Marine Stewardship Council (MSC) Pre-Assessment of the Seychelles-flagged tuna purse seine fishery

December 2015

Confidential pre-assessment report to the Seychelles Fisheries Authority

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Acronyms used

ANABAC.....Asociación Nacional de Armadores de Buques Atuneros Congeladores
B .....Biomass
BIOT.....British Indian Ocean Territory
CAS .....Consequence Spatial Analysis
Cat. .....Category
CBD.....Convention on Biological Diversity
CCS .....Catch Certificate Scheme
CEPESCA .....Confederación Española de Pesca
CFP .....Common Fisheries Policy
cm.....centimetre
CMM.....Conservation and Management Measures
CNCP.....Cooperating non-Contracting Parties (of IOTC)
COI.....Commission de l'Océan Indien
COMESA .....Common Market of Eastern and Southern Africa
CPC .....Contracting Party and Cooperating Non-Contracting Party
CPUE.....Catch per Unit Effort
DG MARE.....Directorate General for Maritime Affairs and Fisheries
DWFN .....Distant Water Fishing Nation
EAF .....ecosystem approach to fisheries
EC .....European Commission
EEZ.....Exclusive Economic Zone
ETP.....Endangered, Threatened and Protected
EU .....European Union
EUR.....Euro
F.....Fishing mortality
FAD.....Fish Aggregating Device
FAO.....Food and Agriculture Organization of the United Nations
FIP.....Fishery Improvement Project
F_{MSY}.....Fishing mortality rate that would give maximum sustainable yield
FPA .....Fisheries Partnership Agreement
GEF .....Global Environment Fund
GT .....Gross Tonnes
IFREMER .....Institut Français de Recherche pour l'Exploitation de la Mer
IOC.....Indian Ocean Commission
IOTC.....Indian Ocean Tuna Commission
IOTTP.....Indian Ocean Tuna Tagging Programme
IRD.....Institut de Recherche pour le Développement
ISSF .....International Sustainability Seafood Foundation
IUU .....Illegal Unreported and Unregulated (fishing)
LME .....Large Marine Ecosystem
m .....metre(s)
MCS .....Monitoring, Control and Surveillance
MPA.....Marine Protected Area
MSC .....Marine Stewardship Council
MSY .....Maximum Sustainable Yield
mt.....Metric tonnes
N.....No (in relevant MSC scoring tables)

N/A .....not applicable or not available
Na (or na) .....not applicable
NGO.....non-governmental organisation
nm .....nautical mile
OPAGAC.....Organización de Productores Asociados de Grandes Atuneros Congeladores
PCM .....Post-capture mortality
PSA .....Productivity Susceptibility Analysis
RBF .....Risk-Based Framework
RFMO .....Regional Fisheries Management Organisation
RTTP-IO.....Regional Tuna Tagging Project – Indian Ocean
SB.....Spawning Biomass
SFA.....Seychelles Fisheries Authority
SICA .....Scale Intensity Consequence Analysis
SFPA .....Sustainable Fisheries Partnership Agreement
SWIO .....Southwest Indian Ocean
SWIOFC .....Southwest Indian Ocean Fisheries Commission
SWIOFP.....South West Indian Ocean Fisheries Project
t .....tonne(s)
UNCLOS .....United Nations Convention on the Law of the Sea
UoA.....Unit of Assessment
UoC.....Unit of Certification
URT .....United Republic of Tanzania
USD.....United States dollar
VMS .....Vessel Monitoring System
WIO .....Western Indian Ocean
WIO-LaB .....Western Indian Ocean Land Based Impacts on the Marine Environment (Project)
WIOMSA.....Western Indian Ocean Marine Science Association
WPEB.....Working Party on Ecosystem and Bycatch
Y.....yes (in relevant MSC scoring tables)

EXECUTIVE SUMMARY

Introduction and Units of Assessment

This MSC pre-assessment has been conducted by Tim Huntington, Michael Keatinge and Graeme Macfadyen of Poseidon Aquatic Resource Management Ltd. The pre-assessment has been based upon the recently introduced MSC Fisheries Certification Requirements v2.0. Six units of assessment has been identified, consisting of two major fishing methods and three oceanic tuna species, these being:

UoA	A. Purse seine (free-school)	B. Purse-seine (FAD)
Target stocks	1. Skipjack tuna (*Katsuwonus pelamis*) 2. Yellowfin tuna (*Thunnus albacares*) 3. Bigeye tuna (*Thunnus obesus*)	1. Skipjack tuna (*Katsuwonus pelamis*) 2. Yellowfin tuna (Thunnus albacares) 3. Bigeye tuna (*Thunnus obesus*)
Fishing method	Purse seine (free school)	Purse seine (FAD-associated)
Fishing fleet	Seychelles-flagged purse seine fleet operating within the Seychelles Exclusive Economic Zone (EEZ), high seas areas and EEZs of Kenya, Madagascar, Tanzania, Mauritius, Comores, Iles Eparses, and Mayotte.	
Non-target catch (P2)	Primary species: None Secondary species (main): • Bullet tuna (*Auxis rochei*) • Frigate tuna (*Auxis thazard*) • Blue marlin (*Makaira nigricans*) • Rainbow runner (Elagatis bipinnulata) • Silky shark (*Carcharhinus falciformis*) Secondary species (minor): • Common dolphinfish (*Coryphaena hippurus*) • Wahoo (*Acanthocybium solandri*) • Spotted oceanic trigger fish (*Canthidermis maculatus*) • Kawakawa (*Euthynnus affinis*)	Primary species: None Secondary species (main): • Bullet tuna (*Auxis rochei*) • Frigate tuna (*Auxis thazard*) • Blue marlin (*Makaira nigricans*) • Rainbow runner (*Elagatis bipinnulata*) • Silky shark (*Carcharhinus falciformis*) • Common dolphinfish (*Coryphaena hippurus)* *Secondary species (minor):* • Spotted oceanic trigger fish (*Canthidermis maculatus*) • Wahoo (*Acanthocybium solandri*) • Kawakawa (*Euthynnus affinis*)

To make the pre-assessment simpler, the six UoAs have been aggregated where possible, with a focus on the differences. For instance, both P1 (stock status) and P3 (management) are the same across both free-school and FAD-associated fisheries. The main differences lie in P2 (ecosystems), both in terms of the bycatch and habitat (FAD-associated fisheries are considered to be an 'enhanced fishery').

The pre-assessment has used a combination of primary and secondary data collected in the Seychelles and from published sources. A site visit was conducted by Tim Huntington in November 2015.

Scoring and findings of the pre-assessment

The scoring can be summarised as follows:

UoA		Principle	PIs less than 60	Overall outcome
A: Purse seine (free-school)	A.1 Skipjack tuna	1 Stock	2 / 5	Fail
		2 Ecosystem	3 / 15	Fail
		3 Management	0 / 7	Conditional pass
	A.2 Yellowfin tuna	1 Stock	3 / 5	Fail
		2 Ecosystem	3 / 15	Fail
		3 Management	0 / 7	Conditional pass
	A.3 Bigeye tuna	1 Stock	2 / 5	Fail
		2 Ecosystem	3 / 15	Fail
		3 Management	0 / 7	Conditional pass
B: Purse seine (FAD-associated	B.1 Skipjack tuna	1 Stock	2 / 5	Fail
		2 Ecosystem	3 / 15	Fail
		3 Management	0 / 7	Conditional pass
	B.2 Yellowfin tuna	1 Stock	3 / 5	Fail
		2 Ecosystem	3 / 15	Fail
		3 Management	0 / 7	Conditional pass
	B.3 Bigeye tuna	1 Stock	2 / 5	Fail
		2 Ecosystem	3 / 15	Fail
		3 Management	0 / 7	Conditional pass

Fail <60	Pass with condition (60 – 79)	Pass (≥80)

It can be seen that all six UoAs fail under both P1 (target species stock status) and P2 (ecosystems), but might achieve a conditional pass under P3 (management). This is explained Principle by Principle below.

Principle 1 Target species stock: there are three fundamental issues with all three of these stocks in respect of P1. Firstly, the IOTC does not currently have any Conservation and Management Measures in place, other than the FAD limitation measure (Resolution 15/08, which is yet to be evaluated) to regulate the fisheries for yellowfin tuna (UoAs A.2 and B.2).

Secondly the IOTC does not currently have a clearly defined Harvest Strategy for all three of these target species stocks. There are no clearly defined Harvest Control Rules (HCR's) for these two fisheries and the assessment team cannot provide objective evidence of well-defined pre-agreed rules or actions used by the Indian Ocean Tuna Commission (IOTC) for determining a management action in response to changes in indicators of stock status with respect to reference points. And while IOTC resolution 12/01 does provide an approach, it is none-the-less just an initial step on the path towards fully developing harvest control rules and, ultimately, a harvest strategy. Likewise, while IOTC resolution 13/10 (part 4) does establish the basis of a harvest strategy and specifies that the Scientific Committee shall develop and assess potential HCRs to be applied, considering the status of the stocks against reference points, these are currently not in place.

The Scientific Committee concluded in their 2015 report that the IOTC does not currently have any Conservation and Management Measures in place, other than the FAD limitation measure (Resolution 15/08, which is yet to be evaluated) to regulate the fisheries for yellowfin tuna. In other words, there are no clearly defined 'management actions'. Taking these two points together it must be concluded that the IOTC does not currently have a clearly defined Harvest Strategy for the stocks of bigeye, yellowfin, or skipjack tuna.

Thirdly and finally, harvest control rules for these stocks are not well-defined and there is no specific plan of control if the stock size falls below the trigger point (MSY). While there may be evidence of an intention to end overfishing and rebuild this stock should depletion occur and the IOTC Scientific Committee might be called on to provide such advice, it cannot be argued that there are generally understood harvest rules in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached (thus meeting the SG60). Rather, on balance, it must be argued that well defined and effective harvest control rules are NOT yet in place for this stock.

Principle 2 Ecosystem impacts: no primary non-target species are present, so this scores 100, 80 and 80 for the P2.1 Outcome, Management and Information PIs respectively. Of the non-target species are considered to be secondary species, two (the kawakawa and the blue marlin) have sufficient information to assess their status via the default assessment tree whilst the others are data-deficient and thus need were assessed using the PSA under the RBF. Of the 'main' secondary species (e.g. >5% of the bycatch[1]), one (the silky shark) is high risk dues to a combination of its life strategy and high susceptibility to purse seines, even in free school sets. Two other species, the rainbow runner and the blue marlin may achieve conditional passes. In the case of the rainbow runner, this species, whilst of medium resilience, is highly susceptible to a number of surface gears in both oceanic and coastal fisheries. The blue marlin is over fished but not currently subject to overfishing, and there is insufficient data to fully account for fisheries mortality. The other two main species, bullet tuna and frigate tuna are both highly productive species and should achieve an MSC pass without major conditions, although fishing mortality data from artisanal fisheries is again a concern.

Encounterability of marine turtles is very low (0.01 turtles per set) and low (e.g. 0.01 turtles per set) for free school and FAD-associated sets respectively and the majority of entrapped turtles are released alive. Sets on whale sharks are banned by IOTC and interactions with dolphins are almost unknown in the Western Indian Ocean. There are a number of IOTC regulations aimed at conserving some shark species, marine turtles and cetaceans. Information on ETP interaction rates and results is reasonable and improving, especially with the recent imposition of 100% observer coverage.

There are no habitat-related issues with the free-school fishery. Whilst there are no habitat-related issues directly associated with the FAD-dependent fishery, there is increasing concern over the beaching of abandoned, lost and discarded FADs on coral reefs, esp. around the Seychelles. Whilst there is some regional IOTC measures (e.g. FAD limits) and fleet measures (e.g. tracking and recovery of FADs), there is still a significant loss rate with no strategy to address this. In addition, there is limited information on the spatial extent of beaching and on the timing & location of FAD beaching.

[1] Normally this is 5% of the total catch volume, but we have used the more precautionary 5% threshold for discarded bycatch

These UoAs are part of a number of different fisheries targeting the oceanic tunas and contributes to the removal of a significant biomass of these top predators on a recurrent basis. A widespread decline in the abundance of these top predators, as well as large pelagic sharks has been demonstrated, as has the emergence of several mid-sized, lower-trophic-level species such as crocodile shark and lancet fish. Whilst there has not been a major impact on oceanic productivity detected to date, the continued and increasing pressure of tuna fisheries is of concern and this suggests a greater approach to ecosystem-based management by IOTC is required. There is also a need to progress ecosystem modelling in the Indian Ocean and to assess the trophic implications of both tuna fishing and other factors such as climate change. In the case of the FAD-associated fishery, whilst there is no strong evidence of recruitment over-fishing linked to FAD use, the ecosystem impact of the extensive and increasing use of FADs is still largely unknown and it cannot be stated with any certainty that it is highly likely that UoA will not disrupt the key elements underlying ecosystem structure and function.

Principle 3 Fisheries management: Under Governance and Policy, the failure of all CPCs to transpose regional-level IOTC Resolutions into national legislation results in a score of under 80 for the PI on the legal and customary framework, while for the PIs on: consultation roles and responsibilities; and long term objectives PIs score over 80.

Under the Fishery Specific Management System, the CMMs in effect when viewed in their totality are sufficient to score the PI on fisheries specific objectives as over 80, given that the CMMs provide the rationale (read objectives/goals) for the strategies and actions agreed in the Resolutions (or Recommendations). Decision-making processes are also clearly defined at the regional level for taking decisions related to fishery specific issues (although necessary action is not always taken). Compliance and enforcement is assessed as weak at both regional and national level, impacting on P1 and P2 outcomes and P3 implementation, and therefore has some conditions associated with bringing the PI over 80. Monitoring and evaluation through the defined roles and responsibilities at regional level covers most parts of the evaluation system, but is largely internal in nature.

Progressing to a Fisheries Improvement Project (FIP)

Given the current condition of yellowfin tuna (currently both over-fished and subject to over-fishing), as well as the recent Echebastar certification results that indicated that well defined harvest control rules are not yet in place, both the free school and the FAD-associated fisheries are not yet ready for full assessment. Whilst there are likely to be some relatively rapid gains to be made in terms of fleet operation and information gathering, other key elements, such as the imposition of harvest control rules by all fleets fishing these regional stocks, are likely to take a longer time and will require the agreement and cooperation of all IOTC Contracting Parties and Cooperating Non-Contracting Parties. A full list of recommendations for FIP actions is provided in Appendix D.

In order to initiate implementation of the FIP, it is suggested that a stakeholder workshop is convened in the Seychelles to develop a long-term work plan using the findings of this pre-assessment to address the weak points in the two UoAs.

1 INTRODUCTION

1.1 AIMS/SCOPE OF PRE-ASSESSMENT

The Seychelles Fisheries Authority (SFA) has requested that a pre-assessment of the Seychelles flagged tuna-directed purse seine fishing fleet is conducted against the Marine Stewardship Council (MSC) standard for responsible fisheries. As an oceanic archipelago, the Seychelles is highly dependent upon developing a sustainable blue economy, with pelagic tuna fishing being a core pillar.

With the MSC standard now globally recognised as a benchmark for well managed fisheries, the intention is for the Seychelles to ensure that it main export fisheries are MSC certified in due course. However, this is not achievable immediately, and a Fisheries Improvement Project (FIP) will be needed to address any shortcomings. A pre-assessment is an essential first step to identifying the fisheries strengths and weaknesses and will act as a benchmarking took for any resulting FIP.

1.2 CONSTRAINTS TO THE PRE-ASSESSMENT OF THE FISHERY

This current pre-assessment was subject to a number of constraints as follows:

1. It was not possible to meet any of the tuna stock specialists within the IOTC Secretariat over the site visits as they were on duty travel at the time. However, the pre-assessment coincided with the publication of the latest Report of the 17th Session of the IOTC Working Party on Tropical Tunas (held over 23 – 28 October 2015) and it was also possible to communicate with Dr David Wilson, the IOTC Deputy Secretary / Science Manager by email.
2. It was not possible to meet or communicate with vessel owners, operators or associations. Permission was initially by SFA before the site visit and then with Hunt Deltel (the agency representing the majority of the Seychelles-flagged vessels) via email on 3 November 2015, but no response has been received to date.
3. Detailed data on the composition of the FAD and non-FAD non-target catch of the Seychelles-flagged vessels is not yet available, so the team have used published FR/ESP discarded bycatch data as a proxy until the Seychelles data becomes available.

2 DESCRIPTION OF THE FISHERY AND DEFINITION OF THE UNIT OF ASSESSMENT

2.1 OVERVIEW OF THE FISHERY

2.1.1 Geographical context and environmental conditions

The Western Indian Ocean (WIO) is characterised by a seasonally reversing monsoon wind system that dominates the ocean climate north of 25º south, and results in strong northwards and southward winds and currents at different times of the year. These meso-scale processes bring increased nutrient supply to the surface and result in biological productivity that is the forage base for the stocks of tuna that occur throughout the WIO. Primary production rates in the region vary considerably, with a general increase from the south of the WIO to the north, and from the eastern offshore areas to the western coastal areas. Another characteristic of the WIO is a relatively shallow thermocline, usually at 50-100 metres (m), which favours the concentration of fish in a habitat within reach of the fishing fleets.

Given the migratory movement of tuna in the WIO and the pattern of catches throughout the year, and the position and size of the Seychelles EEZ, Seychelles is well placed to serve as the main regional hub for the purse seine fleet in the WIO. The vast majority of the frozen purse seine catch in the WIO (around 80 %) is either landed for processing/canning in Seychelles (around 30 % of landings in Seychelles), or transshipped through Victoria for processing elsewhere in the WIO (around 70 % of landings in Seychelles), although at some times of the year vessels land product direct to processing plants in Mauritius, Madagascar and Kenya, for canning or loining. Newly established deep frozen tuna processing plants with a capacity of 30,000 tonnes in Mauritius will also intensify the visits to Port Louis of the new generation of purse seiners vessels, mainly French in origin. Their characteristics enable the storage on board at -40 °C of dry deep frozen fish, supplied to the processing plants who export fillets, steaks and saku (frozen sashimi grade) blocks to markets in Asia and Europe. The high levels of processing of purse seine catch in the region, and the fact that more than 90 % of catches end up in EU markets, is a notable feature of the purse seine fishery.

2.1.2 Conditions governing access to the fishery

Discussion of conditions of access to fishery relate to three main categories as discussed below.

Access by domestically flagged vessels to their own waters

All countries in the WIO have their own small-scale domestic fleets exploiting inshore coastal resources, with small-scale fishing vessels needing to be licenced by the relevant Fisheries Department to fish. Information specifically on foreign and domestic tuna fishing vessels is presented in the following section, and all domestically flagged vessels in the WIO require licences to fish in their own waters.

Access by vessels to high seas areas under IOTC competence

For high seas areas, any vessel wishing to fish in areas under the competency of the IOTC must be on the IOTC's list of authorised fishing vessels. In accordance with IOTC Resolution 15/04 (Concerning The IOTC Record Of Vessels Authorised To Operate In The IOTC Area Of

Competence), the Commission maintains a record of authorised fishing vessels, based on submissions by each Contracting Party and Cooperating Non-Contracting Party (CPC)_ of those vessels that are:

a) 24 metres in length overall or above;

b) in case of vessels less than 24 meters, those operating in waters outside the Economic Exclusive Zone of the Flag State and that are authorised to fish for tuna and tuna-like species in the IOTC area of competence.

All CPCs which issue authorisations to fish to their flag vessels to fish for species managed by the IOTC must submit to the IOTC information about the competent authority that has provided the authorisation. Resolution 15/04 requires that CPCs only authorise vessels to fish in IOTC areas of competence if they comply with IOTC Conservation and Management Measures (CMMs).

Access by foreign vessels to the EEZs of countries in the region

All countries/territories in the region allow some form of distant water fishing nation (DWFN) vessel activity in their own EEZs, with the exception of the Maldives and India where policy is not to allow fishing by foreign vessels; the British Indian Ocean Territory, which is a no-take Marine Protected Area; and Somalia, where the lack of a functioning government in recent years due to the civil war, the risk of piracy, and the lack of a declared EEZ, all make the licensing situation complex both legally and practically. Access by DWFN vessels for tuna and tuna-like species in the exclusive economic zones (EEZs) of WIO States can be granted through a number of different mechanisms, all of which are used extensively. These include EU Sustainable Fisheries Partnership Agreements (SFPAs)[2], bilateral intergovernmental agreements, reflagging, chartering, joint ventures or similar arrangements between WIO states and foreign vessels, and private commercial agreements between foreign associations or companies and governments in the region. SFPAs are used by the EU to gain access for its vessels with some coastal States in the region. The EU currently has five active SFPAs and related legislative Protocols with Mauritius, Comoros, Madagascar, Mozambique and Seychelles. (Poseidon et al, 2014a)

There are moves towards greater transparency of information related to the costs of access, especially in the south of the WIO region, although publicly available information is far from universally available. Costs of access vary significantly, with differences explained by a number of factors including the size of the EEZ to which access is provided, the duration of time that fish are likely to spend in respective EEZs and therefore the likely catches, and the proximity to potential piracy. Most purse seine vessels operating in the WIO (and especially the EU-flagged ones) purchase access to all key fishing zones in the region in advance and on a yearly basis, because of the need to establish a regional network of fishing opportunities to cover all potential migratory movements of tuna in the region. Longline vessels tend to fish predominantly in high seas areas, and access to multiple/all EEZs in the region is less important, although access to some EEZs is nevertheless still significant. (Poseidon et al, 2014a)

[2] Referred to prior to reform of the EU's Common Fisheries Policy in 2013 as 'Fisheries Partnership Agreements'.

2.1.3 Overview of the fishing fleets, fishermen and fishing practices in the Western Indian Ocean

In 2014 catches of yellowfin (YFT), skipjack (SKJ), bigeye (BET) and albacore tuna (ALB) in the WIO was around 1,021,696 t (IOTC, Nominal Catch Database), of which 48% was YFT and 44% SKJ[3]. ***Purse seine vessels*** accounting around 310,055 t or 30% of the total for these species. In 2013 the purse seine fleet operating in the WIO numbers 44 vessels, with 22 from the EU, five from Mayotte (which became EU vessels as of 1 January 2014 when Mayotte becomes part of the EU), with other important fleets from Seychelles and Iran. Vessel numbers have declined from 68 in 2005, largely as a result of piracy in the region, but there are indications that with the improving piracy situation a number of vessels may return to the WIO in the coming years (although increasing vessel numbers could itself lead to a renewal of piracy activities). Skipjack and yellowfin tuna are the two main species caught (representing 90 % of total purse seine catches in 2014), with bigeye tuna providing the balance (along with very small quantities of albacore (less than 0.5 %)). Vessels rely heavily on the use of fish aggregating devices (FADs), with around 80 % of the catches by Spanish and Seychelles vessels in 2014 (214,778 t), and 85 % of the catches by Spanish vessels in 2014 (114,613 t), taken around such floating objects. The increasing use of FADs, developments in their technology, and the use of supply vessels to assist in the deployment of FADs and assess the amount of fish under them, have all served to increase the efficiency of the fishing effort per vessel in recent years.

The ***longline*** catch of YFT, SKJ and BET in the WIO over 2014 was 165,508 t, with vessels operating in the Indian Ocean as a whole comprised of around 470 large-sale deep-freezing vessels, with Taiwan, Japan and China having the most vessels. Around seventy vessels (mainly from the EU, Tanzania and South Africa) have been identified as targeting swordfish when reported to the IOTC Record of Active Vessels and are likely to operate primarily in the WIO. Other large-sale deep-freezing vessels may operate in either or both the WIO and the East Indian Ocean (EIO). In addition there are over 1,500 smaller-scale, fresh-tuna longline vessels in the Indian Ocean as a whole, mostly from Indonesia, Taiwan and Sri Lanka, but the number of vessels operating in the WIO and EIO cannot be identified with the data available. A number of coastal countries (for example, Mozambique, Seychelles and Comoros) have plans to develop their longline fleets. There has been decline in overall effort since the beginning of 2000s that can be traced to a combination of factors, including declines in catch rates and the piracy threat in recent years, with a general shift in effort eastwards (a shift in effort that could be reversed in the future if improvements in the piracy situation are maintained). Different fleets display marked differences in catch composition: the Taiwan / China and Seychelles fleets (the latter beneficially owned by Taiwanese interests) target bigeye tuna; the Japanese and Omani fleet targets yellowfin tuna; the Spanish, UK and Portuguese fleet targets swordfish and shark; and the France/Réunion fleet targets swordfish and tuna.

The ***pole and line fishery*** is the most traditional of all fisheries in the WIO, originating in the 12th century and in 2014 caught 111,620 t of YFT, SKJ and BET. The main fishing country is Maldives, with vessels targeting skipjack tuna (78 % of catches, with the balance being yellowfin tuna), although there is also a pole and line fishing fleet in western India, and a

[3] Information and text in this section taken largely from Poseidon et al (2014a), but updated to reflect more recent data on vessel numbers

South African fishery targeting albacore (principally in the Atlantic and to a lesser extent in the WIO). In all cases, vessels land fish fresh. Effort in the Maldivian fishery has declined drastically in recent years, with many pole and line vessels switching to the more profitable handline yellowfin tuna fishery.

Gillnet fisheries (126,700 t of YFT, SKJ and BET in 2014) are concentrated in the northern Arabian Sea and the Somali region, with catches predominantly of yellowfin tuna (65 % of catches, the balance being mostly skipjack tuna). The environmental conditions of the northern Arabian Sea bring large yellowfin tuna close to the surface and fishermen from India, Oman, Pakistan and especially Iran (around 6 000 vessels) have taken advantage of this seasonal fishery.

Handline fisheries (90,969 t of YFT, SKJ and BET in 2014) are predominantly artisanal and not well documented, but Yemen, Maldives, India and Comoros all make important contributions to total catches, with yellowfin and skipjack tuna being the main target species (80 % and 20 % of catches respectively).

2.2 THE UNITS OF ASSESSMENT

Overall this pre-assessment is considering two different purse seine fisheries, (i) the free-school and (ii) FAD-dependent purse seine fisheries. Both these fisheries essentially target the same species (yellowfin, skipjack and bigeye), are undertaken by the same vessels and over the same area e.g., the Seychelles EEZ, the high seas and countries where the Seychelles has fishing agreements. These are described after some general information on the fleet that is common to all the UoAs.

2.2.1 General information (all Units of Assessment)

The fishing fleet

The Seychelles-flagged fleet currently consists of twelve industrial purse seine fishing vessels (see Table 1 overleaf). These vessels vary in length from around 70 m to 106 m. Of these, ten are Spanish-owned, whilst two (the *Morne Blanc* and the *Morne Seselwa*) are French-owned. It is understood that, unlike these two French vessels have dry storage, freezing the fish down upon catch and then placing them in dry storage at -40°C and thus can go for further value addition. This is in contrast to the Spanish boats who have brine wells that store fish at around -20°C and are thus only really suitable for canning. The implications of this for the MSC full assessment will need to be investigated over the course of the FIP, in that it is possible that the French vessels target larger yellowfin tuna and thus have a reduced dependency upon FADs.

Fishing methods used

The purse seine used by the Seychelles-flagged fleet vary according to the size of the vessel, but are generally 250 – 280 metres (m) deep and 1,500 – 1,800 m in length. The nylon mesh size is around 50 mm. The net lengths are divided into separate panels, which can be replaced when the nets are damaged. The first sets of the day usually commence at around 3/4 am and is usually completed at around 9/10 am. Each set lasts around 1 hour for unsuccessful sets and 2 to 2.5 hours on large, successful hauls. Depending on opportunities, there may be up to 3 sets in a day, but a single set is more normal. Trip lengths may last from 30 to 40 days. Vessels fish all the year round, with 2-3 weeks every two years for servicing and refitting.

A purse seiner circles the school with a deep curtain of netting, then the bottom of the net is pursed (closed) underneath the fish school by hauling a wire running from the vessel through rings along the bottom of the net and then back to the vessel, preventing the fish from "sounding", or swimming down to escape the net.

Searching for the fish schools and assessing their size and direction of movement is an important part of the fishing operation. Sophisticated electronics, such as echo sounders, sonar, and track plotters, may be used to search for and track schools, assessing their size and movement and keeping in touch with the school while it is surrounded with the seine net. Crows nests may be built on the masts for further visual support. Large vessels can have observation towers and helicopter landing decks. Helicopters and spotter planes are used for detecting fish schools. A very heavy boom, which carries the power block, is fitted at the mast. On the deck are three drum purse seine winches and a power block, with other specific winches to handle the heavy boom and net. Vessels are usually equipped with a skiff. Fishing for tuna schools may occur by setting the purse seine around schools, or on natural objects referred to as log sets. These techniques are opportunistic.

The Seychelles-flagged purse seine operation is, like the Spanish flagged fleet, essentially a FAD operation, although free schools are also targeted over Nov – January when YFT form spawning aggregations. Vessels are now limited to deploying 550 instrumented FADs at any one time (‘active FADs), but may carry many more. The French fleet is also moving towards increased FAD use for the above reasons.

FADs have evolved over the last six to seven years to reduce the potential for turtle and shark engagement through the use of ‘sausage nets’ rather than hung net panels. ISSF is now advocating the greater use of non-entangling ropes, rather than nets. They have also reduced the use of bamboo (due to concerns of over-harvesting on the Seychelles) and now use metal pipes. This has resulted in an increased risk of ghost fishing from abandoned and lost FADs, as well as impacts on coral reefs if they ground. Almost all FADs are of this type.

Fish is stowed in wells, each holding approximately 50 tonnes, but the number of wells and their capacity will vary according to vessel size. Fish are generally frozen in a brine mix once in the wells and offloaded to carriers or directly into marketing or processing facilities when in port. Two Seychelles seiners have small blast freezer for dry freezing at -40°. There are no permissible high seas transfers.

