic fish distributed from the Palk Strait around the western coast of India to the Gulf of Aden and the Gulf of Oman. Spawning occurs once per year peaking in August and September. Individuals become sexually mature at around 1 year, with a maximum recorded age of 3 years[10].

Oil sardine landings for 2016 were estimated by the CMFRI to be around 12,473t in Maharashtra and 26,684t in Goa. Combined, these represent around 15% of the national oil sardine landings of 244,992t[5].

There do not appear to be any established reference points for the IOS stock(s), partially because of the lack of a consensus on the number and geographical limits of stocks in the region (although see below for a possible exception). That there are no established reference points is also supported by previous analyses[11,12].

1.4 Ecosystem and Habitat

There is some evidence that interactions with ETP species are recorded. The 2015-16 CMFRI annual report states that interactions with ETP elasmobranch species were limited to one sawfish and two juvenile whale sharks, although it also reports that there is a rampant trade in devil ray gill plates[13]. However, the 2016-17 CMFRI report does not include any mention of ETP species[14]. The 2014 DADF publication *Handbook on Fisheries Statistics*[15] does not include a summary or details of ETP interactions, nor does the CMFRI publication *Marine fish landings in India*[16].

A list of critically endangered species in India, published by the Ministry of Environment and Forests in 2011, included the hawksbill turtle; leatherback turtle; pondicherry shark; knife-tooth sawfish; large-tooth sawfish; and long-comb sawfish[17]. The Wildlife (Protection) Act of 1972 also covers the whale shark; pointed sawfish; giant guitarfish; longman's beaked whale; spinner dolphin; humpback dolphin; common dolphin; bottlenose dolphin; risso's dolphin; and thorny ray[18]. Any of these species could

[8] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/
[9] CMFRI website. http://www.cmfri.org.in/
[10] Fishbase, Indian Oil Sardine. http://www.fishbase.org/summary/1511
[11] Fishsource, IOS Goa. https://www.fishsource.org/stock_page/2274
[12] Fishsource, IOS Maharashtra. https://www.fishsource.org/stock_page/2273
[13] CMFRI annual report, 2015-16. http://eprints.cmfri.org.in/10897/
[14] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/
[15] DADF Handbook on Fishery Statistics, 2014.
http://www.indiaenvironmentportal.org.in/files/file/handbook%20on%20fisheries%20statistics%202014.pdf
[16] CMFRI, Marine Fish Landings in India, 2016. http://eprints.cmfri.org.in/11831/
[17] Ministry of Environment and Forests, 2011. "Critically Endangered Animal Species of India".
http://envfor.nic.in/sites/default/files/critically_endangered_booklet.pdf
[18] CMFRI, "Marine Biodiversity of India – Status and Challenges"
http://eprints.cmfri.org.in/10406/1/01_KK_JOSHI_2.pdf

potentially interact with a pelagic purse seine fishery, and without evidence that interactions are recorded and reported it is not possible to determine whether measures are required to mitigate these interactions.

Purse seine gears are generally not thought to have substantial interactions with physical habitats, a position apparently shared by Indian fishery managers[19]. The 2016-17 CMFRI annual report includes an extensive section on marine habitats in general, covering the impacts of marine litter and pollution, the ecology of mud bank and seagrass beds, restoration of mangroves, and a summary of a study conducted in Kerala on ecological variations in sardine habitats and their impact on the sardine fishery[20].

The newly-launched National Policy on Marine Fisheries, 2017, states that the Ecosystem Approach to Fisheries Management (EAFM) will be implemented as part of the policy, "with due consideration to the well-being of all living and non-living constituents of the marine ecosystem and the social attributes of stakeholders"[21]. International stakeholders have reported that there is currently very little information on the environmental impact of the fishery, in terms of bycatch or ecosystem effects[22]. The 2016-17 CMFRI annual report does include a section on ecosystems modelling, including a report of a project to conduct a multivariate stock status, MSY and optimum fishing effort analysis for IOS in Kerala state waters; there is no indication that this project will be repeated for other states or that the results will influence management efforts in other states in the short term[23]. It is also worth noting that the main potential ecosystem effect of the IOS fishery is likely to be the impact of the removal of large quantities of prey for larger fish, mammals, and seabirds. Even if the potential impacts in this area were known, without a mechanism by which total fishing effort can be modulated it is currently not possible for these impacts to be mitigated via reduced total catch.

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[19] DADF, 2014. "Report of the Technical Committee to Review the Duration of the Ban Period and to Suggest further Measures to Strengthen the Conservation and Management Aspects". http://dahd.nic.in/sites/default/files/Report%20of%20the%20Technical%20Committee%20to%20Review%20the%20Duration%20of%20the%20Ban%20Period%2022%20Sept.%202014.pdf

[20] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/

[21] DADF National Policy on Marine Fisheries, 2017. F. No. 21001/05/2014-FY.

[22] Fishsource fishery profile, Indian Oil Sardine (Goa). https://www.fishsource.org/stock_page/2274

[23] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/

MANAGEMENT

The two clauses in this section relate to the general management regime applied to the fishery under assessment. A fishery must meet all the minimum requirements in every clause before it can be recommended for approval.

M1	Management Framework – Minimum Requirements		
	M1.1	There is an organisation responsible for managing the fishery.	Yes
	M1.2	There is an organisation responsible for collecting data and assessing the fishery.	Yes
	M1.3	Fishery management organisations are publicly committed to sustainability.	Yes
	M1.4	Fishery management organisations are legally empowered to take management actions.	Yes
	M1.5	There is a consultation process through which fishery stakeholders are engaged in decision-making.	Yes
	M1.6	The decision-making process is transparent, with processes and results publicly available.	Yes
		Clause outcome:	Yes

Evidence

M1.1 – Management of the Indian oil sardine fishery falls under the jurisdiction of a number of different authorities. The over-arching federal authority is the Department of Animal Husbandry, Dairying and Fisheries (DADF) within the Ministry of Agriculture and Farmers Welfare, which has primary jurisdiction over fishing activities conducted in the EEZ waters beyond 12nm from shore. Fisheries active within 12nm of shore fall under the jurisdiction of state governments; for the purposes of this assessment, the relevant primary authorities are the Directorate of Fisheries in Goa and the Department of Fisheries in Maharastra. At both the national and state levels of governance there are also other authorities with some degree of influence, including the Ministries of Defence; Science and Technology; Food and Processing Industries; Earth Sciences; and Environment, Forests and Climate Change[24].

M1.2 – The Central Marine Fisheries Research Institute (CMFRI) was created by the Indian government in 1947 and is the primary national research organisation for marine wild capture fisheries and mariculture[25]. The CMFRI collects landings data using a sampling methodology referred to as a Stratified Multistage Random Sampling Scheme, and also conducts rapid stock assessments for 28 of the most economically important species groups caught in Indian fisheries, including oil sardine[26]. Data continually collected and analysed by the CMFRI is used by the state governments to inform their management decisions; rather than state-level research organisations, the CMFRI maintains a regional presence, with centres in Mandapam, Visakhapatnam and Veraval, and research centres in Mangalore, Kozhikode, Mumbai, Vizhinjam, Karwar, Tuticorin and Chennai[27]. Another relevant agency is the Fishery Survey of India (FSI). The FSI is responsible for surveying and assessing fish stocks in the Indian EEZ, conducting marine fisheries forecasting, and the monitoring of fishery resources for regulation, management and conservation[28]. However, based on the FSI's most recent annual report (2015/16), current research appears to be

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[24] Sriramachandra Murty, V (2015). The status of fisheries science in India – Including results of certain field developments, the results of application of innovations resulting from fisheries science work. Fishing Chimes, V.34 No. 11 pp.9-31

[25] CMFRI website, "About Us". http://www.cmfri.org.in/about-us

[26] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/

[27] CMFRI website. http://www.cmfri.org.in/

[28] FSI website, "Mandate". http://fsi.gov.in/LATEST-WB-SITE/fsi-mand-frm.htm

focussed on demersal and tuna fisheries, and it is not clear whether FSI efforts are relevant to this IOS assessment specifically[29]. A final potentially relevant organisation is the Central Institute of Fisheries Technology (CIFT), within the Indian Council of Agricultural Research (ICAR). CIFT is responsible for "basic and strategic research in fishing and processing", and the "design and develop[ment] of energy efficient fishing systems for responsible fishing and sustainable management"[30].

