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Pre-Assessment of the U.S. Yellowfin, Skipjack, and Bigeye Purse Seine Fishery

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WWF US

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MRAG Americas, Inc.

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Contents

1. Executive summary

This report sets out the results of a pre-assessment of the U.S.-based yellowfin (*Thunnus albacares*), skipjack (*Katsuwonus pelamis*), and bigeye (*T. obesus*) tuna purse seine fishery located in the Western and Central Pacific Ocean (WCPO) and Eastern Pacific Ocean (EPO) in relation to the Marine Stewardship Council's (MSC) Principles and Criteria for Sustainable Fishing. There are 38 active US-flagged large purse seine vessels (size class 6 categorized by IATTC, or larger than 400 tons carrying capacity) that fish on floating fish aggregating devices (FADs) and operate within the WCPO (FAO zone 71) and, to a lesser degree, the EPO (FAO zone 77); however, this pre-assessment only covers the 11 vessels that are directly engaged in the fishery since the data provided by the client include only those 11 vessels. Additionally, because this fleet fishes FADs, this pre-assessment considers all encircling gear, both FAD and unassociated, as one gear type.

The Client Group consists of the following companies: M&F Fishing Inc., Western Pacific Fisheries Inc., DeSilva Sea Encounter Corp., C&F Fishing Ltd., Pacific Princess Partnership Ltd., Friesland Fishing Company LLC, JM Fisheries LLC, and Tradition Mariner LLC.

The assessment team consisted of Jodi Bostrom, Mónica Valle-Esquivel, and Erin Wilson. Qualifications of the team are as follows:

Jodi Bostrom (Team Leader and Principle 2) joined MRAG Americas as a Senior Fisheries Consultant and MSC Fisheries Program Manager in mid-2015. Prior to joining MRAG Americas, she spent five years working at the Marine Stewardship Council (MSC) in London as a Senior Fisheries Assessment Manager. Among many other things, she developed the MSC's benthic habitats policy and the Consequence Spatial Analysis (a risk-based framework for assessing habitat impacts in data-deficient situations) as part of the MSC Standard revision. Prior to the MSC, Jodi spent 11 years with the National Academy of Sciences' Ocean Studies Board in Washington, DC. She received an M.Sc. in Environmental Science at American University in 2006 and a B.Sc. in Zoology at the University of Wisconsin in 1999. Jodi's main areas of work at MRAG Americas are serving on MRAG Americas' MSC fisheries assessment teams and reviewing MSC assessment reports for technical quality and compliance. She has particular experience in the Principle 2 components of the MSC Standard.

Mónica Valle-Esquivel (Principle 1) joined MRAG Americas in 2010 as Senior Fisheries Biologist. She has over 15 years of experience working with tropical coral reef fishery resources and related institutions, scientists, managers, fishers, and other stakeholders in the US, Latin America and the Caribbean. Her work with MRAG has involved the analysis of a variety of fisheries against sustainability criteria, and the development of fishery improvement projects, particularly of lobster fisheries in Central America. Recently, she participated as a key expert to improve the scientific approaches for queen conch fisheries management in CARIFORUM states and conducted the 5-year Review of Essential Fish Habitat for the NOAA Fisheries Caribbean Council. Dr. Valle specializes in fish and shellfish population dynamics, stock and ecosystem-based assessments, design and evaluation of management strategies, statistical analysis, and fishery simulation modeling. Before joining MRAG, Dr. Valle did postdoctoral work as a stock assessment scientist at the University of Miami, in a joint program with NOAA Fisheries, evaluating management strategies for a variety of fish and shellfish species in the US Atlantic and Caribbean. She has also provided scientific advice to FAO, CITES, CARICOM, ACP Fish II and other international organizations for the management of spiny lobster and queen conch fisheries. She coordinated a United Nations (UNIDO) pilot project within the Gulf of Mexico Large Marine

Ecosystem program in Mexico and has co-authored a Manual for the Assessment and Management Conch Fisheries in the Caribbean. Dr. Valle received a B.S. degree in Biology from the National Autonomous University of Mexico (UNAM), and a Ph.D. in Marine Biology and Fisheries from the Rosenstiel School of Marine and Atmospheric Science, University of Miami.

Erin Wilson (Principle 3) joined MRAG Americas, Inc. as a Fisheries Consultant in February 2015. She has collaborated on several MSC assessments, works as a team member for the North and South Pacific albacore tuna fishery and US West Coast Groundfish fishery, and conducts routine audits for the International Seafood Sustainability Foundation. Prior to joining MRAG Americas, she spent 2 years working at the Oregon Department of Fish and Wildlife (ODFW) as a Natural Resource Specialist and Biological Technician for the Oregon Marine Reserves. She has collaborated on a multitude of projects that focus on marine science and conservation in both a biological and social science aspect. She received a M.Sc. in Marine Resource Management from Oregon State University and a B.S. in Zoology from Colorado State University, along with a Spanish minor.

These individuals collectively have knowledge of the stock status and assessment, ecosystem impacts, and management systems applicable to this fishery.

The process used in this pre-assessment was to have several phone calls and email exchanges with the main points of contact to understand the scope of the work and unit of assessment, to research and review the available information, and to analyze the information and apply the results to the scoring. This pre-assessment was undertaken using the MSC Fisheries Certification Requirements v2.0 and prepared in accordance with the MSC Pre-Assessment Reporting Template v2.1.

Main strengths and weaknesses

<u>Principle 1:</u>
The IATTC has good information to monitor, conduct stock assessments, and support the harvest strategy for Eastern Pacific tropical tunas (skipjack, yellowfin and bigeye). Stock assessments are robust to uncertainties and appropriate for the stocks. IATTC Resolution C-16-02 sets out harvest control rules for tropical tunas, which focuses on the stock that needs strictest management (YFT at present). The harvest strategy needs to be reviewed, improved, and adapted to each stock, including the development of stock-specific reference point values. It is unclear how the main tools to implement harvest control rules (namely closures and FAD limits) are linked to stock status or exploitation rates, so it is also unclear whether they will be effective. Trigger values for taking management action need to be better defined for each tropical tuna stock, SKJ in particular.

The WCPO also collects sufficient information to monitor and assess the Western Central Pacific tuna stocks regularly. Stock assessments for SKJ, YFT, and BET are robust to uncertainties and appropriate for the stocks. Since 2013 the harvest strategy for tropical tunas has consisted of interim, *ad hoc* measures that are not necessarily responsive to the state of the stocks. CMM-2014-06 sets out a plan to develop a formal harvest strategy for these stocks. A stock-specific harvest strategy needs to be adopted that includes management action responses to changes in stock status, and harvest control rules aimed at maintaining the stock above reference levels and reducing exploitation rates.

<u>Principle 2:</u>
Overall, the fishery has a good amount of data; however, logbook data would likely be needed for a full assessment to confirm the absence of main primary and/or secondary species. Additionally, without knowing the exact fishing range of the UoA, the team could not score PI 2.3.1 accurately since it could not determine (1) which species' distinct population

segments (DPSs) and/or stocks were relevant, (2) which species' national and/or international limits were relevant to know which scoring issue (a or b) should be scored, and (3) if there are combined effects of MSC UoAs (scoring issue a at SG80 and SG100) to be considered. Strong ETP management appears to be in place. There is a lack of information on the UoAs' protection of VMEs and the impact of FAD fishing on the ecosystem. However, the fishery's impact on ETP species, the habitat, and the ecosystem are likely low.

Principle 3:
There is effective cooperation between the IATTC and WCPFC, as well as strong domestic management for this fishery from the Western Pacific Regional Fishery Management Council (WPRFMC). While there are several regulations and conservation measures in place both nationally and internationally to prevent overfishing of these stocks, it is unclear how consistently sanctions are applied and whether the fishery overall complies with management measures internationally. There is also no formal explanation that ensures that all parts of the decision-making process have been disclosed, nor is there evidence that the management decisions represent all the information presented.

Overall, the team concludes that the fishery is likely consistent with the MSC Fisheries Standard.

2. Introduction

2.1 Aims/scope of pre-assessment

The MSC is an independent, global, non-profit organization. It works to enhance responsible management of seafood resources and to ensure the sustainability of global fish stocks and the health of the marine ecosystem. The MSC harnesses consumer power by identifying sustainable seafood products through an eco-label. The MSC has identified the following mission statement: "To safeguard the world's seafood supply by promoting the best environmental choice."

The objective of the pre-assessment is to provide a focus for an eventual Fishery Improvement Project or MSC full assessment. This part of the process provides a basis for understanding the fishery in the context of the MSC Fishery Certification Requirements v2.0 and informs the client of the likelihood of achieving certification of their fishery. The pre-assessment also clarifies with the client the philosophy and expectations of the MSC and identifies the strengths and weaknesses of the fishery with respect to the MSC Standard.

It is important to note that a pre-assessment of a fishery does not attempt to duplicate a full assessment against the MSC Standard, and it can only provide guidance. A full assessment involves expert team members and public consultation stages that are not included in a pre-assessment. A pre-assessment provides a provisional assessment of a fishery based on a limited set of information provided by the client.

2.2 Constraints to the pre-assessment of the fishery

Given that this was a desk review only, there were some constraints with data availability (e.g., no logbooks). The government shutdown also delayed this pre-assessment considerably and likely affected the amount of data made available to the team. Without knowing the exact fishing range, the team cannot accurately determine which species are relevant to this assessment and cannot accurately score PIs 2.3.1 or 2.3.2 since it cannot determine which species have national and/or international limits (i.e., to know whether to score scoring issue a or b).

2.3 Units of Assessment

Possible units of assessment (UoAs) are as follows:
Species: Skipjack tuna, yellowfin tuna, and bigeye tuna
Geographical Areas: WCPO (FAO zone 71) and EPO (FAO zone 77)
Method of Capture: U.S. purse seine vessels fishing on unassociated and associated (FAD) schools
Stock: U.S. west coast tuna stocks
Management System: NOAA Fisheries and Western Pacific Regional Fishery Management Council (WPRFMC), along with international collaboration from the Inter-American Tuna Commission (IATTC) and Western and Central Pacific Fisheries Commission (WCPFC)
Client: U.S. Pacific Tuna Group

These UoAs were chosen since these species are the main tuna species targeted by this fleet, and these are the main areas where the fleet fishes. Other eligible fishers would likely include the additional U.S.-flagged purse seine vessels not included in this pre-assessment.

2.4 Total Allowable Catch (TAC) and Catch Data

Table 1a. TAC and Catch Data – WCPFC
Annual catch (mt) of the United States and the Participating Territories (American Samoa, Guam, and Commonwealth of the Northern Mariana Islands) by species and gear for purse seine vessels in the WCPFC Statistical Area.[1]

TAC	**Year**	N/A	**Amount**	N/A
UoA share of TAC	**Year**	N/A	**Amount**	N/A
UoC share of TAC	**Year**	N/A	**Amount**	N/A
Total green weight catch by UoC	**Year (most recent)**	2016	**Amount**	SKJ: 177,385 YFT: 17,992 BET: 4,705
	Year (second most recent)	2015	**Amount**	SKJ: 219,425 YFT: 17,019 BET: 1,525

Table 1b. TAC and Catch Data – IATTC
Annual catch (mt) of the United States by species and gear for purse seine vessels in the IATTC Statistical Area.[2]

TAC	**Year**	N/A	**Amount**	N/A
UoA share of TAC	**Year**	N/A	**Amount**	N/A
UoC share of TAC	**Year**	N/A	**Amount**	N/A
Total green weight catch by UoC	**Year (most recent)**	2016	**Amount**	SKJ: 40,036 YFT: 4,535 BET: 2,816
	Year (second most recent)	2015	**Amount**	SKJ: 16,826 YFT: 3,212 BET: 2,384

3. Description of the fishery

3.1 Scope of the fishery in relation to the MSC program

[1] U.S. National Report and Data Submissions to the Western and Central Pacific Fisheries Commission https://www.pifsc.noaa.gov/frmd/rfmo_reports_and_data.php
[2] EPO total estimated catch by year, flag, gear, species https://www.iattc.org/PublicDomainData/IATTC-Catch-by-species1.htm

The MRAG Americas has determined that the fishery would be within scope if MSC certification were sought.

3.2 Overview of the fishery

The U.S. purse seine fishery includes large-scale purse seine vessels that operate in the Western and Eastern Pacific Ocean. Large-scale purse seine fisheries are defined by IATTC as having a carrying capacity greater than 400 short tons (363 metric tons) (NOAA Fisheries 2017). The U.S. purse seine fishery fishes on floating FADs. Species included in this fishery are bigeye, yellowfin, and skipjack tuna. These species of oceanic tunas are of major commercial importance on a global scale. They can either form free schools or those associated with floating objects and are considered principal species associated with FADs. According to global trends from 1950-2015, 64% of the total catch was caught by purse seine, with skipjack and yellowfin being the primary species, followed by longline (12%), which is the primary gear type catching bigeye tuna (ISSF 2017). According to the 2017 stock assessment for these species, populations are above target populations levels, not overfished and are not subject to overfishing (IATTC 2017a).

Skipjack and yellowfin are classified as “tropical” tunas and are found in waters with temperatures greater than 18ºC, while bigeye could be classified as intermediate, but is often treated as tropical species in fishery statistics (ISSF 2017). They are considered highly migratory species (HMS), which makes the management of these species very complicated because HMS migrate thousands of miles across international boundaries and are fished by many nations (NOAA Fisheries 2017). NOAA Fisheries and the Western Pacific Regional Fishery Management Council (WPRFMC) manage this fishery in the Pacific islands, and the IATTC and the WCPFC manage these oceanic tunas internationally. Working with the U.S. Department of State, NOAA fisheries domestically implements the IATTC and WCPFC conservation and management measures (NOAA Fisheries 2017). The South Pacific Tuna Treaty (SPTT) set operational terms and conditions for the U.S. tuna purse seine fleet to fish in the Western and Central Pacific Ocean (WCPO), including waters under the jurisdiction of the Pacific Island Parties Treaty. The SPTT is a model of international cooperation and has helped establish fisheries observer and data reporting requirements, as well as additional monitoring that includes logbooks, cannery landing receipts and port sampling (NOAA Fisheries 2018a).

3.3 Principle One: Target species background

The diagnostic features, geographic distribution (and maps), habitat and biology, and global fishery information for each of these species are provided by FAO[3]. Further details on stock structure and biological features for each species in the Pacific Ocean and Eastern Pacific Ocean are available from the IATTC[4] and ISSF (2018). In this section we have compiled the biological information from those sources, and the generalized maps of predicted species distribution from AquaMaps[5], a joint project of FishBase and SeaLifeBase.

3.3.1 Skipjack Tuna

3.3.1.1 Biology and Distribution

Skipjack tuna (Figure 1) is a cosmopolitan in tropical and warm-temperate waters, but it is not found in the eastern Mediterranean Sea (Figure 2). It is a highly migratory, schooling, and oceanodromous species, found at depths from 0m to 260m. Principally found in offshore

[3] FAO Fact Sheets (http://www.fao.org/fishery/species/search/en)
[4] IATTC (http://www.iattc.org/FisheryStatusReportsENG.htm)
[5] AquaMaps (www.aquamaps.org)

waters, this species exhibits a strong tendency to school in surface waters. Schools are associated with birds, drifting objects, sharks, whales or other tuna species

Figure 1. *Katsuwonus pelamis* (Linnaeus, 1758). Source: FAO Species Fact Sheets[6]

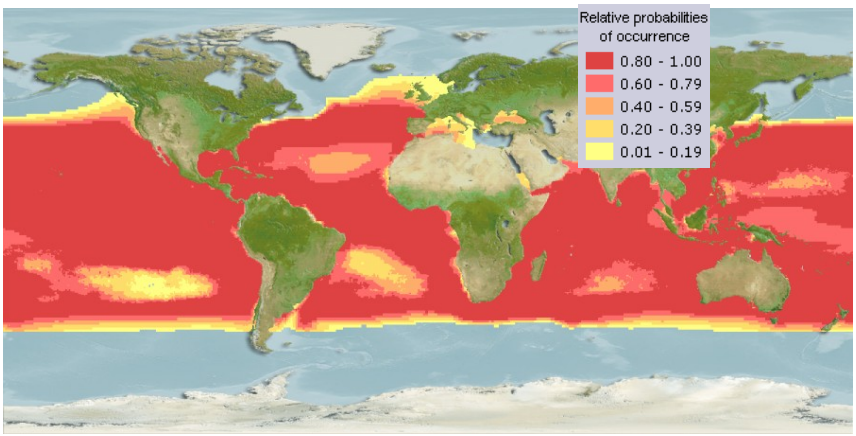


Figure 2. Reviewed Native Distribution Map for skipjack tuna. (www.aquamaps.org, Version Jan. 2018, accessed12/03/18).

It achieves a length of 108cm and maximum weight of 34.5kg. In the absence of reliable age determination methods, estimates of longevity vary between 8 and 12 years. The maximum fork length is about 108 cm corresponding to a weight of 32.5 to 34.5 kg; common to 80 cm fork length and a weight of 8 to 10 kg. Fork length at first maturity is about 45 cm. It feeds on fish, crustaceans, cephalopods and mollusks. Cannibalism is common. The main predators of skipjack are other tunas and billfishes.

Skipjack tuna spawn in batches throughout the year in equatorial waters, and from spring to early fall in subtropical waters, with the spawning season becoming shorter as distance from the Equator increases. Fecundity increases with size but is highly variable, the number of eggs per season in females of 41 to 87 cm fork length ranging between 80,000 and 2 million. It is hypothesized that the skipjack tuna in the eastern central Pacific originate in equatorial waters, and that the pre-recruits (up to 35 cm fork length) split into a northern group migrating to the Baja California fishing grounds, and a southern group entering the central and south American fishing areas. Having remained there for several months, both groups return to the equatorial spawning areas (FAO Species Fact Sheets).

3.3.1.2 Stock Structure

There are five stocks of skipjack comprising the eastern Pacific Ocean, western and central Pacific Ocean, West Atlantic, East Atlantic, and Indian Ocean stocks. Worldwide, skipjack is primarily caught in the Pacific Ocean (70%), followed by the Indian Ocean (24%), and the Atlantic Ocean (6%).