Table 1: List of Seychelles-flagged purse seine fishing vessels

Name of Vessel	Dimensions			License dates		Agent		Owner
	Power (hp)	Size (GRT)	Length (m)	From	To	Local	Foreign	
1. Artza	6,000	3,870	94.79	15/05/2015	14/05/2016	Hunt Deltel	ANABAC	Atunsa Inc
2. Euskadi Alai	6,000	2,788	88.65	28/07/2015	27/07/2016	Hunt Deltel	ANABAC	Hartswater Ltd
3. Galerna II	8,046	3,445	83.45	15/04/2015	14/04/2016	Hunt Deltel	OPAGAC	Isabella Fishing Ltd
4. Galerna III	8,046	3,445	84.85	29/10/2015	28/10/2016	Hunt Deltel	OPAGAC	Isabella Fishing Ltd
5. Intertuna Tres	8,445	1,328	101.65	16/06/2015	15/06/2016	Hunt Deltel	OPAGAC	Interatun Ltd
6. Izaro	6,114	2,706	88.65	01/02/2015	31/01/2016	Hunt Deltel	ANABAC	Hartswater Ltd
7. Jai Alai	6,114	2,706	88.65	20/03/2015	19/03/2016	Hunt Deltel	ANABAC	Hartswater Ltd
8. Playa De Anzoras	3,753	2,446	85.50	10/01/2015	09/01/2016	Hunt Deltel	ANABAC	Beach Fishing Ltd
9. Txori Aundi	5,850	2,020	68.57	01/02/2015	31/01/2016	Hunt Deltel	ANABAC	Inpesca Fishing
10. Txori Toki	4,350	4,134	106.50	11/08/2015	10/08/2016	Hunt Deltel	ANABAC	Fishing Indico Ltd
11. Morne Blanc	3,753	2,298	76.00	09/07/2015	08/07/2016	As	SAPMER	Tuna Fishing Co
12. Morne Seselwa	7,956	2,400	106.50	15/12/2014	14/12/2015	As	SAPMER	Tuna Fishing Co

Colour code: Spanish-owned French-owned

Fishing areas

The area of the fishery is seasonal – the Seychelles is in the heart of the fishery so boats can fish in within 1-2 days sailing from Victoria. They tend to fish south of Mozambique Channel over March – May (often landing in Diego Suarez) then north of Somalia over July –Nov). With the closure of the BIOT region to fishing vessels do not go east, although sometimes go as far as Indonesia. The vessels tend to steam to prospective FADs at night (at around 16 knots) and fish only during the day.

The Seychelles has fisheries access agreements with seven other Indian Ocean coastal states, of which Kenya, Comores and Mauritius are the most important (see table below).

Table 2: Countries for which Seychelles-flagged vessels currently have fishing agreements

Vessel name	Comoros	France	Kenya	Madagascar	Mauritius	Mayotte	Tanzania
Artza			■				
Draco	■		■		■		
Galerna II	■		■		■		
Galerna III	■		■				
Intertuna Tres			■		■		
Izaro	■	■	■	■			■
Jai Alai			■				
Playa de Anzoras	■	■	■	■		■	
Txori Aundi	■		■				

Source: SFA (unpublished data)

Marine Protected Areas

According to the Western Indian Ocean Marine Science Association (WIOMSA) there are 83 Marine Protected Areas in the Western Indian Ocean region, with the Seychelles having as many as 16 officially gazetted marine conservation areas. Until the declaration of the BIOT MPA (see below), the largest of all MPAs in the region was the Quirimbas National Park in Mozambique which spans over 7,500 km².

On 1 April 2010 the BIOT Commissioner proclaimed a marine protected area (MPA) in BIOT, an area of around 544,000 km². No further fishing authorisations have been issued since that date and the last fishing authorisations expired on 31 October 2010. From 1 November 2010 onwards all BIOT waters (to 200 nautical miles), including coastal and pelagic areas, became a no-take MPA to commercial fishing. Diego Garcia and its territorial waters are excluded from the MPA (the MPA exclusion zone) and include a recreational fishery. BIOT itself does not operate a flag registry and has no commercial tuna fleet or fishing port. In 2009, the year before the area was closed, the Seychelles-flagged fleet caught 2,463 t in Chagos waters (55% YFT), around 3.6% of the fleet's catch that year.

Some of these MPAs are strict 'no-take' areas while others are 'multiple use areas' where fishing is still allowed, but somewhat restricted in terms of fishing gear and methods, seasonal closures etc. There are some MPAs where management plans are in place, but a majority of the existing areas fall under the category of so called 'paper parks' where no or insufficient management exists.

2.2.2 Seychelles-flagged purse seine tuna fishery

Fishing effort

The Seychelles-flagged purse seine operation is, like the Spanish flagged fleet, a FAD operation, although free schools are also targeted over Nov – January when YFT form spawning aggregations. The Seychelles flagged fleet caught around 60,225 t of tuna in 2014, of which 87% of the catch was from FAD sets and 13% from free school sets. 81% of the 1,396 sets in 2014 were on FADs and 19% were on free schools. This reflects the fact that FAD sets are preferred as they have a higher likelihood of a successful set (usually >90%) compared to free schools (c. 50% success rate) and the higher SKJ catch rates are appreciated.

Table 3: Fishing days, set types and catch in the Seychelles EEZ and non-EEZ waters 2010 - 2014

Year	Set type	Seychelles EEZ			Non-Seychelles EEZ		
		Fishing days	No. of sets	Catch (t)	Fishing days	No. of sets	Catch (t)
2010	FAD Associated School	198	248	7,810	1,090	1,514	59,617
	Free Swimming School	58	98	2,781	158	266	5,568
	Unidentified School	197	-	-	623	3	10
	Sub-total	***453***	***346***	***10,592***	***1,870***	***1,783***	***65,195***
2011	FAD Associated School	228	290	8,862	927	1,343	43,429
	Free Swimming School	133	228	4,107	213	397	6,679
	Unidentified School	279	1	135	566	-	-
	Sub-total	***640***	***519***	***13,103***	***1,707***	***1,740***	***50,108***
2012	FAD Associated School	164	207	4,616	742	1,034	32,214
	Free Swimming School	129	237	5,685	209	356	8,423
	Unidentified School	304	-	-	587	-	-
	Sub-total	***596***	***444***	***10,301***	***1,537***	***1,390***	***40,637***
2013	FAD Associated School	149	206	5,503	860	1,334	44,380
	Free Swimming School	23	42	1,124	147	236	6,047
	Unidentified School	148	1	21	482	6	249
	Sub-total	***320***	***249***	***6,647***	***1,489***	***1,576***	***50,676***
2014	FAD Associated School	185	310	6,593	907	1,276	45,627
	Free Swimming School	40	57	1,001	207	319	7,035
	Unidentified School	224	-	-	546	-	-
	Sub-total	***449***	***367***	***7,593***	***1,660***	***1,595***	***52,662***

Year	Set type	Seychelles EEZ						Non-Seychelles EEZ					
		Fishing days		No. of sets		Catch (t)		Fishing days		No. of sets		Catch (t)	
Average (2010 - 2014)	FAD Associated School	185	38%	252	66%	6,677	69%	905	55%	1,300	80%	45,053	87%
	Free Swimming School	77	16%	132	34%	2,939	30%	187	11%	315	19%	6,750	13%
	Unidentified School	230	47%	0	0%	31	0%	561	34%	2	0%	52	0%
	Sub-total	**492**	**100%**	**385**	**100%**	**9,647**	**100%**	**1,653**	**100%**	**1,617**	**100%**	**51,856**	**100%**

Target catch composition

Overall average (2010 – 2014) catches in the Seychelles EEZ consists of mainly YFT and SKJ. However, there is a marked different in the catches of FAD and free-school (FS) catches, with the former mainly (59%) catching SKJ with 33% YFT and 8% BET. In contrast the free schools have a much higher catch of YFT (87%), with only 5% SKJ and 8% BET. The figures for FAD catches outside of the Seychelles is similarly dominated by SKJ (56%), but the free school catches, whilst still YFT dominated are at lower levels (67%) with a higher proportion of SKJ (21%) than in the Seychelles EEZ.

Table 4: Summary of catches by Seychelles-flagged vessels (average 2010 - 2014)

Year	Set type	Seychelles EEZ						Non-Seychelles EEZ					
		SKJ		YFT		BET		SKJ		YFT		BET	
Average (2010 - 2014)	FAD	3,961	96%	2,173	46%	541	69%	25,354	95%	16,262	78%	3,428	81%
	Free	136	3%	2,554	54%	247	31%	1,389	5%	4,518	22%	791	19%
	U/C	28	1%	2	0%	0	0%	37	0%	13	0%	1	0%
	Sub-total	**4,126**	**100%**	**4,729**	**100%**	**788**	**100%**	**26,781**	**100%**	**20,794**	**100%**	**4,221**	**100%**

Table 5: Catches in the Seychelles EEZ (2010-2014) by Seychelles-flagged vessels

Year	Set type	SKJ	YFT	BET	Total
2010	FAD Associated School	4,876	2,195	739	7,810
	Free Swimming School	52	2,593	137	2,781
	Unidentified School	-	-	-	-
	Sub-total	***4,928***	***4,788***	***876***	***10,592***
2011	FAD Associated School	5,447	2,714	701	8,862
	Free Swimming School	341	3,398	367	4,107
	Unidentified School	128	6	1	135
	Sub-total	***5,917***	***6,118***	***1,069***	***13,103***
2012	FAD Associated School	2,570	1,738	308	4,616
	Free Swimming School	133	4,969	570	5,672
	Unidentified School	-	-	-	-
	Sub-total	***2,703***	***6,707***	***878***	***10,288***
2013	FAD Associated School	2,958	1,988	558	5,503
	Free Swimming School	73	963	87	1,124
	Unidentified School	14	6	1	21
	Sub-total	***3,045***	***2,957***	***646***	***6,647***
2014	FAD Associated School	3,956	2,232	399	6,586
	Free Swimming School	82	845	74	1,001
	Unidentified School	-	-	-	-
	Sub-total	***4,037***	***3,077***	***472***	***7,587***

Table 6: Catches outside the Seychelles EEZ (2010-2014) by Seychelles-flagged vessels

Year	Set type	SKJ	YFT	BET	ALB	Total
2010	FAD Associated School	36,930	17,600	5,075	-	59,605
	Free Swimming School	1,966	2,938	650	14	5,568
	Unidentified School	5	4	1	-	10
	Sub-total	***38,901***	***20,543***	***5,726***	***14***	***65,183***
2011	FAD Associated School	24,927	15,676	2,813	-	43,416
	Free Swimming School	2,118	3,577	955	29	6,679
	Unidentified School	-	-	-	-	-
	Sub-total	***27,046***	***19,253***	***3,768***	***29***	***50,095***
2012	FAD Associated School	16,419	13,828	1,965	-	32,212
	Free Swimming School	519	6,685	1,085	134	8,423
	Unidentified School	-	-	-	-	-
	Sub-total	***16,938***	***20,513***	***3,050***	***134***	***40,636***
2013	FAD Associated School	21,791	18,767	3,818	1	44,378
	Free Swimming School	979	4,446	575	48	6,047
	Unidentified School	182	61	6	-	249
	Sub-total	***22,952***	***23,275***	***4,399***	***49***	***50,674***
2014	FAD Associated School	26,704	15,439	3,471	12	45,626
	Free Swimming School	1,363	4,947	693	33	7,035
	Unidentified School	-	-	-	-	-
	Sub-total	***28,067***	***20,386***	***4,164***	***45***	***52,661***

Target catch size distribution

The mean average of skipjack on FAD sets is slightly small at 2.6 kg against the 3.1 kg of free school sets (see **Figure 1** overleaf). This suggests that only mature skipjack tuna is being caught by both fisheries. In contrast the average size of FAD and free school yellowfin tuna differ markedly, with an average of 4.9 kg and 31.9 kg respectively. With the average weight at maturity for this species being around 18 kg, this suggests that the majority of yellowfin tuna are immature juveniles. A similar situation exists for BET, where the average size of FAD and free school bigeye tuna is 4.0 kg and 25.6 kg respectively.

Location of catches

Over 80% of the Seychelles-flagged catch is caught in the high seas areas. Over 12% is caught in the Seychelles EEZ and the balance is caught in other EEZs where there are fisheries agreements (see Section 0), these being mainly Kenya (2%) and Madagascar (0.8%) waters.

Table 7: Proportion of Seychelles catch taken in different sea areas over 2014

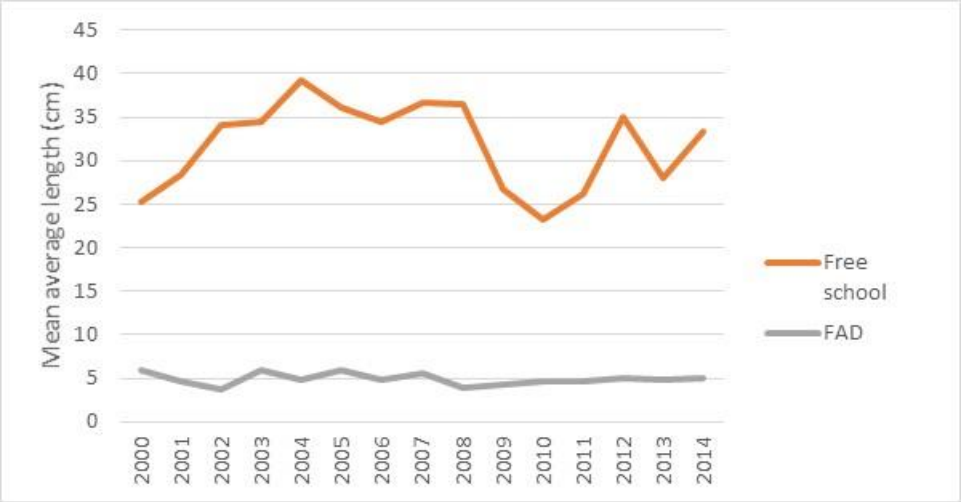
Location	Catch	%
High Seas	**48,645**	**80.7%**
Seychelles	***7,593***	***12.6%***
Kenya	1,235	2.0%
Madagascar	487	0.8%
Tanzania	319	0.5%

Location	Catch	%
Mauritius	283	0.5%
Comores	239	0.4%
Iles Eparses	217	0.4%
Mayotte	132	0.2%
Other	1,105	1.8%
TOTAL	**60,255**	**100.0%**

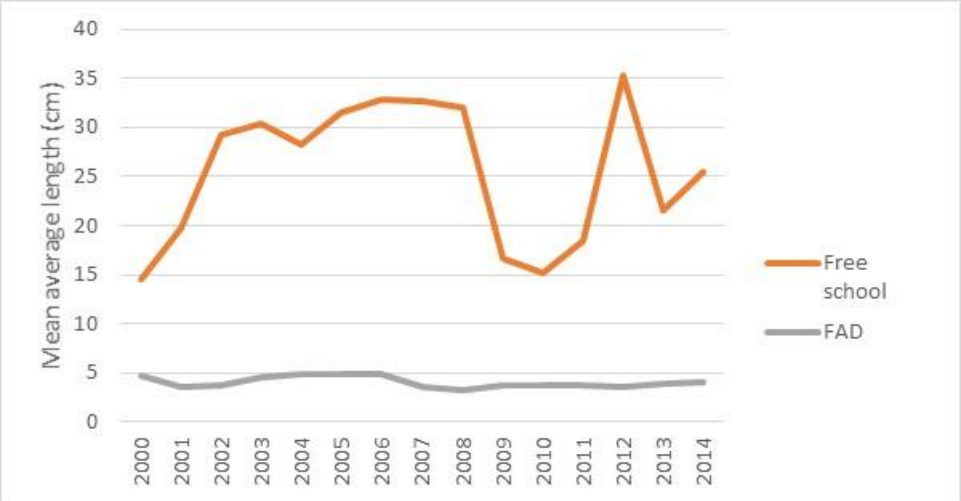
Figure 1: Fish sizes on free school and FAD sets for SKJ, YFT & BET (2000 - 2014)

A. Skipjack tuna

B. Yellowfin tuna



C. Bigeye tuna



Source: SFA (unpublished data)

Bycatch composition

Whilst skipjack, yellowfin and bigeye tuna dominate the catch, there is a non-target bycatch from these fisheries, mainly made up of neritic tunas and various other pelagic and oceanic species (see below for further analysis). Until recently this bycatch was discarded at sea, with some being retained for crew consumption and some being landed.

According to SFA, less than 0.5% of the catch has been traditionally discarded, of which around 1/3 is undersize or damaged target species (see Table 8 below).

Table 8: Estimates of discards and landings from the Seychelles fleet over 2010 - 2014

Year	Landings (t)	Discards (t)	%
2010	77,527	196	0.25%
2011	60,952	0	0.00%
2012	56,508	314	0.56%
2013	57,522	103	0.18%
2014	58,196	19	0.03%

Source: SFA (unpublished data)

Longer-term data form the French and Spanish purse seine fleets suggests a higher discarded proportion of around 3.5% for free school and 3.2% for FAD-associated catches. This dataset (see Table 9 below) suggests that discards from free school sets have increased over recent years and those from FAD-associated sets have decreased.

Table 9: Proportion of landed and discarded catch from observed free school and FAD associated sets of the FR & ESP vessels over 2005 - 2014

Year	Free school sets			FAD-associated sets		
	Landings (t)	Discards (t)	%	Landings (t)	Discards (t)	%
2005	1,192	2	0.2%	372	16	4.3%
2006	2,016	3	0.1%	1,218	54	4.4%
2007	4,037	77	1.9%	2,472	186	7.5%
2008	3,791	15	0.4%	5,050	430	8.5%
2009	1,111	94	8.5%	1,498	4	0.3%
2010	894	29	3.2%	n/a	n/a	n/a
2011	3,359	113	3.4%	3,248	47	1.4%
2012	3,921	199	5.1%	3,208	5	0.2%
2013	6,071	898	14.8%	1,991	29	1.5%
2014	11,057	551	5.0%	5,780	28	0.5%
Avg	**3,486**	**120**	**3.5%**	**2,760**	**89**	**3.2%**

Note: FS sets exclude 2013 data as skewed by 300 t tuna discarded alive due to a technical issue

Source: IRD (unpublished data)

With IOTC Resolution 15/06 the discard of SKJ, YFT or BET is prohibited unless it is unfit for human consumption". The landing of all non-targeted species is encouraged (including but not limited to other tunas, rainbow runner, dolphinfish, triggerfish, billfish, wahoo, and barracuda). There is a ready market in the Seychelles for both the neritic tuna (mainly used as bait for the local longline fleet) as well as the other pelagic fish that are bought by Oceana, Sea Harvest and others.

Until the recent 100% observer programme started, the bycatch from the Seychelles-flagged vessels, both in terms of discards and landings, have gone unrecorded. The recent development of 100% observer coverage (see below) means that this information is now being captured, but has yet to be compiled. Therefore, we have used historic data from the Spanish and French purse seine fleets to estimate likely the bycatch and its composition for both the FAD and non-FAD sets (see table below).

Table 10: Bycatch from French and Spanish purse seiners (2003 - 2009)

Common name	Species	Free %	FAD %
Skipjack tuna	*Katsuwonus pelamis*	19%	25%
Bigeye tuna	*Thunnus obesus*	2%	1%
Yellowfin tuna	*Thunnus albacares*	4%	4%
Bullet tuna	*Auxis thazard*	25%	20%
Frigate tuna	*Auxis rochei*	12%	5%
Rainbow runner	*Elagatis bipinnulata*	9%	10%
Silky shark	*Carcharhinus falciformis*	5%	6%
Mahi mahi	*Coryphaena hippurus*	3%	9%
Spotted oceanic triggerfish	*Canthidermis maculatus*	3%	4%
Wahoo	*Acanthocybium solandri*	1%	2%
Kawakawa	*Euthynnus affinis*	3%	0%

Key: Target species Non-target species

Source: Amande *et al*, 2012

IRD provided the team more recent data on the species composition of discards (in biomass) at sea derived from a large set of observers having boarded on French purse seiners over 2005-2014 (see Table 11 overleaf) . This suggests that the silky shark is also a significant non-target catch in both free-school (11% of bycatch) and non-FAD (5.6%) sets. Otherwise this more detailed dataset echoes the earlier bycatch composition suggested by Amande *et al* (2012).

Finally on the subject of bycatch, it should be understood that the catch composition of these non-target species in Table 10 and Table 11 is that of the discarded bycatch. Therefore, the actual biomass discarded as a proportion of the whole catch is much smaller, given that discards represent less than 5% of the whole catch. For instance, silky shark, which represents 11.2% of the discarded catch (see Table 11) in free schools, only represents 0.4% of the whole catch. However, given the large biomass involved in the fishery, this may be significant for vulnerable species, an aspect investigated further in Section 3.3.3.

Table 11: Composition of observed discarded bycatch from French purse seiners (2005 - 2014)

A. Free-school sets

Scientific name	% bycatch
Katsuwonus pelamis	21.29%
Thunnus albacares	12.21%
Carcharhinus falciformis	11.16%
Elagatis bipinnulata	10.24%
Canthidermis maculata	8.31%
Auxis thazard	5.01%
Coryphaena hippurus	3.39%
Makaira indica	3.13%
Manta birostris	2.99%
Tetrapturus audax	2.57%
Thunnus obesus	2.06%
Mobula spp	1.99%
Acanthocybium solandri	1.95%
Carangidae	1.67%
Euthynnus affinis	1.53%
Makaira nigricans	1.50%
Mobula japanica	1.36%
Carcharhinus longimanus	1.13%
Auxis spp	1.10%
Thunnus alalunga	0.86%
Xiphias gladius	0.69%
Mobula mobular	0.55%
Seriola rivoliana	0.45%
Lobotes surinamensis	0.28%
Sphyraena barracuda	0.26%
Prionace glauca	0.24%
Ranzania laevis	0.19%
Istiophoridae	0.18%
Uraspis secunda	0.18%
Mobulidae	0.17%
Unknown fish	0.15%
Mola mola	0.14%
Istiophorus platypterus	0.13%
Isurus oxyrinchus	0.13%
Isurus spp	0.11%
Dermochelys coriacea	0.10%

B. FAD associated sets

Scientific name	% bycatch
Katsuwonus pelamis	21.03%
Thunnus albacares	13.55%
Canthidermis maculata	13.17%
Elagatis bipinnulata	11.28%
Coryphaena hippurus	9.14%
Auxis thazard	5.93%
Carcharhinus falciformis	5.56%
Thunnus obesus	5.45%
Acanthocybium solandri	3.40%
Auxis spp	2.47%
Kyphosus vaigiensis	1.74%
Decapterus macarellus	0.76%
Balistidae	0.76%
Rhincodon typus	0.57%
Makaira indica	0.57%
Sphyraena barracuda	0.48%
Euthynnus affinis	0.46%
Makaira nigricans	0.44%
Abalistes stellaris	0.43%
Lobotes surinamensis	0.34%
Xiphias gladius	0.34%
Carcharhinus longimanus	0.31%
Auxis rochei	0.22%
Aluterus monoceros	0.19%
Uraspis secunda	0.16%
Tetrapturus audax	0.16%
Manta birostris	0.13%
Kyphosus cinerascens	0.13%
Platax teira	0.11%

Target species

Non-target species (≥5%)

Non-target species (0.1 - 4.9%)

Source: IRD (unpublished data)

Fisheries-dependent information

Information on the nature and volume of the catch from these fisheries has historically be derived mainly from logbooks and landing records. There has also been a mandatory 5% observer coverage for vessels over 24 m since IOTC Resolution 11/04 in 2004. However, the Seychelles has decided to increase observer coverage to 100% on their flagged vessels and this has been in place since February 2014. There is now a pool of 60 trained observers who now use tablets and laptops to record information using the ObServe[4] data requirements including information on trips, sets, FADs, tuna rejections and bycatch (including composition and raised total biomass). They also observe how protected species are released and assess their fate. Observers are debriefed after the trip and heir reposts are subject to a quality control process.

[4] For more information on the ObServe database, see Cauquil *et al*, 2015

2.3 DEFINITION OF THE UNIT OF ASSESSMENT

For the purpose of this pre-assessment we suggest that two main units of assessment are considered:

- **UoA A: Seychelles-flagged tuna purse seine fisheries on free schools in the Western Indian Ocean**
- **UoA B: Seychelles-flagged tuna purse seine fisheries on FAD-associated schools in the Western Indian Ocean**

These are further detailed below:

2.3.1 UoA A: Seychelles-flagged tuna purse seine fisheries on free schools in the Western Indian Ocean

Target stocks (P1)	Skipjack tuna (*Katsuwonus pelamis*) Yellowfin tuna (*Thunnus albacares*) Bigeye tuna (*Thunnus obesus*)
Fishing method	Purse seine (free school)
Fishing fleet	Seychelles-flagged purse seine fleet operating within the Seychelles Exclusive Economic Zone (EEZ), high seas areas, and EEZs in the WIO
Non-target catch (P2)	Primary species: None Secondary species (main): • Bullet tuna (*Auxis rochei*) • Frigate tuna (*Auxis thazard*) • Blue marlin (*Makaira nigricans*) • Rainbow runner (Elagatis bipinnulata) • Silky shark (*Carcharhinus falciformis*) Secondary species (minor): • Common dolphinfish (*Coryphaena hippurus*) • Wahoo (*Acanthocybium solandri*) • Spotted oceanic trigger fish (*Canthidermis maculatus*) • Kawakawa (*Euthynnus affinis*)

2.3.2 UoA B: Seychelles-flagged tuna purse seine fisheries on FAD-associated schools in the Western Indian Ocean

Target stocks (P1)	Skipjack tuna (*Katsuwonus pelamis*) Yellowfin tuna (*Thunnus albacares*) Bigeye tuna (*Thunnus obesus*)
Fishing method	Purse seine (FAD-associated)
Fishing fleet	Seychelles-flagged purse seine fleet operating within the Seychelles Exclusive Economic Zone (EEZ), high seas areas, and EEZs in the WIO
Non-target catch (P2)	Primary species: None Secondary species (main): • Bullet tuna (*Auxis rochei*) • Frigate tuna (*Auxis thazard*) • Blue marlin (*Makaira nigricans*) • Rainbow runner (Elagatis bipinnulata) • Silky shark (*Carcharhinus falciformis*) • Common dolphinfish (*Coryphaena hippurus*) Secondary species (minor): • Spotted oceanic trigger fish (*Canthidermis maculatus*) • Wahoo (*Acanthocybium solandri*) • Kawakawa (*Euthynnus affinis*)

3 DESCRIPTION OF THE TARGET SPECIES, ECOSYSTEM IMPACTS AND MANAGEMENT SYSTEMS

3.1 SCOPE OF THE FISHERIES IN RELATION TO THE MSC PROGRAMME

All three UoAs appear to be in scope as follows:

1. No amphibians, reptiles, birds or mammals are targeted by the fisheries under P1
2. No explosives are used
3. We are not aware that either the FAD nor the free school fisheries are being conducted under any controversial unilateral exemption to an international agreement
4. There are no over-whelming disputes over these fisheries
5. No introduced species are targeted
6. We note, however, that the FAD fishery is considered as being set on an 'enhanced' habitat and this will be addressed in P2.4.

Other aspects of the UoAs include:

7. The units of assessment and certification are clearly defined
8. Other eligible fishers and opportunities for certificate sharing are readily identifiable
9. There is no of inseparable or practically inseparable (IPI) catches, although the mixed nature of these fisheries means this remains a possibility, but this would not affect the scoping.
10. No over-lapping fisheries have been identified at this point, although it is recognised that the Spanish-flagged vessels in the EU fleet are essentially prosecuting the same fisheries as in this pre-assessment.

3.2 PRINCIPLE ONE: TARGET SPECIES BACKGROUND

3.2.1 Skipjack tuna

Stock status

As no new stock assessment was carried out for skipjack tuna in 2015, the current IOTC stock status is determined on the basis of the 2014 assessment and other indicators presented to the IOTC working group (WPTT) in 2015.

The 2014 stock assessment model results did not differ substantively from the previous (2012 and 2011) assessments; however, the final overall estimates of stock status differ somewhat due to the revision of the input parameters and updated standardised CPUE indices.

All the runs carried out in 2014 indicate the stock is above a biomass level that would produce MSY in the long term (i.e. $SB_{2013}/SB_{MSY} > 1$) and – again in all runs - that the current proxy for fishing mortality is below the MSY-based reference level (i.e. $Ccurrent/C_{MSY} < 1$).

- The median value of MSY from the model runs investigated was 684,000 t with a range between 550,000 and 849,000t.
- Current spawning stock biomass was estimated to be 57% of the unfished levels.
- Catches in 2014 (≈ 432,500 t) remain lower than the estimated MSY values from the 2014 stock assessments.
- The average catch over the previous five years (2010 - 2014 ≈ 402,000 t) also remains below the estimated MSY.

Thus, on the weight-of-evidence available in 2014, the skipjack tuna stock is determined to be not overfished and is not subject to overfishing:

- The recent declines in catch/sets on FADs, as well as the large decrease on free school skipjack tuna are of some concern, as the IOTC woking group (WPTT) does not fully understand the cause of those declines.
- Also there remains considerable uncertainty in the assessment, and the range of runs analysed illustrate a range of stock status to be between 0.73–4.31 of SB_{2013}/SB_{MSY} based on all runs examined.

Conclusion: If catch remains below the estimated MSY levels, then immediate management measures are not required. However, continued monitoring and improvement in data collection, reporting and analysis is required to reduce the uncertainty in assessments.

Concerning the target stock level, and noting that while B_{MSY}, B_{2010}, and B_0 are unknown, both SB_{2013}/SB_{1950} (=SB_0) = 0.58 [0.53 – 0.62] and SB_{2013}/SB_{MSY} = 1.59 [1.13– 2.14] have been determined. Based on these values the best estimate of SB_{MSY}/SB_0 is 0.36 Resolution 13/10 provides that BLIM = 0.40 B_{MSY} implying an SB_{LIM}/SB_0 of 0.15. Noting CB2.3.3.4, a value of 0.20 might be more prudent. However, even against this more conservative (but consistent with CB2.3.3.4) standard the base case median estimate of SB relative to its unfished state is 0.58 [0.25 - 0.65], where even the lower 95% confidence bound is well above the default value of 0. 20. Therefore, taking account of the uncertainty associated with the base case status estimates, there is a high degree of certainty (i.e. greater than 95%, as set out in MSC CR CB2.2.1.3) that the stock is above the point where recruitment would be impaired – the default value for this being around 50% of the B_{MSY} level. This meets SG100.

Based on the assessment conducted in 2013, there is a low risk of exceeding MSY-based reference points by 2016 and 2023 if catches are maintained at the current levels of ≈ 425,000 t (< 1% risk that $B_{2016} < B_{MSY}$ and 1% risk that C_{2023}>MSY where the latter is taken as a proxy of $F > F_{MSY}$). There is thus a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years. This meets SG100.

In resolution 13/10 the IOTC adopted interim target (B_{MSY} and F_{MSY}) and limit (B_{LIM} = 0.40 B_{MSY} and F_{LIM} = 1.50 F_{MSY}) reference points for skipjack tuna. The resolution specifies that the IOTC Scientific Committee should assess stocks against these reference points and provide advice against them, as is done both in tabular form and using Kobe process presentations. The resolution also calls on the Scientific Committee to further investigate reference points and Harvest Control Rules (HCR) using Management Strategy Evaluation (MSE). Stock assessments for skipjack are well advanced (see IOTC–2012–WPTT14) and though results are uncertain the influence of alternative assumptions and model approaches is explored.