M1.3 – The DADF website does not appear to contain a summary of the goals and objectives of the Department in relation to fisheries; however the over-arching approach of the Indian government is most recently defined in the 2017 National Policy on Marine Fisheries (NPMF). The NPMF is founded on seven 'pillars', the first of which is "sustainable development", and also aims to ensure that fishery management in India is in line with the FAO Code of Conduct for Responsible Fisheries[31]. The DADF was also responsible for creating the National Fisheries Development Board (NFDB), a semi-autonomous organisation responsible for "coordinating fishery development in an integrated and holistic manner", and to "achieve sustainable management and conservation of natural aquatic resources including the fish stocks" (amongst other goals)[32]. At the state level, the Goa Directorate of Fisheries states that one of its goals is to "manage and conserve the fisheries resources", although it also aims to "increase the fish production in the state"[33]. Similarly, the Maharashtra Department of Fisheries states that its aims include "sustainable fisheries development with ecological balance" and "ensuring protection of environment and conservation of biodiversity"[34].

M1.4 – There are legal instruments in place informing and empowering the management of fisheries at the federal and state levels. The core national legislation is the Indian Fisheries Act of 1897, and at the state level the Goa Marine Fishing Regulation Act (1980) and the Maharashtra Marine Fishing Regulation Act (1981)[35]. The Indian Fisheries Act delegates much of the legislative power over fisheries to the individual states, with the Marine Fishing Regulation Acts detailing each state's individual regulations, such as sanctions, licensing rules, closed areas and seasons, etc. Other relevant legislation includes the Maritime Zones of India Act, 1981 (which controls the activities of foreign fishing vessels within the Indian Maritime Zone); the Environment (Protection) Act, 1986 (which makes Environmental Impact Assessments mandatory for certain activities); the New Deep Sea Fishing Policy, 1991 (which licenses and controls deep sea fishing); the recommendations of the Murari Committee, 1995 (all of which were adopted by the India government in 1997, introducing a range of new technical measures and licensing changes); the Biological Diversity Act, 2002 (which aims to protect biological diversity); the Marine Fisheries (Regulation and Management) Bill, 2009; and the NPMF, 2017[35].

M1.5 – The Indian national government offers a range of mechanisms through which fishery stakeholders are consulted during the development of fishery management mechanisms. The CMFRI holds annual stakeholder consultation meetings at many of its regional offices, and summarises the outcomes of these meetings in its annual report. The 2016/17 report summarises stakeholder meetings held in Vereval, Mumbai, Karwar, Vizhinjam, Tuticorin, Mandapam, Chennai and Visakapatnam. There were also a series of separate consultation events held on the specific issue of elasmobranch management during August and September 2016 at eight CMFRI centres around India[36]. At the time of this report, the DADF website provided a link to a consultation on

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[29] FSI annual report, 2015-16. http://fsi.gov.in/LATEST-WB-SITE/pdf_files/statistics/ar2015-16e.pdf
[30] CIFT website, "About Us". http://cift.res.in/cift-about
[31] DADF National Policy on Marine Fisheries, 2017. F. No. 21001/05/2014-FY.
[32] NFDB website, "Objectives". http://nfdb.gov.in/objectives.htm
[33] Goa DoF, "Aims and Goals": http://fisheries.goa.gov.in/?page_id=591
[34] Maharashtra DoF, "About Us": http://fisheries.maharashtra.gov.in/en/about-us
[35] Rajesh, KM, "Fisheries Legislation in India". CMFRI, Mangalore.
[36] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/

the National Inland Fisheries and Aquaculture Policy, led by an expert committee composed of regional fisheries managers, scientists, and academics. The consultation requests responses from a range of stakeholders including fishers, fish farmers, other areas of the fishing industry, academics, NGOs, and others[37]. The Fishery Survey of India (FSI) also holds regional workshopping and engagement events[38]. There is less explicit evidence of stakeholder consultations at the state level, although there is considerable evidence of stakeholder interactions via training, fishing festivals and other outreach events[39].

M1.6 – The CMFRI annual report includes a large amount of information in relation to fishery management, including summaries of landings estimates by state, scientific efforts such as ecosystems modelling and genetic analyses, climate change, economic impacts, social components to fisheries management, budgets, training, and major events[36]. Additionally, the regular stakeholder consultation meetings described above represent an effort to ensure transparency of process. The DADF also produces an annual report summarising fisheries management activities but this is necessarily at a higher level due to the broader area covered by the department[40]. At the state level, the Goa Directorate of Fisheries produces an annual report with a similar set of contents as the national CMFRI report[39]; no equivalent report could be found from the Maharashtra Department of Fisheries. The majority of the information used to inform this assessment report was freely available online, with the remainder provided by the applicant organisation with no restrictions on use.

Improver Programme Notes

The management of the fishery currently meets the requirements of section M1. There are some references which indicate that the complexities of multi-jurisdictional management may have an impact on the management of stocks, particularly cross-boundary stocks such as IOS, but the effects of this are assessed in other sections of this report. There are also some areas of information (most notably the details of the rapid stock assessments) which do not appear to be made available online, risking the current 'pass' rating against M1.6. The rapid stock assessment process is relatively simple, and as such the absence of publically available reports does not represent a substantial gap in information; however explicit details of the rapid stock assessments should be made available, and as more complex stock assessments are introduced they must also be made available online in order to maintain approval under this section.

Standard clauses 1.3.1.1, 1.3.1.2

M2	Surveillance, Control and Enforcement - Minimum Requirements		
	M2.1	There is an organisation responsible for monitoring compliance with fishery laws and regulations.	GAP
	M2.2	There is a framework of sanctions which are applied when laws and regulations are discovered to have been broken.	Yes
	M2.3	There is no substantial evidence of widespread non-compliance in the fishery, and no substantial evidence of IUU fishing.	GAP
	M2.4	Compliance with laws and regulations is actively monitored, through a regime which may include at-sea and portside inspections, observer programmes, and VMS.	GAP
		Clause outcome:	GAP

[37] National Inland Fisheries and Aquaculture Policy consultation 2016-17. http://dahd.nic.in/sites/default/files/National%20Inland%20Fisheries%20And%20Aquaculture%20Policy.pdf
[38] DADF annual report, 2016/17. http://dahd.nic.in/sites/default/files/Annual%20Report%202016-17.pdf
[39] Goa DoF annual report, 2016. http://fisheries.goa.gov.in/wp-content/uploads/2017/05/Final-Printed-Fish-Trail-Vol-III-2016-28-09-16.rar
[40] DADF annual report, 2016/17. http://dahd.nic.in/sites/default/files/Annual%20Report%202016-17.pdf

Evidence

M2.1 – The main organisation responsible for enforcing fisheries rules and regulations appears to be the Indian Coastguard (ICG), whose stated duties include "taking such measures as are necessary to preserve and protect the maritime environment and to prevent and control marine pollution", and "enforcing the provisions of such enactments as are for the time being in force in the maritime zone"[41]. The Department of Defence annual report 2016/17 states that during the 2016 calendar year, the ICG was responsible for the following enforcement activities[41]:

- Poacher trawler apprehension (11 boats & 69 crew)

- Apprehension on Marine Wild Life Violation (11 boats & 104 crew)

- Repatriation of fishermen (333 Indian fishermen from Sri Lanka and 9 Sri Lankan fishermen from India)

These numbers seem relatively low for all enforcement activities across all Indian marine waters, and it is not clear whether these categories cover all forms of enforcement activity.

The Goa Directorate of Fisheries reports that its Enforcement Section is responsible for, among other activities, "implementation of the Marine Fishing Regulation Act, 1980"; "conducting patrolling of the sea coast up to 5km"; "booking of offences"; and the registration and licensing of trawlers and fishing nets[42]. The assessment team was not able to find information on any equivalent Section within the Maharashtra DoF. The Maharashtra Marine Fishing Regulation Act (1981) defines an "Enforcement Officer" as a DoF officer[43]. Licensing of fishing vessels in Maharashtra may be the responsibility of the Maharashtra Maritime Board (MMB), whose stated functions include the "Enforcement of Maritime Acts and Rules for administration and conservancy of ports, for regulating traffic, fare-structures, licensing of crafts, etc"[44].