[6] http://www.fao.org/fishery/species/2494/en

In the Atlantic Ocean, ICCAT manages skipjack tuna as two separate stocks (eastern and western Atlantic), delineated at -30 degrees longitude. The species is managed as a single stock in the Indian Ocean. In the Pacific Ocean, it is possible that there is just one continuous stock, as large-scale movements are thought to be rare, and thus rates of transfer between widely separate ocean regions are likely not high. IATTC manages skipjack tuna fisheries in the Eastern Pacific Ocean and skipjack fisheries in the western and central Pacific are managed by the Western and Central Pacific Fisheries Commission (WCPCO). For the purposes of stock assessment, it is assumed that skipjack in the EPO do not interact with skipjack in the western and central Pacific. Additionally, for the purposes of some analyses, it is assumed that there are six non-interacting sub-populations in the EPO which take exchange rates between sub-populations into account.[7] The boundary between the EPO and the WCEPO is set at 150°W longitude. The WCPFC assumes a single stock in the WCPO; in the WPO, the assessment model area contains three spatial regions and transfer rates between them are taken into account.[8]

3.3.1.3 Fishery indicators and state of the stock

3.3.1.3.1 Skipjack Tuna – Eastern Pacific Ocean

Stock Assessment

IATTC is responsible for assessing stock status and identifying harvest reference points for highly-migratory species of tunas in the EPO. A complete summary of the status of all tuna stocks is provided by ISSF (2018), including the status of the stocks in the EPO produced by IATTC (2014). This information is presented in this section (c) for skipjack, yellowfin, and bigeye.

In 2014, skipjack catches in EPO were about 327,200 tons, representing a 3% drop from 2016. Skipjack catches in the EPO are very variable (Figure 3). Purse seine fishing dominates the catches (over 99% of the total), with an overall increase in since the 1990, although with significant fluctuations throughout the catch history. The skipjack EPO stock is not overfished, and overfishing is not occurring.

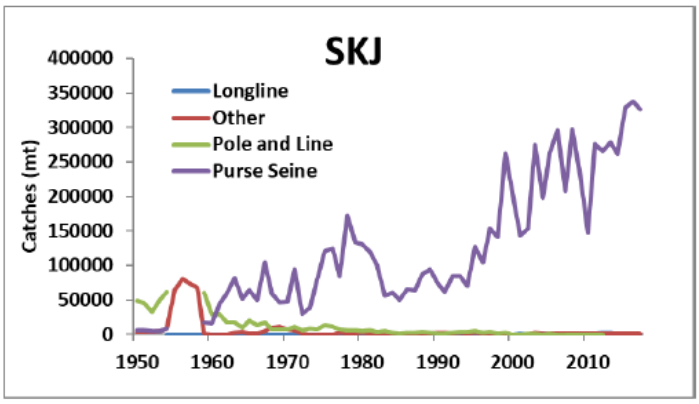


Figure 3. Catches of skipjack tuna in the EPO from 1950 to 2017, by gear type (ISSF, 2018).

Skipjack tuna is a notoriously difficult species to assess. Due to its high and variable productivity (i.e. annual recruitment is a large proportion of total biomass), it is difficult to detect the effect of fishing on the population with standard fisheries data and stock assessment methods. This is particularly true for the stock of the EPO, due to the lack of age-composition data and the limited tagging data. The stock assessment methods applied

[7] https://www.iattc.org/Meetings/Meetings2015/SAC-06/PDFs/Docs/_English/SAC-06-07_Skipjack-tuna-stock-status-2014.pdf
[8] https://www.wcpfc.int/node/1887

to skipjack require a variety of information, including data on retained catches, discards, indices of abundance, and the size compositions of the catches of the various fisheries, tagging data, and oceanographic data. In addition, assumptions have to be made about processes such as growth, recruitment, movement, natural mortality, selectivity, and stock structure.

The last skipjack assessment was carried out in 2012 (Maunder, 2012a) and it uses four alternative assessment methods: a) fishery and biological indicators; b) analysis of tagging data; c) a length-structured stock assessment model; and d) a Spatial Ecosystem and Population Dynamic Model (SEAPODYM). The results of all four of these methods are compared when evaluating the status of skipjack in the EPO. Movement rates between the EPO and the western Pacific cannot be estimated with currently-available tagging data. In some analyses the EPO is divided into six independent sub-regions to accommodate spatial structure of the population and fishery dynamics. In 2015, only one of the methods was updated with data up to 2014.

Previous assessments of skipjack in the EPO have had difficulty in estimating the absolute levels of biomass and exploitation rates (Maunder 2002; Maunder and Harley 2005) in particular because it is not known whether the catch per day fished for purse-seine fisheries is proportional to abundance. The analysis of currently available tagging data is unlikely to improve the skipjack stock assessment (Maunder 2012a) and the fully length-structured model produced unrealistic estimates (Maunder 2012b). In addition to these issues, the levels of age-specific natural mortality are uncertain or unknown, and current yield-per-recruit (YPR) calculations indicate that the YPR would be maximized by catching the youngest skipjack in the model (Maunder and Harley 2005). Therefore, neither the biomass- nor fishing mortality-based reference points, nor the indicators to which they are compared, are available.

One of the major problems listed above is the uncertainty as to whether the CPUE of the purse-seine fisheries is an appropriate index of abundance for skipjack, particularly when the fish are associated with FADs. Purse-seine CPUE data are particularly problematic, because it is difficult to identify the appropriate unit of effort.

Since the stock assessments and reference points for skipjack in the EPO are so uncertain, alternative methods have been used to assess and manage the stock. Maunder and Deriso (2007) developed a simple method to generate indicators for biomass, recruitment, and exploitation rate and to compare the current value of eight indicators to their historical distributions: catch, catch-per-day-fished by floating object fisheries, catch-per-day-fished by unassociated fisheries, standardized effort, average weight per fish, relative exploitable biomass, relative recruitment, and relative exploitation rate. These indicators are updated regularly and are agreed upon by IATTC on an interim basis; they now cover the period 1975 through 2017 (IATTC 2018; Maunder 2018).

In 2018 these indicators (updated with data through 2017, Figure 4) showed that there is no indication of a risk from overfishing, but some indicators are approaching or exceeding historic levels (e.g. average weight is near its lower reference level) and there is concern over the substantial increase in numbers of sets on floating objects in recent years (IATTC 2018; ISSF 2018; Maunder 2018).

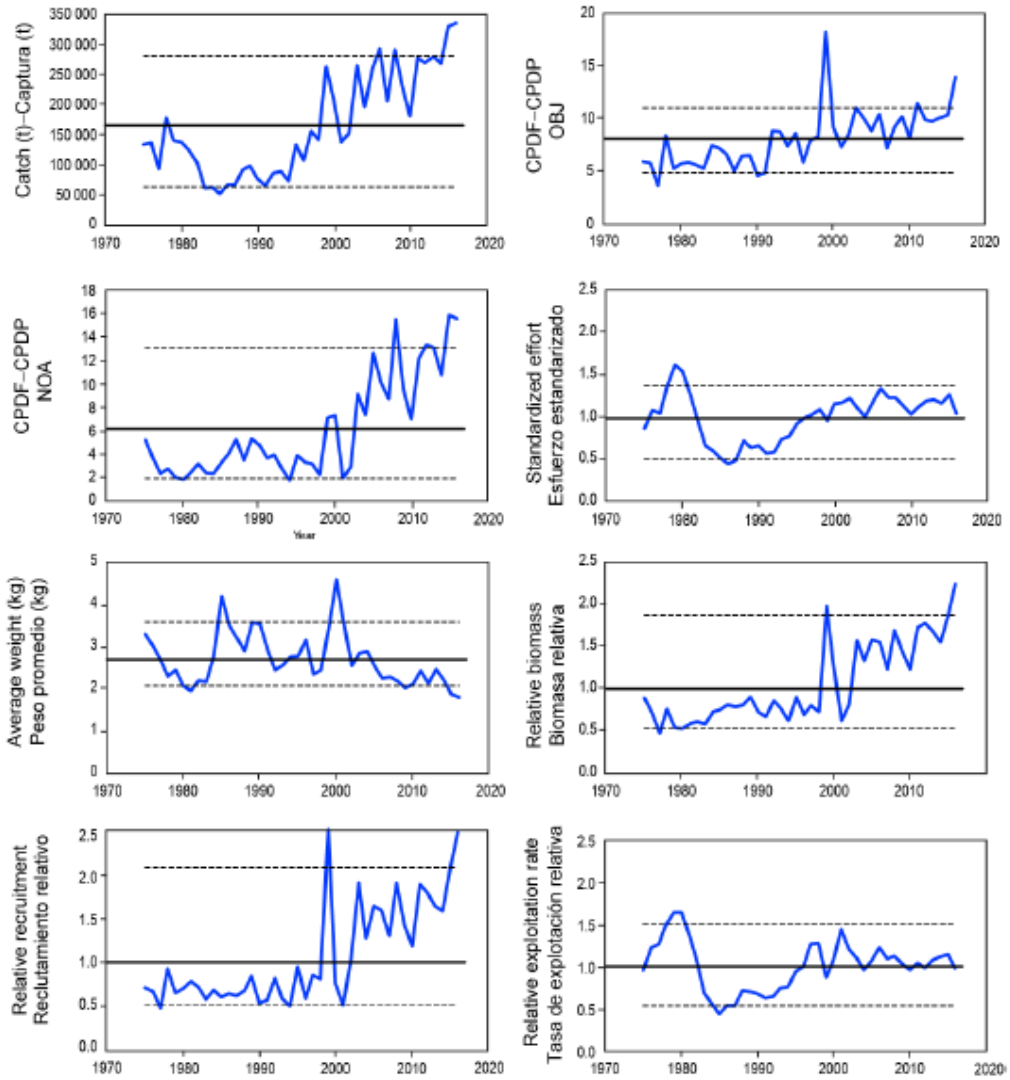


Figure 4. Indicators of stock status for skipjack tuna in the eastern Pacific Ocean. OBJ: floating-object fishery; NOA: unassociated fishery; CPDF: catch per day fished. All indicators are scaled so that their average equals one. (IATTC 2018).

While a number of methods have been used to assess the status of skipjack tuna in the EPO and a number of stock indicators are available, there is still no reliable index of relative abundance or MSY reference points to determine stock status with confidence. Fishery indicators are updated regularly

Management

Limit reference point: In 2014, on an interim basis, IATTC agreed to the staff's recommendation of the equilibrium spawning biomass corresponding to that which produces a 50% reduction in recruitment from the unfished level. This corresponds to a spawning biomass that is about 8% of the unfished level. Although no MSY-based reference points are available for EPO skipjack, it is very likely that the stock is above this limit.

Target reference point: In 2014, on an interim basis, IATTC agreed to the staff's recommendation of F_{MSY} and SSB_{MSY}. Although no MSY-based reference points are available for EPO skipjack, it is very likely that the stock is around this target.

Harvest control rule: In 2016, IATTC adopted HCR for tropical tunas based on the interim target and limit reference points adopted in 2014 (Resolution C-16-02). The HCR aims to prevent fishing mortality from exceeding the MSY level for the tropical tuna stock (bigeye, yellowfin or skipjack) that requires the strictest management. If fishing mortality or spawning biomass are approaching or exceeding the corresponding limit reference point as measured by an estimated probability of 10% or greater of exceeding the limit, the HCR also triggers the establishment of additional management measures to reduce fishing mortality and rebuild the stock.

A summary of the stock status of skipjack tuna in the EPO is provided by ISSF (2018):

EPO SKJ	ESTIMATE	YEARS	NOTES
RECENT CATCH	327	2017	
5-YEAR CATCH	308	2013-17	
MSY	N/A		
F/F_{MSY}	≤1		
SSB/SSB_{MSY}	≥1		
TAC	N/A		

Catches and MSY in 1000 tonnes.

3.3.1.3.2 Skipjack Tuna – Western Central Pacific Ocean

From the latest ISSF review of tuna fisheries (ISSF 2018), the WCPO Skipjack stock supports the largest tuna fishery in the world, accounting for 38% of worldwide tuna landings. Catches in 2017 were 1,574,700 tons, a 10% decrease from 2016. Purse seining, which accounts for 80% of the catches, increased steadily over the past three decades. In contrast, pole-and-line fishing (about 8%) has been declining steadily (Figure 5). Overfishing is not occurring, and the stock is not overfished.

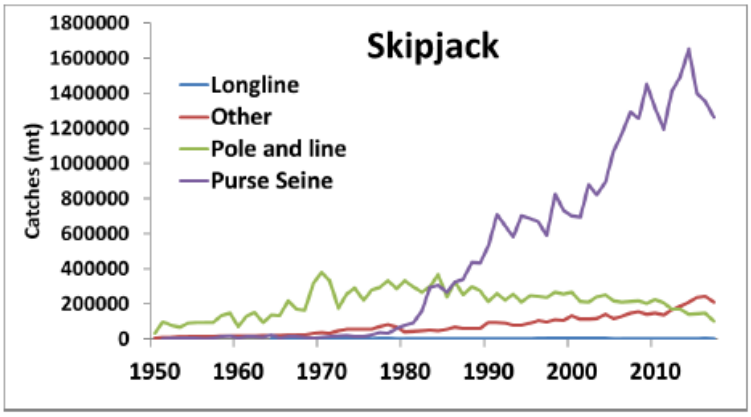


Figure 5. Catches of skipjack tuna in the WCPO from 1950 to 2017, by gear type.

Stock Assessment

The last skipjack assessment was conducted by the Secretariat of the Pacific Community (SPC) for the WCPFC's Scientific Committee (SC) in 2016. The 2016 SC meeting was not able to reach consensus regarding which model runs should be used to characterize stock status. The "reference case" model, which is largely consistent with previous assessments, was selected by the majority of the SC members (Figure 6):

a. Fishing mortality rates have increased significantly since the beginning of industrial tuna fishing but are estimated to have decreased moderately in the last several years. The ratio F_{recent}/F_{MSY} is estimated to be 0.45 (90% C.I. range:0.38-0.64), indicating that overfishing is not occurring.
b. The stock is not in an overfished state as spawning biomass (in 2015) is above the SSB_{MSY} level: SSB_{latest}/SSB_{MSY} = 2.56 (90% C.I. range: 1.6-3.08).
c. MSY is estimated to be 1.892 million tons. Recent catches are lower than MSY.

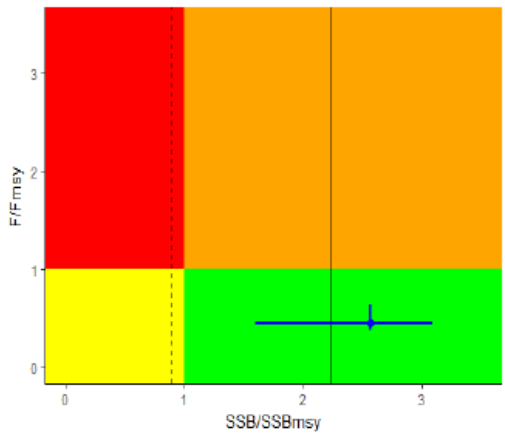


Figure 6. Latest estimate of SSB/SSBMSY and F/FMSY (in blue) for WCPO skipjack tuna. Solid black line represents interim target reference point and dashed black line represents limit reference point (ISSF 2018).

Management

Limit reference point: 20% of the equilibrium spawning biomass that would be expected in the absence of fishing under current (most recent 10 years of the current assessment, excluding the last year) environmental conditions (20%$SSB_{current,\ F=0}$). The skipjack stock is above the limit. The value of $SSB_{current}/SSB_{F=0}$ is 0.58, which is above this limit.

Target reference point: CMM 2017-01, which acts as a bridge to the adoption of a harvest strategy, establishes that, pending agreement on a TRP, the SSB of skipjack tuna is to be maintained on average at a level consistent with the interim target reference point adopted in CMM 2015-06. CMM-2015-06 established an interim target equal to 50% of the equilibrium spawning biomass that would be expected in the absence of fishing under current (most recent 10 years of the current assessment, excluding the last year) environmental conditions (50%SSBcurrent, F=0). The value of SSBcurrent/SSBF=0 is 0.58, which is near this target.

Harvest control rule: Not defined. CMM-2014-06 calls for WCPFC to develop and implement a harvest strategy approach that includes target reference points, harvest control rules and other elements. At its 2016 meeting, the WCPFC refined the workplan for doing so.

A summary of the stock status of Skipjack tuna in the WCPO provided by ISSF (2018) follows:

WCPO SKJ	ESTIMATE	YEARS	NOTES
RECENT CATCH	1575	2017	
5-YEAR CATCH	1790	2013-17	
MSY	1892	2011-14	
F/F_{MSY}	0.45	2011-14	
SSB/SSB_{MSY}	2.56	2015	
TAC	N/A		

Catches and MSY in 1000 tonnes.

3.3.2 Yellowfin Tuna

3.3.2.1 Biology and Distribution

Yellowfin tuna (Figure 7) occurs worldwide in tropical and subtropical seas, found in the Pacific, Indian and Atlantic oceans in epipelagic waters, but is absent from the Mediterranean Sea (Figure 78). It is highly migratory, schooling, and oceanodromous, occurring in depths ranging between 1 and 250m. It feeds on fishes, crustaceans and squids. It is sensitive to low concentrations of oxygen and therefore is not usually caught below 250m in the tropics. It achieves a length of 239cm and maximum weight of 200kg.

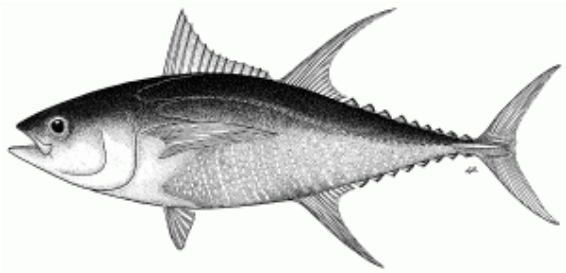


Figure 7. *T. albacares* (Bonnaterre, 1788). Source: FAO Species fact sheets[9]

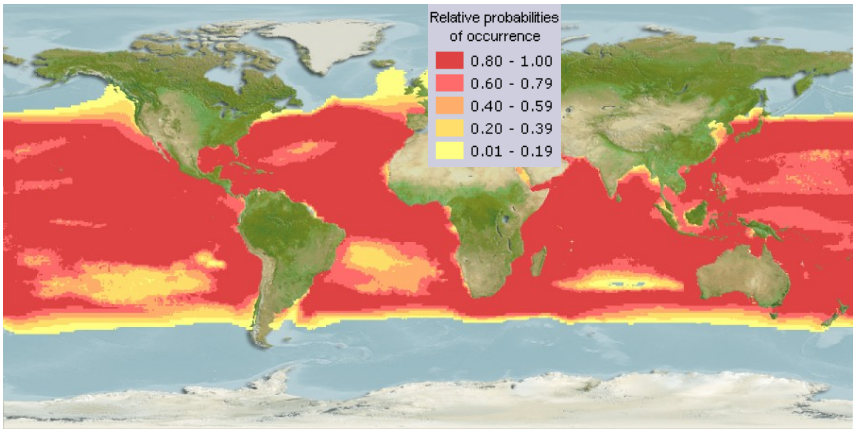


Figure 8. Reviewed Native Distribution Map for yellowfin tuna. (www.aquamaps.org, Version Jan. 2018, accessed 12/03/18)

The species recruits to the fishery at about 30 cm length, and maturity occurs at 100 cm length. Individuals smaller than the maturity sizes are often found in dense schools together with bigeye and skipjack tunas. During the early stages of their life span, the yellowfin is

[9] http://www.fao.org/fishery/species/2497/en

caught by baitboats and purse seiners targeting skipjack, resulting in a considerable share of juveniles in the catch. (FAO Species Factsheets).