The target reference points for this stock have been set as ratios: B/B_{MSY} and F/F_{MSY}. This is reasonable and consistent with practice elsewhere as well as with MSC requirements. The reference points are estimated based on MSY and are appropriate for tuna stocks. MSY is estimated within the stock assessment and reported to the management system. The relation of the stock relative to MSY is reported as part of the determination of stock status: the SG80 is met.

While resolution 13/10 sets interim target (B_{MSY} and F_{MSY}) and limit (B_{LIM} = 0.40 B_{MSY} and F_{LIM} = 1.50 F_{MSY}) reference points for skipjack tuna, no rationale is available to support these choices. Concerning the target stock level, and noting that while B_{MSY}, B_{2010}, and B_0 are unknown, both SB_{2013}/SB_{1950} (=SB_0) = 0.58 [0.53 – 0.62] and SB_{2013}/SB_{MSY} = 1.59 [1.13– 2.14] have been determined. Based on these values the best estimate of SB_{MSY}/SB_0 is 0.36 Resolution 13/10 provides that B_{LIM} = 0.40 B_{MSY} implying an SB_{LIM}/SB_0 of 0.15.

This is a low value to use without explanation and appears inconsistent with MSC requirements that specify that if the target reference point is analytically determined to be below 40% B_0, and there is no analytically determined limit reference point, then the default value of B_{LIM} should be 20% B_0.

Although the IOTC has yet to adopt a specific limit reference point, management advice is provided relative to MSY as a target. The default 40% B_{MSY} is assumed here for purposes of defining stock status. However, the lack of a well-defined limit reference point indicates that the SG80 is not met.

For the target reference point, clearly the intention of the IOTC (management response) and the basis on which scientific advice is supplied is to maintain the stock at or above the MSY level. Therefore, although an interim target reference point is defined at a level consistent with B_{MSY} – thus meeting SG80 - a more precise definition justified through scientific analysis and research would be necessary before the higher guidepost could be met.

Harvest Strategy

The concept of a Harvest Strategy is clearly defined in MSC-MSCI Vocabulary V 1.0 It is “the combination of i) monitoring, ii) stock assessment, iii) harvest control rules and iv) management actions, which may include an MP or an implicit MP and be tested by MSE.”

The critical issue is the presence of the four elements (monitoring, stock assessment, harvest control rules and management actions).

While neither a Management Procedure (MP or implicit MP) or the undertaking of a full MSE are absolutely required, it is noteworthy that the IOTC has described its limit and target reference points as Interim.

None the less, it is the absence of the last two elements, harvest and control rules and management actions that are of most concern. Firstly there is no clearly defined HCR for this fishery. That is to say, the assessment team cannot provide objective evidence of well-defined pre-agreed rules or actions used by the Indian Ocean Tuna Commission (IOTC) for determining a management action in response to changes in indicators of stock status with respect to reference points. And while IOTC resolution 12/01 does provide an approach it is none-the-less just an initial step on the path towards fully developing harvest control rules and, ultimately, a harvest strategy.

Likewise while IOTC resolution 13/10 (part 4) does establish the basis of a harvest strategy and specifies that the Scientific Committee shall develop and assess potential harvest control rules (HCRs) to be applied, considering the status of the stocks against reference points, these are currently not in place.

In addition the Scientific Committee concluded in their 2015 report that the IOTC does not currently have any Conservation and Management Measures in place, other than the FAD limitation measure (Resolution 15/08, which is yet to be evaluated) to regulate the fisheries for yellowfin tuna. It must be concluded that the same situation pertains to skipjack management.

In the absence of a robust and precautionary harvest strategy being in place, this stock fails this PI.

Harvest control rules and tools

Harvest control rules for this stock are not well-defined and there is no specific plan of control if the stock size falls below the trigger point (MSY). There is, however, evidence of an intention to end overfishing and rebuild this stock should depletion occur and the scientific committee is called on to provide such advice. Therefore there are generally understood harvest rules in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached meeting the SG60. However these are neither well defined nor have they been tested to ensure that the exploitation rate is reduced as limit reference points are approached; consequently the (PI 1.2.2 a) SG80 is not met.

Similarly as the current, interim, framework for this stock does not include well-defined harvest control rules or specific guidance on management then it then it cannot be said that selection of the harvest control rules takes into account the main uncertainties. Rather it must be concluded that the (PI 1.2.2 b) SG80 has not been met.

Turning to the tools used to implement harvest control rules and whether they are appropriate and effective in controlling exploitation. Noting that the biomass of this stock has, to date, remained above the target reference point and there has not been any occasion where a level of control in response to excess fishing pressure has been demonstrated. None-the-less, as with the WPTT's assessment of the current status of

Conservation and Management Measures in place for yellowfin fisheries, it must be concluded that for this fishery too, the IOTC does not currently have any Conservation and Management Measures in place, other than the FAD limitation measure (Resolution 15/08, which is yet to be evaluated) to regulate fisheries for skipjack. And while there is some evidence that some IOTC members have controlled their own catches in an effective manner, meeting the SG60. Nevertheless, there are as of yet no harvest control rules at the IOTC level and, thus, no evidence that the tools are effective, so the SG80 cannot be met.

Information and monitoring

Skipjack data in the Indian Ocean are comprehensive, informative and relevant. These data consider (a) stock structure, (c) fleet composition (d) stock abundance (mainly standardised CPUE series) (e) fishery removals, and (f) other data and provide information on the spatial distribution of catches, their size frequencies, results of tagging studies as well as growth and mortality models. The data are adequate to allow appropriate stock assessments and to evaluate the status of the stock against target and limit reference points. In addition environmental data are used in CPUE standardization and to help explain recruitment. Stock structure data while limited are consistent with an Indian Ocean-wide stock.

Overall, data are adequate for stock assessment and for an appropriate harvest control rule, and thus meet the (PI 1.2.3 a) SG80.

However, despite the best efforts of the IOTC secretariat it remains the case that i) issues remain with some of these data and ii) there are information gaps such that it cannot be concluded that this information constitutes a comprehensive range of information. Consequently the data do not presently allow the implied harvest control rule to be applied with a high degree of certainty, so the SG100 is not met.

IOTC has put considerable effort into the reporting and recording of catches by the contracting parties. These are summarised in the following resolutions:

- 13/03 recording of catch and effort data by fishing vessels in the IOTC area of competence
- 11/04 regional observer scheme
- 10/02 Mandatory statistical requirements
- 10/08 active vessels fishing for tunas and swordfish in the IOTC area
- 10/09 functions of the Compliance Committee
- 06/03 establishing a vessel monitoring system programme
- 03/03 amendment of the forms of the IOTC statistical documents

The IOTC secretariat puts considerable effort into considering any issues identified relating to the statistics of tropical tunas. This list covers the main issues that the Secretariat considers affect the quality of the statistics available at the IOTC, by type of dataset and type of fishery. Specifically it includes issues relating to non-reporting of fishery removals and attempts to rectify or estimate these.

Standardized CPUE indices are available from several fleets. Tagging data is also available. Together these are considered are adequate for the harvest strategy.

While indicators of stock abundance - mainly standardised catch-per-unit-effort indices – are available, a single index covering the entire time series is not available.

While data are sufficient to meet (PI 1.2.3b) SG80 they do not presently allow the implied harvest control rule to be used with great confidence, preventing the SG100 being met.

Finally, IOTC Resolution 13/03 requires that all purse seine, longline, gillnet, pole and line, hand line and trolling fishing vessels over 24 metres length overall and those under 24 metres if they fish outside the EEZs of their flag States within the IOTC area of competence to keep a bound paper or electronic logbook and to record, inter alia, the weight (kg) or number by species per set/shot/fishing event for each of a comprehensive list of species. For purse seine, this includes IOTC species, marine turtles, marine mammals, sharks, rays and other bony fish.

It is apparent that IOTC has put considerable effort into the recording and reporting of catches and that the current level of reporting is adequate given the large number of small countries involved and the difficult task of monitoring small vessels often far away or on the high seas. Overall, data are sufficient to meet the (PI 1.2.3c) SG80.

Assessment of stock status

A single quantitative modelling method (SS3) was applied to this stock with management advice based on the range of results from the model. The SS3 assessment model is age-structured, iterated on a quarterly time-step, spatially aggregated, with four fishing fleets and Beverton-Holt recruitment dynamics. Model parameters (virgin recruitment, selectivity by fleet, recruitment deviations, and M in some cases) were estimated by fitting predictions and observations of CPUE, length frequency data for all fleets, and tag recoveries (for the purse seine fleets, and in some cases, the Maldivian P&L fleet). The stock status was reported relative to reference points.

- The 2011 assessment was the initial comprehensive assessment effort. While the results are very useful, there are unresolved uncertainties in basic productivity exemplified by the lack of good estimates of fishing mortality.
- Based on the stock assessment carried out in 2012, the stock was considered to be not overfished and not subject to overfishing (Table 1). [IOTC–2013–WPTT15–R[E]
- No new stock assessment was carried out for skipjack tuna in 2013.
- Spawning stock biomass is estimated to have declined by approximately 45 % in 2011 from unfished levels. Total catch has continued to decline with 314,537 tonnes landed in 2012, in comparison to 384,537 tonnes in 2011.
- The recent declines in catches from this stock are thought to be caused by a recent decrease in purse seine effort as well as a decline in CPUE of large skipjack tuna in the surface fisheries. There remains considerable uncertainty in the assessment, and the range of runs analysed illustrate a range of stock status to be between 0.73–4.31 of SB_{2011}/SB_{MSY} based on all runs examined.

The assessment approach is appropriate for the stock and for the current implied harvest control rule, meeting the (PI 1.2.4 a) SG80, but it is as yet unclear whether this model accounts adequately for the features of this fishery, so it does not meet the SG100.

The assessment estimate stock status relative to reference points and SB_{2011}/SB_{MSY} (rather than B_{2011}/B_{MSY}) and $_{F2011}/F_{MSY}$ are presented as point estimates with 95% confidence intervals, meeting the (PI 1.2.4 b) SG60.

The stock assessment methods used in the analysis of this stock report uncertainty in estimates of stock status. These uncertainties have also been examined as alternative model structures. Similarly the stock status associated with these alternatives have been evaluated in a probabilistic manner. While these weightings are not statistical rigorous they represent a consensus of experts on relative importance and have been carried through Kobe plots a strategy matrix. A decision table is provided to help assess risk. The use of probability in the management advice allows risk to be taken into account in the decision making, meeting the (PI 1.2.4 c) SG100.

The stock assessment of bigeye is primarily reviewed through the Working Party for Tropical Tunas of the IOTC's Scientific Committee. Additionally, outside experts are invited to participate in the Working Party meetings. Thus whereas there is clearly a degree of peer review that meets SG80 it is not clearly apparent that this review was externally reviewed and, on that basis, cannot be said to have met (PI 1.2.4 d) SG100.

3.2.2 Yellowfin tuna

Stock status

In 2015, three models were applied to the yellowfin tuna stock in the IOTC area of competence all of which give qualitatively similar results. Stock status is based on the SS3 model formulation. Spawning stock biomass in 2014 was estimated to be 23% (21–36%) of the unfished levels and 66% (58–74%) of the level that can support MSY.

The low level of stock biomass in 2014 is consistent with the long-term decline in the primary stock abundance indices (longline CPUE indices) and recent trends are attributable to increased catch levels.

Total catch has continued to increase with 430,327t taken in 2014, up from 407,633 t in 2013 and 400,322 t in 2012, in comparison to 329,184 t landed in 2011, 301,655 in 2010 and 266,848 t landed in 2009.

The assessment is more pessimistic that the 2012 assessment due to the increase in catches and the changes in assessment assumptions regarding the recruitment processes.

Fishing mortality estimates for 2014 was 34% higher than the corresponding fishing mortality rate that would produce MSY. Thus, on the weight-of-evidence available in 2015, the yellowfin tuna stock is determined to be overfished and subject to overfishing.

The outlook for the stock, notes that the substantial increase in longline, gillnet, handline and purse seine effort and associated catches in recent years has substantially increased the pressure on the Indian Ocean stock as a whole, with recent fishing mortality exceeding the MSY-related levels.

The current assessment estimates that the stock biomass is below the level that will support the MSY and current levels of catch. There is a very high risk of continuing to exceed the biomass MSY-based reference point if catches increase further or are maintained at current levels (2014) until 2017 (>99% risk that $SB_{2017} < SB_{MSY}$), and similarly a very high risk that $F_{2017} > F_{MSY}$ (≈100% if maintained).

The modelled probabilities of the stock achieving levels consistent with the Commission's current management objective (e.g. $SB > SB_{MSY}$) are 50% for a future constant catch at 80% of current catch levels by 2024. Higher probabilities of rebuilding require longer timeframes

and/or larger reduction of current catches. The K2MSM provided in the most recent report of the WPTT, provides the IOTC with a range of options for reducing catches and the probabilities of the yellowfin tuna stock recovering to the MSY target levels.

On the basis of the most recent assessment, the WPTT concluded that the stock status determination changed in 2015 as a direct result of the large and unsustainable catches of yellowfin tuna taken over the last three years, and the relatively low recruitment levels estimated by the model in recent years.

Further, the WPTT noted that the IOTC **does not currently have any Conservation and Management Measures in place,** other than the FAD limitation measure (Resolution 15/08, which is yet to be evaluated) to regulate the fisheries for yellowfin tuna.

Given the short term projected decline in stock status if catches are maintained or increased from 2014 levels, catches should be reduced in conformity with the decision framework described in Resolution 15/10.

The following key points are also noted to the IOTC:

- Maximum Sustainable Yield estimate for the whole Indian Ocean is 421,000 t with a range between 404,000–439,000 t. The average catches (357,000 t) since 2006 were below the MSY level.
- Interim reference points: Noting that the Commission in 2015 agreed to Resolution 15/10 on target and limit reference points and a decision framework, the following should be noted:
- Fishing mortality: Current fishing mortality is considered to be **well above** the interim target reference point of F_{MSY}, and at or just under the interim limit reference point of $1.4*F_{MSY}$.
- Biomass: Current spawning biomass is considered to be well below the interim target reference point of SB_{MSY}, however above the interim limit reference point of $0.4*SB_{MSY}$.
- Main fishing gear (average catch 2011–14):
    - Purse seine ≈33.8% (FAD associated school ≈21.7%; free swimming school ≈12.1%);
    - Longline ≈18.7% (frozen ≈4.6%, fresh ≈14.1%);
    - Handline ≈18.6%;
    - Gillnet ≈15.1%;
    - Trolling ≈6.8%;
    - Pole-and-line ≈4.9%; ≈Other 2.1%).
- Main fleets (Average catch 2011–14):
    - European Union ≈26% (EU, Spain ≈15%; EU, France ≈11%);
    - Maldives ≈11%;
    - Indonesia ≈10%;
    - I.R. Iran ≈9%;
    - Sri Lanka ≈9%;
    - Yemen ≈8%;
    - India ≈8%.

Concerning the target stock level, and noting that while B_{MSY}, B_{2014}, and B_0 are unknown, both SB_{2014}/SB_0 = 0.23 [0.21 – 0.36] and SB_{2014}/SB_{MSY} = 0.66 [0.58– 0.74] have been determined. Based on these values the best estimate of SB_{MSY}/SB_0 is 0.35 Resolution 13/10 provides that B_{LIM} = 0.40 B_{MSY} implying an SBLIM/SB_0 of 0.14. Noting that from CB2.3.3.4 a value of 0.20 might be more prudent. Against this more conservative (but consistent with CB2.3.3.4) standard the base case median estimate of SB relative to its unfished state is only 0.23 with an 80% CI [0.21 - 0.36], and the lower 80% confidence bound is just above the default value of 0. 20. For a 95% confidence interval, the lower bound is estimated to be 0.19

Therefore, taking account of the uncertainty associated with the base case status estimates, there is NOT high degree of certainty (i.e. greater than 95%, as set out in MSC CR CB2.2.1.3) that the stock is above the point where recruitment would be impaired – the default value for this being around 50% of the B_{MSY} level. Hence this does NOT meet (PI1.1.1a) SG80 or SG100. And while the current point estimate of SB_{2014}/SB_0 = 0.23 is above 0.2, the best that might be said is that it is likely that the stock is above the point where recruitment would be impaired. Hence this does meet SG60 but not SG80.

In 2015, three models were applied to the yellowfin tuna stock, all of which give qualitatively similar results. On the weight-of-evidence available in 2015, the yellowfin tuna stock is determined to be overfished and subject to overfishing. The stock status determination changed in 2015 as a direct result of the large and unsustainable catches of yellowfin tuna taken over the last three (3) years, and the relatively low recruitment levels estimated by the model in recent years. Therefore it cannot be concluded that stock is at or fluctuating around its target reference point and Hence this does NOT meet (PI 1.1.1b) SG60.

Reference points

For this stock, the target reference points have been set as ratios: B/B_{MSY} and F/F_{MSY}. This is reasonable and consistent with practice elsewhere as well as with MSC requirements. The reference points are estimated based on MSY and are appropriate for tuna stocks. MSY is estimated within the stock assessment and reported to the management system. The relation of the stock relative to MSY is reported as part of the determination of stock status: the (PI 1.1.2a) SG80 is met.

Resolution 13/10 sets interim target (B_{MSY} and F_{MSY}) and limit (B_{LIM} = 0.40 B_{MSY} and F_{LIM} = 1.40 F_{MSY}) reference points for yellowfin tuna. No rationale is available to support these choices. Concerning the target stock level, and noting that while B_{MSY}, B_{2010}, and B_0 are unknown, both SB_{2014}/SB_0 and SB_{2014}/SB_{MSY} have been determined. Based on these values the best estimate of SB_{MSY}/SB_0 is 0.35 Resolution 13/10 provides that B_{LIM} = 0.40 B_{MSY} implying an SB_{LIM}/SB_0 of 0.12. Noting CB2.3.3.4, a value of 0.20 might be more prudent. Although the IOTC has yet to adopt a specific limit reference point, management advice is provided relative to MSY as a target. The default 50% B_{MSY} is assumed here for purposes of defining stock status. However, the lack of a well-defined point indicates that the (PI 1.1.2b) SG80 is not met.

Finally, on the weight-of-evidence available in 2015, the yellowfin tuna stock is determined to be overfished and subject to overfishing. Consequently it cannot be concluded that the target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.

Evidence of stock rebuilding within a specified timeframe

In 2015, three models were applied to the yellowfin tuna stock, all of which give qualitatively similar results. Stock status is based on the Stock Synthesis III model formulation. On the weight-of-evidence available in 2015, the yellowfin tuna stock is determined to be overfished and subject to overfishing. The stock status determination changed in 2015 as a direct result of the large and unsustainable catches of yellowfin tuna taken over the last three (3) years, and the relatively low recruitment levels estimated by the model in recent years. The WPTT concluded that the IOTC **does not currently have any Conservation and Management Measures in place, other than the FAD limitation measure (Resolution 15/08, which is yet to be evaluated) to regulate the fisheries for yellowfin tuna.**

On the basis of the foregoing it must be concluded that it cannot be shown that the there is evidence of stock rebuilding within a specified timeframe

Harvest Strategy

The concept of a Harvest Strategy is clearly defined in MSC-MSCI Vocabulary V 1.0, 1st October 2014. It is "the combination of i) monitoring, ii) stock assessment, iii) harvest control rules and iv) management actions, which may include an MP or an implicit MP and be tested by MSE." The critical issue is the presence of the four elements (monitoring, stock assessment, harvest control rules and management actions).

While neither a Management Procedure (MP or implicit MP) or the undertaking of a full MSE are absolutely required, it is noteworthy that the IOTC has committed to undertake full MSE and on that basis has described its limit and target reference points as Interim.

None the less, it is the absence of the last two elements, harvest and control rules and management actions that are of most concern. Firstly there is no clearly defined HCR for this fishery. That is to say, the assessment team cannot provide objective evidence of well-defined pre-agreed rules or actions used by the Indian Ocean Tuna Commission (IOTC) for determining a management action in response to changes in indicators of stock status with respect to reference points. And while IOTC resolution 12/01 does provide an approach it is none-the-less just an initial step on the path towards fully developing harvest control rules and, ultimately, a harvest strategy.

Likewise while IOTC resolution 13/10 (part 4) does establish the basis of a harvest strategy and specifies that t*he Scientific Committee shall develop and assess potential harvest control rules (HCRs) to be applied, considering the status of the stocks against reference points,* these are currently not in place.

In addition the Scientific Committee concluded in their 2015 report that the IOTC does not currently have any Conservation and Management Measures in place, other than the FAD limitation measure (Resolution 15/08, which is yet to be evaluated) to regulate the fisheries for yellowfin tuna.

Harvest control rules and tools

Harvest control rules for this stock are not well-defined and there is no specific plan of control if the stock size falls below the trigger point (MSY). There is, however, evidence of an intention to end overfishing and rebuild this stock should depletion occur and the scientific committee is called on to provide such advice. Therefore there are generally understood

harvest rules in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached meeting the SG60. However these are neither well defined nor have they been tested to ensure that the exploitation rate is reduced as limit reference points are approached; consequently the (PI 1.2.2a) SG80 is not met.

As the current, interim, framework does not include well-defined harvest control rules or specific guidance on management it then it cannot be said that selection of the harvest control rules takes into account the main uncertainties. Rather it must be concluded that the (PI 1.2.2b) SG80 has not been met.

In 2015 the WPTT concluded that the IOTC does not currently have any Conservation and Management Measures in place, other than the FAD limitation measure (Resolution 15/08, which is yet to be evaluated) to regulate the fisheries for yellowfin tuna. Hence it must be concluded that the (PI 1.2.2c) SG60 has not been met.

Information and monitoring

Yellowfin data in the Indian Ocean are comprehensive, informative and relevant. These data consider (a) stock structure, (c) fleet composition (d) stock abundance (mainly standardised CPUE series) (e) fishery removals, and (f) other data and provide information on the spatial distribution of catches, their size frequencies, results of tagging studies as well as growth and mortality models. The data are adequate to allow appropriate stock assessments and to evaluate the status of the stock against target and limit reference points. In addition environmental data are used in CPUE standardization and to help explain recruitment. Stock structure data while limited are consistent with an Indian Ocean-wide stock.

Overall, data are adequate for stock assessment and for an appropriate harvest control rule, and thus meet the (P1 1.2.3a) SG80.

However, despite the best efforts of the IOTC secretariat it remains the case that i) issues remain with some of these data and ii) there are information gaps such that it cannot be concluded that this information constitutes a comprehensive range of information. Consequently the data do not presently allow the implied harvest control rule to be applied with a high degree of certainty, so the (P1 1.2.3a) SG100 is not met.

IOTC has put considerable effort into the reporting and recording of catches by the contracting parties. These are summarised in the following resolutions:

- 13/03 On the recording of catch and effort data by fishing vessels in the IOTC area of competence
- 11/04 On a regional observer scheme
- 10/02 Mandatory statistical requirements for IOTC Members & Cooperating Non-Contracting Parties
- 10/08 Concerning a record of active vessels fishing for tunas and swordfish in the IOTC area
- 10/09 Concerning the functions of the Compliance Committee
- 06/03 On establishing a vessel monitoring system programme
- 03/03 Concerning the amendment of the forms of the IOTC statistical documents

In addition the IOTC secretariat puts considerable effort into considering any issues identified relating to the statistics of tropical tunas. This list covers the main issues that the Secretariat considers affect the quality of the statistics available at the IOTC, by type of dataset and type of fishery. Specifically it includes issues relating to non-reporting of fishery removals and attempts to rectify or estimate these.

Standardized CPUE indices are available from several fleets. Tagging data is also available. Together these are considered are adequate for the harvest strategy.

While indicators of stock abundance - mainly standardised catch-per-unit-effort indices – are available, a single index covering the entire time series is not available.

While data are sufficient to meet (PI 1.2.3b) SG80 they do not presently allow the implied harvest control rule to be used with great confidence, preventing the SG100 being met.

Finally, IOTC Resolution 13/03 requires that all purse seine, longline, gillnet, pole and line, handline and trolling fishing vessels over 24 metres length overall and those under 24 metres if they fish outside the EEZs of their flag States within the IOTC area of competence to keep a bound paper or electronic logbook and to record, inter alia, the weight (kg) or number by species per set/shot/fishing event for each of a comprehensive list of species. For purse seine, this includes IOTC species, marine turtles, marine mammals, sharks, rays and other bony fish.

It is apparent that IOTC has put considerable effort into the recording and reporting of catches and that the current level of reporting is adequate given the large number of small countries involved and the difficult task of monitoring small vessels often far away or on the high seas. Overall, data are sufficient to meet the (PI 1.2.3 d) SG80.

Assessment of stock status

The primary assessment tool for Indian Ocean yellowfin is Synthesis III model which incorporates multiple fisheries, gears, growth and selectivity models and spatial variability. Alternative model structures have been explored and sensitivity testing has been conducted; this has considered both model structure and uncertainty. The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery. The model is able to make use of the available data, meeting the (PI 1.2.4a) SG100.

The assessment estimates stock status relative to reference points and SB_{2014}/SB_{MSY} and F_{2014}/F_{MSY} are presented as point estimates with 80% confidence intervals, meeting the (PI 1.2.4b) SG60.

In 2015, the WPTT undertook projections of yellowfin tuna stock status under a range of management scenarios, following the recommendation of both the Kobe process and the Commission (to harmonise technical advice to managers across RFMOs by producing Kobe II management strategy matrices).

The stock assessment methods used in the analysis of this stock report uncertainty in estimates of stock status. These uncertainties have also been examined as alternative model structures. Similarly the stock status associated with these alternatives have been evaluated in a probabilistic manner. The use of probability in the management advice allows risk to be taken into account in the decision making, meeting the (PI 1.2.4c) SG100.

In 2015, three models were applied to the yellowfin tuna stock in the IOTC area of competence, a BBPM, SCAA and Stock Synthesis III model, aland while all 3 models gave qualitatively similar results there has not been a systematic testing of the assessment. Nor have alternative hypotheses and assessment approaches have been rigorously explored, preventing the (PI1.2.4d) SG100 being met.

The most recent stock assessment (IOTC-2015-WPTT17-R[E]) included an invited expert, Dr Simon Hoyle, New Zealand, both prior to and during the WPTT meeting which contributed greatly to the group's understanding of tropical tuna data, CPUE standardisation and assessment methods. Thus whereas there is clearly a degree of peer review (i.e. national scientists and invited experts review the work) that meets SG80 it is not clearly apparent that this review was externally reviewed and, on that basis, cannot be said to have met (PI 1.2.4e) SG100.

3.2.3 Bigeye tuna

Stock status

No new stock assessment was carried out for bigeye tuna in 2014 or 2015, thus, the stock status is currently determined on the basis of the 2013 assessment and other indicators presented in 2015.

The most recently agreed stock status estimate is therefore based on the base case stock assessment conducted at the Fifteenth Session of the IOTC Working Party on Tropical Tunas held in San Sebastian, Spain, 23–28 October 2013. Report IOTC–2013–WPTT15–R[E].

The 2013 Bigeye stock assessment model results did not differ substantively from the previous (2010 and 2011) assessments; however, the final overall estimates of stock status differ somewhat due to the revision of the catch history and updated standardised CPUE indices. All the runs (except 2 extremes) carried out in 2013 indicate the stock is above a biomass level that would produce MSY in the long term (i.e. $SB_{2012}/SB_{MSY} > 1$) and in all runs that current fishing mortality is below the MSY-based reference level (i.e. $F_{2012}/F_{MSY} < 1$).

- On the weight-of-evidence available in 2015, the bigeye tuna stock is determined to be not overfished and is not subject to overfishing.
- If catch remains below the estimated MSY levels, then immediate management measures are not required. However, continued monitoring and improvement in data collection, reporting and analysis is required to reduce the uncertainty in assessments.

Concerning the target stock level, and noting that while B_{MSY}, B_{2010}, and B_0 are unknown, both SB_{2012}/SB_{1952} (=SB_0) = 0.4 [0.27 – 0.54] and SB_{2012}/SB_{MSY} = 1.44 [0.87 – 2.22] have been determined. Based on these values the best estimate of SB_{MSY}/SB_0 is 0.28. Resolution 13/10 provides that B_{LIM} = 0.50 B_{MSY} implying an SB_{LIM}/SB_0 of 0.14. Noting CB2.3.3.4, a value of 0.21, (B_{LIM} = 0.75 B_{MSY}) might be more prudent. However, even against this more conservative (but consistent with CB2.3.3.4) standard the base case median estimate of SB relative to its unfished state is 0.40 [0.27-0.38], where even the lower 95% confidence bound is well above the default value of 0.21. Therefore, taking account of the uncertainty associated with the base case status estimates, there is a high degree of certainty (i.e. greater than 95%, as set out in MSC CR CB2.2.1.3) that the stock is above the point where

recruitment would be impaired – the default value for this being around 50% of the B_{MSY} level. This meets (PI 1.1.1a) SG100.

The current estimate of SB_{2012}/SB_{MSY} is 1.44 [0.87 – 2.22]. When other model approaches are used, as shown fin the Kobe plot, the high degree of confidence is maintained. That is, a) the Kobe plot shows that, based on the trajectory of the median of 12 plausible model options (purple points) the stock has always been above the target level; and b) based on the trajectory of the all 12 plausible model options there is no evidence to suggest that the stock has not been above or fluctuating around the target in recent years. The latter is necessary in order to have a high degree of certainty i.e. greater than 95%, as set out in MSC CR CB2.2.1.3. This meets (PI 1.1.1b) SG100

Limit and target reference points

For this stock, the target reference points have been set as ratios: B/B_{MSY} and F/F_{MSY}. This is reasonable and consistent with practice elsewhere as well as with MSC requirements. The reference points are estimated based on MSY and are appropriate for tuna stocks. MSY is estimated within the stock assessment and reported to the management system. The relation of the stock relative to MSY is reported as part of the determination of stock status: the (PI 1.1.2a) SG80 is met.

Resolution 13/10 sets interim target (B_{MSY} and F_{MSY}) and limit (B_{LIM} = 0.50 B_{MSY} and F_{LIM} = 1.30 F_{MSY}) reference points for bigeye tuna. No rationale is available to support these choices. As noted earlier, while $B_{MSY,}$ B_{2012}, and B_{1952} (=B_0) are unknown, both SB_{2012}/SB_{1952} (=SB_0) = 0.4 [0.27 – 0.54] and SB_{2012}/SB_{MSY} = 1.44 [0.87 – 2.22] have been determined. Based on these values the best estimate of SB_{MSY}/SB_0 is 0.28. Resolution 13/10 provides that B_{LIM} = 0.50 B_{MSY} implying an SB_{LIM}/SB_0 of 0.14. This is a low value to use without explanation and appears inconsistent with MSC requirements that specify that if the target reference point is analytically determined to be below 40% B_0, and there is no analytically determined limit reference point, then the default value of B_{LIM} should be 20% B_0. Alternatively, were SB_{MSY}/SB_0 < 0.27 then the default LRP should be 75%B_{MSY} implying SB_{LIM}/SB_0 = 0.21. Although the IOTC has yet to adopt a specific limit reference point, management advice is provided relative to MSY as a target. The default 50% B_{MSY} is assumed here for purposes of defining stock status. However, the lack of a well-defined point indicates that the (PI 1.1.2b) SG80 is not met.