M2.2 – The Indian Fisheries Act of 1897 empowers government representatives (such as police officers) to arrest individuals committing offences against the Act[45]. More detailed sanctions are defined in the state fishery legislation. The Goa, Daman and Diu Marine Fishing Regulation Act (1980) sets out a range of potential penalties, including a substantial fine (up to five times the value of the fish involved); the suspension or revocation of the relevant vessel licencing; and the seizure of the illegally caught fish or proceeds[46]. Similarly, the Maharashtra Marine Fishing Regulation Act (1981) lists potential penalties including the seizure of fish and the impounding of fishing vessels; a substantial fine of up to five times the value of the fish caught; and the suspension or revocation of the fishing vessel licencing[43].

M2.3 – Some sources have been critical of the extent to which some fishery regulations rely on self-reporting and may not be fully enforced[47]; have stated that enforcement of closed areas is 'questionable'[48]; have stated that

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[41] Ministry of Defence annual report, 2016-17. https://mod.gov.in/sites/default/files/AnnualReport1617.pdf
[42] Goa DoF, Enforcement Section. http://fisheries.goa.gov.in/?page_id=204
[43] Maharashtra marine fishing regulation act, 1981.
http://fisheries.maharashtra.gov.in/sites/default/files/maharashtra_marine_fishing_regulation_act_1981.pdf
[44] Maharastra Maritime Board website, "Functions of MMB".
https://mahammb.maharashtra.gov.in/1172/Functions-of-MMB
[45] Indian Fisheries Act, 1897. https://indiankanoon.org/doc/286852/
[46] Goa, Daman and Diu Marine Fishing Regulation Act, 1980.
http://mpeda.gov.in/MPEDA/pdf/state_mfras/mfra_goa.pdf
[47] *The Goan*, June 2017, "Enforcement of new fisheries guidelines questioned".
http://englishnews.thegoan.net/story.php?id=34084
[48] Project Seahorse, "Rules and Regulations Governing Fisheries in Different States along the Indian Coast".

fishing vessels of Indian build operating in the EEZ waters outside state control fish under a 'legal vacuum'[35]. India has not been awarded a 'yellow card' or a 'red card' by the EU under the IUU regulation[49].

M2.4 – The National Policy on Marine Fisheries (NPMF), introduced in 2017, states that "The existing mechanisms in place for a sound and effective MCS regime for marine fisheries sector need further strengthening"[50]. There is an online registering and licensing system in place at the national level, and individual states (including Goa and Maharashtra) have licencing requirements implemented by their respective fisheries departments/directorates. There does not currently appear to be a Vessel Monitoring System (VMS) in place, logbooks do not appear to be mandatory[51], and there is no evidence of an at-sea observer programme. The Enforcement Section of the Goa DoF is responsible for conducting inspections of around 1,200 fishing vessels and 2,000 canoes, and conducting patrols within 5km of shore[42]. As there is no clear equivalent Section in the Maharashtra DoF, it is not clear what enforcement activities are carried out in the state.

Improver Programme Notes

There is a clear framework for issuing meaningful sanctions against vessels and individuals breaking fisheries legislation and regulations. However, there is a lack of information available on the monitoring and enforcement of legislation, and what information is available indicates there may be some gaps in monitoring and enforcement efforts. In order to achieve approval under this section, the fishery must first clearly set out the responsible organisations (clarifying, for example, the relative roles of (or in the case of Maharashtra, the existence of) the national and state enforcement agencies) and the activities conducted to ensure fishers adhere to rules and regulations. Secondly, the fishery must also ensure that enforcement activities are robust and non-compliance with regulations is tackled, by implementing the NPMF and strengthening other MCS efforts.

Standard clause 1.3.1.3

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[49] European Commission website, EU rules to combat illegal fishing, "Overview of existing procedures as regards third countries". https://ec.europa.eu/fisheries/sites/fisheries/files/illegal-fishing-overview-of-existing-procedures-third-countries_en.pdf

[50] DADF National Policy on Marine Fisheries, 2017. F. No. 21001/05/2014-FY.

[51] DADF National Policy on Marine Fisheries, 2017. F. No. 21001/05/2014-FY.

CATEGORY A SPECIES

The four clauses in this section apply to Category A species. Clauses A1 - A4 should be completed for **each** Category A species. If there are no Category A species in the fishery under assessment, this section can be deleted. A Category A species must meet the minimum requirements of all four clauses before it can be recommended for approval. If the species fails any of these clauses it should be re-assessed as a Category B species.

Species Name		Indian Oil Sardine	
A1	**Data Collection - Minimum Requirements**		
	A1.1	Landings data are collected such that the fishery-wide removals of this species are known.	Yes
	A1.2	Sufficient additional information is collected to enable an indication of stock status to be estimated.	GAP
		Clause outcome:	GAP

Evidence

A1.1 – The CMFRI monitors marine fish landings using the Stratified Multistage Random Sampling Scheme (SMRSS). Fish landings take place at 1,341 landing locations around India at all times of the day and night, with an estimated 7,293,000 separate landing events nationally in 2016. Due to the scale of the monitoring regime which would be required to record each of these landings individually, the CMFRI considers sampling to be the only financially feasible way to produce estimates of landings volumes[52]. Sampling is stratified both temporally and spatially, separating each maritime state into sampling zones and calendar months. Field staff undergo 12 weeks of training and are subjected to random, unannounced inspections by senior staff[53]. According to one source sampling coverage is relatively limited, with around 3.1% of landings sampled in Goa, and 1-7% in Maharashtra. Periodic data quality checks are made through field inspections and sample error is estimated at 5-20%[52]. In addition to location and month, landings samples are recorded by gear type[54].

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[52] Sathianandan, TV, "CMFRI Data Collection System for Marine Fish Landings Estimation" (Presentation). http://dahd.nic.in/sites/default/files/CMFRI%20Data%20Collection%20System%20for%20Marine%20Fish%20Landings_0.pdf

[53] Mini KG (2015), Monitoring and Quantifying Marine Fish Landings in India: Survey Design, Sampling and Estimation followed by CMFRI, Summer School on Recent Advances in Marine Biodiversity Conservation and Management, 16 Feb – 8 March 2015, CMFRI

[54] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/
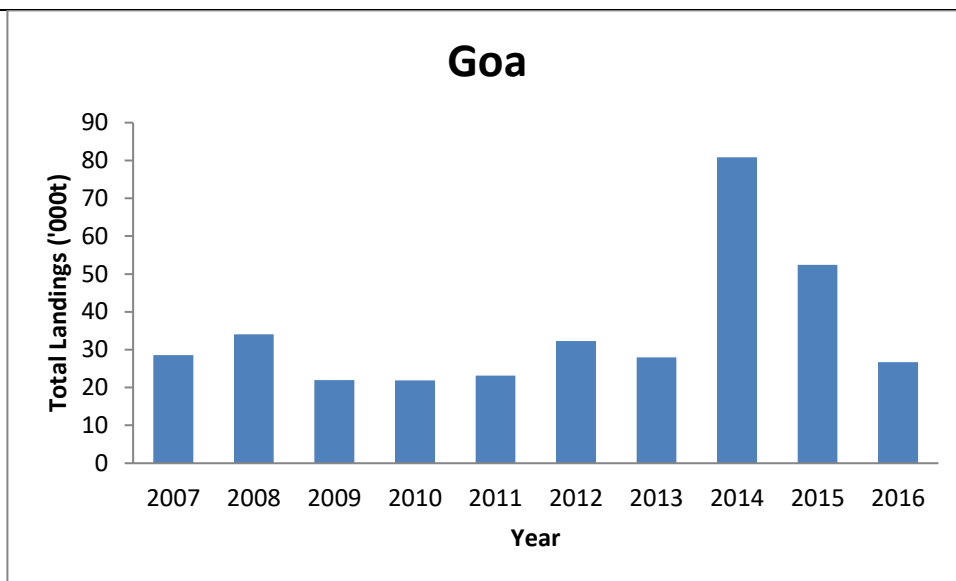
Estimated annual landings of Indian Oil Sardine in Goa, 2007-2016. From data provided by the applicant, taken from CMFRI annual reports.
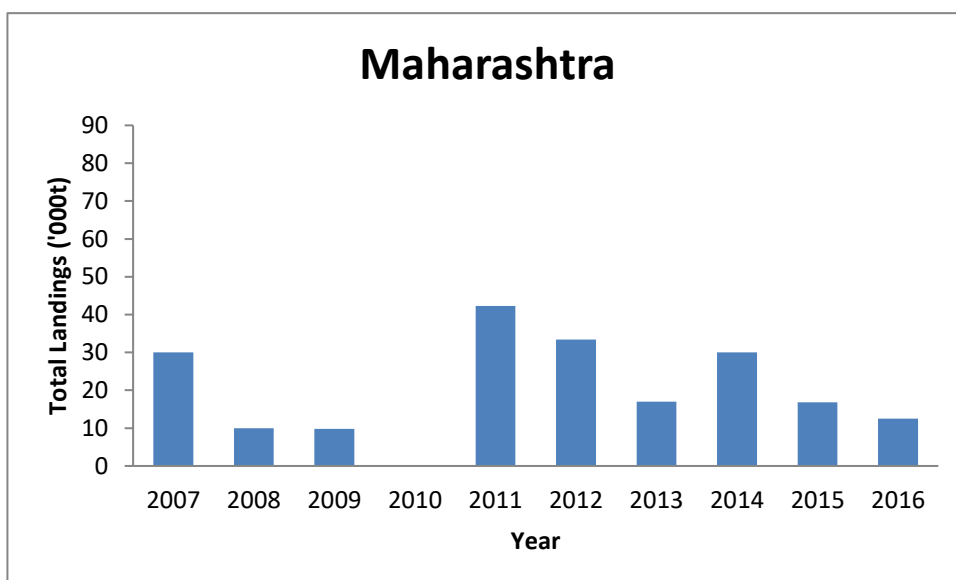
Estimated annual landings of Indian Oil Sardine in Maharashtra, 2007-2016. No data for 2010. From data provided by the applicant, taken from CMFRI annual reports.