Larval distribution in equatorial waters is transoceanic the year round, but there are seasonal changes in larval density in subtropical waters. It is believed that the larvae occur exclusively above the thermocline. Schooling occurs more commonly in near-surface waters, primarily by size, either in monospecific or multispecies groups. In some areas, i.e. eastern Pacific, larger fish (greater than 85 cm fork length) frequently school with porpoises. Association with floating debris and other objects is also observed.

3.3.2.2 Stock structure

In the Atlantic, ICCAT manages yellowfin fisheries as a single stock, based on observed transatlantic movements obtained with tagging and longline catch data. However, movement data are highly uncertain and there may be some degree of extended local residence times and/or site fidelity that could indicate multiple stocks. Also, in addition to the main spawning grounds in the equatorial zone of the Gulf of Guinea, there are several other spawning grounds (Gulf of Mexico, Southeastern Caribbean Sea, Cape Verde) but their relative importance is unknown.[10]

IOTC also treats yellowfin as a single stock in the Indian Ocean[11]. Although the distribution of YFT in the Pacific is nearly continuous, lack of evidence for long-ranging east-west or north-south migrations of adults suggests that there may not be much exchange between the YFT from the eastern and the central Pacific, nor between those from the western and the central Pacific. This hints at the existence of subpopulations[12]. IATTC manages the EPO stock and WCPFC manages the WCPO stock, the boundary being set at 150°W longitude.

3.3.2.3 Fishery Indicators and Stock Status

3.3.2.3.1 Yellowfin Tuna – Eastern Pacific Ocean

The summary of IATTC catches provided by ISSF (2018) shows that yellowfin catches in the EPO in 2017 were about 223,100 tons, 12% lower than 2016 catch levels. The main fishing gear is purse seine (95% of the catch), and recent catches by this gear are about 51% of the record high caught in 2002 (Figure 9). Catches from longline vessels are smaller in magnitude and have also declined substantially in recent years. The yellowfin stock in the EPO is not currently overfished. Slight overfishing is taking place, and increased fishing effort could significantly reduce spawning biomass without substantially increasing catches.

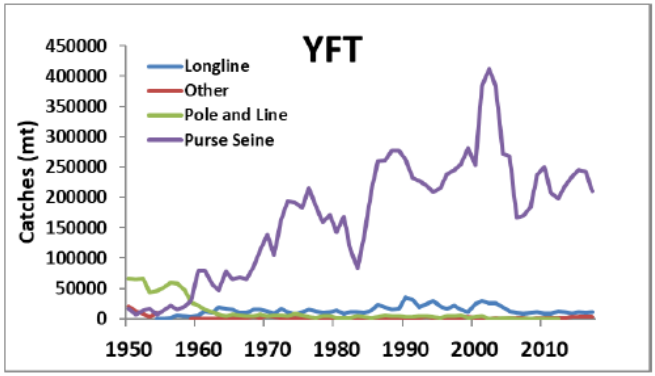


Figure 9. Catches of yellowfin tuna in the EPO from 1950 to 2017, by gear type (ISSF 2018).

[10] https://www.iccat.int/Documents/SCRS/ExecSum/YFT_ENG.pdf
[11] http://www.iotc.org/files/proceedings/2011/sc/IOTC-2011-SC14-R[E].pdf
[12] https://www.iattc.org/Meetings/Meetings2018/SAC-09/PDFs/Docs/_English/SAC-09-06-EN_Yellowfin-tuna-assessment-for-2017.pdf

Stock Assessment

The 2018 IATTC update assessment (IATTC 2018; Minte-Vera *et al*., 2018) indicated the following:

1. The ratio of spawning biomass SSB_{recent}/SSB_{MSY} is estimated to be 1.08 (range: 0.95-1.18), indicating that the stock is not overfished.
2. The ratio F_{recent}/F_{MSY} is estimated to be 1.01 (range: 0.90-1.14) (F_{mult}=0.99), indicating that slight overfishing is occurring. However, fishing capacity of the purse seine fishery continues to increase, which is a concern.
3. MSY is estimated to be 264,300 tons. Increasing the average weight of the yellowfin caught could increase the MSY.
4. The assessment of stock status is highly sensitive to the assumed relationship between spawning biomass and recruitment, as is the case for all stock assessments that use MSY-based reference points. The base case assessment makes a very optimistic assumption that recruitment to the fishery remains high even when the spawning stock is depleted. This results in MSY occurring at low levels of spawning stock and consequently the measure used to report stock status, $SSB_{current}/SSB_{MSY}$, remains high even for low stock sizes. Stock status is more pessimistic if a stock-recruitment relationship is assumed, which is more plausible and accepted by other RFMOs. The assessment results are also sensitive to the natural mortality assumed for adult yellowfin and the length assumed for the oldest fish.

Analyses made using the base case assessment results indicate that increasing fishing mortality would change the long-term catches only marginally, while reducing the spawning biomass considerably. For these reasons, according to ISSF (2018) fishing mortality for yellowfin tuna in the EPO should not be allowed to increase. The assessment results of 2018 are illustrated below (Figure 10):

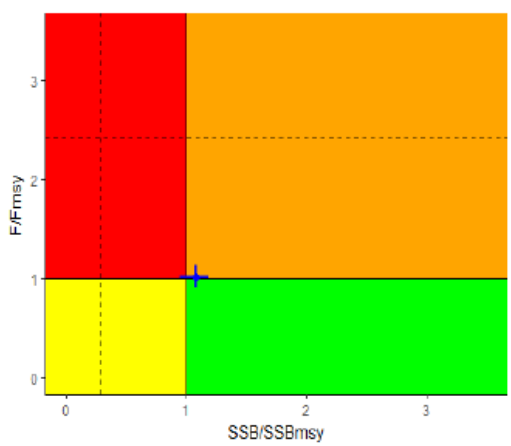


Figure 10. Latest estimate of SSB/SSBMSY and F/FMSY (in blue, including range) for EPO yellowfin. Solid black lines represent interim target reference points and dashed black lines represent interim limit reference points. (ISSF 2018).

A summary of the status of the YFT stock in the EPO is provided by ISSF (2018):

EPO YFT	ESTIMATE	YEARS	NOTES
RECENT CATCH	223	2017	
5-YEAR CATCH	243	2013-17	
MSY	264	2015-17	
F/F_{MSY}	1.01	2015-17	range: 0.90-1.14
SSB/SSB_{MSY}	1.08	Start of 2018	range: 0.95-1.18
TAC	N/A		

Catches and MSY in 1000 tonnes.

3.3.2.3.2 Yellowfin Tuna – Western Central Pacific Ocean

The summary of IATTC catches provided by ISSF (2018) shows that (provisional) yellowfin catches in the WCPO in 2017 were about 660,300 tons, a 4% increase from 2016. The main fishing gear is purse seine (63% of the catch). Twenty percent of the catches are also taken by a number of mixed gears in the Philippines and Indonesia, and 15% by longliners (Figure 11). The WCPO yellowfin tuna stock is not overfished and overfishing is not occurring. Most of the catches are taken from the tropical region where the stock is considered fully exploited and increased fishing pressure should not occur.

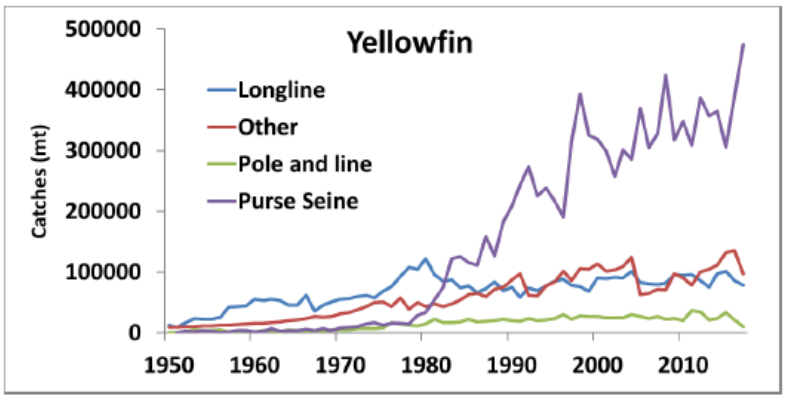


Figure 11. Catches of yellowfin tuna in the WCPO from 1950 to 2017, by gear type (ISSF 2018).

<u>Stock Assessment</u>

A new yellowfin assessment was conducted in 2017. New developments included examination of an alternative regional structure, exploration of uncertainties in the assessment model, particularly in response to the inclusion of additional years of data and improving diagnostic weaknesses of previous assessments. The results were similar to those from the previous (2014) assessment and indicated that (Figure 12):

1. The yellowfin stock is not in an overfished state as spawning biomass is above the SSB_{MSY} level (SSB_{latest}/SSB_{MSY} = 1.39, range between 0.80 and 1.91 across different models).
2. The ratio F_{recent}/F_{MSY} (for the period 2011-2014) is estimated to be 0.74 (range across different models between 0.54 and 1.13), indicating that overfishing is not occurring.
3. MSY is estimated to be 664,200 tons. Current (2017) catches are below MSY.
4. The optimistic estimate of overall stock status should be tempered by the patterns estimated at a sub-regional level. The tropical Pacific, from which most of the catches

are taken, is at least fully exploited with no potential for a substantial increase in catches to be sustainable.

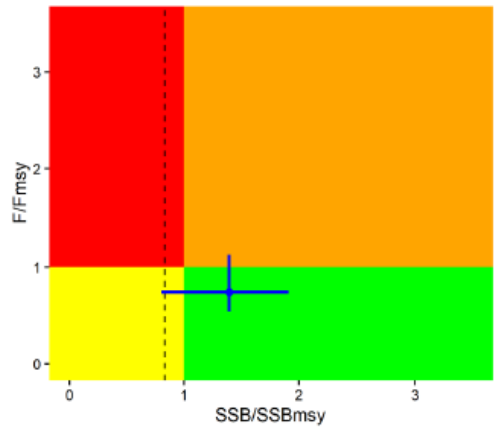


Figure 12. Latest estimate of SSB/SSB$_{MSY}$ and F/F$_{MSY}$ (in blue, including range) for WCPO yellowfin tuna. Dashed black line represents limit reference point (ISSF 2018).

Management

Limit reference point: 20% of the equilibrium spawning biomass that would be expected in the absence of fishing under current (most recent 10 years of the current assessment, excluding the last year) environmental conditions (20%SSB$_{current,\ F=0)}$. The yellowfin stock is estimated to be above this limit. The median value of SSB$_{recent}$/SSB$_{F=0}$ across all models chosen by SC13 to evaluate stock status is 0.33, which is above this limit.

Target reference point: Not defined. CMM 2017-01, which acts as a bridge to the adoption of a harvest strategy, establishes that, pending agreement on a TRP, the spawning biomass depletion ratio (SB/SB$_{F=0}$) is to be maintained at or above the average SB/SB$_{F=0}$ for 2012-2015.

Harvest control rule: Not defined. CMM-2014-06 calls for WCPFC to develop and implement a harvest strategy approach that includes target reference points, harvest control rules and other elements. At its 2016 meeting, the WCPFC refined the workplan for doing so.

A summary of the status of the YFT stock in the WCPO is provided by ISSF (2018):

WCPO YFT	ESTIMATE	YEARS	NOTES
RECENT CATCH	660	2017	
5-YEAR CATCH	605	2013-17	
MSY	664	2011-14	Median across model grid
F/F$_{MSY}$	0.74	2011-14	Median across model grid
SSB/SSB$_{MSY}$	1.39	2015	Median across model grid
TAC	N/A		

Catches and MSY in 1000 tonnes.

3.3.3 Bigeye Tuna

3.3.3.1 Distribution

Bigeye tuna (Figure 13) is a pelagic-oceanic and oceanodromous species, occurring in tropical and subtropical waters of the Atlantic, Indian and Pacific Oceans, but not the Mediterranean Sea (Figure 14). It inhabits a depth range between 0m and 250m. Temperature and thermocline depth seem to be the main environmental factors governing the vertical and horizontal distribution of the species. Although a pelagic species, the bigeye swims in deeper waters than other tropical tunas and shows intense vertical migration in the water column. In all oceans, the species occupies deeper waters during the day and shallower waters during the night. Juveniles and small adults of bigeye tuna school at the surface in mono-species groups or together with yellowfin tuna and/or skipjack. Schools may be associated with floating objects.

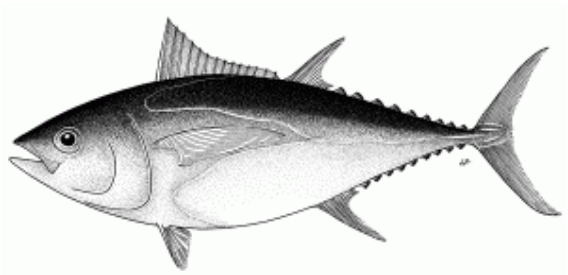


Figure 13. *T. obesus* (Lowe, 1839)

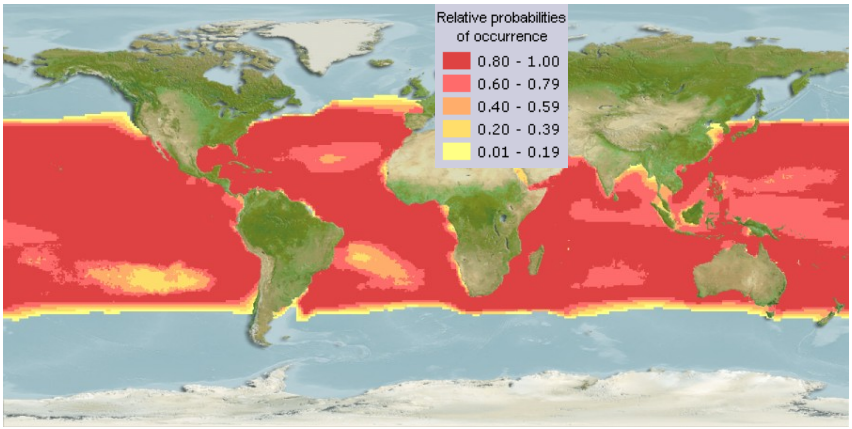


Figure 14. Reviewed native distribution map for bigeye tuna. (www.aquamaps.org, Version Jan. 2018. Accessed 12/04/18)

In the eastern Pacific some spawning is recorded between 10°N and 10°S throughout the year, with a peak from April through September in the northern hemisphere and between January and March in the southern hemisphere. Mature fish spawn at least twice a year. The food spectrum includes a wide variety of fish, cephalopods and crustaceans. The main predators are large billfish and toothed whales.

The species starts to be commercially harvested near 30 cm length, but most of the fish landed vary from 40-60 cm length; individuals up to 200 cm length have been reported. Sexual maturity is attained at 100-130 cm FL, corresponding to 3-4 years of age. Relative to other major tuna species, bigeye has relatively high growth rates. Growth parameters suggest that a 105 cm FL is reached at age 3, a 140 cm FL at age 5 and at 163 cm FL at age 7. Juveniles and small adults of bigeye tuna form dense schools at the surface in mono-species groups or together with yellowfin tuna and skipjack. Schools may be associated with

floating objects and FADs. These characteristics make the species highly susceptible to the purse seine fleets, which have harvested the species intensively (IATTC 2018; FAO Species Fact Sheets[13], accessed 12/04/2018).

3.3.3.2 Stock Structure

ICCAT manages bigeye tuna fisheries as harvesting a single, Atlantic-wide stock but has not ruled out the possibility of separate north and south Atlantic stocks.[14] IOTC also treats bigeye as a single stock in the Indian Ocean.[15]

Some tagging studies in the Pacific suggest a very low level of mixing between the eastern and the western Pacific, thus it is assumed that there are two stocks, one in the EPO and the other in the WCPO, with no exchange between these regions, and managed by IATTC and the WCPF, respectively[16]. The boundary between the EPO and the WCPO is 150°W longitude.

3.3.3.3 Fishery Indicators and Stock Status

3.3.3.3.1 Bigeye Tuna – Eastern Pacific Ocean

The summary of IATTC information provided by ISSF (2018) shows that bigeye catches in 2017 were about 101,600 tons, a 10% increase from 2016 (Figure 15). Longline fishing dominated the catches in weight until the mid-1990s. Purse seine fishing accounts for the majority of catches in recent years (62%), and longlining accounts for 38%.

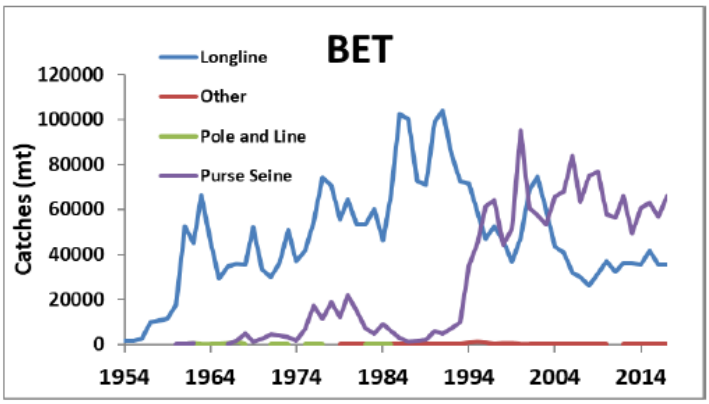


Figure 15. Catches of bigeye tuna in the EPO from 1954 to 2017, by gear type (ISSF 2018).

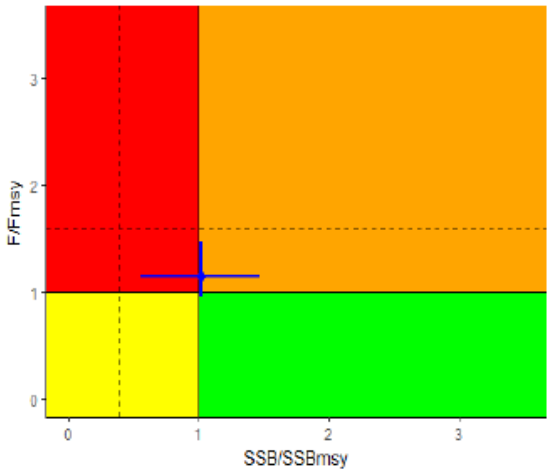
Stock Assessment

In 2018, the IATTC conducted an update assessment of the EPO bigeye stock, which showed more pessimistic results than the previous (2015) assessment. However, results could be unreliable due high uncertainty in the model assumptions, the reliability of the recent longline data, and other issues. The results of the 2017 assessment (Figure 16) indicate the following (ISSF 2018):

1. The current ratio of spawning biomass $SSB_{current}/SSB_{MSY}$ is estimated at 1.02 (range: 0.56-1.47). This indicates that the stock is not overfished.