In respect of the target reference point, while clearly the intention of the IOTC (management response) and the basis on which scientific advice is supplied is to maintain the stock at or above the MSY level, and although an interim target reference point is defined at a level consistent with B_{MSY} – thus meeting (PI 1.1.2c) SG80 - a more precise definition, justified through scientific analysis and research, is not currently available. This would be necessary before the higher guidepost could be met.

Harvest Strategy

The concept of a Harvest Strategy is clearly defined in MSC-MSCI Vocabulary V 1.0, 1st October 2014. It is “the combination of i) monitoring, ii) stock assessment, iii) harvest control rules and iv) management actions, which may include an MP or an implicit MP and be tested by MSE.” The critical issue is the presence of the four elements (monitoring, stock assessment, harvest control rules and management actions).

While neither a Management Procedure (MP or implicit MP) or the undertaking of a full MSE are absolutely required, it is noteworthy that the IOTC has committed to undertake full MSE and on that basis has described its limit and target reference points as Interim.

None the less, it is the absence of the last two elements, harvest and control rules and management actions that are of most concern. Firstly there is no clearly defined HCR for this fishery. That is to say, the assessment team cannot provide objective evidence of well-defined pre-agreed rules or actions used by the Indian Ocean Tuna Commission (IOTC) for determining a management action in response to changes in indicators of stock status with respect to reference points. And while IOTC resolution 12/01 does provide an approach it is none-the-less just an initial step on the path towards fully developing harvest control rules and, ultimately, a harvest strategy.

Likewise while IOTC resolution 13/10 (part 4) does establish the basis of a harvest strategy and specifies that the Scientific Committee shall develop and assess potential harvest control rules (HCRs) to be applied, considering the status of the stocks against reference points, these are currently not in place.

In addition the Scientific Committee concluded in their 2015 report that the IOTC does not currently have any Conservation and Management Measures in place, other than the FAD limitation measure (Resolution 15/08, which is yet to be evaluated) to regulate the fisheries for yellowfin tuna. It must be concluded that the same situation pertains to bigeye management.

Harvest control rules and tools

Harvest control rules for this stock are not well defined and there is no specific plan of control if the stock size falls below the trigger point (MSY). There is, however, evidence of an intention to end overfishing and rebuild this stock should depletion occur and the scientific committee is called on to provide such advice. Therefore while it might be argued that there are generally understood harvest rules in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached (thus meeting the SG60), these are neither well defined nor have they been tested to ensure that the exploitation rate is reduced as limit reference points are approached. On balance it must be argued that well defined and effective harvest control rules are NOT in place for this stock.

As the current, interim, framework does not include well-defined harvest control rules or specific guidance on management it then it cannot be said that selection of the harvest control rules takes into account the main uncertainties. Rather it must be concluded that the (PI 1.2.2b) SG80 has not been met.

Finally, noting that the biomass of this stock has, to date, remained above the target reference point and there has not been any occasion where a level of control in response to excess fishing pressure has been demonstrated. None-the-less, as with the WPTT's assessment of the current status of Conservation and Management Measures in place for yellowfin fisheries, it must be concluded that for this fishery too, the IOTC does not currently have any Conservation and Management Measures in place, other than the FAD limitation measure (Resolution 15/08, which is yet to be evaluated) to regulate fisheries for bigeye And while there is some evidence that some IOTC members have controlled their own catches in an effective manner, suggesting the possibility of meeting the (PI 1.2.2c)

SG60, nevertheless, there are as of yet no harvest control rules at the IOTC level and, thus, no evidence that the tools are effective, so the SG80 cannot be met.

Information and monitoring

Bigeye data in the Indian Ocean are comprehensive, informative and relevant. These data consider (a) stock structure, (c) fleet composition (d) stock abundance (mainly standardised CPUE series) (e) fishery removals, and (f) other data and provide information on the spatial distribution of catches, their size frequencies, results of tagging studies as well as growth and mortality models. The data are adequate to allow appropriate stock assessments and to evaluate the status of the stock against target and limit reference points. In addition environmental data are used in CPUE standardization and to help explain recruitment. Stock structure data while limited are consistent with an Indian Ocean-wide stock.

Overall, data are adequate for stock assessment and for an appropriate harvest control rule, and thus meet the SG80. However, despite the best efforts of the IOTC secretariat it remains the case that i) issues remain with some of these data and ii) there are information gaps such that it cannot be concluded that this information constitutes a comprehensive range of information. Consequently the data do not presently allow the implied harvest control rule to be applied with a high degree of certainty, so the (PI 1.2.3a) SG100 is not met.

IOTC has put considerable effort into the reporting and recording of catches by the contracting parties. These are summarised in the following resolutions:

- 13/03 On the recording of catch and effort data by fishing vessels in the IOTC area of competence
- 11/04 On a regional observer scheme
- 10/02 Mandatory statistical requirements for IOTC Members & Cooperating Non-Contracting Parties
- 10/08 Concerning a record of active vessels fishing for tunas and swordfish in the IOTC area
- 10/09 Concerning the functions of the Compliance Committee
- 06/03 On establishing a vessel monitoring system programme
- 03/03 Concerning the amendment of the forms of the IOTC statistical documents

In addition the IOTC secretariat puts considerable effort into considering any issues identified relating to the statistics of tropical tunas. This list covers the main issues that the Secretariat considers affect the quality of the statistics available at the IOTC, by type of dataset and type of fishery. Specifically it includes issues relating to non-reporting of fishery removals and attempts to rectify or estimate these.

Standardized CPUE indices are available from several fleets. Tagging data is also available. Together these are considered are adequate for the harvest strategy.

While indicators of stock abundance - mainly standardised catch-per-unit-effort indices – are available, a single index covering the entire time series is not available.

While data are sufficient to meet (PI 1.2.3b) SG80 they do not presently allow the implied harvest control rule to be used with great confidence, preventing the SG100 being met.

Finally, IOTC Resolution 13/03 requires that all purse seine, longline, gillnet, pole and line, handline and trolling fishing vessels over 24 metres length overall and those under 24 metres if they fish outside the EEZs of their flag States within the IOTC area of competence to keep a bound paper or electronic logbook and to record, inter alia, the weight (kg) or number by species per set/shot/fishing event for each of a comprehensive list of species. For purse seine, this includes IOTC species, marine turtles, marine mammals, sharks, rays and other bony fish.

It is apparent that IOTC has put considerable effort into the recording and reporting of catches and that the current level of reporting is adequate given the large number of small countries involved and the difficult task of monitoring small vessels often far away or on the high seas. Overall, data are sufficient to meet the (PI 1.2.3 d) SG80.

Assessment of stock status

A variety of methods including ASAP, ASPM and SS3 have been used to model this stock. It is clear that care has been taken to ensure that the assessment is appropriate for the stock and for the harvest strategy (and implied HCRs) and takes into account the major features relevant to the biology of the species and the nature of the fishery. Alternative models are explored. Overall the assessment Is appropriate for the stock and for the harvest control rule and thus meets the SG80. However there remain issues with some parameters that could impact the current of stock status. As such the assessment does not take into account all major features relevant to biology of the species and the nature of the fishery and, consequently, has not achieved (PI 1,2,4a) SG100.

The assessment estimates stock status relative to reference points and SB_{2012}/SB_{MSY} (rather than B_{2012}/B_{MSY}) and F_{2010}/F_{MSY} are presented as point estimates with 95% confidence intervals, meeting the (PI 1.2.4b) SG60.

IOTC–2013–WPTT15 Reports that the WPTT NOTED that a range of quantitative modelling methods (ASAP, ASPM and SS3) were applied to bigeye tuna in 2013 and provide an overview of the key features of each of the three stock assessments a summary of the assessment results. The WPTT also noted the value of comparing different modelling approaches evaluating alternative hypothesis about the quality of the data used. Evaluating and validating the data is integral in the assessment, as fitting to alternative CPUE indices and assuming different model structures can have a large influence on the assessments.

Hence, stock assessment methods have been use report uncertainty in estimates of stock status. Likewise uncertainties have been examined as alternative model and the stock status associated with these alternatives have been evaluated in a probabilistic manner by weighting of the alternatives. While these weightings may not be rigorous they represent a consensus of experts on the relative importance. These have then been presented as Kobe plots and a Kobe strategy matrix. However, given the type of uncertainties in the model, it is not possible for the assessment to provide probabilistic management advice suitable to take account of risk. Therefore, while the (PI 1.2.4c) SG80 is met, but not the SG100.

While a range of quantitative modelling methods (ASAP, ASPM and SS3) were applied to bigeye tuna in 2013 – constituting a degree of testing – there has not been a systematic testing of the assessment. Nor have alternative hypotheses and assessment approaches have been rigorously explored, preventing the (PI 1.2.4d) SG100 being met.

The stock assessment of bigeye is primarily reviewed through the Working Party for Tropical Tunas of the IOTC's Scientific Committee. Additionally, outside experts are invited to participate in the Working Party meetings. Thus whereas there is clearly a degree of peer review that meets SG80 it is not clearly apparent that this review was externally reviewed and, on that basis, cannot be said to have met (PI 1.2.4e) SG100.

3.3 PRINCIPLE TWO: ECOSYSTEM IMPACTS

3.3.1 Overview of the aquatic ecosystem

The WIO is characterised by a seasonally reversing monsoon wind system that dominates the ocean climate north of 25º South. During the boreal winter when the northeast monsoon is established, a general westward flow close to the equator develops into an overall southward coastal current along the east African coast. During the southwest monsoon, the general circulation in the Arabian Sea reverses northward, with strong winds along the coast of Arabia towards the Indian sub-continent, shifting towards the east and generating upwelling along the coastal areas and an energetic eddy field.

The most characteristic of these eddies is the Great Whirl, occurring off the east coast of Somalia, a clockwise circulation pattern, appearing around May and extending until a month after the winds have died, lasting on average 166 days per year with strong surface currents (up to 2.5 t/sec)[5]. A second, smaller eddy, known as the Socotra eddy, often accompanies the Great Whirl. These meso-scale processes bring increased nutrient supply to the upper layer during the monsoon seasons, contributing to the growth of phytoplankton blooms twice a year[6]. The upwelling associated with these processes creates an area of intense biological productivity from the coast of Somalia to the Gulf of Oman; this feature is continuous with an offshore region. In the northern Arabian Sea, north of 15º north, the high biological productivity results in a depleted oxygen content at a relative shallow depth, a limiting factor in the distribution of some species.

Another characteristic of the WIO is a relatively shallow thermocline, usually at 50-100 metres (m), which compares with the eastern Indian Ocean (EIO) where the thermocline is more than 100 m in the area from Sumatra to Sri Lanka[7].

Episodes of anomalous oceanographic and atmospheric conditions affect the WIO at irregular intervals. There are effects related with El Niño Southern Oscillation (ENSO) events in the Pacific, although the timing, intensity and modality of the Indian Ocean ENSO are not necessarily synchronised with the ENSO events in the Pacific Ocean. The Indian Ocean dipole is an atmospheric anomaly that could be associated with the ENSO, and which is characterised by warmer than usual surface waters, a deeper thermocline and a reduced primary productivity in the WIO, a pattern that is reversed in the EIO[8]. The three most important dipole events in recent times took place in 1998, 2003 and 2006-7, with more pronounced effects when they coincide with an ENSO event.

Another atmospheric event that has been documented is moving sea-surface temperature anomalies, known as Madden-Julian Oscillation (MJO), promoting strong air-ocean interactions in a zone known as the Seychelles-Chagos Thermocline Ridge (SCTR). The SCTR is characterised by high surface temperature and a shallow thermocline, and anomalies such as the MJO have been reported as having a strong influence on the distribution of the fisheries.

[5] Beal & Donohue, 2013.
[6] Resplandy et al., 2011.
[7] Longhurst, 1998.
[8] Marsac, 2008.

3.3.2 Status and management of primary non-target species

Primary species, in accordance with "General requirements for Principle 2" (FCR,SA3.1), are those "*species where management tools and measures are in place, intended to achieve stock management objectives reflected in either limit or target reference points*."

Of the four tuna species effectively managed by IOTC, only albacore is considered as a non-target species. It represents only 0.075% of the Seychelles-flagged purse seine fleet catch in 2014 and is therefore considered not to be impacted by these fisheries.

There are no other managed species that might be considered under P2.1

3.3.3 Status and management of secondary non-target species

Secondary species are "*species in the catch that are within scope of the MSC program but are not covered under P1 because they are not included in the Unit of Assessment"* and are not included as primary species (see Section 0) as they are not subject to management. Furthermore, they are also assigned main secondary species because they represent more than 2% or 5% (according to their respective resilience) of the UoA catch.

Table 12 below presents the classification of secondary non-target species.

Table 12: Classification of non-target species per UoA

Element		UoA A: Free-school purse seine tuna fishery	UoA B: FAD-dependent purse seine tuna fishery
Secondary	Main (>5% of catch)	• Bullet tuna (*Auxis rochei*) • Frigate tuna (*Auxis thazard*) • Blue marlin (*Makaira nigricans*) • Rainbow runner (*Elagatis bipinnulata*) • Silky shark (*Carcharhinus falciformis*)	• Bullet tuna (*Auxis rochei*) • Frigate tuna (*Auxis thazard*) • Blue marlin (*Makaira nigricans*) • Rainbow runner (*Elagatis bipinnulata*) • Silky shark (Carcharhinus falciformis) • Common dolphinfish (*Coryphaena hippurus*)
	Minor (<5% of catch)	• Common dolphinfish (*Coryphaena hippurus*) • Wahoo (*Acanthocybium solandri*) • Spotted oceanic trigger fish (*Canthidermis maculatus*) • Kawakawa (*Euthynnus affinis*)	• Wahoo (*Acanthocybium solandri*) • Spotted oceanic trigger fish (*Canthidermis maculatus*) • Kawakawa (*Euthynnus affinis*)

It should be noted that the species mix of the bycatch is essentially the same across both UoAs. The only difference is that the common dolphinfish is composes more than 5% of the bycatch composition in FAD-associated fisheries and is therefore considered a 'main' secondary species for this UoA.

The only two secondary species listed above that have had a formal stock assessment are the kawakawa and the blue marlin. Therefore, the majority of these secondary main species will be assessed through a Productivity Susceptibility Analysis (PSA) in accordance with the criteria presented **Appendix C** in order to get PSA scores and MSC PSA-derived scores.

Bullet tuna (Auxis thazard)

Stock status: No quantitative stock assessment is currently available for frigate tuna in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock status indicators have been used by IOTC. According to the latest IOTC WPNT, aspects of the fisheries for frigate tuna combined with the lack of data on which to base a more formal assessment are a cause for considerable concern. Stock status in relation to IOTC's B_{MSY} and F_{MSY} target reference points remains uncertain, indicating that a precautionary approach to the management of frigate tuna should be applied.

This said, a PSA analysis conducted for the combined purse seine, gill net and longline fisheries in the Indian Ocean suggests that the species is generally robust and its high productivity outweighs its susceptibility to these gears, indicating it might achieve a score of >80 in a risk-based analysis (see Error! Reference source not found.).

Total annual catches for frigate tuna have increased substantially in recent years with peak catches taken in 2013 (~98,565 t). There is insufficient information to evaluate the effect that this level of catch, or a further increase in catch may have on the resource. Research emphasis on improving indicators and exploration of stock structure and stock assessment approaches for data poor fisheries should be considered a high priority for this species.

The following was also noted by the 5th Session (2015) of the IOTC Working Party on Neritic Tunas:

- The MSY estimate for the whole Indian Ocean is unknown.
- Species identification, data collection and reporting urgently need to be improved.
- Reconstruction of the catch history needs to occur before a reliable assessment can be attempted.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.

Management: this species is not currently managed.

Information: there is insufficient information available on the catches of this species.

Indian Ocean bullet tuna (Auxis rochei)

Stock status: No quantitative stock assessment is currently available for bullet tuna in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock status indicators have been used by IOTC used. According to the latest IOTC WPNT, aspects of the fisheries for frigate tuna combined with the lack of data on which to base a more formal assessment are a cause for considerable concern. The stock status in relation to IOTC's B_{MSY} and F_{MSY} target reference points remains uncertain, indicating that a precautionary approach to the management of bullet tuna should be applied.

This said, a PSA analysis conducted for the combined purse seine, gill net and longline fisheries in the Indian Ocean suggests that the species is generally robust and its high productivity outweighs its susceptibility to these gears, indicating it might achieve a score of >80 in a risk-based analysis (see Error! Reference source not found.).

Table 13: PSA scores for secondary species (excluding kawakawa and blue marlin)

			Productivity Scores [1-3]									Susceptibility Scores [1-3]						Cumulative only						
Scientific name	Common name	Fishery descriptor	Average age at maturity	Average max age	Fecundity	Average max size	Average size at Maturity	Reproductive strategy	Trophic level	Density Dependance	Total Productivity (average)	Availability	Encounterability	Selectivity	Post-capture mortality	Total (multiplicative)	PSA Score	Catch (tons)	Weighting	Weighted Total	Weighted PSA Score	MSC PSA-derived score	Risk Category Name	MSC scoring guidepost
Auxis thazard	Frigate tuna	Purse seine	1	1	1	1	1	1	3		1.29	3	3	3	3	3.00	3.26	10,977	0	1	2.59	93	Low	≥80
Auxis thazard	Frigate tuna	Longline	1	1	1	1	1	1	3		1.29	3	2	1	3	1.43	1.92	2,960	0	0	2.59			
Auxis thazard	Frigate tuna	Gillnet	1	1	1	1	1	1	3		1.29	1	2	2	3	1.28	1.81	35,811	1	1	2.59			
Auxis rochei	bullet mackerel	Purse seine	1	1	1	1	1	1	3		1.29	3	3	3	3	3.00	3.26	513	0	0	2.59	95	Low	≥80
Auxis rochei	bullet mackerel	Longline	1	1	1	1	1	1	3		1.29	3	2	1	3	1.43	1.92	2,975	0	1	2.59			
Auxis rochei	bullet mackerel	Gillnet	1	1	1	1	1	1	3		1.29	1	2	2	3	1.28	1.81	2,554	0	1	2.59			
Elagatis bipinnulata	Rainbow runner	Purse seine	1	1	1	2	2	1	3		1.57	3	3	3	3	3.00	3.39	500	0	1	3.10	73	Med	60-79
Elagatis bipinnulata	Rainbow runner	Longline	1	1	1	2	2	1	3		1.57	3	3	3	3	3.00	3.39	554	0	1	3.10			
Elagatis bipinnulata	Rainbow runner	Gillnet	1	1	1	2	2	1	3		1.57	1	2	2	3	1.28	2.02	696	0	1	3.10			
Coryphaena hippurus	Dolphinfish	Purse seine	1	1	1	2	2	1	3		1.57	3	3	3	3	3.00	3.39	1,500	0	1	3.10	78	Med	60-79
Coryphaena hippurus	Dolphinfish	Longline	1	1	1	2	2	1	3		1.57	3	3	3	3	3.00	3.39	1,552	0	1	3.10			
Coryphaena hippurus	Dolphinfish	Gillnet	1	1	1	2	2	1	3		1.57	1	2	2	3	1.28	2.02	3,096	1	1	3.10			
Acanthocybium solandri	Wahoo	Purse seine	1	1	1	1	2	1	3		1.43	3	3	3	3	3.00	3.32	1	0	0	3.03	95	Low	≥80
Acanthocybium solandri	Wahoo	Longline	1	1	1	1	2	1	3		1.43	3	3	3	3	3.00	3.32	45	0	0	3.03			
Acanthocybium solandri	Wahoo	Gillnet	1	1	1	1	2	1	3		1.43	1	2	2	3	1.28	1.91	986	1	2	3.03			
Canthidermis maculatus	Oceanic triggerfish	Purse seine	1	1	2	1	1	2	3		1.57	3	3	3	3	3.00	3.39	310	1	2	3.14	62	Med	60-79
Canthidermis maculatus	Oceanic triggerfish	Longline	1	1	2	1	1	2	3		1.57	3	3	3	3	3.00	3.39	165	0	1	3.14			
Canthidermis maculatus	Oceanic triggerfish	Gillnet	1	1	2	1	1	2	3		1.57	2	2	2	3	1.58	2.22	126	0	0	3.14			
Carcharhinus falciformis	Silky shark	Purse seine	2	2	3	3	3	3	3		2.71	3	3	3	3	3.00	4.05	310	1	2	3.73	32	High	<60
Carcharhinus falciformis	Silky shark	Longline	2	2	3	3	3	3	3		2.71	3	3	2	3	2.33	3.57	165	0	1	3.73			
Carcharhinus falciformis	Silky shark	Gillnet	2	2	3	3	3	3	3		2.71	2	2	2	3	1.58	3.14	126	0	1	3.73			

Sources: Productivity: Fishbase and supporting papers; Catch: IOTC database (2014)

The total annual catches for bullet tuna over the past three years have ranged between 8,400 t and 9,000 t. There is insufficient information to evaluate the effect that this level of catch, or an increase in catch may have on the resource. Research emphasis on improving indicators and exploration of stock structure and stock assessment approaches for data poor fisheries should be considered a high priority for this species.

The following was also noted by the 5th Session (2015) of the IOTC Working Party on Neritic Tunas:

- The MSY estimate for the whole Indian Ocean is unknown.
- Species identification, data collection and reporting urgently need to be improved.
- Reconstruction of the catch history needs to occur before a reliable assessment can be attempted.
- Limit reference points: IOTC has not adopted limit reference points for any of the neritic tunas under its mandate.

Management: this species is not currently managed.

Information: there is insufficient information available on the catches of this species.

Blue marlin (Makaira nigricans)

Stock status: the last stock assessment for blue marlin was undertaken by IOTC in 2013. The standardised longline CPUE series indicate a decline in abundance in the early 1980s, followed by a constant or slightly increasing abundance over the last 20 years. In 2013, an ASPIC stock assessment that indicated that the stock was subject to overfishing in the past which reduced the stock biomass to below the B_{MSY} level. Total reported landings increased substantially in 2012 to 16,969 t, well above the MSY estimate of 11,690 t. In 2013 and 2014 reported catches declined slightly to 14,521 t and 14,495 t respectively, still above the MSY level. Given the high catches over the last three years, that are well above the MSY level, the stock is likely to have moved to a state of being subject to overfishing. However, the impact that these increased catches is likely to have on biomass is uncertain. Thus, on the weight-of evidence available, the **stock status remains overfished but not subject to overfishing** (Report of the 13th Session of the IOTC Working Party on Billfish held in Olhão, Portugal, 1–5 September 2015).

The following was also noted by the 13th Session (2015) of the IOTC Working Party on Billfish:

- The MSY estimate for the whole Indian Ocean is 11,700 t (estimated range 8,023–12,400 t).
- Provisional reference points: Although the Commission adopted reference points for swordfish in Resolution 15/10 on target and limit reference points and a decision framework, no such interim reference points, nor harvest control rules have been established for blue marlin.

Management: this species is not currently managed. The IOTC recommends that a precautionary approach to the management of blue marlin should be considered by the Commission, to reduce catches below MSY estimates (~11,000 t), thereby ensuring the stock does not remain

below B_{MSY} (overfished). In IOTC Resolution 15/05, CPCs are encouraged to reduce in 2016 the level of catches, where the baseline is the average catches for the period between 2009 and 2014.

Information: IOTC recognised that the uncertainty in the data available for assessment purposes and the CPUE series suggests that their advice should be interpreted with caution as the stock may be in an overfished state (biomass less than B_{MSY}). Given that reported catches over the last two years have been well in excess of the MSY levels recommended, fishing effort is likely to be a serious concern, suggesting the stock may have moved back to a subject to overfishing status. The limited data being reported for gillnet fisheries, and the importance of sports fisheries for this species, require efforts to be made to rectify these information gaps urgently. It is likely that there is a low risk of exceeding MSY-based reference points by 2015 if catches are maintained at 2011 levels.

Kawakawa (Euthynnus affinis)

Stock status: IOTC's analysis using a stock-reduction analysis for a second year indicates that the stock is near optimal levels of F_{MSY}, and stock biomass is near the level that would produce MSY (B_{MSY}). Due to the quality of the data being used, the simplistic approach employed in 2015, combined with the rapid increase in kawakawa catch in recent years, measures need to be taken to slow the increase in catches in the IOTC area of competence. Based on the weight-of-evidence available to the WPNT, the kawakawa stock for the whole Indian Ocean is classified as ***not overfished*** and ***not subject to overfishing***. A separate analysis done on a sub-population (north-west Indian Ocean region) in 2014 indicated that that stock may be experiencing overfishing, although spawning biomass is likely to be above the level to produce MSY. There remains considerable uncertainty about stock structure and about the total catches.

The following was also noted by the 5th Session (2015) of the IOTC Working Party on Neritic Tunas:

- The MSY estimate for the whole Indian Ocean is estimated to be between 125,000 and 188,000 t and so catch levels should be stabilised or reduced in future to prevent the stocks becoming overfished.
- Reconstruction of the catch history needs to occur, as do annual catches submitted to IOTC.
- Improvement in data collection and reporting is required to assess the stock using more traditional stock assessment techniques.
- Given the rapid increase in kawakawa catch in recent years, some measures need to be taken to decrease the catches in the Indian Ocean.
- Limit reference points: IOTC has not adopted limit reference points for any of the neritic tunas under its mandate.

Management: this species is not currently managed.

Information: Due to a lack of fishery data for several gears, only data poor assessment approaches can currently be used by IOTC. Aspects of the fisheries for this species combined with the lack of data on which to base a more formal assessment are a cause for considerable concern. In the interim until more traditional approaches are developed the data-poor approaches will be used to assess stock status. The continued increase of annual catches for kawakawa is likely to have further increased the pressure on the Indian Ocean stock as a whole resource. Research emphasis on improving indicators and exploration of stock structure and stock assessment approaches for data poor fisheries should be undertaken. There is a high risk of exceeding MSY-based reference points by 2016 if catches are maintained at current (2013) levels (96% risk that $B_{2016}<B_{MSY}$, and 100% risk that $F_{2016}>F_{MSY}$) or an even higher high risk if catches are increased further (120% of 2013 levels) (100% risk that $SB_{2016}<SB_{MSY}$, and 100% risk that $F_{2016}>F_{MSY}$).

Rainbow runner (Elagatis bipinnulata)

Stock status: the status of rainbow runner stocks in the Indian Ocean is unknown. Nicol *et al* (2009) consider this species to having high biological productivity (score of 0.28) and FishBase (accessed 06 Nov 2015) consider it to have medium resilience with a minimum population doubling time of 1.4 – 4.4 years. Despite the high productivity, the PSA analysis (see Error! Reference source not found.) suggests that rainbow runner might score a conditional pass (60 – 79) as the stock is wildly distributed and overlaps a number of large fisheries (mainly purse seine, gillnet and longline) and is particularly vulnerable to surface-set gears.

Management: this species is not currently managed.

Information: there is currently limited information in the catch of this species, particularly form purse seine fisheries.

Dolphinfish (Coryphaena hippurus)

Stock status: the status of common dolphinfish stocks in the Indian Ocean is unknown. Nicol *et al* (2009) consider this species to having very high biological productivity (score of 0.02) and FishBase (accessed 06 Nov 2015)[9] consider it to have medium resilience with a minimum population doubling time of less than 15 months. Despite the very high productivity, the PSA analysis (see Error! Reference source not found.) suggests that dolphinfish might score a high conditional pass (60 – 79) as the stock is wildly distributed and overlaps a number of large fisheries (mainly purse seine, gillnet and longline) and is particularly vulnerable to surface-set gears, esp. on FADs and other drifting objects.

Management: this species is not currently managed.

[9] Nicol S., Lawson T., Briand K., Kirby D., Molony B., Bromhead D., Williams P., Schneiter E., Kumoru L. and Hampton J. (2009). Characterisation of the tuna purse seine fishery in Papua New Guinea. ACIAR Technical Report No. 70, 44 pp.

Information: there is currently limited information in the catch of this species, particularly form purse seine fisheries.

Wahoo (Acanthocybium solandri)

Stock status: the status of wahoo stocks in the Indian Ocean is unknown. Nicol *et al* (2009) consider this species to having high biological productivity (score of 0.27) and FishBase (accessed 06 Nov 2015) consider it to have medium resilience with a minimum population doubling time of 1.4 - 4.4 years and of moderate to high vulnerability. A PSA analysis conducted for the combined purse seine, gill net and longline fisheries in the Indian Ocean suggests that the species is generally robust and its high productivity outweighs its susceptibility to these gears, indicating it might just achieve a score of >80 in a risk-based analysis (see Error! Reference source not found.).

Management: this species is not currently managed.

Information: there is currently limited information in the catch of this species, particularly form purse seine fisheries.

Oceanic triggerfish (Canthidermis maculatus)

Stock status: the status of oceanic trigger stocks in the Indian Ocean is unknown. Nicol *et al* (2009) consider this species to having high biological productivity (score of 0.27) and FishBase (accessed 06 Nov 2015) consider it to have medium resilience with a minimum population doubling time of 1.4 - 4.4 years and of moderate to high vulnerability. Despite the high productivity, the PSA analysis (see Error! Reference source not found.) suggests that oceanic triggerfish might score a low conditional pass (60 – 79) as the stock is wildly distributed and overlaps a number of large fisheries (mainly purse seine, gillnet and longline) and is particularly vulnerable to surface-set gears, esp. on FADs and other drifting objects. It has been hypothesised that the escape and recolonisation of log and drifting FADs is also accelerated by sonoferous (e.g. drumming) species, possibly including the spotted oceanic triggerfish that forms massive schools of many thousands individuals around drifting FADs (Taquet *et al* 2007).

Management: this species is not currently managed.

Information: there is currently limited information in the catch of this species, particularly from purse seine fisheries.

Silky shark (Carcharhinus falciformis)

Stock status: The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2012 (IOTC–2012–SC15–INF10 Rev_1) consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type. Silky shark received a high vulnerability ranking (No. 4) in the ERA rank for longline gear because it was estimated as one of the least productive shark species, and with a high susceptibility to longline gear. Silky shark was estimated as the second most vulnerable shark species in the ERA ranking for purse seine gear,

due to its low productivity and high susceptibility for purse seine gear. Our own PSA analysis echoes this, indicating it would not achieve even a conditional score of >60 in a risk-based analysis (see Error! Reference source not found.).