A1.2 – There is evidence that other fishery-dependent data are collected – for example, age and length frequency sampling and estimation of fishing effort. There is also the potential for fishery-independent data collection through the FSI, whose annual reports evidence the collection of such data for demersal and tuna fisheries[55]; however the only indication that any such efforts are directed towards pelagic resources is a note on the FSI website stating that the estimated potential of pelagic resources is 1.7 million tonnes[56]. The CMFRI annual report also indicates that estimates of sustainable yield may be made, although does not provide any details on raw data used or procedure[57]. In summary, although there are data collected beyond total landings, it is not clear

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[55] FSI annual report, 2015-16. http://fsi.gov.in/LATEST-WB-SITE/pdf_files/statistics/ar2015-16e.pdf
[56] FSI website, "Survey and Research" http://fsi.gov.in/LATEST-WB-SITE/fsi-res-act-frm.htm
[57] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/

whether these are adequate to permit the calculation of an estimate of stock status, and in any case the estimate of stock status which is produced uses only catch data to inform its derivation (see section A2).

Improver Programme Notes

Landings data are estimated for the fishery, but sampling coverage is relatively low and the upper end of the error range is a not-insubstantial 20%. Although a 'pass' rating has been awarded for this section, the fishery may wish to improve landings data collection to maximise the probability of approval and to ensure the other aspects of stock assessment, many of which rely on an accurate estimate of total landings, are based on solid data. The fishery should also ensure that adequate fishery-independent data are collected, particularly as the biological characteristics of the resource (rapid reproduction, highly influenced by environmental factors) mean population size is likely to fluctuate substantially between years and even between seasons.

Standard clause 1.3.2.1.1

A2	**Stock Assessment - Minimum Requirements**		
	A2.1	A stock assessment is conducted at least once every 3 years (or every 5 years if there is substantial supporting information that this is sufficient for the long-term sustainable management of the stock), and considers all fishery removals and the biological characteristics of the species.	GAP
	A2.2	The assessment provides an estimate of the status of the biological stock relative to a reference point or proxy.	GAP
	A2.3	The assessment provides an indication of the volume of fishery removals which is appropriate for the current stock status.	GAP
	A2.4	The assessment is subject to internal or external peer review.	GAP
	A2.5	The assessment is made publically available.	GAP
		Clause outcome:	GAP

Evidence

A2.1 – The CMFRI conducts rapid stock assessments of IOS at multiple spatial scales (across the whole of India, for each coast (east and west) and for each state). The details of the rapid stock assessment methodology do not appear to be made explicit by the CMFRI, but the applicant reports that the methodology used is described in the CMFRI scientific paper "Depleted and Collapsed Marine Fish Stocks along Southwest Coast of India – A Simple Criterion to Assess the Status" (KS Mohamed *et al*, 2010[58]). At the time the paper describing the methodology was written, there were no abundance data available for the stocks being classified and so an assumption was made that catch is proportional to abundance. According to the methodology, the following categories are used to classify stocks by simple comparison of recent catches to the historical maximum catch:

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[58] Mohamed, KS, *et al* (2010), "Depleted and Collapsed Marine Fish Stocks along Southwest Coast of India – A Simple Criterion to Assess the Status". http://eprints.cmfri.org.in/7855/1/sunil1.pdf

Stock Classification	Recent average catch in historical maximum (%)
Abundant	> 70
Less abundant	50-69
Declining	11-49
Depleted	6-10
Collapsed	< 5

Stock abundance criteria used to classify stocks assessed under the CMFRI rapid stock assessment methodology[58].

There does not appear to be any evidence to suggest that any more sophisticated an approach has been adopted for rapid stock assessments over the intervening 7 years. The 2016/17 CMFRI annual report classifies IOS as 'Abundant' in Goa[59] (i.e. recent catches were greater than 70% of the historical maximum level). The CMFRI report does not include an indication of the classification of IOS in Maharashtra, and the assessment team was unable to determine the classification via alternative sources.

The CMFRI annual report 2016/17 states that estimates of stock status, MSY and optimum fishing effort were calculated for IOS in Kerala using a multispecies stock assessment model; however no equivalent study has yet been conducted for the IOS stock(s) covered by this IFFO RS IP application[59].

The rapid stock assessment methodology provides a convenient and simple indication of the status of the stock relative to historical levels; however the use of total catch as an indicator of abundance does not take into account the effects of varying levels of effort. The methodology does not take into account the biology of the species, although it does account for all fishery removals (as estimated using the CMFRI random sampling methodology) and keeping in mind the potential 5-20% error and low coverage rate.

A2.2 – There do not appear to be any established reference points for the IOS stock(s), partially because of the lack of a consensus on the number and geographical limits of stocks in the region (although see below for a possible exception). That there are no established reference points is also supported by previous analyses[60,61].

The CMFRI annual report for 2016/17 includes a table, under the section for Karnataka and Goa, which lists "population and stock parameters of important resources". One such resource is IOS, to which table indicates vales for M (2.74); F (3.05); SSB (163,445t); yield (783,490t) and MSY (1,423,000t)[62]. It is not entirely clear over what area these statistics apply, although with total national landings of 244,992t in 2016 it is likely to represent the entire Indian IOS fishery. If this is the case the fishery may currently be substantially under-exploiting the IOS stock; however, additional details of the stock assessment process would be required to confirm this. Furthermore, the scientific basis for considering IOS from the entire Indian coastline to be a single stock would need to be justified.

A2.3 – The rapid stock assessment does not provide an indication of an appropriate level of removals for the fishery. To some extent the catch recommendation produced by the assessment could be considered to be "as much as possible"; under the classification scheme described above, the more IOS is caught, the healthier the stock is considered to be. As noted in A2.2, there is some evidence that there may be one or MSY estimates for

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[59] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/
[60] Fishsource, IOS Goa. https://www.fishsource.org/stock_page/2274
[61] Fishsource, IOS Maharashtra. https://www.fishsource.org/stock_page/2273
[62] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/

the stock(s), and if this is the case there may also be estimates of an appropriate level of catch. However if so these are not published in the CMFRI annual reports or any other documentation available to the assessment team.

A2.4 – The full detail of recent rapid stock assessments was not available to the assessment team. The paper describing the rapid assessment methodology appears to have been subjected to internal peer review but is not from a peer reviewed journal[63]. It is likely that the rapid stock assessment is also subjected to internal peer review; however without sight of the document the assessment team is not able to confirm.

A2.5 – Some information from the stock assessment is made available through the CMFRI annual report and other government documents; however the stock assessment itself does not appear to be published and made available.

Improver Programme Notes

Although there is a form of stock assessment conducted for the IOS, it falls substantially short of the level demanded by the IFFO RS requirements. The rapid stock assessment needs to be conducted in more detail, taking into account the biological characteristics of IOS, should result in a clear estimate of the current status of the stock relative to one or more reference points or proxies, and should indicate an appropriate level of fishery removals in the short term. The stock assessment methodology and outcomes should be summarised, or preferably detailed, in a stock assessment report which is both peer reviewed and made publically available. As discussed in Improver Programme Note 3 of the introduction, the number and location of IOS stocks in Indian waters is not certain. For the purposes of meeting the requirements of section A2, all fish covered by the assessment must be subject to a stock assessment. In other words, and depending on the biological stocks, it may be necessary to conduct multiple stock assessments. It is also likely that the biological stock(s) will be fished by states other than Goa and Maharashtra, and in this case the removals of those states should also be factored into the assessment.