[13] http://www.fao.org/fishery/species/2498/en
[14] http://www.iccat.es/Documents/SCRS/ExecSum/BET_EN.pdf
[15] http://www.iotc.org/files/proceedings/2011/sc/IOTC-2011-SC14-R[E].pdf
[16] https://www.iattc.org/Meetings/Meetings2018/SAC-09/PDFs/Docs/_English/SAC-09-05-EN_Bigeye-tuna-assessment-for-2017.pdf

2. The ratio of $F_{current}/F_{MSY}$ is estimated at 1.15 (range: 0.95-1.46), indicating that overfishing was occurring on average in the 3 most recent years (2015-2017). Fishing capacity of the purse seine fishery continues to increase, as does the number of purse seine sets on floating objects, which is a concern.
3. The estimate of MSY is 95,500 tons. MSY has been reduced to about half its level in 1993, when the expansion of the floating-object fishery began, as the overall selectivity from all fleets combined shifted towards smaller individuals. Since bigeye tuna can grow to large sizes (close to 200 cm), catching them when they are small results in a loss of potential yield, i.e. the catches that could be taken by other gears that target larger individuals, such as longlining. This is known as "growth overfishing".
4. As for all stock assessments that use MSY-based reference points, the assessment of stock status is highly sensitive to the assumed relationship between spawning biomass and recruitment. The base case assessment makes an optimistic assumption that recruitment to the fishery remains high even when the spawning stock is depleted. This results in MSY occurring at low levels of spawning stock and consequently $SSB_{current}/SSB_{MSY}$ remains high even for low stock sizes. The assessed stock status is more pessimistic if a stock-recruitment relationship, which is also plausible and more commonly applied in other tRFMO assessments, is assumed. The assessment results are also more pessimistic if a higher value is assumed for the average size of the older fish, if lower rates of natural mortality are assumed for adult bigeye, and if the size data from longline fisheries are given higher weight in the analyses.



5.

Figure 16.#Latest estimate of SSB/SSB_{MSY} and F/F_{MSY} (in blue, including range) for EPO bigeye. Solid black lines represent interim target reference points and dashed black lines represent interim limit reference points. Note that the stock assessment results are highly uncertain (ISSF 2018).

Due to many uncertainties in this new assessment, the IATTC developed alternative empirical fishery indicators to assess the status of the stock and to provide management advice. All the indicators, except catch, show strong trends over time, indicating increasing fishing mortality and reduced abundance, and are at, or above, their reference levels. The increasing number of sets and the decreasing mean weight of the fish in the catch suggest that the bigeye stock in the EPO is under increasing fishing pressure and that the measures in place are insufficient to prevent overfishing. The conclusions reached from analyzing these fishery indicators are qualitatively similar to the updated assessment. Thus, ISSF is taking a cautious view of the status of BET in the EPO and considers that overfishing is taking place.

Management

Limit reference point: In 2014, on an interim basis, IATTC adopted the equilibrium spawning biomass corresponding to that which produces a 50% reduction in recruitment from the unfished level. This calculation is based on the assumption that the steepness of the stock-recruitment relationship is h=0.75, which is more conservative than the assessment assumption that h=1.0. This corresponds to a spawning biomass that is about 8% of the un-fished level. SSB_{recent}/SSB_0 was estimated to be 0.21, which is above this limit, but this estimate should be taken with caution given the high uncertainty in the 2018 stock assessment.

Target reference point: In 2014, on an interim basis, IATTC adopted the recommendation of F_{MSY} and SSB_{MSY}. The level of F estimated by the 2018 assessment, which is highly uncertain, is above this level. Alternative fishery indicators suggest that the current management measures are insufficient to constrain F.

Harvest control rule: In 2016, IATTC adopted HCR for tropical tunas based on the interim target and limit reference points adopted in 2014 (Resolution C-16-02). The HCR aims to prevent fishing mortality from exceeding the MSY level for the tropical tuna stock (bigeye, yellowfin or skipjack) that requires the strictest management. If fishing mortality or spawning biomass are approaching or exceeding the corresponding limit reference point as measured by an estimated probability of 10% or greater of exceeding the limit, the HCR also triggers the establishment of additional management measures to reduce fishing mortality and rebuild the stock.

A summary of the status of the BET stock in the EPO developed by ISSF (2018) is provided below:

EPO BET	ESTIMATE	YEARS	NOTES
RECENT CATCH	102	2017	
5-YEAR CATCH	96	2013-17	
MSY	95		
F/F_{MSY}	1.15	2015-17	Highly uncertain
SSB/SSB_{MSY}	1.02	Start of 2018	Highly uncertain
TAC	N/A		

Catches and MSY in 1000 tonnes.

3.3.3.3.2 Bigeye Tuna – Western Central Pacific Ocean

According to ISSF (2018) provisional bigeye catches in 2017 were about 118,000 tons, a 19% decrease from 2016. The main fishing gears are purse seine (5-year average ~44%) and longline (43%) (Figure 17). Bigeye catches in the WCPO by other gears are relatively minor. The latest assessment indicates that the Western Pacific bigeye tuna stock is not overfished, with biomass above the limit reference point established by WCPFC. The management measures in place appear to be sufficient to prevent overfishing.

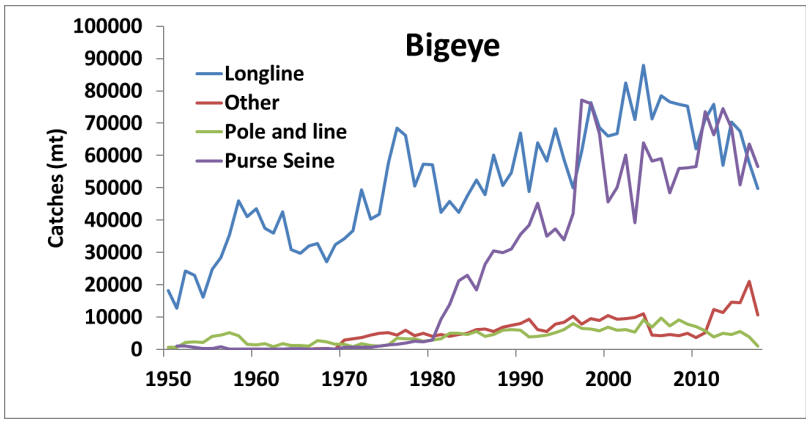


Figure 17. Catches of bigeye tuna in the WCPO from 1950 to 2017, by gear type.

Stock Assessment

SPC conducted the latest assessment in 2017 (WCPFC 2018a), which provided more optimistic results than the previous assessment, partly due to the use of a new growth curve. Still, some uncertainties remain, and the SC has recommended that several aspects of the assessment be investigated further to inform future assessments.

During 2017-2018, more growth data were collected and analyzed, giving further support to the validity of the new growth curve. In 2018, the assessment was updated, and the SC decided to remove model runs where the old growth curve was used. The new assessment indicated the following (ISSF 2018) (Figure 18):

a. The median ratio of F_{recent}/F_{MSY} is estimated at 0.77 (range between 0.59 and 1.06 across different models), indicating that overfishing is likely not occurring (across all model runs, there is a roughly 6% chance that F_{MSY} is being exceeded).
b. The median ratio of spawning biomass SSB_{recent}/SSB_{MSY} in the model runs is estimated at 1.38 (range between 0.96 to 1.88 across all models), indicating that the stock is not overfished. It was estimated that there is a 0% probability that the recent spawning biomass has breached the limit reference point established by WCPFC ($SSB_{recent}/SSB_{F=0}$ =0.2).
c. The estimate of MSY is 159,000 tons. MSY has been reduced to less than half its levels prior to 1970 through harvest of small bigeye ("growth overfishing"). Recent catches (2013-2017 average = 141,800 tons) are below MSY.

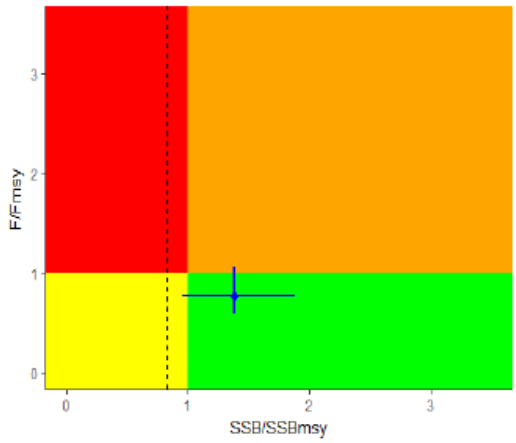


Figure 18. Latest (2017) estimate of SSB/SSB_{MSY} and F/F_{MSY} (in blue, including range) for WCPO bigeye tuna. Dashed black line represents limit reference point (ISSF 2018).

The updated assessment is clearly more optimistic than previous ones. Still, some uncertainties remain, and the SC has recommended that several aspects of the assessment be investigated further to inform future assessments.

Management

Limit reference point: 20% of the equilibrium spawning biomass that would be expected in the absence of fishing under current (most recent 10 years of the current assessment, excluding the last year) environmental conditions (20%$SSB_{current, F=0}$). This LRP was adopted by the Commission in 2012. The median value of $SSB_{recent}/SSB_{F=0}$ is 0.36, which is above this limit.

Target reference point: Not defined for the long term. CMM 2017-01, which acts as a bridge to the adoption of a harvest strategy, establishes that, pending agreement on a TRP, the spawning biomass depletion ratio ($SB/SB_{F=0}$) is to be maintained at or above the average $SB/SB_{F=0}$ for 2012-2015.

Harvest control rule: Not defined. CMM-2014-06 calls for WCPFC to develop and implement a harvest strategy approach that includes target reference points, harvest control rules and other elements. At its 2017 meeting, the WCPFC refined the workplan for doing so.

The latest assessment results are summarized by ISSF (2018) as follows:

WCPO BET	ESTIMATE	YEARS	NOTES
RECENT CATCH	118	2017	
5-YEAR CATCH	142	2013-17	
MSY	159	2015	Median across model grid
F/F_{MSY}	0.77	2012-15	Median across model grid
SSB/SSB_{MSY}	1.38	2012-15	Median across model grid
TAC	N/A		

Catches and MSY in 1000 tonnes.

3.4 Principle Two: Ecosystem background

This fishery occurs in the WCPO, which covers about 35 million km^2 (Allian et al. 2012) and, to a lesser extent, the EPO. Since this is a large area, the ecosystem in which the fishery takes place covers a wide range of water temperatures, ocean current circulation patterns, and species. The WCPFC is working "to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks (i.e. tunas, billfish, marlin) in the [WCPO]" (WCPFC 2010) though conservation and management measures and resolutions to be followed by the Members, Cooperating Non-Members, and Participating Territories (CCMs). The IATTC is responsible for the conservation and management of tuna and other marine resources in the EPO, which is done through resolutions and recommendations to be followed by members and cooperating non-members.

This fishery utilizes purse seine gear that fish on floating FADs and operates within the WCPO and, to a lesser degree, the EPO. As stated above, since this fishery fishes FADs, the pre-assessment considers all encircling gear, both FAD and unassociated fishing, as one gear type. Based on logbook data for the last five years (2013-2017), FAD fishing included sets on a drifting raft, FAD, or payao, on a drifting log, debris, or dead animal, on a live whale, and on "other". With regard to the set on the live whale, the data show that this happened once in 2015, that no tuna species were retained or discarded from this set, and that one silky shark was caught.

Much work has been done to score the global tuna fisheries against the MSC Standard, particularly Medley et al. (2018). Therefore, that work is used extensively throughout the Principle 2 background and scoring sections as appropriate.

3.4.1 Primary and secondary species status

According to the MSC Standard, a primary species is a species that is caught but is not the target species, that is within scope of the MSC program (i.e., not an amphibian, reptile, bird, or marine mammal), and that has management tools and measures in place. A secondary species is a species that is not considered primary or is a species that is out of scope (i.e., amphibian, reptile, bird, or marine mammal) but is not ETP (see ETP definition below). The MSC Standard requires the consideration of "main" primary and secondary species. A "main" species is one that makes up 5% or more by weight of the total catch of all species by the UoA, is a species that is classified as less resilient, or an exceptionally large catch occurs. (Refer to the MSC Standard for definitions of these latter two points. They are not discussed further here because they are not relevant to these UoAs.)

3.4.1.1 WCPO

Based on the provided observer data for the WCPO, the 12-year average (2006-2017) total retained catch was 38722.5 MT, with 5% of that at 1936.12 MT. Therefore, there appear to be no main primary or secondary species; however, logbook data would likely be needed to confirm this during a full assessment.

3.4.1.2 EPO

The data provided by the client for the EPO does not provide catch data for non-target species by weight but rather by number. To determine the primary and secondary species accurately, catch totals by weight would be needed. However, given the low catch numbers, it is likely that there are no primary or secondary species. This too would need to be confirmed with additional data during a full assessment.

3.4.1.3 Cumulative impacts on primary and secondary species

If additional data were to determine that main primary and/or secondary species do exist, it is likely that there are other MSC UoAs (i.e., MSC-certified and in-assessment UoAs) that also consider those species as main primary and/or secondary. If so, a full assessment would need to consider them in more detail.

3.4.1.4 Primary and secondary species management

While FADs have their benefits for purse seining, their impact on tuna stocks and the broader marine ecosystem has increasingly come into question so RFMOs have (or are creating) FAD management plans, which include elements to limit environmental impacts (ISSF 2018):

- Collect and report data on FAD type, usage, and catch per effort (via logbooks and observers)
- Enhance monitoring of FAD use and associated bycatch
- Improve FAD designs that reduce entanglement and minimize bycatch and marine debris
- Implement FAD recovery policies
- Adopt management measures, such as limits on the overall number of FADs used and/or FAD sets made
- Adopt effective bycatch mitigation measures

Both WCPFC and IATTC have and continue to consider various FAD management options (WCPFC 2016, Hall and Román-Verdesoto 2017). Table 2 shows what IATTC and WCPFC are doing with regard to ISSF's best practices for FAD management of environmental impacts (Restrepo and Justel-Rubio 2018).

Table 2. Level of progress in implementing the recommended best practices for FAD management. (Dark blue = element consistent with recommended best practices, medium blue = element is present but amendments or change in procedure is needed to be consistent with best practices, light blue = element is missing or inconsistent with best practices.) Source: ISSF 2018

RFMO	Environmental Impact Elements					
	Require use of non-entangling FAD designs	**Promote use of bio-degradable FADs**	**Establish FAD recovery policy**	**Require mitigation measures for bycatch species in FAD sets**	**Adopt safe handling and release practices for sharks, rays, and sea turtles**	**Prohibit intentional setting on whale sharks and cetaceans**
IATTC	In place and consistent with best practices	Res. C-18-05 includes provisions for considering recommendations on the use of biodegradable materials	Res. C-17-02 includes some provisions for FAD recovery	Retention prohibition	In place and consistent with best practices	Missing
WCPFC	Provided voluntarily	In place and consistent with best practices	Missing	Retention prohibition	For sea turtles, whale sharks, and rays	In place and consistent with best practices

3.4.1.5 Shark finning

Logbook and observer data show that this fishery regularly interacts with several shark species. This pre-assessment does not have enough information to assess the likelihood that shark finning is not occurring, and a full assessment would need to consider this in more detail. However, the WCPFC's Conservation and Management Measure (CMM) 2010-07 outlines several requirements relevant to shark finning. (See below for more details on this CMM.)

3.4.2 ETP species

According to the MSC Standard, an ETP species is a species recognized by national ETP legislation; species listed in a binding international agreement (refer to MSC Fisheries Standard SA3.1.5.2 for the list of relevant binding international agreements); or out-of-scope species that are listed in the IUCN Redlist as vulnerable, endangered, or critically endangered. Based on this definition, there are several ETP species that overlap with the UoAs. Table 3 provides a list of ETP species encountered by the UoAs.

Table 3. ETP species encountered by the UoAs and the catch numbers for 2013-2017. Unless stated otherwise, these catches occurred in WCPO. (Note: EPO data available only for 2015-2017.)

Species	UoAs' Catch 2013	UoAs' Catch 2014	UoAs' Catch 2015	UoAs' Catch 2016	UoAs' Catch 2017
Marine mammals					
Baleen whale (unidentified *Mysticeti* spp.)	1	2			
Common bottlenose dolphin	10				
False killer whale	56	22	2	2	
Humpback whale		2			
Indo-Pacific bottlenose dolphin	32				
Killer whale			19		
Melon-headed whale	1		4		
Rough-toothed dolphin		11		10	
Sei whale		6	2		
Short-finned pilot whale	45		1		
Spinner dolphin		22		6	
Striped dolphin	12				
Rays					
Giant manta ray	18	57	14	25	7
Ray (unidentified *Mobula* spp.)	52	31	12 (WCPO), 7 (EPO)	10	6
Sea turtles					
Green turtle		3	2	3	
Hawksbill turtle			1	1	1
Loggerhead turtle	2	2	1	2	
Olive Ridley turtle	1				
Sharks					
Oceanic whitetip shark	18	37	23 (WCPO), 3 (EPO)	48 (WCPO), 2 (EPO)	25
Scalloped hammerhead shark				1	

The observer data show that the 19 killer whales caught in 2015 were retained for crew consumption, and one of the unidentified rays was retained for an unknown reason in 2014. All other species were discarded either alive, dead, or in an unknown state.

3.4.2.1 ETP species status

The MSC FCR v2.0 requires the consideration of the UoAs' catches of ETP species with regard to national and international catch limits. Where such limits do not exist, the team must consider the likelihood of the UoAs' effects on the species ability to recover (i.e., are the UoAs hindering recovery). Without knowing the exact fishing range of the UoAs, the team cannot accurately score PI 2.3.1 since it cannot determine:

- Which species' DPSs and/or stocks are relevant to be able to consider stock status compared to the UoAs' catch of that species
- Which species' national and/or international limits are relevant to know which scoring issue (a or b) should be scored
- If there are combined effects of MSC UoAs (scoring issue a at SG80 and SG100) to be considered

The UoAs' catch numbers appear to be relatively low, but without the data listed above, the team feels it is appropriate to score this PI precautionarily.