The current IUCN threat status of 'Near Threatened' applies to silky sharks in the western and eastern Indian Ocean and globally. There is a paucity of information available on this species but several recent studies have been carried out for this species in the recent years. Silky sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived (over 20 years), mature relatively late (at 6–12 years), and have relativity few offspring (<20 pups every two years), the silky shark can be vulnerable to overfishing. Despite the lack of data, there is some anecdotal information suggesting that silky shark abundance has declined over recent decades, including from Indian longline research surveys, which is indicators currently available for silky shark in the Indian Ocean therefore the stock status is uncertain.

Management: a precautionary approach to the management of silky shark is required for this species, which is not currently managed.

Information: Mechanisms need to be developed by the IOTC to encourage CPCs to comply with their recording and reporting requirement on sharks, so as to better inform scientific advice. The silky shark is one of five species where catch data is required to be reported as species level, originally by Recommendation 08/04 [superseded by Resolution 12/03, then by Resolution 13/03, then by Resolution 15/01], and also includes the blue shark, shortfin mako, silky shark, scalloped hammerhead and the oceanic whitetip.

3.3.4 Summary

The nine secondary main and minor species within the two main UoAs were scored as follows:

Table 14: Summary of MSC scores and risk category of P2 'Non-target species stock status'

UoA A: Free-school purse seine tuna fishery

Main /minor	UoA /Secondary main species	PSA score	MSC score	Scoring guidepost	Risk category
Main	Bullet tuna (*Auxis rochei*)	2.59	95	>80	Low
Main	Frigate tuna (*Auxis thazard*)	2.59	93	>80	Low
Main	Blue marlin (*Makaira nigricans*)	n/a	n/a	60-79	N/A
Main	Rainbow runner (*Elagatis bipinnulata*)	3.10	73	60-79	Medium
Main	Silky shark (*Carcharhinus falciformis*)	3.73	32	<60	High
Minor	Wahoo (*Acanthocybium solandri*)	3.03	95	>80	Low
Minor	Common dolphinfish (*Coryphaena hippurus*)	3.10	78	60-79	Medium

Minor	Spotted oceanic trigger fish (*Canthidermis maculatus*)	3.14	62	60-79	Medium
Minor	Kawakawa (*Euthynnus affinis*)	n/a	n/a	>80	N/A

UoA B: FAD-dependent purse seine tuna fishery

Main /minor	UoA /Secondary main species	PSA score	MSC score	Scoring guidepost	Risk category
Main	Bullet tuna (*Auxis rochei*)	2.59	95	>80	Low
Main	Frigate tuna (*Auxis thazard*)	2.59	93	>80	Low
Main	Blue marlin (*Makaira nigricans*)	n/a	n/a	60-79	N/A
Main	Rainbow runner (*Elagatis bipinnulata*)	3.10	73	60-79	Medium
Main	Silky shark (*Carcharhinus falciformis*)	3.73	32	<60	High
Main	Common dolphinfish (*Coryphaena hippurus*)	3.10	78	60-79	Medium
Minor	Wahoo (*Acanthocybium solandri*)	3.03	95	>80	Low
Minor	Spotted oceanic trigger fish (*Canthidermis maculatus*)	3.14	62	60-79	Medium

Main /minor	UoA /Secondary main species	PSA score	MSC score	Scoring guidepost	Risk category
Minor	Kawakawa (*Euthynnus affinis*)	n/a	n/a	>80	N/A

3.3.5 Identification of ETP Impacts

Species interactions

Marine turtles: Amande *et al* (20012) reports that EU observers recorded interactions with four turtle species – green turtle *Chelonia mydas* (IUCN endangered), loggerhead turtle *Caretta caretta* (IUCN endangered), Olive ridley *Lepidochelys olivacea* (IUCN vulnerable) and Kemp's Ridley sea turtle *Lepidochelis kempii* (IUCN critically endangered) during on board monitoring of the French and Spanish Indian Ocean tuna purse seine catches. Of these, only the Kemp's Ridley turtles were recorded in association with FAD-associated sets, albeit at very low levels.

Table 15: Observed bycatch levels of marine turtles over 2003 - 2009

Name	Species code	Free-school		FAD-associated	
		Weight (t)	% bycatch	Weight (t)	% bycatch
Olive Ridley turtle *Lepidochelys olivacea*	LOL	0.07	0.0135	None	None
Green turtle *Chelonia mydas*	CMM	0.03	0.0005	None	None
Loggerhead turtle *Caretta caretta*	CCC	0.02	0.0038	None	None
Kemp's Ridley sea turtle *Lepidochelis kempii*	LKE	None	None	0.02	0.0007
TOTALS		**0.12**		**0.02**	

Source: Amande *et al* (2012)

A paper by Bourjea *et al* (2014) showed that of 3,132 observed FAD associated sets over 1995 – 2011 in the Indian Ocean 148 turtles were caught (0.05 per set), of which 75% were released alive. Of the 3,013 observed free-school sets, 34 turtles were caught (0.01 per set).

Whale sharks: whale sharks are listed on CITES Appendix II. In Seychelles waters, the Wild Animals (Whale Shark) Protection Regulations, 2003 declares the whale shark (*Rhincodon typus*) is protected throughout Seychelles at all times. No specific data have been available to the assessment team in relation to encounters with whale sharks. However whale sharks are most likely encountered during sets deliberately

made on them (prohibited by IOTC Resolution 13/04, see next section) and not on free school sets. Nevertheless, while they are unlikely to be retained or feature as bycatch in free school sets on account of their size they have been included under the ETP component as whale shark meets with ETP qualifying criteria and the species is undoubtedly vulnerable to fishing interactions. It is normal practice for these animals to be released from the gear prior to bringing catches aboard and there is no direct evidence to suggest that animals are directly harmed or killed in such encounters although clearly there is potential for such events to occur. The frequency with which this may happen however in free school sets is likely to be very low and possible population level impacts are therefore considered negligible. This finding is supported by evidence of Capietto *et al* (2014).

Dolphins and other cetaceans: with respect to dolphin interaction with the fisheries, the free-school set fishery of the Indian Ocean differs from that of the eastern Pacific in that free-school sets are not normally made on dolphin schools in the Indian Ocean. This is especially the case with respect to the Spanish purse seine fleet who fish much more using FADs or on schools whose presence is indicated by bird activity. Evidence to this effect was provided to the assessment during discussions with Echebaster management and vessel skippers, an observer in the Seychelles and during communications with others involved in the fishery directly, as well as by reviewing Echebaster logbooks. It is inevitable that there would be some association between dolphins and tuna schools in the Indian Ocean as is the case in other areas, however, according to Ardill *et al* (2013), in practice tuna-dolphin association is rarely seen in the western Indian Ocean, such that skippers very rarely set on dolphin schools. The finding is based on analysis and review of extensive fishery data from the Indian Ocean (Intertek, 2014).

Management

IOTC has a number of Conservation and Management Measures relevant to ETPs. These include:

Species	CMM
Marine turtles	**Resolution 12/04: On the conservation of marine turtles.** This Resolution introduced amendments to Resolution 09/06 on Marine Turtles, by removing the term 'hard-shelled' to provide equal protection for all marine turtles in the IOTC area of competence and clarify the data reporting requirements for interactions with marine turtles.

Species	CMM
Sharks	**Resolution 13/06: On a scientific and management framework on the Conservation of sharks species caught in association with IOTC managed fisheries.** This Resolution prohibits, as an interim pilot measure, the retention onboard, transshipment, landing or storing any part or whole carcass of oceanic whitetip sharks (*Carcharhinus longimanus*) by all vessels on the IOTC record of authorized vessels or authorized to fish for tuna or tuna-like species. **Resolution 12/09: On the conservation of thresher sharks (family Alopiidae) caught in association with fisheries in the IOTC area of competence.** This Resolution prohibits the retention onboard, transshipment, landing, storing, selling or offering for sale any part or whole carcass of the three species of thresher sharks (family Alopiidae, but the bigeye thresher shark (*Alopias superciliosus*) is particularly endangered and vulnerable. **Resolution 13/05: On the conservation of whale sharks (*Rhincodon typus*).** This Resolution aims to mitigate the interactions between whale sharks and purse seine fishing gear; gather additional information from CPCs on the interaction rates with other fishing gears, in particular gillnets and longlines; and requests that the IOTC SC develop best practice mitigation and handling guidelines for consideration by the Commission at its 18th Session in 2014, to mitigate the impacts of fishing on whale sharks in the IOTC area of competence.
Cetaceans	**Resolution 13/04: On the conservation of cetaceans.** The Resolution aims to mitigate the interactions between cetaceans and purse seine fishing gear; gather additional information from CPCs on the interaction rates with other fishing gears, in particular gillnets and longlines; and requests that the IOTC SC develop best practice mitigation and handling guidelines for consideration by the Commission at its 18th Session in 2014, to mitigate the impacts of fishing on cetaceans in the IOTC area of competence

Information

There is some information available in relation to the rate of interaction with ETP species of EU purse seine fleets operating in the Indian Ocean (Intertek, 2014). These allow for a good understanding of the ETP species involved as well a general understanding of levels of interaction and to a lesser extent the likely fate (outcome) for species from capture events. Examples of such data include a review of EU purse seine fleet observer data from 2003-2007 (Amande *et al*, 2008; and Amande *et al,* 2012). Other sources of data include fisher records of bycatch as well as a wide range of published studies e.g. Romanov (2002), Pianet (2006), Sarralde *et al* (2006) and Delgado de Molina *et al* (2005). The reports of the Working Party on Ecosystems and Bycatch of the IOTC (WPEB) provide a useful annually updated source of information in relation to bycatch of all types of species and interactions with ETP species in Indian Ocean tuna fisheries.

3.3.6 Identification of critical habitats

This fishery takes place in the upper part (from the surface to around 280 m deep) of the water column in deep oceanic waters. As such, there is no physical impact with the bottom habitat and no vulnerable marine ecosystems (VMEs) are directly affected.

The extensive use of artificial drifting FADs by the Seychelles-flagged fleet, and their potential impact on the wider ecosystem, is discussed more fully in the next section (ecosystem elements). This section is therefore limited to the impact of the fishery on the physical environment and its associated communities.

Outcome

As stated above, this open water pelagic fishery does not have any direct impact on any particular VME, nor on the wider and commonly encountered pelagic habitat of the upper water column. However, there may be an impact on the structure and function of coral reefs arising from the beaching of abandoned, lost or discarded artificial FADs from the FAD-directed fishery.

An estimated 10% of FADs are lost end up being beached on coral reefs and other coastal line forms (Maufroy, *et al*., 2015). A study by Balderson and Martin (2015) found that nearly 26% of 214 beached FADs in the Seychelles were from Seychelles-flagged purse seine vessels. Of all the beached FADs observed, 39% were attached to a coral reef. The effects of these beached FADs was coral damage, ghost fishing in the FAD nets (including those whose sausage net had been ripped open) and 2% of beached FADs had turtles entangled with them. Furthermore, with the replacement of biodegradable bamboo, once a commonly used material for making FADs, with metal pipework the damage is likely to be more seer and persistent. The overall impact of these beached FADs on the structure and function of coral reefs has not been assessed. Whilst it is unlikely to reduce this to the point where there would be serious or irreversible harm, it is likely to be an additional stressor to a system already at risk from climate change and other threats.

Habitats management strategy

With the ecosystem impacts of industrial tuna purse seine fishing being considered in the next section, there are no measures or strategies required to address the direct impact of these UoAs on the commonly encountered pelagic habitat. This said, there is evidently a need to reduce the indirect impact of FAD use on critical habitats such as coral reefs after control has been lost if they are abandoned, lost or discarded. Whilst there is a limit on the total number of FADs that can be used by IOTC-registered fishing vessels, there are no effective measures or strategies to prevent this loss or damage.

Habitats information

The nature, distribution of the main pelagic habitat, and that of VMEs such as coral reefs around the Western Indian Ocean region is well known. The spatial overlap of the direct fishing activity is also well known, as all the vessels are subject or monitoring with VMS. However the issue of the FAD loss is less well quantified and spatially analysed. Whilst there has been some work done on the Seychelles (e.g. via Balderson and Martin, 2015), there is little information on the numbers of lost FADs, not their fate and the possible habitat damage inflicted if and when beached. Whilst some may retain their radio transmitter beacons, the vast majority will not and will be effectively lost.

3.3.7 Identification of cumulative impacts

The sustainability of the ecosystem (maintenance of its structure, productivity, function and diversity, including habitat and associated dependent and ecologically related species) as well as the sustainability of the fisheries, which depend on it (MSC Principle 2), requires the consideration of the cumulative impacts of multiple fisheries.

Where there are two separate but overlapping main Units of Assessment, cumulative impacts on Principle 2 components/performance indicators (especially primary species, secondary species, ETP species and habitats) is a key issue for MSC which has introduced certification requirements to ensure that the cumulative impact of all MSC fisheries is within sustainable limits and will not be at risk of generating negative cumulative impacts (FCR v 2.0).

Thus, a UoA assessed against MSC standard FCRv2.0 need to consider the combined impact of itself and other overlapping UoAs on performance indicators (PI) of Principle 2.

The additive impact of each component/PI of the two UoAs which can lead to cumulative impacts are analysed below; and cumulative impacts which might need consideration are identified. Two particular areas are discussed, (i) the removal of significant proportions of key species and (ii) the impact of FADs on ecosystem dynamics.

Ecosystem outcome

Removal of large volumes of key, higher trophic level species: key species can be considered as species upon which the success of many other species is dependent, or on which overall normal and healthy ecosystem function depends on. Key prey species are those for which there is likely to be little by way of alternative species at the same or similar trophic level. Depletion of low-tropic level species upon which many higher-level organisms are ultimately dependent can lead to changes in food web dynamics and consequent shifts in fish fauna community structure. Conversely removal of higher trophic level species including predators such as tuna and sharks can lead to changes in food web structures and trophic cascades, where lower level species may increase in abundance, unchecked by normal predatory controls. Changes of this nature would be indicative of serious or irreversible harm at an ecosystem level.

Depletion of higher-level predators in the Ocean has been documented. Preliminary results of an analysis of abundance trends of several elasmobranch and teleost fish in the Indian Ocean pelagic ecosystem were presented to IOTC's WPEB meeting in October 2009, based on data from research longline cruises. A widespread decline in the abundance of top predators such as large pelagic sharks and tunas was demonstrated, as was the emergence of several mid-sized, lower-trophic-level species such as crocodile shark and lancetfish. The relative abundances of lancetfish and tuna showed a dramatic shift between 1960-1990 and 2000-2008, with tuna being replaced by lancetfish. During 1960-1990 there were 5 tuna to 1 lancetfish, now there is 1 tuna to 5 lancetfish.

This is considered to be likely related to removal of large numbers of top predators in directed shark fisheries as well as bycatch of sharks in certain tuna fisheries, especially longline fisheries, gillnet fisheries and to a lesser extent, those utilizing drifting artificial FADs (where unobserved capture of sharks is known to be a source of significant ongoing unrecorded mortality). The recorded decline in top predators is also due in part to declines in large pelagic tunas, especially southern bluefin, bigeye and yellowfin tuna, but less so skipjack. Yellowfin has a trophic level of 4.3, while bigeye has a trophic level of 4.5. SKJ has a trophic level of around 3.8. Some changes in fish community structure within the pelagic ecosystem is considered unavoidable as a consequence of the fishing down of tuna stocks in the early period of industrial fishery development, and significant levels of removal of large tunas is directly attributable to the operation of the free school set purse seine tuna fishery. However, significant depletion of other top predators such as sharks is considered very unlikely to result from free school sets due to the confirmed low level of encounter and retention (see previous section), especially in free school sets.

Impact of FADs on ecosystem dynamics: the use of FADs has a number of implications for the marine environment. Around 66% and 80% of sets in Seychelles and high seas waters are made on FADs. With 12 vessels each deploying up to 550 instrumented FADs at any one time, the Seychelles-flagged fleet may have 6,600 active FADs in the water. Tuna, as well as other species, tend to associate with floating objects that may act as an indicator of productive areas, as a meeting point, or as a reference point for local and large scale movements/migrations. It is

worth mentioning that tuna tend to forage *away* from FADs and re-aggregate under them in order to rest and digest food caught during previous foraging period (Bromhead *et al* 2003).

FADS may have a number of different ecosystem effects as follows:

1. **Increase in fishing zones for species such as BET**, with small bigeye being taken now in areas where they were not fished before. There are two main concerns: first a short-term risk to reduce the yield per recruit, and second, a risk to face in the future a recruitment overfishing due to the recent FAD catches. At present there is no strong evidence of the latter (Fonteneau *et al*, 2000)[10]. One of the major difficulty presently faced by all tuna RFMOs is estimate the long-term yield per recruit effect of drifting FADs fisheries for each tuna species. Any yield per recruit calculation needs a good knowledge of growth and natural mortality at all ages. Unfortunately, the natural mortality (M) estimated for juvenile tunas is poorly estimated for ail tuna species and this uncertainty will largely influence any conclusions obtained from stock assessments.
2. **Genetic erosion** for some fraction of stocks which may show, in relation with their genome, a behaviour of strong association with FADs. This sub-population may then be eliminated by the selective pressure on FADs.
3. **Differential effects of FADs upon each of the major tuna species**. Because of their different intrinsic potential to face growth and recruitment overfishing, the FAD fishery may introduce a specific advantage or disadvantage for each of the targeted species (yellowfin, skipjack or bigeye) and may accelerate the potential effects of fisheries in the pelagic ecosystems.
4. **FAD = ecological trap**? This question is still pending (Marsac *et al*. , 2000)[11], but several facts are consistent to support the hypothesis that the recent massive seeding of FADs in the equatorial areas could modify one or more biological characteristics of the concerned tropical tunas: movement pattern, growth and natural mortality.

Ecosystem management strategy

The IOTC, and in particular its Working Party on Ecosystems and Bycatch (WPEB), has the remit for ecosystem management relating to tuna fisheries in the Indian Ocean. They have implemented a number of CMMs on the recording of catch and effort data, the conservation of key species such as various billfish, FAD management and on developing target and limit reference points. However, as recognised by a WPEB

[10] Fonteneau A., Pallarés P., Pianet R., 2000, A worldwide review of purse seine fisheries on FADs. In: Le Gall, J.-Y., Cayré, P., Taquet M. (Eds.), Pêche thonière et dispositifs de concentration de poissons.Actes Colloques-IFREMER, pp. 15–35..

[11] Marsac F., & Cayré P., (1998). Telemetry applied to behaviour analysis of yellowfin tuna (*Thunnus albacares*) movements in a network of Fish Aggregating Devices. Hydrobiologia, 371/372, 155-17l.

Working Paper to IOTC in 2014 (Juan-Jordá *et al*, 2014), a combination of a lack of data, an absence of clear objectives to mitigate the impacts on bycatch species and the lack of specific provisions concerning the impact of fisheries on non-target species and conservation of biodiversity suggests that an ecosystem approach to fisheries is only at an early stage of being adopted. Juan-Jordá *et al* goes on to say "*There are no clear objectives in place to maintain the structure and functioning of marine food webs and ecosystem health. The IOTC Convention Agreement does not contain any specific provisions concerning the conservation of biodiversity and minimization of impacts of IOTC fisheries on dependent species and ecosystems*".

Ecosystem information

Information on target species ecology and stock status is reasonably well known and monitored in the Indian Ocean. However the low level of bycatch data has hindered any efforts of the WPEB to develop and test indicators, including single species and multispecies indicators, to track the impact of IOTC fisheries on bycatch species including sharks, seabirds, turtles and marine mammals, as part of an EAFM (Juan-Jordá *et al*, 2014). This is currently being improved for much of the industrial fleet, including the Seychelles-flagged vessels via initiatives such as the ObServe programme, but data sets are currently poorly populated. Furthermore, there is a continuing lack of data from the large artisanal and coastal fisheries for tuna and other pelagic species. Finally, unlike other major oceanic areas, there is a lack of LME level ecosystem modelling such as ECOPATH and Spatial Ecosystem And Population Dynamic Model (SEAPODYM) for the ecosystem and key species in the Indian Ocean.

3.4 PRINCIPLE THREE: EFFECTIVE MANAGEMENT

The intent of Principle 3 (P3) is to ensure that: a) there is an **institutional** and **operational framework appropriate** to the size and scale of the UoAs for implementing Principles 1 and 2, and b) that this **framework** is capable of **delivering sustainable fisheries** in accordance with the outcomes articulated in these Principles.' (MSC online training, Scoring a Fishery FCR v 2.0).

The jurisdictional categories applying to the management system of the UoAs are: shared stocks, straddling stocks, and stocks of highly migratory species.

Evaluation of the UoAs under P3 performance indicators is required given that the UoAs are subject to international cooperation to manage stocks.

The MSC-requirements concerning P3 are that the performance of other fisheries management bodies where they are also subject to international cooperation to manage the stock should not be individually assessed, except where they impact directly on P1 and P2 outcomes and/or P3 implementation. In this context it is noted that vessels falling under this pre-assessment which are flagged in Seychelles fish in high seas areas (81% of the volume of their catches), the Seychelles EEZ (about 13% of the volume of catches), and the EEZs of other countries[12] (only about 8% of the volume of catches). All of these catches are of species which are subject to international cooperation for management of the stocks.

Based on MSC guidance provided in relevant documentation (see Section 4.1), and additional guidance provided by the MSC Fishery Assessment Managers (Pers. Comm., 19 November 2015) to validate the approach used, the pre-assessment for P3 has been completed as follows:

1. The assessment of P3 for all Performance Indicators (PIs) focusses first and foremost on the governance and policy and fisheries specific management system provided by IOTC as the relevant RFMO, both because the stocks are shared/straddling/migratory ones, and because of the high percentage of total catches made in high seas areas;
2. Consideration is however given to the performance of national management bodies and management conditions in the context of whether performance might conflict with or impact negatively on regional management arrangements and P1 and P2 outcomes. Most significantly in this regard are PI 3.1.1 (the legal framework) because national legislation must reflect regionally agreed Resolutions if the regional legal framework is to be effective, and PI 3.2.3 (compliance and enforcement) because national bodies must ensure compliance and enforcement with regionally agreed conservation and management measures (CMMs) both of their own flagged vessels and of third country vessels fishing in their waters;

[12]In order importance in terms of catches by the fleet under assessment: Kenya, Madagascar, Tanzania, Mauritius, Comores, Iles Eparses, and Mayotte.

3. Consideration is also given as to whether national level arrangements exist for the fisheries specific management system which may complement or exceed those at regional level i.e. for PIs 3.2.1 to 3.2.4;
4. Scoring in the pre-assessment follows the approach outlined in points 1-3 above, however text in the pre-assessment report also provides some additional review of the performance of management arrangements in the Seychelles against the PIs (but not incorporated into the scoring), given that the PIs represent best practice and so an assessment of Seychelles' performance against them may suggest some activities for inclusion in a FIP. The performance of other countries against the PIs is not assessed (again, except where they have an impact directly on P1 and P2 outcomes and/or P3 implementation), as the FIP is not intended to involve parties in those other countries in which the Seychelles-flagged fleet operates.

A fundamental challenge exists for the anticipated FIP in improving those PIs with low scores, due to the predominantly regional management system in place for the relevant fisheries. While there may be some potential for the client group to influence and lobby for change at regional level, and there are some actions that can meaningfully be taken at national level in the Seychelles, other improvements would require improvements at IOTC level, or in other countries (over which the client would have little/no control). While there are significant potential advantages resulting from the IOTC Secretariat being located in Victoria near to SFA, changes at the regional level are likely to require agreement and action by the CPCs.

3.4.1 Governance and policy

Legal and customary framework

PI 3.1.1 The management system exists within an appropriate and effective legal framework which ensures that it: is capable of delivering sustainability in the UoAs; observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and incorporates an appropriate dispute mechanism

Regional level

A formalised regional legal framework (relevant to both high seas fishing areas and stocks caught by the UoAs in national EEZs) for the management system is provided by The Agreement for IOTC's establishment which was adopted by the FAO Council in 1993, and the Agreement itself which entered into force in 1996. The IOTC's Financial Regulations were adopted in 1997 and the Rules of Procedure in 1997, and have since been expanded/amended. And the IOTC was formed on the basis of international agreements for fisheries management e.g. UNCLOS, Convention on Highly Migratory Species, FAO Code of Conduct for Responsible Fisheries, etc.

The passing of Resolutions and Recommendations by the IOTC provides a mechanism to formally commit to the legal rights created explicitly or established by custom on people dependent on fishing for food and livelihood through special recognition of coastal states highly dependent on fisheries.

Dispute resolution mechanisms are specified in Article XXIII of the IOTC Agreement. The consultation and voting mechanisms within IOTC are formalised in its Rules of Procedure, and are designed to be proactive in avoiding legal disputes to any proposed management-related Resolutions or and Recommendations by ensuring that issues of concern are addressed and considered before any formal decision taken. Dispute resolution mechanisms are transparent, but have not been 'proven' as they have never been tested. This however itself suggests that the management system is acting proactively to avoid legal disputes.[13]

Seychelles itself, and all other countries in which the Seychelles-flagged fleet fishes, are full Contracting Parties to IOTC. All these countries therefore have an obligation (if they have not opted out of Resolutions) to implement the related CMMs[14]. This means that national laws or administrative arrangements and management activities must reflect the agreements reached at regional level. Potential issues of concern are however two-fold.

Firstly, countries can opt out of Resolutions meaning that they are not necessarily binding, although few countries have objected to approved Resolutions. On the other hand, consensus is not necessary to adopt measures, which is positive in that it means CMMs may be agreed in support of effective management that would otherwise not be the case if consensus was required.

Secondly, most binding Resolutions have to be transposed into domestic legislation according to the Article X of the IOTC Agreement. The extent to which they have been is recognised as variable, as highlighted by ongoing IOTC efforts as part of capacity building initiative being supported by the IOTC and donors to present the specific obligations in IOTC Resolutions in legal drafting language for incorporation into national legislative frameworks, and to provide overall guidance to CPCs on the process of transposing the IOTC "regulation framework" into the national legislation.

In the case of Seychelles and other countries in which the fleet operates, review of the legislative frameworks for implementation of IOTC Resolutions are underway under this capacity building project. Reports are not yet publicly available, however indications are that there remain weaknesses, inconsistencies, gaps, and conflicts in many legislative instruments in the region, and that a range of amendments to Acts

[13] In Seychelles specifically, the new Fisheries Act, 2014 also provides for an Appeals Board to address disputes.

[14] Recommendations are slightly different in that they are not binding on the Members and rely on voluntary implementation. The Commission may, by a simple majority of its Members present and voting, adopt Recommendations concerning conservation and management of the stocks for furthering the objectives of the IOTC Agreement

and Regulations are required along with the introduction of some new legal instruments (e.g. regulations, other instruments having the force of law).

Cooperation on management of shared stocks, straddling stocks, and stocks of highly migratory tuna and tuna-like species between different territories in the Indian Ocean takes place through the legal framework of the IOTC. In most cases binding IOTC legal instruments ensure obligations under UNCLOS and UNFSA Articles (e.g. 8 and 10 on collection and sharing of scientific data, scientific assessment, and development of scientific advice).

Clear maritime boundary delimitations in the WIO, and in the countries in which the Seychelles-flagged fleet operates, are an important underpinning of effective fisheries management, and while not specifically required to be assessed in the MSC methodology are therefore also considered in this assessment. There are few disputed maritime boundaries in the region. An agreement for the delimitation of the maritime boundaries of the Republic of Seychelles, the Union of Comoros and Tanzania on the Indian Ocean 'triple-point' was signed in February 2012 in Victoria, Seychelles, as part of the implementation of the African Union border programme paving the way for the marking of the border[15] (NFDS, 2014). The maritime boundary between Madagascar and La Réunion is also settled, as is the boundary between Mozambique and Tanzania, and between Tanzania and Kenya. Some unresolved issues however include: the Kenyan border with Somalia; and sovereignty claims of some of the Iles Eparses; and a demarcating line for the extent of the jurisdiction between mainland Tanzania and Zanzibar within the 12 nautical mile limit[16]. However, even where such disagreements occur, there exists a formal dispute resolution mechanism in the form of the International Tribunal for the Law of the Sea (Article 287 of UNCLOS). In addition it is typical for practical agreements between countries to be reached, for example by encouraging/requiring vessels to stay out of 'grey'/disputed zones, or for co-management of disputed areas (e.g. Tromelin).

Consultation, roles and responsibilities

PI 3.1.2 The management system has effective consultation processes that are open to interested and affected parties, and the roles and responsibilities of individuals involved in the management process are clear and understood by all relevant parties

IOTC Rules of Procedure specify consultation processes and roles and responsibilities, and IOTC Working Parties, a Scientific Committee, a Compliance Committee, a Standing Committee on Administration and Finance, and the Commission itself meet regularly to seek and accept relevant information, including local knowledge. Meetings of the Commission and all of its subsidiary bodies are open to pre-approved observers.

[15] http://www.peaceau.org/uploads/com-auc-delimitation-com-sey-tan-18-02.pdf

[16] The World Bank, through a soon to be implemented SWIOFish project, will assist the two parties in finding an agreement on this issue.

Meeting reports provide evidence that the management system considers the information obtained and can be considered to explain how it is used or not used through specific reference in Resolutions and Recommendations to the information provided to the Commission as the basis for them.

All meeting reports, Resolutions and Recommendations are publicly available on the IOTC website. And IOTC Rules of Procedure clearly specify and provide the opportunity for participation in key meetings, and the IOTC Secretariat works to encourage and facilitate (for example by paying for the participation of some regional scientists, and Working Party chairs can encourage participation of experts) participation through regular communication with relevant parties.

By virtue of its link to FAO and, therefore, to the UN system, Taiwan is only recognised as a province of the People's Republic of China and, as such, is not allowed to participate as a full member of a Cooperating non-Contracting Party. However, Taiwan is actively involved with IOTC.

Staff from Seychelles and all other countries in which the fleet operates participate in IOTC meetings and fora. Budgets and human resource capacities do however have the potential to negatively impact on the ability of staff from IOTC CPCs to full engage with the available consultation processes and to understand and fulfil their roles and responsibilities. This may be less the case in Seychelles than in some other countries, such as Comores, which face significant budgetary and human resource constraints.

In Seychelles, the role and responsibilities for the MFA, other government bodies, SFA and private sector are understood as they pertain to both national management activities and actions and engagement with IOTC at the regional level, and are specified in the Fisheries Act of 2014 (and the SFA Establishment Act, 1984). Consultation between government and private sector (e.g. Fishing Boat Owners Association, Associations of French and Spanish purse seiners (ANABAC, OPAGAC, Orthongel) is generally good, however it is informal and there are no specific consultation mechanisms provided for in the Fisheries Act or subsidiary Regulations. SFA staff have clearly defined responsibilities in job descriptions and ToRs which may include engagement with IOTC and regional issues where necessary/appropriate, and which are considered during performance reviews (staff at junior level are reviewed annually, with senior scientific staff on 2 year contracts having to develop plans and targets which are then assessed annually over a 2-year period. These assessments are also reviewed externally by the Ministry of Administration).