Standard clause 1.3.1.2, 1.3.2.1.2, 1.3.2.1.4

A3	**Harvest Strategy - Minimum Requirements**		
	A3.1	There is a mechanism in place by which total fishing mortality of this species is restricted.	GAP
	A3.2	Total fishery removals of this species do not regularly exceed the level indicated or stated in the stock assessment. Where a specific quantity of removals is recommended, the actual removals may exceed this by up to 10% ONLY if the stock status is above the limit reference point or proxy.	GAP
	A3.3	Commercial fishery removals are prohibited when the stock has been estimated to be below the limit reference point or proxy (small quotas for research or non-target catch of the species in other fisheries are permissible).	GAP
		Clause outcome:	GAP

Evidence

A3.1 – There are management mechanisms in place which restrict the total volume of IOS removals, although these are not specific to the species nor are they reactive to the status of the stock. A monsoon fishing ban is in place annually from June 1 to July 31, during which only smaller craft (either non-motorised or fitted with a motor of maximum 10HP) are permitted to fish. The majority of measures are implemented by the individual

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[63] Mohamed, KS, *et al* (2010), "Depleted and Collapsed Marine Fish Stocks along Southwest Coast of India – A Simple Criterion to Assess the Status". http://eprints.cmfri.org.in/7855/1/sunil1.pdf

states, through the Marine Fishing Regulation Acts (MFRAs). In Maharashtra, the MFRA sets out closed seasons, mesh size restrictions, and closed areas[64]; in Goa, there are closed areas, mesh size restrictions (24mm for fish nets), and a ban on the use of LED light fishing and bull/pair trawling[65]. Maharashtra has also implemented no-trawl zones, mechanised trawlers are not permitted to operate at night, and mechanised purse-seiners (which are the vessel type covered by this report) are restricted from operating in the territorial waters of Thane, Greater Mumbai, Raigad and Sindhudurg.

A3.2 – As noted in A2, the rapid stock assessment does not produce a recommendation for the total level of fishery removals appropriate for any IOS stock.

A3.3 – There is no formal limit reference point or proxy established for any IOS stock, nor is there evidence of any mechanism which would close the fishery temporarily if serious over-exploitation was determined to be occurring.

Improver Programme Notes

Meeting the requirements of this section is largely dependent on the existence of a stock assessment which meets the requirements of A2. However, even absent the existence of a stock assessment, the fishery can begin to implement measures to restrict total fishery removals. It is important that these are either adjustable (to reflect the stock assessment recommendations) or fixed but conservative. As noted above, there are basic measures in place which have the effect of restricting total removals, and if the advanced stock assessment reveals that current removals are substantially below the sustainable maximum then these may be adequate. However, it is important for managers to note that 'total fishing mortality' includes mortality within this stock caused by all fishing activities – including those conducted by states other than Goa and Maharashtra. If effective measures are put in place, and adapted to reflect the changing recommendations of subsequent stock assessments, the other requirements in this section will also be met.

Standard clause 1.3.2.1.3

A4	Stock Status - Minimum Requirements		
	A4.1	The stock is at or above the target reference point, OR IF NOT: The stock is above the limit reference point or proxy and there is evidence that a fall below the limit reference point would result in fishery closure OR IF NOT: The stock is estimated to be below the limit reference point or proxy, but fishery removals are prohibited.	GAP
		Clause outcome:	GAP

Evidence

A4.1 – There are currently no formal limit or target reference points established for any IOS stock(s) (although there does appear to be an unused MSY for the entire IOS population, the process for the derivation of which is not known), and there is no evidence that the fishery would be closed if serious over-exploitation was determined to be occurring.

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[64] Maharashtra marine fishing regulation act, 1981.
http://fisheries.maharashtra.gov.in/sites/default/files/maharashtra_marine_fishing_regulation_act_1981.pdf
[65] Goa, Daman and Diu Marine Fishing Regulation Act, 1980.
http://mpeda.gov.in/MPEDA/pdf/state_mfras/mfra_goa.pdf

Improver Programme Notes

The fishery will become able to meet this requirement once reference points (or proxies) have been established. The simplest way to meet the requirement is to establish a rule stating that the fishery will be closed if the stock falls below the limit reference point.

Standard clause 1.3.2.1.4

CATEGORY B SPECIES

Category B species are those which make up greater than 5% of landings in the applicant raw material, but which are not subject to a species-specific research and management regime sufficient to pass all Category A clauses. If there are no Category B species in the fishery under assessment, this section can be deleted.

Category B species are assessed using a risk-based approach. The following process should be completed once for each Category B species.

If there are estimates of biomass (B), fishing mortality (F), and reference points

It is possible for a Category B species to have some biomass and fishing mortality data available. When sufficient information is present, the assessment team should use the following risk matrix to determine whether the species should be recommended for approval.

Table B(a) - F, B and reference points are available

Biomass is above MSY / target reference point	Pass	Pass	Pass	Fail	Fail
Biomass is below MSY / target reference point, but above limit reference point	Pass, but re-assess when fishery removals resume	Pass	Fail	Fail	Fail
Biomass is below limit reference point (stock is overfished)	Pass, but re-assess when fishery removals resume	Fail	Fail	Fail	Fail
Biomass is significantly below limit reference point (Recruitment impaired)	Fail	Fail	Fail	Fail	Fail
	Fishery removals are prohibited	**Fishing mortality is below MSY or target reference point**	**Fishing mortality is around MSY or target reference point, or below the long-term average**	**Fishing mortality is above the MSY or target reference point, or around the long-term average**	**Fishing mortality is above the limit reference point or above the long-term average (Stock is subject to overfishing)**

23

If the biomass / fishing pressure risk assessment is not possible

Initially, the resilience of each Category B species to fishing pressure should be estimated using the American Fisheries Society procedure described in Musick, J.A. (1999). This approach is used as the resilience values for many species and stocks have been estimated by FishBase, and are already available online. For details of the approach, please refer to Appendix A. Determining the resilience provides a basis for estimating the risk that fishing may pose to the long-term sustainability of the stock. Table B(b) should be used to determine whether the species should be recommended for approval.

Table B(b) - No reference points available. B = current biomass; B_{av} = long-term average biomass; F = current fishing mortality; F_{av} = long-term average fishing mortality.

B > B_{av} and F < F_{av}	Pass	Pass	Pass	Fail
B > B_{av} and F or F_{av} unknown	Pass	Pass	Fail	Fail
B = B_{av} and F < F_{av}	Pass	Pass	Fail	Fail
B = B_{av} and F or F_{av} unknown	Pass	Fail	Fail	Fail
B > B_{av} and F > F_{av}	Pass	Fail	Fail	Fail
B < B_{av}	Fail	Fail	Fail	Fail
B unknown	Fail	Fail	Fail	Fail
Resilience	**High**	**Medium**	**Low**	**Very Low**

Assessment Results

Species Name		Indian Oil Sardine
B1	Species Name	Indian oil sardine
	Table used (Ba, Bb)	Bb
	Outcome	Fail

Evidence

There do not appear to be any established reference points for the IOS stock(s), partially because of the lack of a consensus on the number and geographical limits of stocks in the region (although see below for a possible exception). That there are no established reference points is also supported by previous analyses[66,67]. Without established reference points and an indication of stock status in relation to these, Table Ba cannot be used. To complete Table Bb, a resilience rating must first be established. Fishbase reports *Sardinella longiceps* as having a Medium resilience rating[68]. Reading off Table Bb, this means that IOS will only pass the Category B assessment if biomass is currently around the long term average and fishing mortality is below the long term average; or if biomass is above the long term average and fishing mortality is not above the long term average. As there do not appear to be any estimates of current or long-term averages for either variable, IOS does not pass

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[66] Fishsource, IOS Goa. https://www.fishsource.org/stock_page/2274
[67] Fishsource, IOS Maharashtra. https://www.fishsource.org/stock_page/2273
[68] Fishbase, Indian Oil Sardine. http://www.fishbase.org/summary/1511

Table Bb.