3.4.2.2 ETP species management

CITES is a multilateral treaty established to protect endangered plants and animals. It was drafted at a meeting of members of the International Union for Conservation of Nature (IUCN) and became effective in 1975. It aims to ensure that the international trade of wild animals and plants does not threaten the survival of these species, and it extends varying degrees of protection to more than 35,000 animal and plant species. Each CITES-protected species is assigned an appendix, which specifics the extent of the threat and the trade controls applied to that species. CITES Appendix I, the highest level, includes the species that are threatened with extinction and are, or may be, affected by trade.

The Marine Mammal Protection Act (MMPA) was enacted in 1972 in response to increasing concerns that human activity was causing significant declines in some marine mammal populations. All marine mammals in U.S. waters are protected by the MMPA, which is implemented by NMFS, USFWS, and the Marine Mammal Commission. NMFS performs various conservation and management actions, including:

- Development and implementation of conservation plans for depleted species
- Development and implementation of take-reduction plans to minimize commercial fishing bycatch
- Coordination of the Marine Mammal Health and Stranding Response Program and investigation of unusual mortality events
- Collaboration with other nations to ensure that international trade does not threaten marine mammals
- Investigation and prosecution of MMPA violations

Required by the MMPA, NMFS publishes its List of Fisheries (LOF), which classifies commercial fisheries into one of three categories (I, II, and III) based on the level of incidental marine mammal mortality or serious injury that occurs. Category I and II mean there are "frequent interactions" and "occasional interactions", respectively. Category III means there is a "remote likelihood of/no known interactions". The classification dictates whether or not fishers are subject to actions, such as observer coverage and take-reduction plan requirements. These UoAs have no documented incidental kills or injuries so is a Category III under the LOF.

The MMPA limits the number of each marine mammal species that can be killed as part of fishing activities. This is the potential biological removal (PBR) level, which is defined as "the maximum number of animals, not including natural mortalities, that may be removed from a

marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population" (NMFS 2017).

The IUCN Red List of Threatened Species was introduced in 1994 with the goal of providing information and analyses on the status, trends, and threats to species in order to inform and catalyze conservation action. To achieve this goal, The IUCN Red List aims to:

- Establish a baseline for monitoring species status changes
- Provide a global context for the establishment of local level conservation priorities
- Monitor, on a continuing basis, the status of a representative selection of species that covers all major ecosystems

Table 4 lists these species and the management measures that require their protection. The ESA was established in 1973 and carries out the provisions in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The ESA aims to conserve endangered and threatened fish, wildlife, and plant species and is administered by the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration's NMFS. With regard to fishing activities, the USFWS allows a certain level of "incidental take" of a listed species in cases where "an action may adversely affect a species but not jeopardize its continued existence" (USFWS 2017). Additionally, both WCPFC and IATTC have and continue to consider various FAD management options with regard to various environmental impacts (Table 2).

Table 4. The protection measures and status (where relevant) of the ETP species encountered by these UoAs.

Species	Protection Measure and Status			
	ESA	MMPA	CITES Appx. I	IUCN Red List
Marine mammals				
Baleen whale (unidentified *Mysticeti* spp.)	Endangered?[1]	X	?[1]	?[1]
Common bottlenose dolphin		X		
False killer whale	Endangered: Main Hawaiian Islands Insular DPS	X		
Humpback whale	Endangered	X	X	
Indo-Pacific bottlenose dolphin		X		
Killer whale	Endangered: Southern Resident DPS	X		
Melon-headed whale		X		
Rough-toothed dolphin		X		
Sei whale	Endangered		X	Endangered
Short-finned pilot whale		X		
Spinner dolphin		X		
Striped dolphin		X		
Rays				
Giant manta ray	Threatened			
Ray (unidentified *Mobula* spp.)	Threatened?[2]			
Sea turtles				
Green turtle	Endangered: Central South Pacific and			Endangered

	Central West Pacific DPSs Threatened: East Indian-West Pacific, North Indian, Southwest Indian, Southwest Pacific, Central North Pacific, and East Pacific DPSs			
Hawksbill turtle	Endangered			Critically endangered
Loggerhead turtle	Endangered: North Pacific Ocean and South Pacific Ocean DPSs Threatened: Southeast Indo-Pacific Ocean DPS			Vulnerable
Olive Ridley turtle	Endangered: Mexico's Pacific coast breeding populations Threatened: All other populations			Vulnerable
Sharks				
Oceanic whitetip shark	Threatened			
Scalloped hammerhead shark	Threatened: Indo-West Pacific DPS Endangered: Eastern Pacific DPS			

Notes:
[1] Since the specific baleen whale species were not known, it cannot be said with certainly whether or not they were endangered as per the ESA; listed in CITES Appendix 1; or vulnerable, threatened, or endangered as per the IUCN Red List.
DPS = distinct population segment
[2] Since the specific ray species are not known, it cannot be said with certainly whether or not they were endangered as per the ESA.

The exact fishing range of the UoAs is a key component for assessing PIs 2.3.1 and 2.3.2. Without this information, the team cannot accurately:

1. Determine which species' stocks/DPSs are relevant to this assessment so all possible species have been listed in Tables 3 and 4.
2. Score those PIs since it cannot be determined which species have national and/or international limits to know which scoring issue (a or b) should be scored.

For example, if these UoAs only fish in international waters, it is unlikely that there are relevant Pacific-wide limits so scoring issue a would not be scored for either PI. However, if the UoAs do fish within the U.S. EEZ, then U.S. limits would need to be considered, and scoring issue a would be scored.

3.4.2.3 ETP species information

This fishery has 100% observer coverage. This data along with available logbook data were used in this pre-assessment.

3.4.2.4 Additional national and international marine mammal management and information collection

The Protected Resources Division within the Pacific Islands Regional Office (PIRO) are responsible for protecting marine mammals and recovering endangered and threatened

species in the region. Through management, conservation, and species-specific recovery efforts and public outreach and education, they promote the survival and recovery of protected marine species. They also evaluate the status of species to determine whether they are threatened or endangered under the ESA. For those species, PIRO engages in recovery planning, critical habitat designation, and other conservation and management activities that promote species recovery.

Additionally, PIRO implements several programs to conserve and protect marine mammal populations in the Pacific Islands region, including efforts to reduce the "take" of marine mammals in commercial fisheries and maintain a robust Marine Mammal Health and Stranding Response Network.

The WPFMC has a CMM relevant to marine mammals. CMM 2011-03 prohibits vessels from deliberately setting on cetaceans.

3.4.2.5 Additional international ray management and information

The IATTC has a Resolution and Recommendation relevant to rays. C-15-04 prohibits retaining onboard, transshipping, landing, storing, selling, or offering for sale any part or whole carcass of Mobulid rays and requires vessels to release the rays alive and unharmed.

3.4.2.6 Additional international sea turtle management and information collection

NOAA's International Fisheries Program provides financial, administrative, and technical support to sea turtle projects throughout the WCPO region. The International Sea Turtle Conservation and Management Liaison serves as the Program's point of contact for sea turtle conservation and management projects in the WCPO and coordinates with the WPFMC, the Pacific Islands and Southwest Fisheries Science Centers (PIFSC, SWFSC), the PIRO program staff, the NOAA Fisheries headquarters offices, as well as relevant stakeholders (e.g., environmental non-governmental organizations).

The International Fisheries Program provides partial funding for the following SWFSC activities: leatherback nesting beach research in Papua Indonesia; leatherback satellite telemetry; nesting beach monitoring and aerial surveys in Indonesia, Papua New Guinea, and the Solomon Islands; as well as socioeconomic investigations in the Pacific Islands region. In addition, the International Fisheries Program funds collection of marine turtle skin samples for addition to the SWFSC Marine Mammal and Sea Turtle Molecular Genetics Sample Archive.

The Pacific Islands Forum Fisheries Agency (FFA) provides technical expertise and fiscal resources to train observers placed on U.S. purse seine vessels, training observers on identification, data recording, handling, and fisheries interaction mitigation measures for sea turtles. The FFA provides equipment and materials required to implement appropriate turtle handling and bycatch mitigation, including turtle resuscitation techniques. When requested by NOAA, FFA observers will collect life-history information on sea turtles captured by U.S. purse seiners, including but not limited to species identification, measurements, condition, photographs, and skin biopsy samples. FFA observers record the presence and identifying number of tags on all sea turtles captured.

The IATTC has Resolutions and Recommendations relevant to sea turtles:

- C-04-07 adopted a three-year program to mitigate tuna fishing's impacts on sea turtles.
- C-07-03 implemented the FAO Guidelines to reduce the bycatch, injury, and mortality of sea turtles in fishing operations and to ensure the safe handling of all captured sea turtles; implemented additional observer coverage; required purse seine fishermen to release FAD-entangled sea turtles; and instructed the avoidance of encircling sea turtles.

The WPFMC has a CMM relevant to sea turtles. CMM 2008-03 ensures vessel operators:

- Avoid encircling sea turtles, and if a sea turtle is encircled or entangled, take practicable measures to safely release the turtle
- To the extent practicable, release all sea turtles observed entangled in FADs or other fishing gear; if a sea turtle is entangled in the net, stop net roll as soon as the turtle comes out of the water, disentangle the turtle without injuring it before resuming the net roll, and to the extent practicable, assist the recovery of the turtle before returning it to the water
- Carry and employ dip nets, when appropriate, to handle turtles
- Record all incidents involving sea turtles during fishing operations and report such incidents to the appropriate authorities
- Provide the WPFMC with the results of any research related to the development of modified-FAD designs to reduce sea turtle entanglement and take measures to encourage the use of designs found to be successful at such reduction

3.4.2.7 Additional international shark management and information collection

The IATTC has several Resolutions and Recommendations relevant to sharks.

- C-11-10 prohibits retaining onboard, transshipping, landing, storing, selling, or offering for sale any part or whole carcass of oceanic whitetip sharks; requires the unharmed release of whitetip sharks when brought alongside the vessel; and requires the recording through observer programs of the number of discards and releases of oceanic whitetip sharks (dead or alive).
- C-16-04 amends C-05-03, stating that Members and Cooperating Non-Members (CPCs) shall work with IATTC scientific staff to identify ways to make gear more selective, improve knowledge of key shark species, identify key lifecycle areas (e.g., mating, pupping), and improve handling practices of live sharks to maximize post-release survival.
- C-16-05 requires IATTC scientific staff to develop a workplan and timeline for full stock assessments for silky and hammerhead sharks, requires CPCs to require fishermen to collect catch data for these sharks, and requires purse seine vessels to follow safe release requirements for all sharks.
- C-16-06 prohibits retaining on board, transshipping, landing, or storing, in part or whole, carcasses of silky shark; requires vessels to not fish in silky shark pupping areas; and requires the submission of catch data for silky sharks.

The WPFMC has several CMMs relevant to sharks.

- CMM 2010-07 ensures that Commission CCMs shall:
    - Implement, as appropriate, the FAO International Plan of Action for the Conservation and Management of Sharks (IPOA Sharks)
    - Advise the WPFMC on their implementation of the IPOA Sharks, including, results of their assessment of the need for a National Plan of Action and/or the status of their National Plans of Action for the Conservation and Management of Sharks
    - Include in their National Plans of Action or other relevant policies for sharks measures to minimize waste and discards from shark catches and encourage the live release of incidental catches of sharks
    - Include key shark species, as identified by the Scientific Committee, in their annual reporting to the Commission of annual catch and fishing effort

statistics by gear type, including available historical data, in accordance with the WCPF Convention and agreed reporting procedures
    - Report annual retained and discarded catches
    - As appropriate, support research and development of strategies for the avoidance of unwanted shark captures
    - Consider appropriate assistance to developing CCMs for the implementation of the IPOA and collection of data on retained and discarded shark catches
- CMM 2011-04 prohibits vessels from retaining on board, transshipping, storing on a fishing vessel, or landing any oceanic whitetip shark and requires the release of any whitetip sharks.
- CMM 2012-04 prohibits purse seine vessels from setting on tuna associated with a whale shark and requires the safe release of a whale shark when not deliberately encircled.
- CMM 2013-08 prohibits vessels from retaining on board, transshipping, storing on a fishing vessel, or landing any silky shark and requires the release of any silky sharks.

3.4.3 Habitats

3.4.3.1 Gear impacts

This U.S. tuna fishery operates in deep oceanic waters and uses purse seine gear that is both unassociated and associated with FADs. As noted above, these two types are being assessed as one – the most impacting gear type, which is FADs. Overall, purse seines do not physically impact the seafloor during its operation. Therefore, the effect on pelagic waters would be negligible. Ghost fishing due to lost or discarded gear would impact seafloor habitat. However, since tuna vessels actively attempt to avoid gear loss due to the high cost of replacement, ghost fishing and its effects are also likely to be negligible (Medley et al. 2018).

In the case of FAD sets, the FADs themselves form part of the habitat so interactions through FAD fishing include changes to naturally occurring FADs caused by fishing as well as the addition of artificial FAD to the pelagic habitat. The main question is whether fishing on FADs or deploying FADs causes “serious or irreversible harm to habitat structure and function”. A number of factors suggest that fishing on FADs or deploying FADs does not have serious or irreversible impacts. These include: (i) the short residency and aggregation times of fish under FADs imply they are part of a temporary and dynamic process; (ii) in most cases, natural logs are removed from the purse seine, followed by smaller fish to recolonize the logs immediately upon release; and (iii) the number of FADs naturally fluctuate, being created by processes such as storms and eventually sinking. Because the FAD population is not stable, the processes linking populations to FADs are likely to be opportunistic and robust, implying the FAD fishery’s habitat impact is low (Medley et al. 2018).

While the fishery overlaps with vulnerable marine ecosystem (VME) habitats, such as coral reefs and seamounts, they would not be affected directly by fishing activities since the fishery operates near the surface in deep oceanic waters. Lost gear could sink or drift onshore and therefore impact coral reefs, mangroves, and seagrass beds. The overall impact of this has not been quantified, and some stakeholders have expressed concern that it is an issue. Therefore, according to Restrepo and Justel-Rubio (2018), fisheries should:

- *Support efforts to assess the impact of beaching events on coral reefs in the different ocean regions*
- *Promote the use of biodegradable FADs and further research in their design and use. (Moreno et al. 2016, 2017)*

- *Set up arrangements with governments and NGOs in coastal countries to alert them of FADs drifting in their direction*
- *Develop a policy to recover FADs before they drift out of the fishing area and to take FADs out of the water at the end of the fishing season*
- *Support limits on the overall number of FADs used by purse seine fisheries in each RFMO*
- *Support efforts to improve FAD fishing at the RFMO and national level (e.g., in testing of biodegradable FAD designs, FAD impact studies, etc.)*
- *Report any information necessary to monitor whether the risk to coral reefs will increase in the future (e.g., number of FADs being used, changes in FAD use strategy)*

Overall, there is no evidence that FADs have impacted VMEs, but more information is needed on FAD lifespans, dispersal, etc. to determine with certainty whether or not they interact with or impact VMEs (Medley et al. 2018).

3.4.3.2 Habitat management

In general, pelagic fisheries do not have habitat management measures and/or strategy; they are not deemed necessary since the fisheries do not interact with seafloor habitats or VMEs. However, fisheries utilizing FADs should have management measures/strategies or be working toward their implementation. As noted above in Table 2, both WCPFC and IATTC have and continue to consider various FAD management options with regard to various environmental impacts.

3.4.3.3 Cumulative management of habitats

With regard to the cumulative impacts of FADs on VMEs, it is possible that FADs could impact VMEs outside the fishing area. This has become an increasing issue as more FADs have been released by purse seiner. It is likely that there are other MSC UoAs that also operate in these areas. This pre-assessment does not have enough information to assess potential cumulative impacts fully; however, a full assessment would need to consider them in more detail.

3.4.3.4 Habitat information

The physical, chemical, and biological properties of the pelagic environment within the RFMOs' jurisdictions are monitored, and the habitat itself is adequately mapped in terms of depth and main oceanographic features. Further, the fishing operations and their location are also accurately recorded in relation to those features via VMS and observer coverage. All larger vessels operate a VMS, and thus there is accurate, near real-time monitoring of the spatial extent of interaction and the timing and location of use of the fishing gear. WCPFC and IATTC require 100% coverage for large-scale purse seine vessels. Information on the use and distribution of FADs is not complete, making their level of impact on habitat, especially VMEs, uncertain. More research and data collection are needed in this area. FAD monitoring has been proposed but has not yet been fully implemented (Medley et al. 2018).

3.4.4 Ecosystem

3.4.4.1 Gear impacts

The key impact of the UoAs is the removal of high-level predators from the ecosystem. The removal of these tuna species likely influences and alters lower-level species composition, and these effects may be seen over large spatial and temporal scales (Heithaus et al. 2008). Alterations to lower trophic levels may lead to reduced growth rates and increase the direct

predation of the lower-level species (Connell 2002, Heithaus et al. 2008). However, fisheries that use FADs are experiencing catches with wide size distribution, meaning that tunas of several different trophic levels are being caught. Therefore, the removal of higher-level predators is thought to be less significant and appears to be creating less of an impact (MRAG 2014).

FAD fishing may impact the ecosystem by selectively removing fish species and sizes that frequently interact with FADs (e.g., small and juvenile bigeye and yellowfin, unmarketable species or sizes of other fish species) (Fonteneau et al. 2000, Romanov 2002, Bromhead et al. 2003, Nicol et al. 2009). For example, in the WCPO, yellowfin tuna caught in associated were around 70 cm smaller than those caught in unassociated sets (Leroy et al. 2013).

Additionally, fishing on FADs has significantly expanded the geographical range of purse seine fisheries, potentially impacting portions of the stock that may have previously been unfished, and it may modify species' natural movement and migration patterns (geographically, spatially, and temporally) (Marsac et al. 2000, Dempster and Taquet 2004, Hallier and Gaertner 2008, Dagorn et al. 2010). Due to the congregation of potential prey around FADs, they may also affect the diet of fish since fish may not need to search as much for prey. Leroy et al. (2013) found that the catch weight of most non-target fish species was higher around FADs. This has also been the case for sea turtles and sharks (Molony 2005, Hall 1998, Hall et al. 2000, Clarke et al. 2011).

Since man-made FADs are often made of non-natural products such as plastic, they could become marine debris when they breakdown (Donohue 2005). Plastic can remain in the marine ecosystem for decades, be eaten by marine species, and become entangled in marine species or benthic structures. Therefore, this is another potential ecosystem impact that could arise from FAD fishing. The extent of this impact is unknown due to a lack of information on FAD use and their contribution to the issue of marine debris (National Research Council 2009).