Long-term objectives

PA 3.1.3 The management policy has clear long-term objectives to guide decision-making that are consistent with the MSC fisheries standard, and incorporates the precautionary approach

Regional management through IOTC has long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria, and which incorporate the precautionary approach. For example, the objectives of the IOTC itself are defined as 'to promote cooperation

among its Members with a view to ensuring, through appropriate management, the conservation and optimum utilisation of stocks and encouraging sustainable development of fisheries based on such stocks', and the IOTC's functions and responsibilities support the objectives.

A number of IOTC Resolutions also make specific reference to the precautionary approach and to long-term sustainable utilisation of stocks (e.g. 12/01, 13/10, 12/14), with Resolutions being in many cases fisheries/species specific. Long-term objectives at the IOTC level have also been increasingly recognised, even if just implicitly, through recent Resolutions on the setting of interim target and limit reference points.

However:

- There is potential for short-term objectives of one or more Parties to override long-term objectives because the IOTC follows the UN consensus model in its decision-making; and
- There are no specific long-term objectives defined exclusively for the fisheries in the UoAs (as opposed to more generally for all stocks under IOTC competence).

Management policies in countries in the region in which the fleet fishes are consistent with the long-term objectives at regional management level (but not part of the scoring for this PI). For example:

- The Seychelles Fisheries Policy (2005) has a long-term policy objective clearly stated ("the promotion and development of sustainable fisheries and optimisation of the benefits of this sector for the present and future generations"), and makes specific reference to the adoption of the pre-cautionary approach ("where best scientific advice is unavailable a precautionary approach to management will be taken"). A new fisheries policy is to be prepared in 2016.
- In Kenya, the National Oceans and Fisheries Policy, 2008 recognises the importance of international organisations with respect to fisheries management and their role in harnessing regional collaboration to assist with policy objectives.
- In Tanzania, a now rather old 1997 policy is broad and has a vision of the promotion of conservation and the development and sustainable management of the fisheries resources for the benefit of present and future generations. The policy statement regarding the EEZ (number 18) is as follows: 'to strengthen regional and international collaboration in the sustainable exploitation, management and conservation of resources in shared water bodies and the EEZ.

3.4.2 Fishery specific management system

Fishery-specific objectives (and fisheries management plans)

PI 3.2.1 The fishery specific management system has clear specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2

This PI is concerned with the fishery-specific objectives, not the strategies that implement the objectives (which are assessed under P1 and P2).

The large range of CMMs in effect in the WIO which focus on the tuna stocks and fleets in the UoAs, and which are often specific to gear types and species, can be construed when viewed collectively and in their totality as providing a wide range of fishery-specific objectives. In most cases IOTC Resolutions and CMMs detailing agreement on explicit short- and long-term strategies/actions like scientific and statistical reporting, registration of vessels, FAD management, limit reference targets, fleet capacity, compliance and IUU, port inspections, etc, are prefaced/justified in the opening text of the CMMs with text/rationale for the actions which implicitly provides the objectives which the strategies/actions are intended to support, even if objectives are not specific stated as such.

However, while the IOTC as a whole has long-term objectives within its remit and approach, there are no fisheries-specific objectives collated and included as part of single regional tuna fisheries management plans documented for, and at, the regional level. This means that fishery specific objectives are not clearly articulated, and/or are 'hidden' within different CMMs rather than being specifically defined as objectives, and may not therefore be universally understood by all stakeholders.

There is also no specific tuna fisheries management plan, or specific objectives articulated at a national level in Seychelles (not part of the scoring for this PI), and a Fisheries Development Plan 2007-2011 (prepared by SFA) which did include some specific actions/objectives for different fisheries in the Seychelles (including purse seine fisheries) has now expired. Specific objectives for fisheries management activities in support of Principles 1 and 2 are not therefore well articulated.

Some other countries in which the fleet operates do however have tuna fisheries-specific management or development plans with clearly stated fishery-specific objectives. For example in Kenya there is the Kenya Tuna Fisheries Development and Management Strategy 2013-2018 which provides a strategic step-by-step guide to the development of an industrialised tuna sector in Kenya, including development of tuna fisheries value chain activities, such as fishing, management (including MCS and scientific observers), governance, and processing and value addition. While in Tanzania, a Tuna Fishery Management Strategy provides for 11 strategic goals and fisheries-specific objectives.

Decision-making processes

PI 3.2.2 The fishery specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives and has an appropriate approach to actual disputes in the fishery.

Decision-making processes at regional level and in general terms are well established and based on the consultation mechanisms described earlier under PI 3.1.2. Working Parties analyse technical problems related to the management goals of the Commission. For example, Working Parties related to the different species analyse the status of the stock and offer options to the Scientific Committee for management recommendations to the Commission. The Scientific Committee meets annually and provides advice to the Commission on the status of stocks and the management actions necessary to ensure sustainability of the fishery. The Compliance Committee (CoC) also meets annually and monitors the compliance of the IOTC Contracting Parties and Cooperating Non-Contracting Parties with adopted CMMs, and reports to the Commission. At each Session of the Commission, Members may adopt CMMs concerning the management of tuna and tuna-like species under the IOTC mandate as well as the fisheries which target them. These decisions are passed in the form of either Resolutions or Recommendations.

Decision-making processes at regional level thus often respond to serious and other important issues, but not on all issues identified in relevant research, monitoring, evaluation and consultation, and not always in a transparent, timely and adaptive manner that take account of the wider implications of decisions.

Decision-making processes generally take the pre-cautionary approach, as evidenced by reference to pre-cautionary approaches in the IOTC Resolutions. And formal reporting takes place at regional level through IOTC communication and its website and provides comprehensive information on both fisheries performance (scientific reports) and management actions (CMMs and meeting reports). As noted above, the management system is designed to actively avoid disputes, but has not yet been tested with regards to the extent to which any resulting judicial decisions are implemented.

However, decision-making when existing CMMs are not complied with is less effective than the decision-making to agree on CMMs - see discussion on compliance and enforcement below. The fact that once/when the recently introduced limit reference points are reached the IOTC currently has few/no fisheries management tools to utilise to reduce either effort of catches, is also reflective of the fact that decision-making processes have not resulted in measures and strategies to achieve fishery-specific objectives. Likewise, while there appears increasing recognition that some form of quota or rights-based management is required for effective management of tuna stocks, the slow pace with which decisions are being taken is a further demonstration of the fact that decision-making processes to achieve fishery-specific objectives and actions are not always in evidence.

In Seychelles (not part of the scoring for this PI) formal reporting on decision-making and management action takes place through the SFA website and its regular bulletins, and decision-making processes at the national level are well established and based on the consultation mechanisms described earlier under PI 3.1.2.

Monitoring, compliance and enforcement

PI 3.2.3 Monitoring control and surveillance mechanisms ensure that management measures in the fishery are enforced and complied with[17]

MCS

The use of vessel monitoring systems (VMS) has been mandatory in the WIO since July 2007 for vessels of 15 m overall length and above, although coverage is still low in the small-scale fisheries in the region. There is no centralised VMS or protocols for exchange of information under the IOTC framework although such arrangements exist, in principle, for WIO coastal States under the IOC's Regional Plan for Fisheries Surveillance.

Port State controls were first established in 2003, to be followed by the adoption in 2010 of a Port State Measures resolution virtually identical to the still-not-in-force FAO Port State Measures Agreement. No inspection-at-sea provisions have been adopted for the high seas, although there has been an extension of the mandate of the observers under the transshipment monitoring programme that allows them to conduct a limited inspection on the fishing vessels, allowing them to report a number of Illegal, unregulated or unreported (IUU) infractions to the Compliance Committee. IOTC is currently providing a programme of technical support to the developing States - coastal CPCs of the IOTC responsible for the implementation of the Port State Measures and to facilitate and strengthen the implementation of the PSM Resolution thus ensure the long-term conservation and sustainable use of the tuna resources.

A trade documentation scheme for catches of frozen bigeye tuna was adopted in 2001, but several attempts to replace it with a catch documentation scheme (similar to the one adopted under the EU IUU Regulation) have not yet received support from countries concerned about the cost of implementation.

A Regional Observer Scheme was adopted in 2010, which requires a minimum coverage of 5% in national observer schemes for large-scale vessels and similar coverage of port sampling for small-scale and artisanal fisheries. As implementation depends on separate programmes being implemented at national level, there has been an unequal level of implementation between the different flag States depending on their resources.

[17] Text in this section based principally on Poseidon et al (2014a) and further elaborated based on review of additional information.

In considering the performance of Seychelles specifically against this PI, the pre-assessment notes that the Fisheries Management Division of the SFA has an MCS department that is based at the Fisheries Monitoring Centre (FMC), comprised of inspectors, observers, officers, licensing officers and VMS officers. Personnel are trained through national and regional training programmes. Limitations include numbers of personnel and equipment, for example SFA has to lease larger patrol vessels to monitor the tuna fleet, and at times there are difficulties in maintaining equipment in working order getting supplies and spare parts. The FMC also processes catch report data, authorises for the landing of catch outside Seychelles' waters, and ensures that the licensing unit maintains an updated register of licensed local and foreign fishing vessels. Other notable features are:

- VMS data are used for both compliance and scientific purposes and SFA link them to logbook data to conduct administrative checks;
- The FMC links well with other local agencies such as the Seychelles Coastguard (SCG), the National Drug Enforcement Agency (NDEA) and the Seychelles Police and the Attorney General's Office; and
- An observer scheme was started in 2013 and is now in operation, and mainly scientific in nature (looking at effort in terms of number, type and duration of sets, but less so at compliance), covering Seychelles-flagged vessels and third country vessels fishing in Seychelles' waters;

Sanctions

There is no standardised scheme of sanctions and there is no unified view within IOTC as to what would constitute adequate sanctions for certain infractions. At times, vessels have been proposed for inclusion in the IUU lists even after paying fines imposed by the flag State, without a clear indication of how, in the future they would be removed from the List.

In Seychelles, sanctions (including fines) have been increased in the new Fisheries Act (2014).

Compliance

The IOTCs own performance review in 2009 (the most recent) noted that low levels of compliance with IOTC measures and obligations are commonplace across many CPCs (IOTC, 2009). While this pre-assessment has not assessed Seychelles' compliance with all CMMs in detail, Seychelles has prepared a management plan for Drifting Fish Aggregation Devices in regards to IOTC's Resolution 13/08, and has submitted a fleet development plan to the Commission (of the other countries in which the fleet fishes Madagascar and Mauritius have also submitted fleet development and capacity plans while Comores, Kenya, and Tanzania have failed to do so (IOTC, 2014)).

The IOTC Compliance Committee reviews proposals for listing of vessels in the IOTC IUU List, as well as other possible infractions to IOTC measures. The Compliance Committee also advises the Commission on any requests by non-Member States to become Cooperating non-

Contracting Parties. The current process of evaluating and acting on the level of compliance is an evolving process. Important decisions, such as the listing of a vessel in the IUU list, are done without the benefit of clear guidelines as to what constitute due process, and are, therefore, often political in nature.

There are still many misconceptions on the part of many Members as to what is expected of them once a Resolution is adopted, and that means that often decisions are not transposed into the domestic legislation, and/or no domestic mechanisms are implemented to ensure compliance. Capacity building is required to improve an understanding of the process, and is currently being actively supported through IOTC-support compliance support missions and workshops to strengthen the implementation of active IOTC CMMs, thus increasing the level of compliance.

In most other countries MCS, observer, vessel monitoring systems (VMS), and at-sea enforcement capabilities are low, but improvements are being supported. The new Kenya 2014 Fisheries Bill for example provides for an interagency MCS unit, while Seychelles and other countries in which the fleet operates are currently active in: the IOTC compliance committee; the IOC regional surveillance project; the stop illegal fishing (SIF) working group; the development of the SADC regional fisheries MCS Centre; the SIF and PEW supported Fish I Africa project; and the SmartFish programme in respect to risk assessment in MCS, data harmonisation, and capacity building.

Overall, and terms of the assessment criteria, it can be concluded that while positive steps are being taken, and many MCS, compliance, and sanctions mechanisms are in place, they are not uniformly applied at regional or national levels, and are unlikely to be resulting in a strong deterrent to IUU fishing at the present time. IOTC reports don't however suggest any systematic issues of non-compliance.

Management performance evaluation (general summary of the above)

PI 3.2.4 There is a system for monitoring and evaluating the fishery-specific management system against its objectives. There is effective and timely review of fishery-specific management system.

The main mechanisms for evaluating management performance in terms of the fisheries-specific CMMs, are the annual meetings of the Compliance and Scientific Committee (supported by the relevant working parties), and the Commission meetings.

Internal reviews of management performance are thus conducted through these regular meetings, facilitated by the IOTC Secretariat, and evaluate key parts of the management system including issues specific to different fisheries (e.g. stock status, compliance with Resolutions applicable to different fisheries, etc). Regular IOTC annual reviews include self-reporting by countries on key aspects of management performance e.g. compliance, fleet capacities, etc.

'External' reviews are not regular, and not totally independent. In 2009, the IOTC commissioned a performance review, in line with calls for such reviews of tuna RFMOs by, for example, the UN General Assembly and the FAO. This review was of the whole of the IOTC rather than of a

fishery-specific management system for the UoAs. The 2009 review panel was comprised of an independent expert scientist, and independent legal expert (serving as Chairperson), representatives of 6 IOTC members, and an NGO observer. The criteria used to review performance were those agreed in 2007 at a joint meeting of all tuna RFMOs. A second performance review (held February 2015), again of the IOTC as a whole, has not yet been finalised and reported its findings and will meet again in December 2015 and wont therefore report this year.

The 2009 performance review, in line with the agreed criteria, was comprehensive and covered all parts of the overall IOTC management system.

Also of note is that evaluation reports commissioned by the European Commission to complete ex ante and ex post reviews of the EU Sustainable Fisheries Partnership Agreements (SFPAs) with third countries occur regularly prior to the negotiation of an FPA Protocol, and do provide an external assessment of management performance at national and regional levels as part of the evaluations of the SFPAs. Recent evaluation reports have included coverage of existing or potential SFPAs with Kenya, Madagascar, Comores, Mauritius and Tanzania.

Management performance evaluation in Seychelles specifically (not part of the scoring for this PI) is conducted by the Board of SFA which reviews SFA on an annual basis, but there has been no recent external review of SFA, or any a fisheries-specific management system or plan in the Seychelles.

4 EVALUATION PROCEDURE

4.1 ASSESSMENT METHODOLOGIES USED

These pre-assessments are based on the following versions of the MSC standard, scheme requirements and templates:

- **MSC Fisheries Standard** Version 2.0 (effective 1 April 2015)
- **MSC Fisheries Certification Requirements** Version 2.0 (effective 1 April 2015)
- **MSC Guidance to the Fisheries Standard** Version 2.0 (effective 1 April 2015)
- **MSC Guidance to the Fisheries Certification Requirements** Version 2 (effective 1 April 2015)
- **MSC Pre-assessment Reporting Template** Version 2.0 (effective 1 April 2015)
- **MSC RBF Worksheets** Version 2.01 (effective 15 April 2015)

4.2 SUMMARY OF SITE VISITS AND MEETINGS HELD DURING PRE-ASSESSMENT

4.2.1 Site visit

The team leader, Mr. Tim Huntington, conducted a site visit to the Seychelles. He arrived in Mahe on Monday 2 November and departed Sunday 8 November 2015. His itinerary was as follows:

Table 16: Site visit itinerary

Date	Activity
Monday 02/11/2105	Arrive in the Seychelles Prepare interview preparation notes
Tuesday 03/11/2105	Inception meeting with SFA Meeting with Indian Ocean Tuna (IOT) Meeting with individual SFA staff
Wednesday 04/11/2105	Meeting with the Ministry of Fisheries and Agriculture Meeting with individual SFA staff

Date	Activity
Thursday 05/11/2105	Meeting with Oceana Meeting with the Fishing Boat Owners Association Meeting with IRD Meeting with individual SFA staff
Friday 06/11/2105	Meeting with the Ministry of Fisheries and Agriculture Meeting with IOTC Meeting with individual SFA staff Debriefing meeting with SFA
Saturday 07/11/2105	Report writing
Sunday 08/11/2105	Report writing Depart the Seychelles

A list of people met is given in **Appendix B.**

4.3 STAKEHOLDERS TO BE CONSULTED DURING A FULL ASSESSMENT

Relevant stakeholders have been identified (see table below) to participate in the FIP and any fishery put forward for full assessment.

Table 17: Stakeholders to be consulted during a full assessment

Stakeholders	Interests in the fisheries assessment
SEYCHELLES	
Governmental bodies	
Ministry of Fisheries and Agriculture	Policy environment
Ministry of Finance, Trade and Blue Economy	Policy environment
Ministry of Environment	Environmental interests

Seychelles Fishing Authority	Fisheries management
Fish processing companies	
Indian Ocean Tuna	Chain of custody
Oceana	
Sea Harvest	
Fishing associations	
ANABAC	Spanish agent
OPAGNAC	Spanish agent
SAPMER	French agent
FBOA	Local fisheries workers association
REGIONAL ORGANIZATIONS	
IOTC	Target catch stocks, regional fisheries management
IOC	Regional fisheries management
SWIOFC	Non-target stock management
OTHER ORGANISATIONS	
Hunt Deltel	Vessel agents
WWF Indian Ocean	Target & non-target catch
Island Conservation Society,	FAD use
IRD	Fisheries research

It is anticipated that these **stakeholders** will provide important data and information about the fisheries under assessment to the Conformity Assessment Body (CAB), which will carry out the assessment. Furthermore, they will be involved by the CAB at different stages of the fisheries assessment thanks to a consultation process, developed here after.

a. During the preparation stage, CAB will i) submit a '**Stakeholders announcement**' with specific details defining the UoAs (target species, fishing gear, fishing area), ii) propose an assessment team, iii) announce the site visit and iv) invite **stakeholders** to attend and/or provide written submissions for consideration by the team.

b. RSF's fisheries are data-deficient, and the MSC's default assessment tree is not suitable to evaluate certain specific performance indicators. In these conditions, the Risk Based Framework (RBF) methodology will have to be implemented and a reviewed assessment tree will be proposed and open to **stakeholders' consultation** for a period of 30 days in order to finalise the tree before the site visit begins.

c. During the site visit, the assessment team will collect information and **stakeholders** will be invited once more to attend and/or provide written submissions with relevant information. This whole information will be used to score the fisheries after the site visit.

d. After the site visit, CAB will "provide the 'Peer review college' and a 10 day **stakeholder consultation** will be undertaken on potential conflicts of interest of the shortlisted peer reviewers (normally five) from which the final selection will be made (normally two peer reviewers).

e. After the Preliminary Draft Report reviewed by the client, the Draft report analysed and commented by the peer reviewers, the Public Comment Draft Report (PCDR) will be announced by CAB, who must allow **stakeholders** at least 30 days to comment on the PCDR which includes explicit responses to all written and verbal submissions received from them. At this stage, **stakeholders** will have the opportunity to comment on any conditions and milestones that have been set against the fisheries, as well as the action plan proposed by the client to meet the conditions. In the end, when the Final Report is submitted, CAB will have to allow fifteen working days for involved **stakeholders** to file a notice of objection, and the Final Report will be revised where appropriate. After the objection process, if the fisheries are certified, a surveillance stage of five years will start; and **stakeholders** will be notified of the upcoming surveillance audit and asked to provide their view and any relevant information.

4.4 HARMONIZATION WITH ANY OVERLAPPING MSC CERTIFIED FISHERIES

There are two other fisheries in the Indian Ocean that have either achieved MSC certification (the **Maldives pole and line fishery**) or have been assessed but ultimately failed (e.g. the **Echebastar free school purse seine fishery**). We have notes some points below regarding harmonisation with these previous assessments.

- Any future harmonisation of P1 for the Indian Ocean stocks of yellowfin and, or, skipjack tuna will need to consider the outcome of the harmonisation previously undertaken between, on the one hand, the Maldives Pole & Line skipjack and yellowfin fisheries and the Maldives hand line yellowfin fishery and, on the other hand, the assessments (P1) for skipjack and yellowfin undertaken for the Echebastar purse seine fleet.
- In the latter case, the need for harmonisation arose, not just as a general requirement but, specifically, because of the use of v2.0 at PI 1.2.2 for skipjack and yellowfin.
- The need was to consider the rationales and scoring related to HCRs and the conditions set out for accepting SG60 scoring at PI 1.2.2a.
- Following examination by ASI of a complaint raised by a stakeholder, MSC had become aware that there had been some variability in the interpretation and scoring of PI 1.2.2 (CR v1.3, v1.2, v1.1). A number of certified fisheries have been scored as meeting 1.2.2 scoring issue (c) using an interpretation that harvest control tools are available but not necessarily in use within the fishery, which was not in accordance with the requirements in CR v1.3. This incorrect interpretation has not been used by all CABs or assessment teams.
- The issue of HCRs was debated during the Fishery Standard Review (2013-2014) and resulted in MSC's new fisheries standard version 2.0 (1 October 2014) providing clarification as well as additional explicit requirements for scoring PI1.2.2.
- Version 2.0 maintains the previous general requirement whereby a 60 score can be achieved by the HCR being 'generally understood and in place' but also allows HCRs to be only 'available' but ONLY in the specific situation that the stock has been above B_{MSY} for a recent period of time and is not expected to decline below B_{MSY} in the medium term (i.e. where $B>B_{MSY}$ and $F<F_{MSY}$; and in some other special cases). However, to be only 'available' HCRs must be effectively used in some other fisheries under the control of the management body, or there must be an agreement in place to adopt an HCR before the stock declines to B_{MSY}.
- As it was NOT possible to argue that an HCR was effectively used in some other fisheries under the control of the IOTC (management body), nor was there an agreement in place to adopt an HCR before the stock declines to B_{MSY}, consequently to achieve a score of 60 in respect of PI1.2.2a the harmonization concluded that the HCR was not alone 'generally understood', it was also be 'in place'.

- The results of that harmonisation and in particular the decision of the Independent Adjudicator in connection with two Notices of Objection, one filed by WWF Spain and the WWF Global Fisheries Programme (collectively, "WWF") and one filed by the International Pole and Line Foundation ("IPNLF" or the "Foundation") are relevant.
- In his adjudication the independent adjudicator noted that the case ultimately came down to a single, core, scoring issue under MSC Principle 1: that is, whether a Harvest Control Rule (HCR) is in place or available - so as to satisfy PI 1.2.2 at the SG level of 60.
- In his judgment, the independent adjudicator found that the CAB had established neither that an HCR was in place nor that one was available (as the MSC defines availability).
- This flaw, he decided, was 'fundamental, irremediable and fatal' and, as such, the CAB had effectively acted arbitrarily and unreasonably in assigning a score of 60 under this PI for each of the three free set UoCs (skipjack, yellowfin, and bigeye), and that, therefore, these fisheries must fail.

The independent adjudicator noted specifically that:

- The term HCR is defined by the MSC to mean "[a] set of well-defined, pre-agreed rules or actions used for determining a management action-in response to changes in indicators of stock status with respect to reference points." PI 1.2.2 deals with HCRs. It provides, "There are well defined and effective harvest control rules (HCRs) in place." There are two elements to the score of 60 awarded by the CAB under this PI. First, PI 1.2.2(a) provides, "Generally understood HCRs are in place or available that are expected to reduce the exploitation rate as the point of recruitment impairment (PRI) is approached." Second, PI 1.2.2(c) provides, "There is some evidence that tools used or available to implement HCRs are appropriate and effective in controlling exploitation." WWF contended that HCRs are neither in place nor available for these fishery within the meaning of PI 1.2.2(a), and, therefore, a score of 60 for each of the three stocks was arbitrary and unreasonable. The independent adjudicator agreed.

WWF's argument under PI 1.2.2(a) was as follows:

- The suite of Commission resolutions which establish conservation and management measures for the Indian Ocean nowhere establish HCRs which the Commission is bound to apply.
- Two resolutions adopted by the Commission are most critical in this regard. First, Resolution 12/01 generally provides that the Commission Member States are bound to apply the "precautionary principle" in devising conservation and management measures for fisheries under the jurisdiction of the IOTC. However, WWF pointed out, Resolution 12/01 does not mandate the application of any specific HCR.

- Second, Resolution 13/10 which sets out "interim" target and limit reference points for use by the Scientific Committee. Several points about this resolution are noteworthy.
    1. It is clear that the target and limit reference points are to be used by the Scientific Committee in making "recommendations" to the Commission. However, nothing binds the Commission to accept such recommendations.
    2. The target and limit reference points are "interim" only, and they must be assessed and further refined by the Scientific Committee before being "presented to the Commission for adoption of species-specific reference points." In other words, it was obvious that the Commission has not yet adopted a final HCR.
    3. This fluidity of the regime is underscored by language in the resolution to the effect that the Scientific Committee "shall develop and assess potential harvest control rules (HCRs) to be applied ... [and] will recommend to the Commission HCRs for these tuna and tuna-like species." The language, in short, does in no way speak of HCRs being "in place" at the Commission level.

Thus, while the IOTC may be hard at work and even making progress toward developing HCRs, this is not the equivalent of such rules actually being in place.

The independent adjudicator in his judgement noted that the bright line rule must be that an HCR needs to be adopted and binding at the Commission level to satisfy the "in place" requirement of PI 1.2.2(a). This was/is NOT the case.

- Therefore, in respect of the IOTC stocks for yellowfin, bigeye, and skipjack, it must be concluded that neither a) there is an HCR in place, nor, b) was it the case that to be only ‘available’ the HCRs for yellowfin, bigeye, and skipjack were/are effectively used in some other fisheries under the control of the management body, or there must is an agreement in place to adopt an HCR before the stock declines to B_{MSY}.
- Finally, the independent adjudicator in his judgement discussed the issue of precedence with respect to earlier decisions and concluded that while “it may be suggested that a determination that the subject fishery fails to meet the SG 60 level for PI 1.2.2 is somehow inconsistent with the Independent Adjudicator's decision in In re: PNA Western and Central Pacific Skipjack Tuna Un-associated Purse Seine Fishery (MSC, November 11, 2011). Suffice it to say that such decision was under a different regime than the IOTC and at a time before the MSC had clarified, in CR 2.0 and its guidance to CABs of November 24, 2014, how PI 1.2.2 should be applied. In any case, such decision is not binding on me, and, to the extent it is inconsistent with my analysis, I decline to follow it”.

Finally, four more considerations are presented:

- As the pole and line fishery in Maldives basically represented the whole fishery in the WIO it made more sense to consider things at regional and national level on a more equal footing. For this assessment as the PS is much more regional and the fleet operates mainly in high seas, the emphasis is naturally more on regional issues
- The Echebastar assessment was incorrect in including Seychelles performance in the way it did (unless specifically/only for the purposes of a FIP, which was not made clear if that was the case). Most PIs need to be covered only at regional level. And for those PIs where it is important to consider national performance (in my view particularly 3.1.1 and 3.2.3) then to be consistent it should also have considered other countries in which the fleet operates.

5 ELIGIBILITY OF FISHERY PRODUCTS TO ENTER FURTHER CHAINS OF CUSTODY

In this fishery the chain of custody commences from the landing of the catch on board the fishing vessel and its sorting and subsequent storage in the brine wells. Some vessels are now introducing coloured wells to assist in catch segregation. Catch is usually pre-sorted according to species and size and allocated to particular wells, but this does not always happen, and different sets may be mixed together. Once stored, each vessel will have a well storage plan. The only exception to this are the two French vessels which have dry storage at -40°C and thus require alternative storage plans. However, given the high value of these fish, the larger individuals (e.g., >10 kg) are tagged with their set of origin.

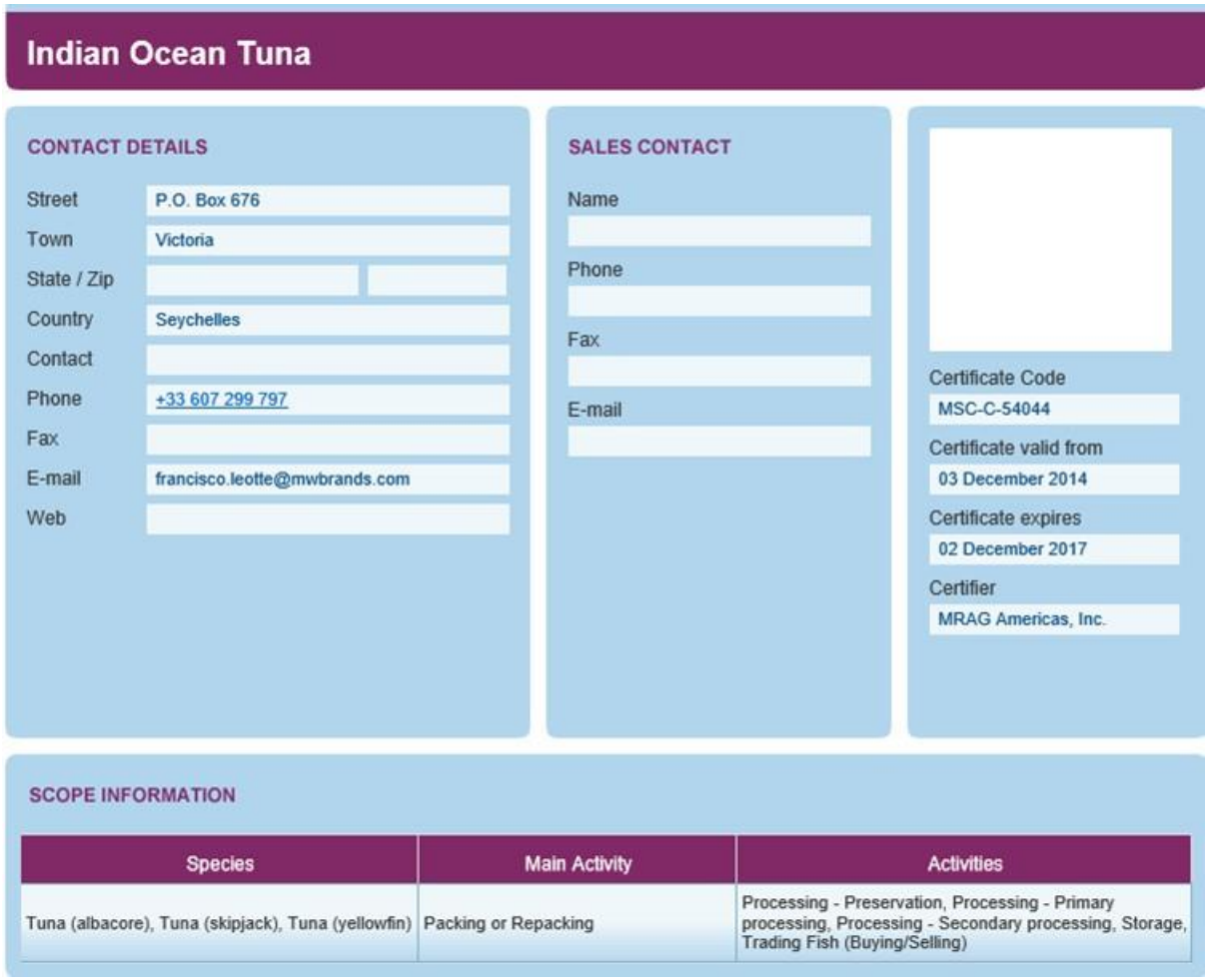
Record 2000 t in 3 days. FR 150 t / day and ESP. 500 t / day. Lots more stevedores. Factories currently don't know if FAD / free-school, but do know vessel origin.