The CMFRI annual report for 2016/17 includes a table, under the section for Karnataka and Goa, which lists "population and stock parameters of important resources". One such resource is IOS, to which table indicates vales for M (2.74); F (3.05); SSB (163,445t); yield (783,490t) and MSY (1,423,000t)[69]. It is not entirely clear over what area these statistics apply, although with total national landings of 244,992t in 2016 it is likely to represent the entire Indian IOS fishery. If this is the case the fishery may currently be substantially under-exploiting the IOS stock; however, additional details of the stock assessment process would be required to confirm this. Furthermore, the scientific basis for considering IOS from the entire Indian coastline to be a single stock would need to be justified.

Improver Programme Notes

Category B is designed to enable fishery managers to demonstrate that stocks for which limited information is available are being responsibly managed through the use of the precautionary approach. The most straightforward way to pass Category B is via Table Ba, which demands a stock to be maintained at or above an established target reference point or proxy, and with fishing mortality at or below MSY. In the case of IOS, there are no established reference points, and so the stock must be assessed against the more conservative Table Bb. As noted above, to pass Table Bb the stock must have biomass at or above the long-term average, with fishing mortality below the long term average. Therefore IOS again fails to meet the requirements, as estimates of these variables are not available.

It is important to note that passing via Table Bb is only ever temporary, as it is not possible to maintain biomass above the long-term average indefinitely. Therefore any fishery intending to maintain approval against the IFFO RS requirements using Section B must aim to establish biomass and fishing mortality reference points, and may find that meeting the Category A requirements becomes feasible.

Standard clauses 1.3.2.1

Species Name		Indian Mackerel
B1	Species Name	Indian mackerel
	Table used (Ba, Bb)	Bb
	Outcome	Fail

Evidence

There do not appear to be any established reference points for the mackerel stock(s). Without established reference points and an indication of stock status in relation to these, Table Ba cannot be used. To complete Table Bb, a resilience rating must first be established. Fishbase reports *Rastrelliger kanagurta* as having a Medium resilience rating[70]. Reading off Table Bb, this means that mackerel will only pass the Category B assessment if biomass is currently around the long term average and fishing mortality is below the long term average; or if biomass is above the long term

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[69] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/
[70] Fishbase, Indian mackerel.
http://www.fishbase.org/Summary/SpeciesSummary.php?ID=111&AT=indian+mackerel

average and fishing mortality is not above the long term average. As there do not appear to be any estimates of current or long-term averages for either variable, mackerel does not currently pass Table Bb.

Improver Programme Notes

Please refer to the IP notes in the Indian Oil Sardine Category B assessment for further detail on the relevance of using Table Bb. See also the Species Categorisation section of the report, and Improver Programme Note 2, for details on why Indian mackerel appears here in section B as well as section D.

Standard clauses 1.3.2.1

Species Name		Lesser Sardine
B1	Species Name	Lesser sardine (*Sardinella fimbriata*)
	Table used (Ba, Bb)	Bb
	Outcome	Fail

Evidence

There is no evidence of any species-specific data collection or analysis for lesser sardine. Without established reference points and an indication of stock status in relation to these, Table Ba cannot be used. To complete Table Bb, a resilience rating must first be established. Fishbase reports *Sardinella fimbriata* as having a High resilience rating[71]. Reading off Table Bb, this means that lesser sardine will only pass the Category B assessment if biomass is currently at or above the long term average. As there are no available estimates of current or long-term averages for *S. Fimbriata* biomass, the species does not pass Table Bb.

Improver Programme Notes

Sardinella fimbriata has been separated out for assessment by request of the applicant. Based on the data available regarding catch composition, there are at least 14 species of non-IOS sardine reportedly caught in IOS fisheries around India, many of which are local to particular areas. Those species which are encountered in the Goa and Maharashtra fisheries are likely to need assessment under Category A or B; any species which do not will be assessed under Category C or D. For the purposes of this Improver Programme assessment, an indicative Category D assessment has been conducted for these remaining minor sardine species; however more detailed catch composition data will be required to enable a full and accurate characterisation to occur. More detail on the other lesser sardine species is provided in Section D.

Note that whatever category/ies the lesser sardine species are assessed under, all must pass before the fishery as a whole can be approved. Only species representing less than 0.1% of the total catch do not need to be assessed.

Standard clauses 1.3.2.1

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[71] Fishbase, *Sardinella fimbriata*. http://www.fishbase.org/summary/Sardinella-fimbriata.html

26

CATEGORY C SPECIES

In a whole fish assessment, Category C species are those which make up less than 5% of landings, but which are subject to a species-specific management regime. In most cases this will be because they are a commercial target in a fishery other than the one under assessment. In a by-product assessment, Category C species are those which are subject to a species-specific management regime, and are usually targeted species in fisheries for human consumption.

Clause C1 should be completed for **each** Category C species. If there are no Category C species in the fishery under assessment, this section can be deleted. A Category C species does not meet the minimum requirements of clause C1 should be re-assessed as a Category D species.

Species Name		N/A	
C1	**Category C Stock Status - Minimum Requirements**		
	C1.1	Fishery removals of the species in the fishery under assessment are included in the stock assessment process, OR are considered by scientific authorities to be negligible.	
	C1.2	The species is considered, in its most recent stock assessment, to have a biomass above the limit reference point (or proxy), OR removals by the fishery under assessment are considered by scientific authorities to be negligible.	
		Clause outcome:	
Evidence			
Improver Programme Notes			
Based on the currently available catch composition data, there are no species in this fishery which fall into the Category C assessment bracket. If, in future, additional information becomes available regarding the catch composition of the fishery, assessment of one or more species under this category may become necessary.			
Standard clauses 1.3.2.2			

CATEGORY D SPECIES

In a whole fish assessment, Category D species are those which make up less than 5% of landings and are not subject to a species-specific management regime. In the case of mixed trawl fisheries, Category D species may make up the majority of landings. In a by-product assessment, Category D species are those which are not subject to a species-specific management regime. In both cases, the comparative lack of scientific information on the status of the population of the species means that a risk-assessment style approach must be taken.

The process for assessing Category D species involves the use of a Productivity-Susceptibility Analysis (PSA) to further subdivide the species into 'Critical Risk', 'Major Risk' and 'Minor Risk' groups. If there are no Category D species in the fishery under assessment, this section can be deleted.

Productivity and susceptibility ratings are calculated using a process derived from the APFIC document "Regional Guidelines for the Management of Tropical Trawl Fisheries, which in turn was derived from papers by Patrick *et al* (2009) and Hobday *et al* (2007). Table D1 should be completed for each Category D species as follows:

- Firstly, the best available information should be used to fill in values for each productivity and susceptibility attribute.

- Table D2 should be used to convert each attribute value into a score between 1 and 3.

- The average score for productivity attributes and the average for susceptibility attributes should be calculated.

- Table D3 should be used to determine whether the species is required to meet the requirements of Table D4. A species which does not need to meet the requirements of D4 is automatically awarded a pass.

- Table D4 should be used to assess those species indicated by Table D3 to determine a pass/fail rating.

- Any Category D species which has been categorised by the IUCN Red List as Endangered or Critically Endangered, or which appears in the CITES appendices, automatically results in a fail.

D1	Species Name		"Lesser Sardines"	
	Productivity Attribute		**Value**	**Score**
	Average age at maturity (years)		<2	1
	Average maximum age (years)		<10	1
	Fecundity (eggs/spawning)		>10,000	1
	Average maximum size (cm)		<60	1
	Average size at maturity (cm)		<30	1
	Reproductive strategy		Broadcast spawner	1
	Mean trophic level		2.5-3.25	2
			Average Productivity Score	**1.14**
	Susceptibility Attribute		**Value**	**Score**
	Overlap of adult species range with fishery		>50% (unknown stocks)	3
	Distribution		Throughout region	1
	Habitat		Highly likely	3
	Depth range		Moderately likely	2
	Selectivity		Medium risk	2
	Post-capture mortality		Most dead or retained	3
			Average Susceptibility Score	**2.33**
			PSA Risk Rating (From Table D3)	**PASS**
			Compliance rating	**PASS**

References

Fishbase species profile, *Sardinella fimbriata*. http://www.fishbase.org/summary/Sardinella-fimbriata.html

Improver Programme Notes

Based on the information provided by the applicant, around 11% of landings by purse seiners were 'lesser sardines', a grouping which reportedly includes at least 14 species: *Sardinella gibbosa*, *S. albella*, S*. fimbriata*, *S. dayi*, *S. sirm, S. sindensis, S. clupeoides, S. melanura, S. lelogaster, S. jonesi, S. brachysoma, Koala coval, Dussumieria acuta*, and *D. hasseltii*[72,73]. According to the IFFO RS fishery assessment process, at least 95% of landings by weight must be assessed using Category A or B. The remaining 5% should be assessed using Category C or D, meaning that (depending on the exact catch composition) there are likely to be one or more lesser sardine species which are assessed via Category C or D. As none of these species is subject to a species-specific management regime, they would be assessed using Category D. Only species representing less than 0.1% of the total landings can be excluded from the assessment entirely.