Ecosystem impacts from FADs are thought to be minimal but are uncertain. Natural FADs (e.g., logs) are unlikely to cause serious or irreversible harm since they have a limited lifespan since they become waterlogged and sink (Taquet *et al.* 2007). It is unclear if and how these impacts vary for man-made FADs since they have a longer lifespan through the use of floats and PVC frames to keep them buoyant (MRAG 2014).

3.4.4.2 Ecosystem management

RFMOs have adopted some management measures that indirectly limit the impact on ecosystems (e.g., limit the number of FADs, ban entangling FADs, set of TACs, limit vessel capacity), but more is likely needed. Therefore, according to Restrepo and Justel-Rubio (2018), fisheries should:

- Support implementation of management measures that ensure close monitoring of the ecosystem, in particular by providing the necessary fishing effort information
- Provide other data that has been identified as relevant through research (e.g., FADs as ecological traps, FAD impacts on coral reefs)
- Promote and support RFMO work to improve FAD information and management

The WCPFC has a conservation and management measure (CMM 2009-02) that enforces a FAD closure in the high-sea areas between 20°S and 20°N, and vessels are prohibited from fishing within one nautical mile of any floating object in this area. This CMM has an indirect effect on the ecosystem since its objective is to reduce catches of juvenile tuna as well as limit effort on target species. IATTC has two relevant resolutions (C-18-05 and C-17-02 as noted in Table 2) that likely have direct and indirect effects on the ecosystem. Additionally, the IATTC requirement to use non-entangling FADs, which are constructed using natural or biodegradable materials, aims to reduce the ecosystem impact of synthetic marine debris.

In 2017, the RFMOs held a joint meeting on the implementation of an ecosystem-based approach to fisheries management. While the RFMOs see the value in such an approach, there are several issues to work through before full implementation could occur, such as the following (FAO 2017):

- Common definition of and understanding of how to operationalize ecosystem-based fisheries management are needed before next steps are taken.
- Large jurisdictional areas of the RFMOs, which include several exclusive economic zones, could constrain the effectiveness of the management
- Improved communication is needed among relevant working groups, committees, stakeholders, etc.

In the interim, the RFMOs each have some level of ecosystem management. IATTC is developing a five-year strategic research plan, "which will incorporate several ecosystem components and improved integration of existing research programs" and catch trophic levels for three purse-seine fishing methods are being monitored as a proxy of ecosystem integrity (FAO 2017). Additionally, on an annual basis, IATTC reviews any new ecosystem concepts, data, and research (FAO 2017). WCPFC's current five-year strategic research plan (2012-2016) includes research and data collection priorities, one of which is to monitor and assess the WCPO's pelagic ecosystems, and the evaluation of potential management options. To work toward a more integrated approach in the future, the research plan details several relevant research areas, such as the following (FAO 2017):

- Undertake "periodic ecological risk assessments, using productivity-susceptibility analysis or other approaches, to identify priorities for enhanced monitoring, biological research, stock assessment and management intervention"
- Establish "ecosystem indicators to monitor the effects of fishing, other anthropogenic effects and natural variability on ecosystem structure, function and biodiversity"
- "Quantify fishery impacts, other anthropogenic impacts and the effects of environmental and climate variability and change on ocean ecosystems"
- Investigate "trophic (predator/prey) relationships"
- Synthesize "data and ideas across disciplines into ecological and ecosystem-based models"

3.4.4.3 Ecosystem information

Various models (e.g., EcoPath, SEAPODYM, Climate and Fishing Impacts on the Spatial Population Dynamics of Tunas model) are being developed or used to analyze predator-prey relationships, to investigate the influence of different fishing and environmental effects on spatial tuna population dynamics, and to investigate whether climate variability can be estimated. Stomach-content sampling is also being conducted in WCPO and EPO to help understand predator-prey relationships (MRAG 2014).

In 2018, ISSF convened a workshop to evaluate measures to reduce the impacts of FADs on the environment (Moreno et al. 2018):

- Limit the number of FADs
- Simplify the FAD's structure
- Avoid FAD deployment areas that have a high risk of stranding
- Build FADs with navigation capability
- Build FADs that can be sunk
- Use anchored FADs

- Recover FADs at sea
- Recover FADs from the coast

Figure 19 shows which measures the workshop participants felt were achievable in the short-term (Moreno et al. 2018). The participants also felt that the anchored FAD and sinkable FAD measures should be eliminated. They felt that it would be too difficult to manage access to anchored FADs and that sinking FADs would not limit marine debris. Ultimately, the participants had several recommendations, including:

- Quantify FAD strandings to establish priority areas based on the vulnerability of the ecosystem and the degree of stranding
- Simplify FAD structure
- Conduct at-sea pilot studies of FADs with navigation capacity to better understand their behavior and the strategy for their use
- Hold workshops in each ocean with scientists and fishers to discuss this workshop's potential solutions and recommendations in terms of each ocean's specific characteristics

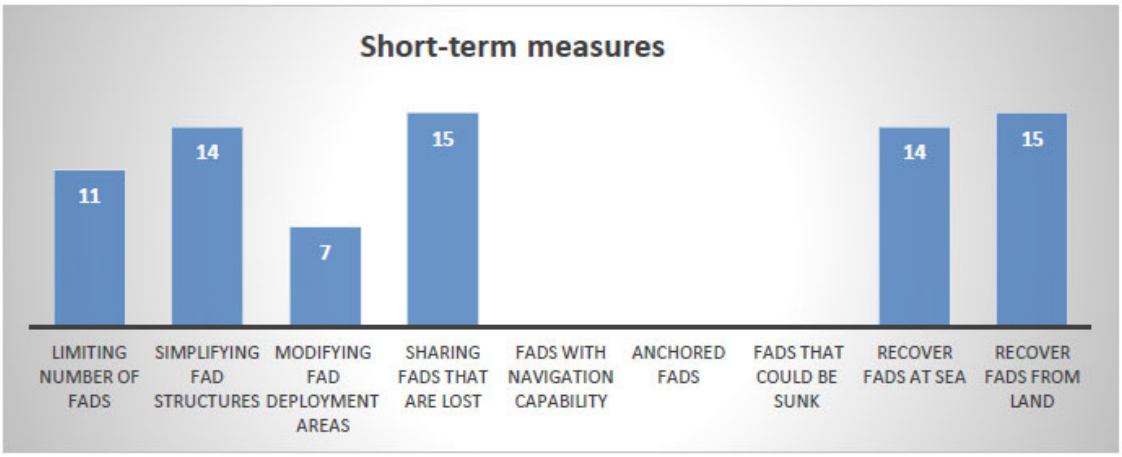


Figure 19. Short-term measures to reduce the impact of FADs on the ecosystem. Source: Moreno et al., 2018

As noted above, RFMOs are working to collect data and monitor the ecosystem in order to support potential management measures. With regard to FADs, their distribution is not monitored directly but is often times noted via vessel interaction records, which can allow for the monitoring of distribution changes over time. The collection of data on species composition around FADs would form a useful part of a FAD management plan to allow for the monitoring of catch composition changes (MRAG 2014).

3.5 Principle Three: Management system background

3.5.1 Area of operation

The U.S. purse seine fleet targeting yellowfin, skipjack, and bigeye operate predominantly in the Western and Central Pacific Ocean (FAO 71) and the Eastern Pacific Ocean (FAO 77). According to FCR SA4.1.1, the jurisdictional category is (e) stocks of highly migratory species (HMS). The term “highly migratory species” derives from Article 64 of the United Nations Convention of the law of the Sea, which in general have a wide geographic distribution, both inside and outside countries’ 200-mile zone (PFMC 2014). Because of the migratory nature of these species, only a small fraction of the total harvest is taken within U.S. waters, thus requiring both national and international management. Nationally, the National Marine Fisheries (NMFS), the Pacific Fishery Management Council (PFMC) and the Western Pacific Regional Fishery Management Council (WPRFMC) manage the tropical tuna fishery on the West Coast and in the U.S. territory of the American Samoa, Hawaii, the Territory of Guam, the Commonwealth of the Northern Mariana Islands, and the U.S. Pacific Remote Island Areas (PRIA) of the Western Pacific Region (SCS 2016). The WPRFMC is predominantly responsible for the U.S. purse seine tuna fishery as most fish are caught beyond the US EEZ. Internationally, the responsibility for their management is shared by between the Inter-American Tropical Tuna Commission (IATTC), which is responsible for the conservation and management of fisheries for tunas and other species taken in the eastern Pacific Ocean, and the Western and Central Pacific Fisheries Commission (WCPFC), which has a parallel role in the western and central pacific (PFMC 2014). Yellowfin, skipjack and bigeye tuna are all managed under the Fishery management Plan for the U.S. West Coast Fisheries for Highly Migratory Species (HMS FMP) and the Fishery Ecosystem Plan (FEP) for Pelagic Fisheries of the Western Pacific in American Samoa, Guam, the CNMI and Hawaii (PFMC 2014, WPRFMC 2018a).

3.5.2 Particulars of any recognized groups with interests in the fishery

There are 11 large U.S. purse seine vessels directly included in this assessment, however there are 38 active U.S. purse seine vessels operating in the IATTC and WCPFC that will be included in the overall scope. A large purse seine is defined by IATTC as having a carrying capacity greater than 400 short tons (363 metric tons) (NOAA Fisheries 2017). This fishery fishes on floating FADs and includes all encircling gear, both FAD and unassociated[17]. There is one cannery in Pago Pago, American Samoa, which is the primary port used for landing in the U.S. (PFMC 2014). 33% of tuna landings were reported at Pago Pago, with the remaining 67% landed in foreign ports (USCG 2014).

3.5.3 Details of consultations leading to the formulation of the management plan

The WPRFMC was created in pursuant to the Magnuson Stevens Act of 1976 (MSA). In 1998, the U.S. Congress charged the NMFS with the establishment of an Ecosystem Principles Advisory Panel (EPAP) that would be responsible for assessing the extent that ecosystem principles were being used in fishery research, management and recommending how to further their use to conserve and protect marine resources (WPRFMC 2009). The EPAP reached consensus that Fishery Ecosystem Plans (FEPs) should be developed and implemented to manage U.S. fisheries and marine resources. The EPAP constructed eight principles which were recognized and used as a guide by the Council in the development of the FEP. These principles are summarized as follows:

- The ability to predict ecosystem behavior is limited

[17] Unassociated (also described as non-associated or FAD free) is the method of fishing on a free-swimming school of tuna without the use or association with FADs (FishWise 2018).

- Ecosystems have thresholds and limits that when exceeded, can affect major system restructuring
- Changes can be irreversible once thresholds have been exceeded
- Diversity is crucial to ecosystem functioning
- Multiple scales interact within ecosystems
- Components of ecosystems are linked, boundaries are open and change with time

In December 2005, the Council recommended the establishment and implementation of the FEP (WPRFMC 2009).

3.5.4 Arrangements for on-going consultations with interest groups

On a national level, the WPRFMC provides several opportunities for stakeholder input into management required by federal statute and implemented through its standard operating procedures. The Councils hold meetings in which the entire Council and its advisory bodies meet and are key to the Council process. The Council meets three times a year, usually in March, June, and October (WPRFMC 2018b). Most meetings take four days, with individual advisory body meetings occurring during the week prior. All meetings are open to the public and meeting information is available on the various Council' website. Dates and locations of Council meetings are publicized in advance. Guides to the Council Process are available on the Council's website, which explain the fishery management process in nontechnical language, give updates on environmental issues, as well as providing information for fishers who want to participate in the decisions that affect their livelihood. Several resources for fishermen, educational resources and links to additional information are also publicly available to interested parties (WPRFMC 2018a).

Like the Council, the IATTC and WCPFC both have websites that have upcoming meeting, past meeting, newsletters, links for other RFMOs, educational resources and data.

3.5.5 Details for non-fishery users or activities which could affect the fishery

There are several overlapping fisheries in FAO 71 and FAO 77 that target skipjack, yellowfin and bigeye tuna, and many of them are MSC certified (see Table 5 in Section 4.4 below).

3.5.6 Details of the decision-making process

The *Magnuson-Stevens Fishery Conservation and Management Act* (MSA) provides the legislative framework and is the primary law governing marine fisheries management in United States. The Act was first enacted in 1976 and has been amended many times over the years. Two major recent sets of amendments to the law were the:

- *The Sustainable Fisheries Act (1996)* addresses many topics and was enacted to amend the outdated MSFCMA of 1976 (https://www.fisheries.noaa.gov/topic/laws-policies). The intention of this revision was to
    a. Strengthen requirements to prevent overfishing and rebuild overfished fisheries
    b. Set standards for fishery management plans to specify objective and measurable criteria for determining stock status
    c. Added three new national standards to address fishing vessel safety, fishing communities, and bycatch
    d. Introduced fish habitat as a key component in fisheries management.
- *Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006*, which has numerous purposes (http://www.nmfs.noaa.gov/msa2005/index.html):

a. Acting to conserve fishery resources
b. Supporting enforcement of international fishing agreements
c. Promoting fishing in line with conservation principles
d. Providing for the implementation of fishery management plans (FMPs) which achieve optimal yield
e. Developing underutilized fisheries
f. Protecting essential fish habitats
g. Additionally, the law calls for reducing bycatch and establishing fishery information monitoring systems.

The MSA contains ten national standards with which all FMPs must conform (MSA 2007). The national standards, listed in abbreviated form below, provide the primary guidance for the management of US fisheries.

Conservation and management measures shall:

1. Prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery.
2. Be based upon the best scientific information available.
3. Manage a fish stock as a unit throughout its range; manage interrelated stocks as a unit or in close coordination.
4. Not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among U.S. fishermen, such allocation shall be fair and equitable; reasonably promote conservation; and avoid accumulation of excessive shares.
5. Consider efficiency in the utilization of fishery resources; no measure shall have economic allocation as its sole purpose.
6. Allow for variations among, and contingencies in, fisheries, fishery resources, and catches.
7. Minimize costs and avoid unnecessary duplication.
8. Consider the importance of fishery resources to fishing communities in order to provide for their sustained participation and minimize adverse community economic impacts.
9. Minimize bycatch and to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.
10. Promote the safety of human life at sea.

The National Oceanic and Atmospheric Agency, National Marine Fisheries Service (NOAA/NMFS) is the U.S. government agency responsible for all aspects of the conservation and management of U.S. fisheries. NOAA/NMFS is also responsible for carrying out the US policies to manage and conserve marine protected resources. Section 302 of the 1976 Magnuson-Stevens Fishery Conservation and Management Act established eight Regional Fisheries Management Councils (RFMCs) to manage fisheries in the United States Exclusive Economic Zone (EEZ) (from three to 200 miles offshore). The Pacific Fishery Management Council (PFMC) is the regional council responsible for managing Pacific Ocean fisheries in the 317,690 mi^2 Federal EEZ off the coasts of California, Oregon and Washington and issued the HMS FMP (PFMC 2018a). The WPRFMC is responsible for managing fisheries in the U.S. territory of American Samoa, Hawaii Archipelago, and several other Pacific islands. This report will focus on efforts from predominately the WPRFMC as most of the tuna is landed outside of the United States EEZ.

The MSA establishes a partnership between the NMFS and the regional fishery management councils for the management of fisheries in the U.S. EEZ. To facilitate the is partnership, NMFS issued Operational Guidelines, which describe the procedures and actions NMFS and regional fishery management Councils must undertake to implement fishery conservation and management measures and regulations for the Nation’s fisheries.

Additionally, each region developed regional operating agreements (ROAs) specific to its region's management needs (NOAA Fisheries 2016).

Under domestic law, the Chair of the Pacific Council is allocated a spot as a Commissioner for the United States Section to the WCPFC (PFMC 2018a). As a member of the Commission, the U.S. is responsible for ensuring that management measures applied within U.S. waters are compatible with those of the WCPFC, and that fishing by US-flagged vessels is carried out in accordance with any measures put in place by WCPFC. This provides a direct role for the Pacific Council in policies and proposals that the U.S. may advocate in the WCPFC.

The WPRFMC consists of thirteen voting members and three non-voting members. The voting members include eight private citizens that are familiar with the commercial and /or non-commercial fisheries, marine conservation or both. There is at least one member each from American Samoa, Guam and Hawaii and CNMI, and are appointed by the Secretary of Commerce. They serve three-year terms and can serve 3 consecutive terms (WPRFMC 2018b). There are also three non-voting members who assist the Council in decision-making, and include members from the U.S. Coast Guard, 14th District, U.S. Department of State and the U.S. Fish and Wildlife Service (WPRFMC 2018b). The WPRFMC has established several standing committees to assist in the decision-making process. These standing committees include an Executive and Budget Committee, a Program and Research Committee, a standing committee for each FEP of the Council, committees on Fishery Rights of Indigenous People, Enforcement/Vessel Monitoring System and International Affairs, and ad hoc committees (WPRFMC 2018b). A Scientific and Statistical Committee (SSC), composed of experts with scientific or technical credentials and experience from State and Federal agencies, academic institutions and other sources, assist the Council in the development, collection, evaluation and peer review of scientific information relevant to the Council's activities. The SSC also recommends the composition of FEP Plan Teams. There are Advisory bodies that provide comments, both written and oral, on issues being considered by the Council. Decisions are based on best available science that is peer reviewed in public meetings, where stakeholders have opportunities for involvement during all stages of decision-making. The WPRFMC also have briefing materials that include meeting agendas along with brief summaries that provide background for each agenda item, reports and materials for each agenda item, written public comment, and other materials to facilitate Council meetings. Copies of briefing materials are made available to the public at the meeting as the Council progresses through the agenda and on the Council's website (WPRFMC 2018b). Final decisions got to the Secretary of Commerce for a second review, public comment and final approval. Regulatory changes may take up to a year or longer to implement, particularly if the complex. Once finalized and approved, they are implemented by the NMFS, found in Title 50 of the Code of Federal Regulations Part 665 (WPRFMC 2018b).

3.5.7 International management

The WCPFC and the IATTC are responsible for the management and conservation of fisheries for tunas taken by tuna-fishing vessels both outside and within areas of national jurisdiction. These two RFMOs agree to establish and maintain consultation, cooperation and collaboration in areas involving exchange of data and information, collaboration on research efforts relating to stocks and species of mutual interest and conservation and management measures (Memorandum of Understanding IATTC and WCPFC). The IATTC *Antigua Convention, Article IX* explains the established decision-making process. Consensus of all the members of the Commission is required for decisions on adoptions of most amendments. The *WCPFC Convention, Article 20* outlines the established

decision-making policies for this area. Again, the general rule for decision making in the Commission shall be by consensus. If all efforts to reach a decision by consensus have been exhausted, the decisions by voting on questions of procedure shall be taken by a majority of those present and voting.