The next risk point in the chain is unloading. Fish are unloaded from individual wells and placed on a conveyor belt for transfer into the processing plant or for subsequent transhipment to other canneries (mainly in Mauritius). With the urgency to offload the vessel and return to fishing, at this point there may be a risk of mixing as fish from multiple wells maybe offloaded at the same time onto a single conveyor, although double conveyors are sometimes used. The larger Spanish vessels usually have more stevedores and unload around 500 t a day, whilst the smaller French vessels usually unload 150 t a day.

Around 250,000 t of tuna is landed into the Seychelles from the wider purse seine fishery, including the fleet under pre-assessment. In 2014 of this, around 71,000 t was purchased by Indian Ocean Tuna, the maid domestic recipient of tuna in Victoria, of which 17,000 was from the Seychelles-flagged vessels (Francois Rossi, IOT, pers. comm., 5 Nov. 2014). Of the fish canned by IOT, 52% was skipjack, 41% yellowfin, 6% bigeye and 1% albacore. IOT also buy fish from pole and line fisheries in the Maldives and Brazil, with around 5,000 t per annum coming in by reefer.

IOT has developed a full traceability system, and already holds an MSC Chain of Custody certificate (see figure below). All incoming raw material is allocated an Electronic Product Number (EPN) which is in the case of the domestic purse seiners, is based on the fishing vessel of origin. At present the catch is not segregated further e.g., against free and FAD sets, but this is possible within the current system.

Fish from IOT is either pre-cooked and canned (around 67%) or packed in raw form for France (yellowfin only), accounting for the remaining 33%.



Indian Ocean Tuna

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SALES CONTACT

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Phone

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E-mail

Certificate Code: MSC-C-54044

Certificate valid from: 03 December 2014

Certificate expires: 02 December 2017

Certifier: MRAG Americas, Inc.

SCOPE INFORMATION

Species	Main Activity	Activities
Tuna (albacore), Tuna (skipjack), Tuna (yellowfin)	Packing or Repacking	Processing - Preservation, Processing - Primary processing, Processing - Secondary processing, Storage, Trading Fish (Buying/Selling)

Key requirements for ensuring the chain of custody for these fisheries will include:

- The documented control system required for managing the chain of custody that ensures only MSC eligible fish is labelled and sold as such; and mitigating the risk of fraudulent claims from within and outside the certified fishery;

- Implementation of a group chain of custody system for the management and control of chain of custody on board catch and carrier vessels;
- Identification and confirmation of individual MSC free school and FAD sets brought on board seiners;
- Segregating the catch between free school and FAD related fisheries;
- Physical and/or temporal separation of MSC and non-MSC fish stored on board vessels, including verification that no mixing has taken place on board i.e. that MSC and non-MSC fish are not mixed in the same well;
- Segregating and demarcation of fish on discharge to the carrier, during storage on board carrier and during discharge on landing;
- Traceability back to MSC free school set during vessel storage and delivery; and
- Verification, recording and reconciliation of MSC catches, inputs and output volumes.

6 PRELIMINARY EVALUATION OF THE FISHERY

6.1 APPLICABILITY OF THE DEFAULT ASSESSMENT TREE

These two UoAs would use the default assessment tree. There are no special characteristics of these fisheries that would warrant revising the tree, beyond that most non-target species would require use of the risk-based framework (RBF, see next sub-section) and that there are no primary non-target species currently in the two UoAs.

As there are no primary non-target species expected, P2.1.1 (Outcome) and P2.1.2 (Management) would likely be scored 100 and 80 respectively, whilst P2.1.3 (Information) would be assessed separately (MSC, pers. comm., 10 June 2015).

6.2 EXPECTATIONS REGARDING USE OF THE RISK-BASED FRAMEWORK (RBF)

As with this pre-assessment, the majority of non-species caught by both UoAs are considered data-deficient. As a result, 2.2.1 will be scored with the RBF (see table below).

Performance indicator	Criteria	RBF?
1.1.1 Stock status	Stock status reference points are available, derived either from analytical stock assessment or using empirical approaches	No (CA & PSA)
2.1.1 Primary species outcome & 2.2.1 Secondary species outcome	Stock status reference points are available, derived either from analytical stock assessment or using empirical approaches	Yes (for 2° species) (PSA)
2.3.1 ETP species outcome	Can the impact of the fishery in assessment on ETP species be analytically determined?	No
2.4.1 Habitats outcome	Are both of the following applicable: (i) Information on habitats encountered is available; and (ii) information of impact of fishery on habitats encountered is available?	No
2.5.1 Ecosystem outcome	Is information available to support an analysis of	Yes (SICA)

	the impact of the fishery on the ecosystem?	

Our current thinking is that the ETP and Habitats outcome PIs could be scored using existing or easily collected information.

6.3 EVALUATION OF THE FISHERY

The two UoAs fisheries have undergone a preliminary scoring exercise using the MSC Full Assessment Reporting Template v2.0 (8 October 2014) as a guide. Given the large number of non-target species P2.2, we have used the individual species information as provided in Section 3 to provide an aggregated score for the different PIs. This said, where one species fails to reach a scoring threshold, this will be reflected in the overall aggregated score.

The following summaries are based upon the 'simplified' scoring sheets as follows:

UoC A Free-school purse seine fishery

- Table 18: Simplified scoring sheet: UoC A.1 Free-school purse seine fishery (Skipjack tuna)
- Table 19: Simplified scoring sheet: UoC A.2 Free-school purse seine fishery (Yellowfin tuna)
- Table 20: Simplified scoring sheet: UoC A.3 Free-school purse seine fishery (Bigeye tuna)

UoC B FAD-dependent purse seine fishery

-

- UoC B FAD dependent purse seine fishery
- Principle 1 Target Species: As for UoC A.

Principle 2 Ecosystem impacts: no primary non-target species are present, so this scores 100, 80 and 80 for the P2.1 Outcome, Management and Information PIs respectively. Of the nine non-target species are considered to be secondary species, two (the kawakawa and the blue marlin) have sufficient information to assess their status via the default assessment tree whilst the others are data-deficient and thus need were assessed using the PSA under the RBF. Of the six 'main' secondary species (e.g. >5% of the bycatch), one (the silky shark) is high risk due to a combination of its life strategy and high susceptibility to purse seines. Three other species, the rainbow runner, dolphin fish and blue marlin may achieve conditional passes. In the case of the rainbow runner and dolphinfish, these species, whilst of medium resilience, are highly susceptible to a number of surface gears in both oceanic and coastal fisheries. The blue marlin is over fished but not currently subject to overfishing, and there is insufficient data to fully account for fisheries mortality. The other two main species, bullet tuna and frigate tuna are both highly productive species and should achieve an MSC pass without major conditions, although fishing mortality data from artisanal fisheries is again a concern.

Encounterability of marine turtles in FAD-associated sets is low e.g. 0.05 turtles per set and the majority of entrapped turtles are released alive. Sets on whale sharks are banned by IOTC and interactions with dolphins are almost unknown in the Western Indian Ocean. There are a number of IOTC regulations aimed at conserving some shark species, marine turtles and cetaceans. Information on ETP interaction rates and results is reasonable and improving, especially with the recent imposition of 100% observer coverage.

Whilst there are no habitat-related issues directly associated with this FAD-dependent fishery, there is increasing concern over the beaching of abandoned, lost and discarded FADs on coral reefs, esp. around the Seychelles. Whilst there is some regional IOTC measures (e.g. FAD limits) and fleet measures (e.g. tracking and recovery of FADs), there is still a significant loss rate with no strategy to address this. In addition, there is limited information on the spatial extent of beaching and on the timing & location of FAD beaching.

This UoA is part of a number of different fisheries targeting the oceanic tunas and contributes to the removal of a significant biomass of these top predators on a recurrent basis. A widespread decline in the abundance of these top predators, as well as large pelagic sharks has been demonstrated, as has the emergence of several mid-sized, lower-trophic-level species such as crocodile shark and lancet fish. Whilst there has not been a major impact on oceanic productivity detected to date, the continued and increasing pressure of tuna fisheries is of concern and this suggests a greater approach to ecosystem-based management by IOTC is required. There is also a need to progress ecosystem modelling in the Indian Ocean and to assess the trophic implications of both tuna fishing and other factors such as climate change.

With this fishery, whilst there is no strong evidence of recruitment over-fishing linked to FAD use, the ecosystem impact of the extensive and increasing use of FADs is still largely unknown and it cannot be stated with any certainty that it is highly likely that UoA will not disrupt the key elements underlying ecosystem structure and function.

Principle 3 Fisheries management: As for UoC A.

- Table 21: Simplified scoring sheet: UoC B.1 FAD-dependent purse seine fishery (Skipjack tuna)
- Table 22: Simplified scoring sheet: UoC B.2 FAD-dependent purse seine fishery (Yellowfin tuna)
- Table 23: Simplified scoring sheet: UoC B.3 FAD-dependent purse seine fishery (Bigeye tuna)

6.3.1 UoC A Free-school purse seine fishery

Principle 1 Target Species: There are three fundamental issues with all three of these stocks in respect of P1.

Firstly, the IOTC does not currently have any Conservation and Management Measures in place, other than the FAD limitation measure (Resolution 15/08, which is yet to be evaluated) to regulate the fisheries for yellowfin tuna.

Secondly the IOTC does not currently have a clearly defined Harvest Strategy for these stocks. The latter is defined in MSC-MSCI Vocabulary V 1.0, 1st October 2014. as "*the combination of i) monitoring, ii) stock assessment, iii) harvest control rules and iv) management actions*". There are no clearly defined HCR's for this fishery and the assessment team cannot provide objective evidence of well-defined pre-agreed rules or actions used by the Indian Ocean Tuna Commission (IOTC) for determining a management action in response to changes in indicators of stock status with respect to reference points. And while IOTC resolution 12/01 does provide an approach, it is none-the-less just an initial step on the path towards fully developing harvest control rules and, ultimately, a harvest strategy. Likewise while IOTC resolution 13/10 (part 4) does establish the basis of a harvest strategy and specifies that the Scientific Committee shall develop and assess potential harvest control rules (HCRs) to be applied, considering the status of the stocks against reference points, these are currently not in place.

The Scientific Committee concluded in their 2015 report that the IOTC does not currently have any Conservation and Management Measures in place, other than the FAD limitation measure (Resolution 15/08, which is yet to be evaluated) to regulate the fisheries for yellowfin tuna. In other words, there are no clearly defined 'management actions'. Taking these two points together it must be concluded that the IOTC does not currently have a clearly defined Harvest Strategy for the stocks of bigeye, yellowfin, or skipjack tuna.

Thirdly and finally, harvest control rules for this stock are not well-defined and there is no specific plan of control if the stock size falls below the trigger point (MSY). While there may be evidence of an intention to end overfishing and rebuild this stock should depletion occur and the scientific committee might be called on to provide such advice, it cannot be argued that there are generally understood harvest rules in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached (thus meeting the SG60). Rather, on balance, it must be argued that well defined and effective harvest control rules are NOT yet in place for this stock.

Principle 2 Ecosystem impacts: no primary non-target species are present, so this scores 100, 80 and 80 for the P2.1 Outcome, Management and Information PIs respectively. Of the nine non-target species are considered to be secondary species, two (the kawakawa and the blue marlin) have sufficient information to assess their status via the default assessment

tree whilst the others are data-deficient and thus need were assessed using the PSA under the RBF. Of the five 'main' secondary species (e.g. >5% of the bycatch[18]), one (the silky shark) is high risk dues to a combination of its life strategy and high susceptibility to purse seines, even in free school sets. Two other species, the rainbow runner and the blue marlin may achieve conditional passes. In the case of the rainbow runner, this species, whilst of medium resilience, is highly susceptible to a number of surface gears in both oceanic and coastal fisheries. The blue marlin is over fished but not currently subject to overfishing, and there is insufficient data to fully account for fisheries mortality. The other two main species, bullet tuna and frigate tuna are both highly productive species and should achieve an MSC pass without major conditions, although fishing mortality data from artisanal fisheries is again a concern.

Encounterability of marine turtles in free school sets is low e.g. 0.01 turtles per set and the majority of entrapped turtles are released alive. Sets on whale sharks are banned by IOTC and interactions with dolphins are almost unknown in the Western Indian Ocean. There are a number of IOTC regulations aimed at conserving some shark species, marine turtles and cetaceans. Information on ETP interaction rates and results is reasonable and improving, especially with the recent imposition of 100% observer coverage.

There are no habitat-related issues with the free-school fishery.

This UoA is part of a number of different fisheries targeting the oceanic tunas and contributes to the removal of a significant biomass of these top predators on a recurrent basis. A widespread decline in the abundance of these top predators, as well as large pelagic sharks has been demonstrated, as has the emergence of several mid-sized, lower-trophic-level species such as crocodile shark and lancet fish. Whilst there has not been a major impact on oceanic productivity detected to date, the continued and increasing pressure of tuna fisheries is of concern and this suggests a greater approach to ecosystem-based management by IOTC is required. There is also a need to progress ecosystem modelling in the Indian Ocean and to assess the trophic implications of both tuna fishing and other factors such as climate change.

Principle 3 Fisheries management: Under Governance and Policy, the failure of all CPCs to transpose regional-level IOTC Resolutions into national legislation results in a score of under 80 for the PI on the legal and customary framework, while for the PIs on: consultation roles and responsibilities; and long term objectives PIs score over 80.

Under the Fishery Specific Management System, the CMMs in effect when viewed in their totality are sufficient to score the PI on fisheries specific objectives as over 80, given that the CMMs provide the rationale (read objectives/goals) for the strategies and actions agreed in the Resolutions (or Recommendations). Decision-making processes are also clearly defined at the regional level for taking decisions related to fishery specific issues (although necessary action is not always taken). Compliance and enforcement is assessed as weak at both regional and national level, impacting on P1 and P2 outcomes and P3 implementation, and therefore has some conditions associated with bringing the PI over 80. Monitoring and evaluation through the defined roles and responsibilities at regional level covers most parts of the evaluation system, but is largely internal in nature.

[18] Normally this is 5% of the total catch volume, but we have used the more precautionary 5% threshold for discarded bycatch

Table 18: Simplified scoring sheet: UoC A.1 Free-school purse seine fishery (Skipjack tuna)

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale / Key points
P1	Outcome	1.1.1	Stock status	N	100	Scores 100 as the stock is at a level which maintains high productivity and has a low probability of recruitment overfishing
		1.1.2	Reference points	N	75	The limit reference point is NOT set above the level at which there is an appreciable risk of impairing reproductive capacity. A more precise definition of the target reference point is required.
	Management	1.2.1	Harvest Strategy	N	<60	Lacks adequate harvest strategy. No clearly defined HCR. IOTC does not currently have Conservation and Management Measures in place.
		1.2.2	Harvest control rules and tools	N	<60	No clearly defined HCR. Instead HCR is 'implied'.
		1.2.3	Information and monitoring	N	80	Issues remain with some of data and there are information gaps.
		1.2.4	Assessment of stock status	N	80	There remains uncertainty in the assessment.
	Number of PIs less than 60					2
P2	Primary Species	2.1.1	Outcome	N	100	Scores 100 as the UoA does not have any impact on this component.
		2.1.2	Management	N	80	Scores 80 as no management strategy is necessary.
		2.1.3	Information	N	60	Data on the catch of non-target species is currently collected but is yet to be analyzed.
	Secondary species	2.2.1	Outcome	Y	<60	One species (silky shark) scores less than 60. For this reason the PI on aggregate scores <60. Some (4/9 species) elements (species) score at least 60 and some (4/9) achieve higher scores exceeding 80.
		2.2.2	Management	Y	<60	No management strategy in place for any 2° species.
		2.2.3	Information	Y	60	Data on the catch of non-target species is currently collected but is yet to be analyzed.

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale / Key points
	ETP species	2.3.1	Outcome	N	90	Interactions with, and the consequences of, free school sets with turtles and whale sharks are limited and highly likely to be within set limits.
		2.3.2	Management	N	90	There are resolutions prohibiting sets on whale sharks and on the conservation of marine turtles and cetaceans.
		2.3.3	Information	N	70	There is some quantitative information on the level of interactions with ETPs, although it may not be sufficient to quantify the level of post-release mortality nor the consequence for each species.
	Habitats	2.4.1	Outcome	N	90	There are no commonly encountered or vulnerable marine ecosystems (VMEs) that might be impacted by free school sets.
		2.4.2	Management	N	80	There is no strategy or measures required to manage habitat impacts.
		2.4.3	Information	N	100	The distribution of habitats and VMEs in the Western Indian Ocean is well known.
	Ecosystem	2.5.1	Outcome	N	80	At present here is no suggestion that the UoA is disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
		2.5.2	Management	N	<60	There are currently some measures in place to take into account the potential impacts of the UoA on key elements of the ecosystem, but they are unlikely to work if fishing effort continues to expand unchecked.
		2.5.3	Information	N	60	Whilst there is some information on the key elements of the ecosystem, the main impacts the UoA on these key ecosystem elements can be inferred from existing information, but have not been investigated in detail.
	Number of PIs less than 60:					3

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale / Key points
P3	Governance & policy	3.1.1	Legal and customary framework	(Note: RBF approach do not apply to principle 3)	60-79	Framework for cooperating is in place through existence of IOTC and related Resolutions, but many CPCs have not translated legal framework into national legislative framework suggesting that such cooperation is not always effective for management. Transparent mechanisms in place for dispute resolution but not tested or proven at regional level. Functioning of IOTC ensure respect for customary rights.
		3.1.2	Consultation, roles and responsibilities		>80	Roles and responsibilities well defined and understood and IOTC consultation processes regularly seek and accept relevant information. Consultation processes provide opportunity for involvement but there are human and financial capacity constraints often on full participation by all parties.
		3.1.3	Long term objectives		>80	Long-term precautionary approaches to fisheries management are embedded in the IOTCs mandate and modus operandi.
	Fishery specific management system	3.2.1	Fishery specific objectives		>80	Specific objectives provided in pre-amble texts to Resolutions agreeing actions as part of CMMs and are therefore explicit. But not collated into one fishery management plan document or logically linked to measurable indicators
		3.2.2	Decision making processes		>80	The management system pro-actively avoids disputes and there is formal and transparent reporting on management performance, management decisions and actions. But the established decision-making processes don't always result in necessary action.
		3.2.3	Compliance and enforcement		60-79	MCS mechanisms are in place but there is no one regional system ensuring comprehensive MCS across the whole fishery. Views on appropriate sanctions differ and again there is no one system applying. Some information on compliance is provided and while there is no systematic evidence of non compliance there are nevertheless serious concerns about compliance in the fishery as a whole
		3.2.4	Management performance evaluation		>80	There are mechanisms in place to evaluate key parts of the management system through the IOTC meetings and committee meetings, and performance reviews of IOTC as a whole have been completed. But evaluation is mostly internal and there is not regular internal and external review covering all parts of the management system.
	Number of PIs less than 60:					0

Table 19: Simplified scoring sheet: UoC A.2 Free-school purse seine fishery (Yellowfin tuna)

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale / Key points
P1	Outcome	1.1.1	Stock status	N	60	There is NOT high degree of certainty (i.e. greater than 95) that the stock is above the point where recruitment would be impaired
		1.1.2	Reference Points	N	65	The limit reference point is NOT set above the level at which there is an appreciable risk of impairing reproductive capacity. A more precise definition of the target reference point is required.
		1.1.3	Stock rebuilding	N	<60	IOTC does not currently have Conservation and Management Measures in place.
	Management	1.2.1	Harvest Strategy	N	<60	Lacks adequate harvest strategy. No clearly defined HCR. IOTC does not currently have Conservation and Management Measures in place.
		1.2.2	Harvest control rules and tools	N	<60	No clearly defined HCR. Instead HCR is 'implied'.
		1.2.3	Information and monitoring	N	80	Issues remain with some of data and there are information gaps.
		1.2.4	Assessment of stock status	N	90	There remains uncertainty in the assessment.
	Number of PIs less than 60					3
P2	Primary Species	2.1.1	Outcome	N	100	Scores 100 as the UoA does not have any impact on this component.
		2.1.2	Management	N	80	Scores 80 as no management strategy is necessary.
		2.1.3	Information	N	60	Data on the catch of non-target species is currently collected but is yet to be analyzed.
	Secondary species	2.2.1	Outcome	Y	<60	One species (silky shark) scores less than 60. For this reason the PI on aggregate scores <60. Some (4/9 species) elements (species) score at least 60 and some (4/9) achieve higher scores exceeding 80.
		2.2.2	Management	Y	<60	No management strategy in place for any 2° species.

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale / Key points
		2.2.3	Information	Y	60	Data on the catch of non-target species is currently collected but is yet to be analyzed.
	ETP species	2.3.1	Outcome	N	90	Interactions with, and the consequences of, free school sets with turtles and whale sharks are limited and highly likely to be within set limits.
		2.3.2	Management	N	90	There are resolutions prohibiting sets on whale sharks and on the conservation of marine turtles and cetaceans.
		2.3.3	Information	N	70	There is some quantitative information on the level of interactions with ETPs, although it may not be sufficient to quantify the level of post-release mortality nor the consequence for each species.
	Habitats	2.4.1	Outcome	N	90	There are no commonly encountered or vulnerable marine ecosystems (VMEs) that might be impacted by free school sets.
		2.4.2	Management	N	80	There is no strategy or measures required to manage habitat impacts.
		2.4.3	Information	N	100	The distribution of habitats and VMEs in the Western Indian Ocean is well known.
	Ecosystem	2.5.1	Outcome	N	80	At present here is no suggestion that the UoA is disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
		2.5.2	Management	N	<60	There are currently some measures in place to take into account the potential impacts of the UoA on key elements of the ecosystem, but they are unlikely to work if fishing effort continues to expand unchecked.
		2.5.3	Information	N	60	Whilst there is some information on the key elements of the ecosystem, the main impacts the UoA on these key ecosystem elements can be inferred from existing information, but have not been investigated in detail.
	Number of PIs less than 60:					3

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale / Key points
P3	Governance & policy	3.1.1	Legal and customary framework	(Note: RBF approach do not apply to principle 3)	60-79	Framework for cooperating is in place through existence of IOTC and related Resolutions, but many CPCs have not translated legal framework into national legislative framework suggesting that such cooperation is not always effective for management. Transparent mechanisms in place for dispute resolution but not tested or proven at regional level. Functioning of IOTC ensure respect for customary rights.
		3.1.2	Consultation, roles and responsibilities		>80	Roles and responsibilities well defined and understood and IOTC consultation processes regularly seek and accept relevant information. Consultation processes provide opportunity for involvement but there are human and financial capacity constraints often on full participation by all parties.
		3.1.3	Long term objectives		>80	Long-term precautionary approaches to fisheries management are embedded in the IOTCs mandate and modus operandi.
	Fishery specific management system	3.2.1	Fishery specific objectives		>80	Specific objectives provided in pre-amble texts to Resolutions agreeing actions as part of CMMs and are therefore explicit. But not collated into one fishery management plan document or logically linked to measurable indicators
		3.2.2	Decision making processes		>80	The management system pro-actively avoids disputes and there is formal and transparent reporting on management performance, management decisions and actions. But the established decision-making processes don't always result in necessary action.
		3.2.3	Compliance and enforcement		60-79	MCS mechanisms are in place but there is no one regional system ensuring comprehensive MCS across the whole fishery. Views on appropriate sanctions differ and again there is no one system applying. Some information on compliance is provided and while there is no systematic evidence of non compliance there are nevertheless serious concerns about compliance in the fishery as a whole
		3.2.4	Management performance evaluation		>80	There are mechanisms in place to evaluate key parts of the management system through the IOTC meetings and committee meetings, and performance reviews of IOTC as a whole have been completed. But evaluation is mostly internal and there is not regular internal and external review covering all parts of the management system.
	Number of PIs less than 60:					0

Table 20: Simplified scoring sheet: UoC A.3 Free-school purse seine fishery (Bigeye tuna)

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale / Key points
P1	Outcome	1.1.1	Stock status	N	100	Scores 100 as the stock is at a level which maintains high productivity and has a low probability of recruitment overfishing
		1.1.2	Reference Points	N	75	The limit reference point is NOT set above the level at which there is an appreciable risk of impairing reproductive capacity. A more precise definition of the target reference point is required.
	Management	1.2.1	Harvest Strategy	N	<60	IOTC does not currently have Conservation and Management Measures in place.
		1.2.2	Harvest control rules and tools	N	<60	Lacks adequate harvest strategy. No clearly defined HCR. IOTC does not currently have Conservation and Management Measures in place.
		1.2.3	Information and monitoring	N	80	No clearly defined HCR. Instead HCR is 'implied'.
		1.2.4	Assessment of stock status	N	85	Issues remain with some of data and there are information gaps.
	Number of PIs less than 60					2
P2	Primary Species	2.1.1	Outcome	N	100	Scores 100 as the UoA does not have any impact on this component.
		2.1.2	Management	N	80	Scores 80 as no management strategy is necessary.
		2.1.3	Information	N	60	Data on the catch of non-target species is currently collected but is yet to be analyzed.
	Secondary species	2.2.1	Outcome	Y	<60	One species (silky shark) scores less than 60. For this reason the PI on aggregate scores <60. Some (4/9 species) elements (species) score at least 60 and some (4/9) achieve higher scores exceeding 80.
		2.2.2	Management	Y	<60	No management strategy in place for any 2° species.
		2.2.3	Information	Y	60	Data on the catch of non-target species is currently collected but is yet to be analyzed.

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale / Key points
	ETP species	2.3.1	Outcome	N	90	Interactions with, and the consequences of, free school sets with turtles and whale sharks are limited and highly likely to be within set limits.
		2.3.2	Management	N	90	There are resolutions prohibiting sets on whale sharks and on the conservation of marine turtles and cetaceans.
		2.3.3	Information	N	70	There is some quantitative information on the level of interactions with ETPs, although it may not be sufficient to quantify the level of post-release mortality nor the consequence for each species.
	Habitats	2.4.1	Outcome	N	90	There are no commonly encountered or vulnerable marine ecosystems (VMEs) that might be impacted by free school sets.
		2.4.2	Management	N	80	There is no strategy or measures required to manage habitat impacts.
		2.4.3	Information	N	100	The distribution of habitats and VMEs in the Western Indian Ocean is well known.
	Ecosystem	2.5.1	Outcome	N	80	At present here is no suggestion that the UoA is disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
		2.5.2	Management	N	<60	There are currently some measures in place to take into account the potential impacts of the UoA on key elements of the ecosystem, but they are unlikely to work if fishing effort continues to expand unchecked.
		2.5.3	Information	N	60	Whilst there is some information on the key elements of the ecosystem, the main impacts the UoA on these key ecosystem elements can be inferred from existing information, but have not been investigated in detail.
	Number of PIs less than 60:					3

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale / Key points
P3	Governance & policy	3.1.1	Legal and customary framework	(Note: RBF approach do not apply to principle 3)	60-79	Framework for cooperating is in place through existence of IOTC and related Resolutions, but many CPCs have not translated legal framework into national legislative framework suggesting that such cooperation is not always effective for management. Transparent mechanisms in place for dispute resolution but not tested or proven at regional level. Functioning of IOTC ensure respect for customary rights.
		3.1.2	Consultation, roles and responsibilities		>80	Roles and responsibilities well defined and understood and IOTC consultation processes regularly seek and accept relevant information. Consultation processes provide opportunity for involvement but there are human and financial capacity constraints often on full participation by all parties.
		3.1.3	Long term objectives		>80	Long-term precautionary approaches to fisheries management are embedded in the IOTCs mandate and modus operandi.
	Fishery specific management system	3.2.1	Fishery specific objectives		>80	Specific objectives provided in pre-amble texts to Resolutions agreeing actions as part of CMMs and are therefore explicit. But not collated into one fishery management plan document or logically linked to measurable indicators
		3.2.2	Decision making processes		>80	The management system pro-actively avoids disputes and there is formal and transparent reporting on management performance, management decisions and actions. But the established decision-making processes don't always result in necessary action.
		3.2.3	Compliance and enforcement		60-79	MCS mechanisms are in place but there is no one regional system ensuring comprehensive MCS across the whole fishery. Views on appropriate sanctions differ and again there is no one system applying. Some information on compliance is provided and while there is no systematic evidence of non compliance there are nevertheless serious concerns about compliance in the fishery as a whole
		3.2.4	Management performance evaluation		>80	There are mechanisms in place to evaluate key parts of the management system through the IOTC meetings and committee meetings, and performance reviews of IOTC as a whole have been completed. But evaluation is mostly internal and there is not regular internal and external review covering all parts of the management system.
	Number of PIs less than 60:					0

6.3.2 UoC B FAD dependent purse seine fishery

Principle 1 Target Species: As for UoC A.

Principle 2 Ecosystem impacts: no primary non-target species are present, so this scores 100, 80 and 80 for the P2.1 Outcome, Management and Information PIs respectively. Of the nine non-target species are considered to be secondary species, two (the kawakawa and the blue marlin) have sufficient information to assess their status via the default assessment tree whilst the others are data-deficient and thus need were assessed using the PSA under the RBF. Of the six 'main' secondary species (e.g. >5% of the bycatch), one (the silky shark) is high risk due to a combination of its life strategy and high susceptibility to purse seines. Three other species, the rainbow runner, dolphin fish and blue marlin may achieve conditional passes. In the case of the rainbow runner and dolphinfish, these species, whilst of medium resilience, are highly susceptible to a number of surface gears in both oceanic and coastal fisheries. The blue marlin is over fished but not currently subject to overfishing, and there is insufficient data to fully account for fisheries mortality. The other two main species, bullet tuna and frigate tuna are both highly productive species and should achieve an MSC pass without major conditions, although fishing mortality data from artisanal fisheries is again a concern.