Without detailed information on the catch composition as it relates to lesser sardines, it is not possible to determine exactly which of these species must be assessed using Category D. However, for the purposes of this Improver Programme report, an indicative assessment of *Sardinella fimbriata* has been conducted. Given the life history characteristics of most small pelagic fishes, it is likely that many and perhaps all lesser sardines would similarly pass the PSA stage of the assessment without requiring further examination under Table D4. However, it is important to recognise that there is likely to be variability between the species, particularly with regards to their susceptibility, and so it is possible that in future assessments there may be sardine species which must be assessed using Table D4.

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[72] Rohit, Prathibha and Sam Bennet, P (2000) Lesser sardines resources of India. In: Marine Fisheries Research and Management. CMFRI; Kochi pp. 282-295
[73] NGK Pillai and P Rohit (2003) Lesser Sardines. In: Status of Exploited Marine Fishery Resources of India, eds M Mohan Joseph and AA Jayaprakash. CMFRI; Kochi pp. 25-29

Standard clauses 1.3.2.2

D1	Species Name		"Tunas"	
	Productivity Attribute		**Value**	**Score**
	Average age at maturity (years)		2-4	2
	Average maximum age (years)		10-30	2
	Fecundity (eggs/spawning)		>10,000	1
	Average maximum size (cm)		>150cm	3
	Average size at maturity (cm)		30-150cm	2
	Reproductive strategy		Broadcast spawner	1
	Mean trophic level		>3.25	3
			Average Productivity Score	**2**
	Susceptibility Attribute		**Value**	**Score**
	Overlap of adult species range with fishery		<25%	1
	Distribution		Global distribution	1
	Habitat		Highly likely	3
	Depth range		Moderately likely	2
	Selectivity		Species >2x mesh size	3
	Post-capture mortality		Retained	3
			Average Susceptibility Score	**2.17**
			PSA Risk Rating (From Table D3)	**PASS**
			Compliance rating	**PASS**

References

Fishbase species profile, bigeye tuna.
http://www.fishbase.org/Summary/SpeciesSummary.php?ID=146&AT=bigeye+tuna

Zhu, GP, *et al* (2011). Size at sexual maturity of bigeye tuna *Thunnus obesus* (perciformes: scombridae) in the tropical waters: a comparative analysis. http://www.trjfas.org/uploads/pdf_675.pdf

Improver Programme Notes

Based on the information provided by the applicant, 0.23% of annual landings by purse seiners were tunas. Due to their relatively small presence in the catch, these species may need to be assessed as Category C or D. Any tuna species representing less than 0.1% of the annual catch can be excluded from the assessment entirely; therefore if the 0.23% represents 3 or more species there may not be any assessment of tuna species required. For the purposes of this Improver Programme report, one tuna species present in Indian waters (bigeye tuna) has been assessed against Category D to give an indicative result. Based on the outcomes of the PSA, the species does not need to be further examined via Table B4; however due to the variation between species it is possible that other tuna species would need further examination. As noted throughout this report, if additional information becomes available which changes the understanding of the catch composition for the fishery, the categories under which each species will need to be assessed may change.

Standard clauses 1.3.2.2

D1	Species Name		Indian Mackerel	
	Productivity Attribute		**Value**	**Score**
	Average age at maturity (years)		<2	1
	Average maximum age (years)		<10	1
	Fecundity (eggs/spawning)		>10,000	1
	Average maximum size (cm)		<60cm	1
	Average size at maturity (cm)		<30cm	1
	Reproductive strategy		Broadcast spawner	1
	Mean trophic level		2.5 – 3.25	2
			Average Productivity Score	**1.14**
	Susceptibility Attribute		**Value**	**Score**
	Overlap of adult species range with fishery		Unknown stock	3
	Distribution		Throughout region	1
	Habitat		Highly likely (targeted)	3
	Depth range		Highly likely (targeted)	3
	Selectivity		>2x mesh size	3
	Post-capture mortality		Retained	3
			Average Susceptibility Score	**2.67**
			PSA Risk Rating (From Table D3)	**PASS**
			Compliance rating	**PASS**

References

Fishbase species profile, Indian mackerel.
http://www.fishbase.org/Summary/SpeciesSummary.php?ID=111&AT=indian+mackerel

Sousa, MI, and Gislason, H (1985). "Reproduction, age and growth of the Indian mackerel, *Rastrelliger kanagurta* (Cuvier, 1816) from Sofia Bank, Mozambique. http://aquaticcommons.org/16931/1/RIP14_001.pdf

Improver Programme Notes

As noted in the introduction to this report, the categorisation of Indian mackerel will depend on its presence in the catch of vessels fishing for IOS for reduction purposes, whether the mackerel itself is used to manufacture fishmeal and fish oil or not. For the purposes of this report, mackerel has been assessed under Categories B and D.

Under a Category D assessment, Indian mackerel passes at the PSA stage without requiring further examination via Table D4.

Standard clauses 1.3.2.2

Table D2 - Productivity / Susceptibility attributes and scores.

Productivity attributes	Low productivity/ High risk — Score 3	Medium productivity/ Medium risk — Score 2	High productivity/ Low risk — Score 1
Average age at maturity (years)	>4	2 to 4	<2
Average maximum age (years)	>30	10 to 30	<10
Fecundity (eggs/spawning)	<1 000	1 000 to 10 000	>10 000
Average maximum size (cm)	>150	60 to 150	<60
Average size at maturity (cm)	>150	30 to 150	<30
Reproductive strategy	Live bearer, mouth brooder or significant parental investment	Demersal spawner "berried"	Broadcast spawner
Mean trophic level	>3.25	2.5–3.25	<2.5

Susceptibility attributes		High susceptibility/ High risk — Score 3	Medium susceptibility/ Medium risk — Score 2	Low susceptibility/ Low risk — Score 1
Availability	1) Overlap of adult species range with fishery	>50% of stock occurs in the area fished	Between 25% and 50% of the stock occurs in the area fished	<25% of stock occurs in the area fished
	2) Distribution	Only in the country/ fishery	Limited range in the region	Throughout region/ global distribution
Encounterability	1) Habitat	Habitat preference of species make it highly likely to encounter trawl gear (e.g. demersal, muddy/sandy bottom)	Habitat preference of species make it moderately likely to encounter trawl gear (e.g. rocky bottom/reefs)	Depth or distribution of species make it unlikely to encounter trawl gear (e.g. epi-pelagic or meso-pelagic)
	2) Depth range	High overlap with trawl fishing gear (20 to 60 m depth)	Medium overlap with trawl fishing gear (10 to 20 m depth)	Low overlap with trawl fishing gear (0 to 10 m, >70 m depth)
Selectivity		Species >2 times mesh size or up to 4 m length	Species 1 to 2 times mesh size or 4 to 5 m length	Species <mesh size or >5 m length
Post capture mortality		Most dead or retained Trawl tow >3 hours	Alive after net hauled Trawl tow 0.5 to 3 hours	Released alive Trawl tow <0.5 hours

Note: Availability 2 is only used when there is no information for Availability 1; the most conservative score between Encounterability 1 and 2 is used.

32

D3		Average Susceptibility Score		
		1 - 1.75	1.76 - 2.24	2.25 - 3
Average Productivity Score	1 - 1.75	PASS	PASS	PASS
	1.76 - 2.24	PASS	PASS	TABLE D4
	2.25 - 3	PASS	TABLE D4	TABLE D4

D4	Species Name		N/A	
	Impacts On Species Categorised as Vulnerable by D1-D3 - Minimum Requirements			
	D4.1	The potential impacts of the fishery on this species are considered during the management process, and reasonable measures are taken to minimise these impacts.		
	D4.2	There is no substantial evidence that the fishery has a significant negative impact on the species.		
			Outcome:	

Evidence

Improver Programme Notes

As noted above, based on the available catch composition data and the outcomes of the PSA analyses, there do not appear to be any species which require further examination via Table D4. If catch composition or PSA information changes, it is possible that species may need to be assessed using this Table in future IFFO RS assessments.