The WCPFC Secretariat includes a 'Scientific Committee' (SC) and a 'Technical and Compliance Committee' (TCC). Article *6* of the WCPFC Convention requires a precautionary approach and a SC to promote and use the best available science for decision making. The SC is required to work with the IATTC, particularly in areas of overlap. Flag states in areas of overlap must nominate whether they will apply WCPFC or IATTC measures. The U.S. has chosen to apply WCPFC measures in such areas (SCS 2016). There is also a Northern Committee that deals with management and conservation issues to the north of 20ºN. The Commission may establish other subsidiary bodies and ad hoc working groups as required (SCS 2016). The SC works closely with the International Scientific Committee (ISC) which has responsibilities for scientific investigations of HMS in the north Pacific, in support of the Northern Committee (WCPFC 2004, SCS 2016).

The WCPFC membership also includes all 26 Secretariat of the Pacific Community (SPC) members. The Oceanic Fisheries Programme (OFP) is part of the Fisheries, Aquaculture and Marine Ecosystems Division of the SPC and is the regional division for tuna research, monitoring, stock assessment and biological and ecological management. It was established to provide scientific services relating to oceanic (primarily tuna) fisheries management. The OFP provides data management, stock assessment services and advice to the WCPFC under an annual service agreement (SPC 2018).

In addition to the WCPFC and IATTC collaboration, the management of tuna fisheries across the WCPO involves several national and international agreements and bodies. The key components to the U.S. purse seine tuna fishery include:

- The Parties to the Nauru Agreement (PNA)
- South Pacific Tuna Treaty (SPTT)
- The Pacific Islands Forum Fisheries Agency (FFA) (not a regulatory body but plays a crucial role in providing technical assistance to members) (SCS 2016).

The Nauru Agreement (PNA)

The PNA is a binding Treaty considered to be a sub-regional or regional fisheries management arrangement for the purpose of the WCPFC Convention and the UNFSA (SCS 2016). This treaty acts as alliance of Pacific island states whose EEZs collectively account for a significant bulk of the region's tuna catch and the majority of the of the purse seine catch. The parties to the PNA are Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu (FFA 2018).
The PNA Agreement is an important component of this assessment as the unit of assessment encompasses PNA waters, and because a large proportion of the U.S tropical tuna fleet is taken from within PNA waters (SCS 2016).

The South Pacific Tuna Treaty (SSPT)

The SPTT is an ongoing agreement between the United States and 16 Pacific Island countries. The treaty allows for U.S. purse seine vessels to fish in the EEZ of the Pacific island countries party to the treaty (NOAA Fisheries 2018a). The Treaty went into force in 1988, extended in 1993, again in 2002, and has lasted more than 30 years. Parties to the South Pacific Tuna Treaty include Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, United States and Vanuatu (NOAA Fisheries 2018a). The SSPT is administered by the Pacific Islands FFA on behalf of the Pacific Island

Parties (PIPs). U.S. purse seine vessels are licensed to fish in all PIP waters, however most of the fishing activity takes place within PNA waters (USCG 2014).

There is a maximum of 40 U.S. purse seine vessels permitted to operate under the SSPT.

3.5.8 Objectives for the fishery

The IATTC *Antigua Convention, Article II* of the states that the objective is to ensure the long-term conservation and sustainable use of the fish stocks covered by this Convention, is in accordance with the relevant rules of international law. In addition, the members of the Commission shall be cautious, or apply a precautionary approach, in cases where information is uncertain, unreliable or inadequate, regarding conservation and management.

The *WCPFC Convention, Article 5,* states that the objective is to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean in accordance with the 1995 UN Fish Stocks Agreement and the 1982 United Nations Convention on the Law of the Sea. The Convention also states that effective management and conservation require the application of the precautionary approach and the best scientific information available.

On a domestic level, the MSA, National Standards and other legislation include explicit, well-defined short- and long-term objectives for sustainable fishing and conservation. Section 102 of the MSA (2007) states that “the US shall cooperate directly or through appropriate international organizations with those nations involved in fisheries for highly migratory species with a view to ensuring conservation and shall promote the achievement of optimum yield of such species throughout their range, both within and beyond the exclusive economic zone.” The MSA also states that conservation and management refer to all the regulations that are required to rebuild, restore, or maintain any fishery resource and the marine environment, and assure that irreversible or long-term adverse effects on fishery resources and the marine environment are avoided. NMFS incorporated precautionary concepts to ensure compliance with the Sustainable Fisheries Act 1996 that includes National Standards for conservation and management of fisheries in the US (MRAG Americas 2018, MSA 2007).

The overall goal of the Pacific Pelagic FEP is to establish a framework under which the Council will improve its abilities to realize the goals of the MSA through the incorporation of ecosystem science and principles. To achieve this goal the WPRFMC has developed the following objectives (summarized below):

- To maintain biological diversity and productive marine ecosystems and foster the long-term sustainable use of marine resources in an ecologically and culturally sensitive manner using science-based ecosystem approach in management.
- To provide adaptive management systems that can quickly address new scientific information, changes in environmental conditions or human use patterns.
- To improve public and government awareness of the marine environment in order to reduce unsustainable human impacts and foster support for responsible stewardship.
- To encourage and provide for the sustained participation of local communities in the development, conservation and management of marine resources.
- To minimize fishery bycatch and waste to the extent practicable.
- To manage and co-manage protected species, habitats and areas.
- To promote the safety of human life at sea.
- To encourage and support compliance and enforcement with all applicable local and federal regulations.

- To increase collaboration with domestic and foreign regional fishery management and other non-governmental organizations to successfully manage marine ecosystems.
- To improve the quantity and quality of available information to support marine ecosystem management.

Precautionary management is the primary theme in managing HMS species and is called for by the MSA, FAO's Code of Conduct for Responsible Fisheries (UN 1995), United Nations' "Highly Migratory Species and Straddling Stocks Agreement" and regional agreements, such as the Multi-Lateral High-Level Conference for Conservation and Management of Highly Migratory Species of the Central and Western Pacific (MHLC) (PFMC 2018a). Precautionary management of HMS species includes consideration of the biological limits and control of the growth rate of fisheries. Multidimensional management, within the context of these precautionary concepts, refers to the complementary methods applied in actual management, including management by catch and effort, protecting reproductive potential, limiting access and limiting bycatch (PFMC 2018b, MRAG Americas 2018).

3.5.9 Details of those individuals or groups granted rights of access to the fishery

The vessels pursing skipjack, bigeye and yellowfin in this fishery are considered large-scale purse seiners. All fishers pursing HMS species in the U.S. must have a permit to harvest tuna and must keep logbooks documenting their catch. Gear restrictions and operational requirements are in place to minimize bycatch, and all large purse seine vessels are required to have 100% observer coverage. The vessels in this fishery fish both on FADs and unassociated FADs.

3.5.10 Fishery regulations

There are several regulations and permit requirements in place both nationally and internationally regarding skipjack, yellowfin and bigeye tuna, as well as additional regulations required for fishing on FADs. Currently the U.S. purse seine fleet in the Pacific is managed as part of international agreements with the aforementioned RFMOs and is regulated by NMFS High Seas Fishing Compliance Act. The High Seas Fishing Compliance Act, adopted in March 1996, requires that all U.S. commercial fishing vessels that fish on the high seas (outside the U.S EEZ, or 200nm) have a High Seas Fishing Compliance Act Permit (HSFCA). HMS vessels that have this permit for fishing beyond 200 nm of the U.S. are required to have VMS tracking. The WPRFMC has also developed management measures applicable to the purse seine fishery in the Western Pacific Region. In EEZ waters around American Samoa, vessels over 50 ft. in length are prohibited from fishing within 50 nm of shore.

The FEP for the Pelagic Fisheries of the Western Pacific requires fishermen to have a permit to harvest tuna and keep logbooks documenting their catch. A Foreign EEZ Form is also required for U.S. Vessels used for Commercial Fishing for HMS in the WCPFC in Areas under the Jurisdiction of any Nation other than the United States (NOAA Fisheries 50 CFR Part 300 Subpart O). A valid WCPFC Area Endorsement is required for any fishing vessel of the United States used for commercial fishing for HMS on the high seas in the WCPFC. The WCPFC Area Endorsement expires upon the expiration of the HSFCA permit (NOAA Fisheries 2018b). All vessels fishing HMS are required to fill out logbooks and return them to the Southwest Fisheries Science Center within 30 days if landed in the United States. In the IATTC, all U.S. commercial vessels that fish for tuna or tuna-like species in the IATTC Convention must be listed as active or authorized on the Regional Vessel Register (RVR) (NOAA Fisheries 2017). An AIDCP approved observer is required when fishing in all areas of the IATTC Convention Area, including the area of overlap between the IATTC and WCPFC (NOAA Fisheries 2017).

FAD Regulations

NMFS issued identification regulations under the authority of the Tuna Conventions Act of 1950, to implement two Resolutions adopted by the IATTC in 2016, which became effective January 1, 2017 (NOAA Fisheries 50 CFR 300.25). These regulations are listed below and apply to all U.S. commercial purse seine vessels used to fish for tuna or tuna-like species:

1. For each FAD deployed or modified on or after January 1, 2017, in the IATTC Convention Area (except the Overlap Area), the vessel owner or operator must either: obtain a unique code from NMFS West Coast Region, Highly Migratory Species Branch); or use an existing unique identifier associated with the FAD (e.g., the manufacturer identification code for the attached buoy).
2. U.S. purse seine vessel owners and operators shall ensure the characters of the unique code or unique identifier be marked indelibly at least five centimeters in height on the upper portion of the attached radio or satellite buoy in a location that does not cover the solar cells used to power the equipment. For FADs without attached radio or satellite buoys, the characters shall be on the uppermost or emergent top portion of the FAD. The vessel owner or operator shall ensure the marking is always visible during daylight. In circumstances where the on-board observer is unable to view the code, the captain or 3 crew shall assist the observer (e.g., by providing the FAD identification code to the observer).
    a. FAD data reporting for purse seine vessels. U.S. vessel owners and operators must ensure that any interaction or activity with a FAD is reported using a standard format provided by the NMFS West Coast Region, Highly Migratory Species Branch

3.5.11 Conservation measures

Several resolutions and Conservation and Management Measures (CMM) have been developed to prevent overfishing of bigeye, yellowfin and skipjack and to limit the growth of fishing capacity in the Western and Eastern Pacific Ocean. Below is a summary of the most recent CMMs in both the IATTC and WCPFC that specifically address the species included in this assessment and FAD regulation. A complete list of the conservation measures can be found at **WCPFC Conservation Measures** and **IATTC Resolutions and Recommendations**.

WCPFC CMM 2008-01 and CMM 2009-02 provides for a FAD closure and catch retention by purse seine vessels in the area bounded by 20ºN and 20ºS for bigeye and yellowfin tuna.

WCPFC CMM 2017-01 Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean states the purpose is to provide a "*robust transitional management regime that ensures the sustainability of bigeye, skipjack, and yellowfin tuna stocks"* in all areas of high seas and all EEZs in the Convention Area. It also establishes a three-month (July, August and September) prohibition of deploying, servicing or setting FADs in place each year for all purse seine vessels. In addition to the three-month FAD closure, CMM 2017-01 also states that it *shall be prohibited to deploy, service or set on FADs in the high seas for two additional sequential months of the year.* In addition, CMM 2017-01 restricts the level of purse seine effort on the high seas in the area 20ºN to 20ºS. U.S. purse seine vessels have 1270 days allocated on the high seas in these areas (WCPFC 2017a).

IATTC C-17-02. This CM reduced the number of days a purse seine vessel can fish for tropical tuna and prohibits fishing for a 72-day period. This measure is applicable during 2018-2020 (IATTC 2017b). C-17-02 also states that purse seine vessels have no more than 450 FADs for vessels 1200m^3 and greater and 300 FADs for vessels less than 1200m^3. It

also states that purse seine vessels do not deploy FADs during a period of 15 days prior to the start of the selected closure period, and that all class-6 purse seine vessels (≥1200m^3) recover within 15 days prior to the start of the closure a number of FADs equal to the number of FADs set upon during that same period (IATTC 2017b).

IATTC C-18-05/C-16-01. Outlines parameters for the collection, analyses, and identification of data for FADs.

The United States has supported efforts by the IATTC and WCPFC by implementing conservation and management measures adopted by RFMOs. These efforts include mirroring the IATTC to control effort in the tuna purse seine fishery and reduce impacts to other species such as sea turtles, sharks, seabirds, and juvenile tunas. Other efforts include time/area closures to reduce the catch of juvenile tunas and required retention of tuna caught in the purse seine fishery. In the WCPFC, these conservation and management measures include limits on the number of days purse seiners can spend fishing in certain areas, seasonal prohibition of the use of FADs by purse seine vessels, closure of specific high seas area in the Western and Central Pacific to purse seine vessels, requirement for purse seine vessels to retain certain tuna species, as well as observer requirements and handling requirements in case the catch a sea turtle (www.fisheries.noaa.gov).

3.5.12 Monitoring and enforcement

The US has a strong enforcement program to deter fisheries violations through successful prosecution and deterrent penalties. NOAA has authority and responsibility under more than 30 federal statutes to manage sustainable fisheries, and to protect living marine resources, including marine areas and species (NOAA Policy for Assessment of Penalties and Permit Sanctions – March 16, 2011, 56pp). Officers and agents in the NOAA Office of Law Enforcement, the US Coast Guard, Customs and Border Protection, Immigration and Customs Enforcement, US Fish and Wildlife Service, and State officers authorized under Cooperative Enforcement Agreements, monitor compliance and investigate potential violations of the statutes and regulations enforced by NOAA. Monitoring, control and surveillance are carried out across the fishing sectors to ensure observance of regulatory and statute requirements. Monitoring, control and surveillance actions include:

- Fishing permit requirements
- Fishing permit and fishing vessel registers
- Vessel and gear marking requirements
- Fishing gear and method restrictions
- Reporting requirements for catch, effort, and catch disposition
- Vessel inspections
- Record keeping requirements
- Auditing of licensed fish buyers
- Control of transshipment
- Monitored unloads of fish
- Information management and intelligence analysis
- Analysis of catch and effort reporting and comparison with landing and trade data to confirm accuracy
- Boarding and inspection by fishery officers at sea
- Aerial and surface surveillance,
- Any other measures agreed by WCPFC
- VMS/EMTU for vessels with High Seas Permits under the High Seas Fisheries Compliance Act

Penalties for fisheries related fisheries related violations include fines; forfeiture of fish, vessels, other property and quota; and imprisonment. With respect to permit sanctions,

where applicable, the statutes that NOAA enforces generally provide broad authority to suspend or revoke permits.

The IATTC *Antigua Convention, Article XVIII* states each Party[18] shall take appropriate measures to ensure the implementation of and compliance with this Convention and any conservation and management measures adopted, including the adoption of the necessary laws and regulations. It also states that each Party, through the Director, shall inform the Committee for the review of legal and administrative provisions, including those regarding infractions and sanctions, as well as actions taken to ensure compliance with conservation and management. Each Party is also required to provide to the Commission a report on the activities of its tuna-fishing vessels every six months. IATTC C 14-02 also requires all commercial vessels greater than 24 meters, harvesting tuna or tuna-like species, to be equipped by 1 January 2016 with a satellite-based VMS. According to the Agreement on the International Dolphin Conservation Program (AIDCP), large purse seine vessels must have an AIDCP or IATTC approved observer on board during the entire time the vessel is in the IATTC Convention Area, including the area of overlap between the IATTC and the WCPFC (IATTC 2017b).

WCPFC Convention Article XXV establishes that each member of the Commission shall enforce the provisions of the Convention and any conservation and management measures issued by the Commission, *Article XXVI* establishes boarding and inspection procedures, *Article XXVII* establishes port-state inspection procedures which allows the port-state to prohibit landings and transshipment of catch and transshipment of catch taken through non-compliance, and *Article XXIX* outlines procedures for in-port and at-sea transshipment (MRAG Americas 2018). The WCPFC Convention establishes a requirement for each member to establish and maintain a record of fishing vessels authorized to fish in the Convention Area beyond that member's area of national jurisdiction (WCPFC Convention). A database is maintained by the Secretariat that contains each member's authorized list of fishing vessels. The database acts as a tool for verification, which ensures all vessels fishing are legally operating in the Convention area. Enforcement of conservation measures falls to the member States, and the WCPFC IUU listing procedure address compliance failures from vessels. The WCPFC notifies Flag States of vessels that are non-compliant, followed by an order from the relevant Flag State to withdraw those vessels from the Commission Area (MRAG Americas 2018).

The WCPFC Regional Observer Programme (CMM 2007-01) requires that all vessels fishing on the high seas in the Convention Area, and in waters under the jurisdiction of one or more coastal states, have 100% observer coverage on all purse seine vessels. The WCPFC also requires that any U.S. fishing vessel used for commercial fishing for HMS on the high seas have a WCPFC Endorsement. In order to obtain this endorsement, a HSFCA permit must have been issued or applied for. The WCPFC requires owners/operators of any U.S. vessel fishing for HMS in the Convention Area be required to submit NOAA Fisheries information about the vessel, its owner and operators, and any fishing authorizations issued by such other nations. Under the SPTT, U.S. purse seine vessels operating throughout the Western and Central Pacific Ocean must be registered and are monitored through logbooks, cannery landing receipts, national surveillance activities, observers, and port sampling. Video Monitoring systems (VMS) are required on all vessels fishing in the high seas within the Convention Area (WCPFC 2014). In 2017, the WCPFC released the Compliance Monitoring Scheme (CMS) to ensure that CCMs implement and comply with obligations arising under the Convention and CMMs. The CMS is designed to: assess compliance; identify areas in which technical assistance or capacity building may be needed to attain compliance;

[18] A "party" is defined in the *Antigua Convention* as the States and regional economic integration organizations which have consented to be bound by this Convention, in accordance with the provisions of Articles XXVII, XXIX, and XXX.

respond to non-compliance through remedial options; and monitor and resolve outstanding instances of non-compliance (WCPFC 2017b). The Commission, specifically the Technical Compliance Committee (TCC) has the role of reviewing and monitoring compliance of the Commission's conservation measures. Evaluations of a member's compliance are done annually with respect to spatial and temporal closures, observer and VMS coverage and provision of scientific data, and catch and effort limits and reporting for target species.

Members of both RFMOs shall not grant a vessel authorization to fish if it is on the respective Convention's IUU vessel list. Sanctions are in place for non-compliance, including refusal, suspension or withdrawal of the authorization to fish (IATTC Antigua Convention, WCPFC Convention).