Encounterability of marine turtles in FAD-associated sets is low e.g. 0.05 turtles per set and the majority of entrapped turtles are released alive. Sets on whale sharks are banned by IOTC and interactions with dolphins are almost unknown in the Western Indian Ocean. There are a number of IOTC regulations aimed at conserving some shark species, marine turtles and cetaceans. Information on ETP interaction rates and results is reasonable and improving, especially with the recent imposition of 100% observer coverage.

Whilst there are no habitat-related issues directly associated with this FAD-dependent fishery, there is increasing concern over the beaching of abandoned, lost and discarded FADs on coral reefs, esp. around the Seychelles. Whilst there is some regional IOTC measures (e.g. FAD limits) and fleet measures (e.g. tracking and recovery of FADs), there is still a significant loss rate with no strategy to address this. In addition, there is limited information on the spatial extent of beaching and on the timing & location of FAD beaching.

This UoA is part of a number of different fisheries targeting the oceanic tunas and contributes to the removal of a significant biomass of these top predators on a recurrent basis. A widespread decline in the abundance of these top predators, as well as large pelagic sharks has been demonstrated, as has the emergence of several mid-sized, lower-trophic-level species such as crocodile shark and lancet fish. Whilst there has not been a major impact on oceanic productivity detected to date, the continued and increasing pressure of tuna fisheries is of concern and this suggests a greater approach to ecosystem-based management by IOTC is required. There is also a need to progress ecosystem modelling in the Indian Ocean and to assess the trophic implications of both tuna fishing and other factors such as climate change.

With this fishery, whilst there is no strong evidence of recruitment over-fishing linked to FAD use, the ecosystem impact of the extensive and increasing use of FADs is still largely unknown and it cannot be stated with any certainty that it is highly likely that UoA will not disrupt the key elements underlying ecosystem structure and function.

Principle 3 Fisheries management: As for UoC A.

Table 21: Simplified scoring sheet: UoC B.1 FAD-dependent purse seine fishery (Skipjack tuna)

Principle	Component	PI	Performance Indicator	RBF required ? (y/n)	Likely scoring level	Rationale / Key points
P1	Outcome	1.1.1	Stock status	N	100	Scores 100 as the stock is at a level which maintains high productivity and has a low probability of recruitment overfishing
		1.1.2	Stock rebuilding	N	75	The limit reference point is NOT set above the level at which there is an appreciable risk of impairing reproductive capacity. A more precise definition of the target reference point is required.
	Management	1.2.1	Harvest Strategy	N	<60	Lacks adequate harvest strategy. No clearly defined HCR. IOTC does not currently have Conservation and Management Measures in place.
		1.2.2	HCRs and tools	N	<60	No clearly defined HCR. Instead HCR is 'implied'.
		1.2.3	Information & monitoring	N	80	Issues remain with some of data and there are information gaps.
		1.2.4	Assessment of stock status	N	80	There remains uncertainty in the assessment.
	Number of PIs less than 60					2
P2	Primary Species	2.1.1	Outcome	N	100	Scores 100 as the UoA does not have any impact on this component.
		2.1.2	Management	N	80	Scores 80 as no management strategy is necessary.
		2.1.3	Information	N	60	Data on the catch of non-target species is currently collected but is yet to be analyzed.
	Secondary species	2.2.1	Outcome	Y	<60	One species (silky shark) scores less than 60. For this reason the PI on aggregate scores <60. Some (4/9 species) elements (species) score at least 60 and some (4/9) achieve higher scores exceeding 80.
		2.2.2	Management	Y	<60	No management strategy in place for any 2° species.
		2.2.3	Information	Y	60	Data on the catch of non-target species is currently collected but is yet to be analyzed.

Principle	Component	PI	Performance Indicator	RBF required ? (y/n)	Likely scoring level	Rationale / Key points
	ETP species	2.3.1	Outcome	N	80	Interactions with, and the consequences of FAD-associated sets with turtles and whale sharks are limited and likely to be within set limits.
		2.3.2	Management	N	90	There are resolutions prohibiting sets on whale sharks and on the conservation of marine turtles and cetaceans.
		2.3.3	Information	N	70	There is some quantitative information on the level of interactions with ETPs, although it may not be sufficient to quantify the level of post-release mortality nor the consequence for each species.
	Habitats	2.4.1	Outcome	N	60	There are no commonly encountered or vulnerable marine ecosystems (VMEs) that might be directly impacted by FAD-associated school sets. However there is some indirect impact through the beaching of abandoned, lost and otherwise discarded FADs on coral reefs, although it is to unlikely to reduce structure and function of these VME habitats to a point where there would be serious or irreversible harm.
		2.4.2	Management	N	70	Whilst there is some regional IOTC measures (e.g. FAD limits) and fleet measures (e.g. tracking and recovery of FADs), there is still a significant loss rate with no strategy to address this.
		2.4.3	Information	N	70	Whilst the distribution of habitats and VMEs in the Western Indian Ocean is well known, there is limited information on the spatial extent of interaction and on the timing and location of FAD beaching.
	Ecosystem	2.5.1	Outcome	N	60	Whilst there is no strong evidence of recruitment over-fishing linked to FAD use, the ecosystem impact of the extensive and increasing use of FADs is still largely unknown and it cannot be stated with any certainty that it is highly likely that UoA will not disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
		2.5.2	Management	N	<60	There are currently some measures in place to take into account the potential impacts of the UoA on key elements of the ecosystem, but they are unlikely to work if fishing effort continues to expand unchecked.
		2.5.3	Information	N	60	Whilst there is some information on the key elements of the ecosystem, the main impacts the UoA on these key ecosystem elements can be inferred from existing information, but have not been investigated in detail.
	Number of PIs less than 60:					3

Principle	Component	PI	Performance Indicator	RBF required ? (y/n)	Likely scoring level	Rationale / Key points
P3	Governance & policy	3.1.1	Legal and customary framework	(Note: RBF approach do not apply to principle 3)	60-79	Framework for cooperating is in place through existence of IOTC and related Resolutions, but many CPCs have not translated legal framework into national legislative framework suggesting that such cooperation is not always effective for management. Transparent mechanisms in place for dispute resolution but not tested or proven at regional level. Functioning of IOTC ensure respect for customary rights.
		3.1.2	Consultation, roles and responsibilities		>80	Roles and responsibilities well defined and understood and IOTC consultation processes regularly seek and accept relevant information. Consultation processes provide opportunity for involvement but there are human and financial capacity constraints often on full participation by all parties.
		3.1.3	Long term objectives		>80	Long-term precautionary approaches to fisheries management are embedded in the IOTCs mandate and modus operandi.
	Fishery specific management system	3.2.1	Fishery specific objectives		>80	Specific objectives provided in pre-amble texts to Resolutions agreeing actions as part of CMMs and are therefore explicit. But not collated into one fishery management plan document or logically linked to measurable indicators
		3.2.2	Decision making processes		>80	The management system pro-actively avoids disputes and there is formal and transparent reporting on management performance, management decisions and actions. But the established decision-making processes don't always result in necessary action.
		3.2.3	Compliance and enforcement		60-79	MCS mechanisms are in place but there is no one regional system ensuring comprehensive MCS across the whole fishery. Views on appropriate sanctions differ and again there is no one system applying. Some information on compliance is provided and while there is no systematic evidence of non compliance there are nevertheless serious concerns about compliance in the fishery as a whole
		3.2.4	Management performance evaluation		>80	There are mechanisms in place to evaluate key parts of the management system through the IOTC meetings and committee meetings, and performance reviews of IOTC as a whole have been completed. But evaluation is mostly internal and there is not regular internal and external review covering all parts of the management system.
	Number of PIs less than 60:					0

Table 22: Simplified scoring sheet: UoC B.2 FAD-dependent purse seine fishery (Yellowfin tuna)

Principle	Component	PI	Performance Indicator	RBF required ? (y/n)	Likely scoring level	Rationale / Key points
P1	Outcome	1.1.1	Stock status	N	60	There is NOT high degree of certainty (i.e. greater than 95) that the stock is above the point where recruitment would be impaired
		1.1.2	Reference Points	N	65	The limit reference point is NOT set above the level at which there is an appreciable risk of impairing reproductive capacity. A more precise definition of the target reference point is required.
		1.1.3	Stock rebuilding	N	<60	IOTC does not currently have Conservation and Management Measures in place.
	Management	1.2.1	Harvest Strategy	N	<60	Lacks adequate harvest strategy. No clearly defined HCR. IOTC does not currently have Conservation and Management Measures in place.
		1.2.2	HCR and tools	N	<60	No clearly defined HCR. Instead HCR is 'implied'.
		1.2.3	Information & monitoring	N	80	Issues remain with some of data and there are information gaps.
		1.2.4	Assessment of stock status	N	90	There remains uncertainty in the assessment.
	Number of PIs less than 60					3
P2	Primary Species	2.1.1	Outcome	N	100	Scores 100 as the UoA does not have any impact on this component.
		2.1.2	Management	N	80	Scores 80 as no management strategy is necessary.
		2.1.3	Information	N	60	Data on the catch of non-target species is currently collected but is yet to be analyzed.
	Secondary species	2.2.1	Outcome	Y	<60	One species (silky shark) scores less than 60. For this reason the PI on aggregate scores <60. Some (4/9 species) elements (species) score at least 60 and some (4/9) achieve higher scores exceeding 80.
		2.2.2	Management	Y	<60	No management strategy in place for any 2° species.

Principle	Component	PI	Performance Indicator	RBF required ? (y/n)	Likely scoring level	Rationale / Key points
		2.2.3	Information	Y	60	Data on the catch of non-target species is currently collected but is yet to be analyzed.
	ETP species	2.3.1	Outcome	N	80	Interactions with, and the consequences of FAD-associated sets with turtles and whale sharks are limited and likely to be within set limits.
		2.3.2	Management	N	90	There are resolutions prohibiting sets on whale sharks and on the conservation of marine turtles and cetaceans.
		2.3.3	Information	N	70	There is some quantitative information on the level of interactions with ETPs, although it may not be sufficient to quantify post-release mortality nor the consequence for each species.
	Habitats	2.4.1	Outcome	N	60	There are no commonly encountered or vulnerable marine ecosystems (VMEs) that might be directly impacted by FAD-associated school sets. However there is some indirect impact through the beaching of abandoned, lost and otherwise discarded FADs on coral reefs, although it is to unlikely to reduce structure and function of these VME habitats to a point where there would be serious or irreversible harm.
		2.4.2	Management	N	70	Whilst there is some regional IOTC measures (e.g. FAD limits) and fleet measures (e.g. tracking and recovery of FADs), there is still a significant loss rate with no strategy to address this.
		2.4.3	Information	N	70	Whilst the distribution of habitats and VMEs in the WIO is well known, there is limited information on the spatial extent of interaction and on the timing and location of FAD beaching.
	Ecosystem	2.5.1	Outcome	N	60	Whilst there is no strong evidence of recruitment over-fishing linked to FAD use, the ecosystem impact of the extensive and increasing use of FADs is still largely unknown and it cannot be stated with any certainty that it is highly likely that UoA will not disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
		2.5.2	Management	N	<60	There are currently some measures in place to take into account the potential impacts of the UoA on key elements of the ecosystem, but they are unlikely to work if fishing effort continues to expand unchecked.
		2.5.3	Information	N	60	Whilst there is some information on the key elements of the ecosystem, the main impacts the UoA on these key ecosystem elements can be inferred from existing information, but have not been investigated in detail.
	Number of PIs less than 60:					3

Principle	Component	PI	Performance Indicator	RBF required ? (y/n)	Likely scoring level	Rationale / Key points
P3	Governance & policy	3.1.1	Legal and customary framework	(Note: RBF approach do not apply to principle 3)	60-79	Framework for cooperating is in place through existence of IOTC and related Resolutions, but many CPCs have not translated legal framework into national legislative framework suggesting that such cooperation is not always effective for management. Transparent mechanisms in place for dispute resolution but not tested or proven at regional level. Functioning of IOTC ensure respect for customary rights.
		3.1.2	Consultation, roles and responsibilities		>80	Roles and responsibilities well defined and understood and IOTC consultation processes regularly seek and accept relevant information. Consultation processes provide opportunity for involvement but there are human and financial capacity constraints often on full participation by all parties.
		3.1.3	Long term objectives		>80	Long-term precautionary approaches to fisheries management are embedded in the IOTCs mandate and modus operandi.
	Fishery specific management system	3.2.1	Fishery specific objectives		>80	Specific objectives provided in pre-amble texts to Resolutions agreeing actions as part of CMMs and are therefore explicit. But not collated into one fishery management plan document or logically linked to measurable indicators
		3.2.2	Decision making processes		>80	The management system pro-actively avoids disputes and there is formal and transparent reporting on management performance, management decisions and actions. But the established decision-making processes don't always result in necessary action.
		3.2.3	Compliance and enforcement		60-79	MCS mechanisms are in place but there is no one regional system ensuring comprehensive MCS across the whole fishery. Views on appropriate sanctions differ and again there is no one system applying. Some information on compliance is provided and while there is no systematic evidence of non compliance there are nevertheless serious concerns about compliance in the fishery as a whole
		3.2.4	Management performance evaluation		>80	There are mechanisms in place to evaluate key parts of the management system through the IOTC meetings and committee meetings, and performance reviews of IOTC as a whole have been completed. But evaluation is mostly internal and there is not regular internal and external review covering all parts of the management system.
	Number of PIs less than 60:					0

Table 23: Simplified scoring sheet: UoC B.3 FAD-dependent purse seine fishery (Bigeye tuna)

Principle	Component	PI	Performance Indicator	RBF required ? (y/n)	Likely scoring level	Rationale / Key points
P1 (MK)	Outcome	1.1.1	Stock status	N	100	Scores 100 as the stock is at a level which maintains high productivity and has a low probability of recruitment overfishing
		1.1.2	Stock rebuilding	N	75	The limit reference point is NOT set above the level at which there is an appreciable risk of impairing reproductive capacity. A more precise definition of the target reference point is required.
	Management	1.2.1	Harvest Strategy	N	<60	IOTC does not currently have Conservation and Management Measures in place.
		1.2.2	Harvest control rules and tools	N	<60	Lacks adequate harvest strategy. No clearly defined HCR. IOTC does not currently have Conservation and Management Measures in place.
		1.2.3	Information and monitoring	N	80	No clearly defined HCR. Instead HCR is 'implied'.
		1.2.4	Assessment of stock status	N	85	Issues remain with some of data and there are information gaps.
	Number of PIs less than 60					2
P2 MK / TH	Primary Species	2.1.1	Outcome	N	100	Scores 100 as the UoA does not have any impact on this component.
		2.1.2	Management	N	80	Scores 80 as no management strategy is necessary.
		2.1.3	Information	N	60	Data on the catch of non-target species is currently collected but is yet to be analyzed.
	Secondary species	2.2.1	Outcome	Y	<60	One species (silky shark) scores less than 60. For this reason the PI on aggregate scores <60. Some (4/9 species) elements (species) score at least 60 and some (4/9) achieve higher scores exceeding 80.
		2.2.2	Management	Y	<60	No management strategy in place for any 2° species.

Principle	Component	PI	Performance Indicator	RBF required ? (y/n)	Likely scoring level	Rationale / Key points
		2.2.3	Information	Y	60	Data on the catch of non-target species is currently collected but is yet to be analyzed.
	ETP species	2.3.1	Outcome	N	80	Interactions with, and the consequences of FAD-associated sets with turtles and whale sharks are limited and likely to be within set limits.
		2.3.2	Management	N	90	There are resolutions prohibiting sets on whale sharks and on the conservation of marine turtles and cetaceans.
		2.3.3	Information	N	70	There is some quantitative information on the level of interactions with ETPs, although it may not be sufficient to quantify post-release mortality nor the consequence for each species.
	Habitats	2.4.1	Outcome	N	60	There are no commonly encountered or vulnerable marine ecosystems (VMEs) that might be directly impacted by FAD-associated school sets. However there is some indirect impact through the beaching of abandoned, lost and otherwise discarded FADs on coral reefs, although it is to unlikely to reduce structure and function of these VME habitats to a point where there would be serious or irreversible harm.
		2.4.2	Management	N	70	Whilst there is some regional IOTC measures (e.g. FAD limits) and fleet measures (e.g. tracking and recovery of FADs), there is still a significant loss rate with no strategy to address this.
		2.4.3	Information	N	70	Whilst the distribution of habitats and VMEs in the WIO is well known, there is limited information on the spatial extent of interaction and timing and location of FAD beaching.
	Ecosystem	2.5.1	Outcome	N	60	Whilst there is no strong evidence of recruitment over-fishing linked to FAD use, the ecosystem impact of the extensive and increasing use of FADs is still largely unknown and it cannot be stated with any certainty that it is highly likely that UoA will not disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
		2.5.2	Management	N	<60	There are currently some measures in place to take into account the potential impacts of the UoA on key elements of the ecosystem, but they are unlikely to work if fishing effort continues to expand unchecked.
		2.5.3	Information	N	60	Whilst there is some information on the key elements of the ecosystem, the main impacts the UoA on these key ecosystem elements can be inferred from existing information, but have not been investigated in detail.
	Number of PIs less than 60:					3

Principle	Component	PI	Performance Indicator	RBF required ? (y/n)	Likely scoring level	Rationale / Key points
P3 GM	Governance & policy	3.1.1	Legal and customary framework	(Note: RBF approach do not apply to principle 3)	60-79	Framework for cooperating is in place through existence of IOTC and related Resolutions, but many CPCs have not translated legal framework into national legislative framework suggesting that such cooperation is not always effective for management. Transparent mechanisms in place for dispute resolution but not tested or proven at regional level. Functioning of IOTC ensure respect for customary rights.
		3.1.2	Consultation, roles and responsibilities		>80	Roles and responsibilities well defined and understood and IOTC consultation processes regularly seek and accept relevant information. Consultation processes provide opportunity for involvement but there are human and financial capacity constraints often on full participation by all parties.
		3.1.3	Long term objectives		>80	Long-term precautionary approaches to fisheries management are embedded in the IOTCs mandate and modus operandi.
	Fishery specific management system	3.2.1	Fishery specific objectives		>80	Specific objectives provided in pre-amble texts to Resolutions agreeing actions as part of CMMs and are therefore explicit. But not collated into one fishery management plan document or logically linked to measurable indicators
		3.2.2	Decision making processes		>80	The management system pro-actively avoids disputes and there is formal and transparent reporting on management performance, management decisions and actions. But the established decision-making processes don't always result in necessary action.
		3.2.3	Compliance and enforcement		60-79	MCS mechanisms are in place but there is no one regional system ensuring comprehensive MCS across the whole fishery. Views on appropriate sanctions differ and again there is no one system applying. Some information on compliance is provided and while there is no systematic evidence of non compliance there are nevertheless serious concerns about compliance in the fishery as a whole
		3.2.4	Management performance evaluation		>80	There are mechanisms in place to evaluate key parts of the management system through the IOTC meetings and committee meetings, and performance reviews of IOTC as a whole have been completed. But evaluation is mostly internal and there is not regular internal and external review covering all parts of the management system.
	Number of PIs less than 60:					0

6.4 OTHER ISSUES SPECIFIC TO THIS FISHERY

Need to include a brief comparison with the other non-Seychelles flagged vessels fishing under license in Seychelles water.

Appendix A: References

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Appendix B: List of stakeholders met

Organization	Name and position
Ministry of Fisheries and Agriculture	Michael Nalletamby (Principal Secretary)
Seychelles Fishing Authority	Philippe Michaud[19] (Chairman) Vincent Lucas (Chief Executive) Jude Bijoux (Fisheries Biologist) Roddy Allisop (Manager (Monitoring & Control) Alex Tirant Logistic Coordinator Observer programme Elisa Socrate (Fisheries Officer) Karine Rassool (Economist)
IRD	Emmanuel Chassot (Fisheries ecologist)
Indian Ocean Tuna Commission	Sarah Martin (Scientific Officer) Florian Giroux (Compliance Officer) Lucia Pierre (Data Management Assistant)
Indian Ocean Tuna Ltd	Joram Madnack (General Manager) Francois Rossi (Operations Manager) Hughes Lespoil (Quality control manager)
Fishing Boat Owners Association	Beatty Hoareau (Beatty@seychelles.sc) Virginie Lagarde lagarde.vir@gmail.com Bertille Bonne fboa.labelproject@sfa.sc Jean-Claude Hoareau hoareaujcseychelles@gmail.com Paul Morin morintrap@seychelles.net
Oceana Fisheries	Cyril Bonnelame (General Manager) Ina Bauta (Quality Consultant)
Sea Harvest	Heribert Azeima (General Manager)

[19] Mr Michaud is also Specials Adviser to the Ministry of Finance, Trade and Blue Economy

Appendix C: RBF

The necessary scientific data to pre-assess the secondary, non-target species in accordance with the data-based MSC standard assessment tree are lacking. That is why the Productivity Susceptibility Analysis (PSA) approach, which is a tool of the Risk-Based Framework (RBF) methodology, has been implemented to assess the potential risk of species / stocks unsustainability resulting from the activities of the two pre-assessed fisheries. A full assessment would include a second tool under the RBF, the SICA, involving stakeholder consultation. A FIP would assist gather relevant data for this approach.

The PSA is a semi-quantitative methodology to determine: i) the *productivity* of a species; and ii) the level of fishing impact a species/stock can sustain (its *susceptibility*). Productivity and susceptibility of a species are defined by a number of attributes which are scored, in accordance with the MSC methodology[20], in order to get a PSA score convertible into a MSC score.

The productivity of any species depends on its life span (maximum age/size), reproductive cycle (age/size at maturity and fecundity), reproductive pattern and trophic level. This information can be found for finfish species from the 'FishBase' on-line database; and from Indian Ocean Tuna Commission (IOTC) database for species under the mandate of IOTC.

In MSC methodology, the productivity of a species is defined by seven attributes which are scored according to the criteria presented in the table below. Since attributes are specific to the species, their scores will be unchanged for the same species, regardless of the fishing area and fishing gear.

Table 24: PSA productivity attributes and scores

Productivity attribute	High productivity (Low risk, score=1)	Medium productivity (Medium risk, score=2)	Low productivity (High risk, score=3)
Average age at maturity	<5years	5-15 years	>15 years
Average maximum age	<10 years	10-25 years	>25 years
Fecundity	>20,000 eggs per year	100-20,000 eggs per year	<100 eggs per year
Average maximum size	<100 cm	100-300 cm	>300 cm
Average size at maturity	<40 cm	40-200 cm	>200 cm
Reproductive strategy	Broadcast spawner	Demersal egg layer	Live bearer
Trophic level	<2.75	2.75-3.25	>3.25

Source: MSC FCR, Risk-Based Framework-Normative

This analysis allows the definition of the overall specific productivity of a species. In this pre-assessment, the overall specific productivity of each species has been defined according to the number of attributes scored 'High productivity', 'Medium productivity' and 'Low productivity' (see table overleaf).

[20] MSC Fisheries Certification Requirements and Guidance, Version. 2.0: Annex PF: Risk-Based Framework – Normative; Annex GPF: Risk-Based Framework – Guidance.

High productivity species are more resilient species which can recover quickly when subjected to fishing pressure and consequently present a low risk of growth/recruitment overfishing. On the contrary, *low productivity species* are very sensitive to fishing pressure and consequently present a high risk of being overfished. The resilience and vulnerability of species are found in FishBase.

Table 25: Distribution of scores of productivity attributes per species and overall species productivity

High productivity	Medium productivity	Low productivity	Overall species productivity
6	1		Highly productive
6	-	1	Highly productive
5	1	1	Productive
4	2	1	Productive to moderately productive
4	1	2	Productive to moderately productive
3	3	1	Moderately productive
3	2	2	Moderately productive
2	3	2	Moderately to poorly productive
-	3	4	Poorly productive

Unlike productivity, susceptibility of a species is closely linked to the fishing area (stock distribution and abundance) and to the fishing gear and fishing pattern.

In MSC methodology, the susceptibility of a species/stock is assessed according to four attributes (**Table 26** overleaf):

- **Areal overlap/availability** is "the sum of the total percentage of all fishery activity with the areal concentration of a stock" (FCR, v. 2.0; annex GPF). What implies that the fishing pressure on a stock should be considered for all vessels exploiting and not only for the vessels being pre-assessed/assessed.
- **Encounterability** is the probability for the species to encounter the fishing gear according to the fishing method and its own behavior.
- **Selectivity of fishing gear** is the probability for the species to be retained according to the mesh size.
- **Post-capture mortality** is the likelihood of post capture survival of the species if released (when, for example, a part of target species is too small to have any commercial value and is discarded). Obviously, retained species do not survive post capture.

Table 26: PSA susceptibility attributes and score

Susceptibility attribute	Low susceptibility (Low risk, score=1)	Medium susceptibility (Medium risk, score=2)	High susceptibility (High risk, score=3)
Areal overlap (availability): overlap of the fishing effort with a species concentration of the stock	<10% overlap	10-30% overlap	>30% overlap
Encounterability: the position of the stock/species within the water column relative to the fishing gear, and the position of the stock/species within the habitat relative to the position of the gear	Low overlap with fishing gear (low encounterability)	Medium overlap with fishing gear	High overlap with fishing gear (high encounterability)
Selectivity of gear type: potential of the gear to retain species	a. Individuals < size at maturity are rarely caught	a. Individuals < size at maturity are regularly caught	a. Individuals < size at maturity are frequently caught
	b. Individuals < size at maturity can escape or avoid gear	b. Individuals < half the size at maturity can escape or avoid gear	b. Individuals < half the size at maturity are retained by gear
Post-capture mortality (PCM): the chance that, if captured, a species would be released and that it would be in a condition permitting subsequent survival	Evidence of majority released post-capture and survival	Evidence of some released post-capture and survival	Retained species or majority dead when released

Source: MSC FCR, Risk-Based Framework-Normative

Appendix D: Key recommendations for actions to be included in a FIP

Table 27: Key FIP recommendations - Principle 1 Stocks

Performance Indicator (s)	Recommendations	UoA		Priority	Key stakeholder
		Free-school	FAD-associated		
1.1.2	**Revise the limit reference point.** Resolution 13/10 sets interim target and limit reference points for each stock. No rationale is available to support these choices. This should be corrected	✓	✓	High	IOTC
1.1.3	**Introduce appropriate Conservation and Management Measures** The WPTT has concluded that the IOTC does not currently have any Conservation and Management Measures in place, other than the FAD limitation measure (Resolution 15/08, which is yet to be evaluated) to regulate the fisheries for yellowfin tuna. The same situation applies to the associated fisheries for skipjack and bigeye.	✓	✓	High	IOTC
1.2.1	**Introduce a robust and precautionary harvest strategy.** This can only be achieved where there is "the combination of i) monitoring, ii) stock assessment, iii) harvest control rules and iv) management actions. The absence of appropriate HCRs means that these fisheries do not have a robust and precautionary harvest strategy.	✓	✓	High	IOTC

Performance Indicator (s)	Recommendations	UoA		Priority	Key stakeholder
		Free-school	FAD-associated		
1.2.2	**Introduce well-defined and effective harvest control rules**. Harvest control rules for these stocks are not well defined and there is no specific plan of control if the stocks size falls below the trigger point (MSY). While there may be evidence of an intention to end overfishing and rebuild stocks should depletion occur and the IOTC Scientific Committee might be called on to provide such advice, it cannot be argued that there are generally understood harvest rules in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached (thus meeting the SG60). On balance it must be argued that well defined and effective harvest control rules are NOT in place for this stock.	✓	✓	High	IOTC

Table 28: Key FIP recommendations - Principle 2 Ecosystems

Performance Indicator (s)	Recommendations	UoA		Priority	Key stakeholder
		Free-school	FAD-associated		
2.1.3, 2.2.3	Detailed (spatial, temporal and other) analysis of non-target catch and fate)	✓	✓	High	SFA
2.2.1	Conservation measures for silky shark and other vulnerable shark species caught by the UoAs	✓	✓	Medium	IOTC
2.2.2	Management and conservation measures imposed for key bycatch species such as blue marlin, rainbow runner, common dolphinfish and spotted oceanic trigger fish	✓	✓	Medium	SWIOFC, IOTC

Performance Indicator (s)	Recommendations	UoA		Priority	Key stakeholder
		Free-school	FAD-associated		
2.3.3	Collection of quantitative information on the incidence and fate of ETP interactions	✓	✓	High	IOTC, SFA
2.4.1	Rapid recovery of beached FADs		✓	Medium	SFA, fleet
2.4.2	Develop strategies to reduce FAD loss, and to report and where possible track uncontrolled FADs; adoption of low impact FAD designs.		✓	High	Fleet
2.4.3	Mapping patterns in lost FAD behaviour and beaching events; researching the impact of different FAD designs on coral reefs.		✓		
2.5.1	Improved research and analysis of FAD use on ecosystem structure and function.		✓		
2.5.2	Development of detail ecosystem management objectives and management mechanisms to enable ecosystem-based management, including, where appropriate, the scale of FAD use.	✓	✓	High	IOTC
2.5.3	Increased data collection to understand ecosystem impacts, esp. from artisanal fleets. Development of ecosystem level modelling to better understand trophic relationships and to model impacts of fisheries removals and the influence of factors such as climate change.	✓	✓	Medium	IOTC

Table 29: Key FIP recommendations - Principle 3 Governance and fisheries-specific management

Performance Indicator (s)	Recommendations	UoA		Priority	Key stakeholder
		Free-school	FAD-associated		
3.1.1	Follow up on recommendations being made as part of ongoing work assessing Seychelles' national fisheries legislation and its incorporation of all regionally required action as contained within IOTC Resolutions that need to be transposed into national law.	✓	✓	High	SFA, Ministry, Office of the Attorney General, IOTC
3.1.2	Establish a more formalised/regular fisheries policy and management stakeholder forum in, with documents processes and related capacity development if necessary, so that stakeholders in Seychelles can better engage with fisheries governance issues at both national and regional level	✓	✓	Medium	SFA, FBOA, Relevant Ministries
3.2.1	Seychelles to develop a national tuna fisheries management plan, to include clear objectives, strategies and related actions that are based on and consistent with regional IOTC Resolutions and Recommendations, can support related outcomes under P1 and P2, and which incorporate best practice in fisheries governance and management as encapsulated in the MSC Principles and related PIs.	✓	✓	High	SFA and all other relevant stakeholders
3.2.3	Develop a specific compliance and enforcement plan (either as part of the proposed national tuna fisheries management plan or harmonised with it) to ensure that; (i) Seychelles is meeting all regional IOTC requirements, and (ii) compliance and enforcement of national and third party vessels in the Seychelles' EEZ is strengthened.	✓	✓	High	SFA
3.2.4	Commission an external independent performance review of SFA, and thereafter undertake similar reviews every 5 years	✓	✓	High	SFA