Standard clause 1.3.2.2

33

FURTHER IMPACTS

The three clauses in this section relate to impacts the fishery may have in other areas. A fishery must meet the minimum requirements of all three clauses before it can be recommended for approval.

F1	Impacts on ETP Species - Minimum Requirements		
	F1.1	Interactions with ETP species are recorded.	GAP
	F1.2	There is no substantial evidence that the fishery has a significant negative effect on ETP species.	GAP
	F1.3	If the fishery is known to interact with ETP species, measures are in place to minimise mortality.	GAP
		Clause outcome:	GAP

Evidence

F1.1 – There is some evidence that interactions with ETP species are recorded. The 2015-16 CMFRI annual report states that interactions with ETP elasmobranch species were limited to one sawfish and two juvenile whale sharks, although it also reports that there is a rampant trade in devil ray gill plates[74]. However, the 2016-17 CMFRI report does not include any mention of ETP species[75]. The 2014 DADF publication *Handbook on Fisheries Statistics*[76] does not include a summary or details of ETP interactions, nor does the CMFRI publication *Marine fish landings in India*[77].

F1.2 – A list of critically endangered species in India, published by the Ministry of Environment and Forests in 2011, included the hawksbill turtle; leatherback turtle; pondicherry shark; knife-tooth sawfish; large-tooth sawfish; and long-comb sawfish[78]. The Wildlife (Protection) Act of 1972 also covers the whale shark; pointed sawfish; giant guitarfish; longman's beaked whale; spinner dolphin; humpback dolphin; common dolphin; bottlenose dolphin; risso's dolphin; and thorny ray[79]. Any of these species could potentially interact with a pelagic purse seine fishery, and without evidence that interactions are recorded and reported it is not possible to determine whether measures are required to mitigate these interactions, or to establish what kind of impacts he fishery has on ETP species.

F1.3 – In the absence of information on the extent to which the fishery interact with ETP species, it is difficult to determine the extent to which mitigating measures are required. However given the nature of the gear, the large geographical range of the fishery, and the number of ETP species present in that range, it is likely that mitigating measures would be appropriate. There is no clear evidence of such mitigating measures currently in place.

Improver Programme Notes

The fishery improvement plan should include the development of an ETP-interaction reporting mechanism, and utilise the results of these reports to inform management and technical measures to mitigate such interactions.

Standard clause 1.3.3.1

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[74] CMFRI annual report, 2015-16. http://eprints.cmfri.org.in/10897/
[75] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/
[76] DADF Handbook on Fishery Statistics, 2014.
http://www.indiaenvironmentportal.org.in/files/file/handbook%20on%20fisheries%20statistics%202014.pdf
[77] CMFRI, Marine Fish Landings in India, 2016. http://eprints.cmfri.org.in/11831/
[78] Ministry of Environment and Forests, 2011. "Critically Endangered Animal Species of India".
http://envfor.nic.in/sites/default/files/critically_endangered_booklet.pdf
[79] CMFRI, "Marine Biodiversity of India – Status and Challenges"
http://eprints.cmfri.org.in/10406/1/01_KK_JOSHI_2.pdf

F2	Impacts on Habitats - Minimum Requirements		
	F2.1	Potential habitat interactions are considered in the management decision-making process.	Pass
	F2.2	There is no substantial evidence that the fishery has a significant negative impact on physical habitats.	Pass
	F2.3	If the fishery is known to interact with physical habitats, there are measures in place to minimise and mitigate negative impacts.	Pass
		Clause outcome:	Pass

Evidence

F2.1 – Purse seine gears are generally not thought to have substantial interactions with physical habitats, a position apparently shared by Indian fishery managers[80]. The 2016-17 CMFRI annual report includes an extensive section on marine habitats in general, covering the impacts of marine litter and pollution, the ecology of mud bank and seagrass beds, restoration of mangroves, and a summary of a study conducted in Kerala on ecological variations in sardine habitats and their impact on the sardine fishery[81].

F2.2 – Given the nature of the gear used in the fishery, and in the absence of evidence to the contrary, it is unlikely to have a substantial impact on physical habitats.

F2.3 – As the fishery is unlikely to interact with physical habitats, it is also unlikely to require measures to mitigate potential impacts.

Improver Programme Notes

It is usually straightforward for a purse seine fishery to meet the requirements of section F2, due to the low probability of significant interactions with the physical environment. However, in some pelagic fisheries, the large size of the nets combined with operations in relatively shallow waters can make habitat interactions possible, and the fishery should be aware of this possibility when developing an improvement plan. Additionally, if other gear types are being used in the IOS reduction fishery (i.e. if the applicant wishes to use IOS sourced from non-purse-seine gears as an approved raw material), this section will need to be updated accordingly to reflect the greater risks presented by other gear types.

Standard clause 1.3.3.2

F3	Ecosystem Impacts - Minimum Requirements		
	F3.1	The broader ecosystem within which the fishery occurs is considered during the management decision-making process.	GAP
	F3.2	There is no substantial evidence that the fishery has a significant negative impact on the marine ecosystem.	GAP
	F3.3	If one or more of the species identified during species categorisation plays a key role in the marine ecosystem, additional precaution is included in recommendations relating to the total permissible fishery removals.	GAP
		Clause outcome:	GAP

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[80] DADF, 2014. "Report of the Technical Committee to Review the Duration of the Ban Period and to Suggest further Measures to Strengthen the Conservation and Management Aspects". http://dahd.nic.in/sites/default/files/Report%20of%20the%20Technical%20Committee%20to%20Review%20the%20Duration%20of%20the%20Ban%20Period%2022%20Sept.%202014.pdf

[81] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/

Evidence

F3.1 – The newly-launched National Policy on Marine Fisheries, 2017, states that the Ecosystem Approach to Fisheries Management (EAFM) will be implemented as part of the policy, "with due consideration to the well-being of all living and non-living constituents of the marine ecosystem and the social attributes of stakeholders"[82]. International stakeholders have reported that there is currently very little information on the environmental impact of the fishery, in terms of bycatch or ecosystem effects[83]. The 2016-17 CMFRI annual report does include a section on ecosystems modelling, including a report of a project to conduct a multivariate stock status, MSY and optimum fishing effort analysis for IOS in Kerala state waters; there is no indication that this project will be repeated for other states or that the results will influence management efforts in other states in the short term[84]. It is also worth noting that the main potential ecosystem effect of the IOS fishery is likely to be the impact of the removal of large quantities of prey for larger fish, mammals, and seabirds. Even if the potential impacts in this area were known, without a mechanism by which total fishing effort can be modulated it is currently not possible for these impacts to be mitigated via reduced total catch.

F3.2 – Information on the impacts of the fishery on the ecosystem is severely limited and so it is not possible to score this clause.

F3.3 – Information on the role of IOS within the ecosystem is severely limited and so it is not possible to score this clause; however as a small pelagic species it is likely that IOS (and other lesser sardine species) play a key role in the marine ecosystem.

Improver Programme Notes

The evidence suggests that the impacts of the fishery on the ecosystem, and the role of IOS within the ecosystem, do not play a substantial role in informing the management of the fishery. The fishery improvement plan should include measures designed to improve the understanding of the ecosystem aspects of the fishery and to factor these into the stock assessment and other management processes.

Standard clause 1.3.3.3

SOCIAL CRITERION

In addition to the scored criteria listed above, applicants must commit to ensuring that vessels operating in the fishery adhere to internationally recognised guidance on human rights. They must also commit to ensuring there is no use of enforced or unpaid labour in the fleet(s) operating upon the resource.

Improver Programme Notes

In the current version of the IFFO RS fishery assessment, the social component is limited to a commitment from applicants. The extent to which this commitment is 'tested' is limited. However, applicants to the Improver Programme should be aware that this section will be under continuing development over the coming year(s), and additional social requirements are likely to be added before the end of any FIP process.

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[82] DADF National Policy on Marine Fisheries, 2017. F. No. 21001/05/2014-FY.
[83] Fishsource fishery profile, Indian Oil Sardine (Goa). https://www.fishsource.org/stock_page/2274
[84] CMFRI annual report, 2016/17. http://eprints.cmfri.org.in/11964/