International Seafood Sustainability Foundation (ISSF)

In addition to the monitoring efforts of the U.S. and the RFMOs, all the purse seines included in this assessment belong to the International Seafood Sustainability Foundation (ISSF). ISSF is a collaboration between fishermen, scientists, NGOs, RFMOs, etc. that work towards the effective conservation and management of tuna resources globally. The areas of focus include tuna conservation, bycatch, illegal fishing and capacity management (ISSF 2018). They have designed several databases for the acquisition and assessment of key data, including the ProActive Vessel Register, the Unique Vessel Identifier database, IMO database, Record of Large-Scale Purse Seine Vessels and RFMO Management Database. The ISSF ProActive Vessel Register (PVR) enables tuna vessel owners to identify themselves and become active participants in sustainability efforts. The PVR is organized by vessel type ('purse seine', 'longline' or 'other' which includes pole and line, handline and troll) and are graded with a 'green checks' or 'red Xs' that indicate whether the vessel follows the conservation measures agreed upon. These conservation measures include registering the vessel with the relevant RFMO, correct listing of vessel's size, call sign and characteristics, and anti-shark finning policies (ISSF 2018). There are additional requirements for large-scale purse vessels, including 100% observer coverage, full retention of tuna policies, names of captains and whether they have completed ISSF's required training for Skipper's Best Practices, and whether the vessel has a publicly available non-entangling FAD policy. ISSF's requirements are often stricter than the relevant RFMO requires (ISSF 2018).

The following vessels are included for this assessment:

SEA ENCOUNTER #7823360
JEANETTE #7505865
FRIESLAND #9310953
CAPT. VINCENT GANN #9018880
WESTERN PACIFIC #7508893
KOORALE #7233280
PACIFIC PRINCESS #7806271
AMERICAN VICTORY #9556674
AMERICAN EAGLE #8974398
AMERICAN TRIUMPH # 8743672
EVELINA DAROSA #8131441

These vessels all have 'green checks' on the PVR record and are also listed on the Large-Scale Purse seine Record. This is an extra way of monitoring that ensures compliance with RFMO policies and regulations.

3.5.13 Dispute resolution

Both the IATTC and the WCPFC operate under charters specifying voting rules and procedures. However, decisions are usually made by consensus of the member states. There also are dispute resolution mechanisms. Additionally, dispute resolution through litigation and the courts is available. Any such disputes are to be well documented and readily available to appropriate parties. The management system at the international level incorporates transparent mechanisms in decision making processes and other activities. WCPFC Convention Annex II establishes the authority to set up a Review Panel to review decisions made by the Commission to settle disputes among members of the Commission (MRAG Americas 2018).

At the domestic level, NOAA has an extensive Dispute Resolution Process, defined by the Administrative Dispute Resolution Act of 1996, Pub. L. No. 104-320. They have an Alternative Dispute Resolution (ADR) process that consists of several approaches used to resolve conflict other than litigation if possible. The ADR process uses mediation, consultation and facilitated problem solving to resolve disputes in a confidential manner www.wfm.noaa.gov/adr/).

3.5.14 Planned education and training for interest groups

Education and outreach are part of the WPRFMC's Guiding Principles. The website includes brochures, displays, library, videos, and internships and activities for students. The Council has also been active in many education associations, including the Centre for Ocean Sciences Education Excellence (COSEE), International Pacific Marine Educators Network (IPMEN), National Marine Educators Association to name a few (WPRFMC 2018a). There are also Community Development Projects that have recently been implemented by the Council.

3.5.15 Date of next review and audit of the management plan

The Council shall meet as often as necessary to discharge its duties but must meet in plenary sessions once every six months. Council meetings vary in duration according to the actions and matters to be considered. The Plan Teams conduct annual reviews and make recommendations to the Council. The Council convenes three regular meetings per year, usually in March, June and October and reviews the recommendations for current policy and management issues. The next meeting is expected in March 2019.

4. Evaluation Procedure

4.1 Assessment methodologies used

This pre-assessment was undertaken using the MSC Fisheries Certification Requirements v2.0 and prepared in accordance with the MSC Pre-Assessment Reporting Template v2.1.

4.2 Summary of site visits and meetings held during pre-assessment

No in-person, on-site meetings were held for this pre-assessment. All communications with the WWF US and the client group coordinator were done via telephone, Skype, or email. Nicole Beetle, WWF US, and John Zuanich, the client group coordinator, were the team's main points of contact.

4.3 Stakeholders to be consulted during a full assessment

As part of the MSC assessment methodology, a thorough stakeholder consultation process must be conducted by the assessment team. This means that stakeholders must be identified, contacted, and their opinions on the potential certification of the fishery solicited and reviewed by the team. This measure is considered part of the due diligence of the team to help ensure that no issue (large or small) is missed. It is also a measure included to try to build good will at the outset of the assessment process.

The U.S. tuna fishery conducted by this client group is undertaken by purse seine fishermen. Thus, the list of direct participant stakeholders would involve purse seine vessel captains and fishermen belonging to the seven companies within the group, as well as other U.S. purse seine fishermen that perform the activity with other tuna fishing companies. The team requires input from the client on which stakeholder groups are directly involved in the commercial fishery.

Some management and research agencies likely concerned with the U.S. tuna purse seine fishery include (the team requires input from the client to complete the list):

- U.S. National Marine Fisheries Service
- Pacific Fishery Management Council (PFMC) for all highly migratory species landed on the U.S. West Coast (Washington, Oregon and California)
- Western Pacific Regional Fishery Management Council (WPRFMC) for all U.S. purse seines fishing in the Western Pacific in American Samoa, Guam, the CNMI and Hawaii
- WCPFC
- IATTC
- Oceanic Fisheries Programme, SPC

Some conservation- and academic-oriented groups that likely have a direct interest in the U.S. tuna purse seine fishery include (the team requires input from the client to complete the list):

- WWF US
- International Seafood Sustainability Foundation (ISSF)
- Marine Stewardship Council (MSC)
- Sustainable Fisheries Partnership (SFP)
- Monterey Bay Aquarium Seafood Watch
- Shark Advocates International
- Common Oceans ABNJ Tuna Project

- FishWise

4.4 Harmonization with any overlapping MSC certified fisheries

There are several in assessment and certified fisheries targeting yellowfin, skipjack, and/or bigeye in the WCPO and/or EPO (Table 5). In some cases, these fisheries are utilizing purse seine nets, meaning that they would also potentially need to harmonize in Principle 2 not just in Principle 1 and/or 3. Harmonization was not undertaken as part of this pre-assessment, but if the fishery were to proceed to full assessment, the MSC requirements (FCR 7.4.16 and Annex PB) outline what harmonization processes and activities should take place to when harmonizing the relevant scores and conditions.

Table 5. Potential overlapping fisheries

Fishery Name	Species	Gear Types	Locations	MSC Status
Panama Tropical Pacific yellowfin and skipjack purse seine tuna	Yellowfin, skipjack	Purse seine	Eastern Central Pacific, Southeast Pacific	In Assessment
Pan Pacific yellowfin, bigeye and albacore longline	Albacore, yellowfin, bigeye	Longline	Eastern Central Pacific, Southwest Pacific, Western Central Pacific	In Assessment
PT Citraraja Ampat, Sorong pole and line skipjack and yellowfin tuna	Yellowfin, skipjack	Pole and line	Western Central Pacific	Certified
SZLC, CSFC, FZLC, and MIFV RMI EEZ longline yellowfin and bigeye tuna	Yellowfin, bigeye	Longline	Western Central Pacific	In Assessment
Northeastern Tropical Pacific purse seine yellowfin and skipjack tuna	Yellowfin, skipjack	Purse seine	Eastern Central Pacific	Certified
Tri Marine Western and Central Pacific skipjack and yellowfin tuna	Yellowfin, skipjack	Purse seine	Eastern Central Pacific, Western Central Pacific	Certified
PNA Western and Central Pacific skipjack and yellowfin, unassociated/ non-FAD set, tuna purse seine	Yellowfin, skipjack	Purse seine	Eastern Central Pacific, Western Central Pacific	Certified
French Polynesia albacore and yellowfin longline	Albacore, yellowfin	Longline	Western Central Pacific	Certified
Fiji albacore and yellowfin tuna longline	Albacore, yellowfin	Longline	Eastern Central Pacific, Western Central Pacific	Certified
SZLC, CSFC, and FZLC Cook Islands EEZ South Pacific albacore and yellowfin longline	Albacore, yellowfin	Longline	Eastern Central Pacific, Southwest Pacific	Certified
WPSTA Western and Central Pacific skipjack and yellowfin free school purse seine	Yellowfin, skipjack	Purse seine	Eastern Central Pacific, Western Central Pacific	Certified
Japanese pole and line skipjack and albacore tuna	Skipjack, albacore	Pole and line	Western Central Pacific	Certified
SZLC, CSFC, and FZLC FSM EEZ longline yellowfin and bigeye tuna	Yellowfin	Longline	Western Central Pacific	Certified
Ishihara Marine Products albacore and skipjack pole and line	Skipjack, albacore	Pole and line	Northwest Pacific, Western Central Pacific	In Assessment
Tropical Pacific yellowfin and skipjack free-school purse seine	Yellowfin, skipjack	Purse seine	Western Central Pacific	In Assessment
Solomon Islands skipjack and yellowfin tuna purse seine and pole and line	Yellowfin, skipjack	Purse seine, pole and line	Western Central Pacific	Certified

5. Traceability (issues relevant to Chain of Custody certification)

5.1 Eligibility of fishery products to enter further Chains of Custody

No traceability information was provided by the client so the team cannot speak to this adequately.

6. Preliminary evaluation of the fishery

6.1 Applicability of the default assessment tree

The results reached in this pre-assessment suggest that the MSC Default Assessment Tree may be normally used for the full assessment. Possible implications that would lead to a need for revisions on the default assessment tree were not found.

6.1.1 Expectations regarding use of the Risk-Based Framework (RBF)

The RBF will not likely be necessary to evaluate the units of assessment, except perhaps to evaluate Principle 2 outcome indicators where sufficient information may not be available to apply the default assessment tree. The IATTC uses PSA as one of the methods to assess the skipjack tuna stock in the EPO, thus the use of RBF is implicit in the stock assessment, but not the only method.

6.2 Evaluation of the fishery

Analysis of the information showed that this fishery has several areas where it does not meet the MSC Standard that could prevent the fishery from being certified at this time. These areas would need improvements before moving to a full assessment. No performance indicators (PIs) scored below 60. As noted in Table 6, the indicators marked in red imply that the 60 level is not likely to be met. Indicators marked in yellow imply that the 80 level is not likely to be met; these indicators are liable to raise conditions in a full assessment. More details are provided in the individual scoring tables (Annex 1).

Table 6. Key to likely scoring level in Table 7 and Annex 1

Definition of scoring ranges for PI outcome estimates	Shading to be used
Information suggests fishery is not likely to meet the SG60 scoring issues.	Fail (<60)
Information suggests fishery will reach SG60 but may not meet all of the scoring issues at SG80. A condition may therefore be needed.	Pass with Condition (60-79)
Information suggests fishery is likely to exceed SG80 resulting in an unconditional pass for this PI. Fishery may meet one or more scoring issues at SG100 level.	Pass (≥80)

Principle 1

Eastern Pacific Stocks
Skipjack Tuna

- **PI 1.2.1 Harvest strategy:** IATTC Res C-16-02 sets HCRs for tropical tunas. The HCR focuses on the most vulnerable stock (YFT, BET, or SKJ) and is implemented via time/area closures and catch limits. SKJ is more resilient, but it is unclear how the HCR can be responsive to SKJ stock status without ref. pts. The HS for SKJ including stock assessments and ref. values, need to be reviewed, improved, and adapted to SKJ, so specific management action can be triggered if needed.
- **PI 1.2.2 Harvest control rules and tools:** The HCR for EPO tropical tunas (IATTC Res C-16-02) is expected to maintain biomass above the LRP, above the PRI, and fluctuating around MSY level. The application of the HCR to skipjack is not clear because stock assessments have not provided reliable results or MSY-ref pts. The use of RBF or the status of more vulnerable stocks as a basis does not provide a 'well defined' HCR. Also, the main tools to implement HCR (closures and FAD limits per Res. C-17-02), are not linked to the HCR or SKJ status, so it is not clear that they will be effective. A trigger value for taking management action needs to be defined for SKJ.

Western Central Pacific Stocks
Skipjack Tuna

- **PI 1.2.1 Harvest strategy:** The harvest strategy for skipjack (CMM 2016-01) states that F should be maintained at or below FMSY. The current CMM 2018-01 states that spawning biomass of skipjack tuna should be maintained at a level consistent with the interim target reference point of 50% of the spawning biomass in the absence of fishing. This interim HS has been applied since 2013, but a formal HS and HCR for skipjack is in development, including an updated stock assessment, a review of TRPs, MSE and HCR evaluation. A robust and precautionary strategy for WCPO SKJ will be accomplished once the HCR is reviewed and improved (expected completion in 2020).
- **PI 1.2.2 Harvest control rules and tools:** Only generally understood HCRs are available for SKJ (through CMM 2014-06) and have maintained the stock above the MSY level through 2015. These HCRs do not take uncertainties into account. Although there is some evidence that the main tools of the HS for SKJ (temporal/ spatial limits on purse seine setting on FADs, restrictions on effort (days)) are effective in controlling exploitation, the exploitation levels required are not yet established. Progress toward a formal harvest strategy and HCR need to be demonstrated.

Yellowfin Tuna

- **PI 1.2.1 Harvest strategy:** The objective of the current HS (CMM 2018-01) for WCPO YFT is to maintain the spawning biomass depletion ratio (SB/SBF=0) at or above the average for 2012-2015. Management measures (set for years 2018-2021) include limits of FAD sets and fishing days for the purse-seine fleet and catch limits on longlines. Since 2013 the HS has consisted of a series of ad hoc measures (focused more on bigeye) that are achieving the objectives, but the HS is not necessarily. responsive to the state of the stock, even if sufficient monitoring is in place. A harvest strategy for YFT needs to be adopted that includes management action responses to changes in (yellowfin) stock status and harvest control rules aimed at maintaining the stock at or near target reference points.
- **PI 1.2.2 Harvest control rules and tools:** Only generally understood HCRs are available for WCPO-YFT (through CMM 2014-06), but they have maintained the

stock above the MSY and the PRI, according to the 2017 assessment. However, biomass shows a consistent decline over the time series.

Elements of the HCR for YFT are in progress, and CMM-2018-01 sets out the detail of interim management measures between 2018 - 2021, pending establishment of a HS. The interim HCR is not robust to uncertainties. The main tools of the HS for YFT (temporal/ spatial limits on purse seine setting on FADs, restrictions on effort (days), capacity limits, and longline limits on BET. The effect in controlling exploitation is not yet known, but biomass has shown a steady decline. Appropriate exploitation levels are not well defined.

Bigeye Tuna

- **PI 1.2.1 Harvest strategy:** The objective of the current HS (CMM 2018-01) for WCPO-BET is to maintain SB/SBF=0 at or above the average for 2012-2015. Management measures (2018-2021) include limits of FAD sets and fishing days for the purse-seine fleet and catch limits on longlines. Since 2013 the HS has consisted of ad hoc measures targeted at BET. The BET status has improved, possibly due to different assumptions in growth and spatial structure in the assessment. Thus, the (ad hoc) HS is achieving the objectives, but it is not necessarily responsive to the state of the stock and it has not been evaluated.

  The HS has monitoring in place (recording catch, effort, estimation of CPUEs, stock assessment) to determine if it is working. The HS has provisions for annual review and improvement. CMM-14-06 sets out a plan to develop a formal HS for BET.

- **PI 1.2.2 Harvest control rules and tools:** Only generally understood HCRs are available for WCPO-BET (through CMM 2014-06), but according to the 2018 assessment update, stock biomass has been above MSY throughout the time series, with a ~0% probability that SB<LRP. It is worth noting that the bigeye stock had been overfished up until the results of 2017 assessment, which put it in the green zone of the Kobe plot. This is a function of the new growth model assumptions rather than the effect of management action, which has not reduced fishing mortality and is still at record high levels (even if stable). Thus, the current HCR is not expected to reduce the exploitation rate as the PRI is approached.

  Elements of the HCR for BET are in progress, and CMM-2018-01 sets out the detail of interim management measures between 2018 - 2021, pending establishment of a formal HS. The effect in controlling exploitation is not yet known, but biomass has shown a steady decline and fishing mortality is high. Appropriate exploitation levels are not well defined under the current HCR.

Principle 2

- **PI 2.3.1 ETP species outcome:** Without knowing the exact fishing range of the UoA, the team cannot accurately score this PI since it cannot determine (1) which species' DPSs and/or stocks are relevant to be able to consider stock status compared to the UoAs' catch of that species, (2) which species have national and/or international limits to know which scoring issue (a or b) should be scored, or (3) if there are combined effects of MSC UoAs (scoring issue a at SG80 and SG100) to be considered.
- **PI 2.3.2 ETP species management strategy:** Without knowing the exact fishing range of the UoA, the team cannot accurately score this PI since it cannot determine which species have national and/or international limits to know which scoring issue (a or b) should be scored and which SGs are met. Additionally, without more information directly about the fishery and/or the species involved, it cannot be said that there is an objective basis for confidence that the measures/strategy will work.

More information is also needed to determine the frequency and breadth of the review.

- **PI 2.3.3 ETP species information:** There is some quantitative information, which is adequate to assess the UoA-related mortality and impact and to determine whether the UoA may be a threat to ETP species recovery. The available information does not speak to the magnitude of UoA-related impacts, mortalities, and injuries; the consequences for the status of ETP species; or the adequacy of that information to support a strategy.
- **PI 2.4.2 Habitats management strategy:** Both WCPFC and IATTC have and continue to consider various FAD management options. These measures can be considered partial strategies for both RFMOs, and there is an objective basis for confidence that these partial strategies will work. However, there is a lack of quantitative evidence that the partial strategies are being implemented successfully and that the UoA complies with other fisheries' measures to protect VMEs.
- **PI 2.4.3 Habitats information:** The fishing operations and their location are recorded via VMS and observer coverage. All larger vessels operate a VMS, and thus there is accurate, near real-time monitoring of the spatial extent of interaction and the timing and location of use of the fishing gear. WCPFC and IATTC require 100% coverage for large-scale purse seine vessels. However, there is a lack of information on the distribution and impact of FADs and on any increases in risk to habitats, particularly VMEs.
- **PI 2.5.1 Ecosystem outcome:** Ecosystem impacts from FADs are thought to be minimal but are uncertain. Natural FADs (e.g., logs) are unlikely to cause serious or irreversible harm since they have a limited lifespan since they become waterlogged and sink. It is unclear if and how these impacts vary for man-made FADs since they have a longer lifespan through the use of floats and PVC frames to keep them buoyant. Overall, tropical tuna purse seine fisheries probably do not cause significant changes in marine ecosystems. However, the potential of FADs to act as ecological traps', as well as the potential impact of derelict FADs on ecosystem components are still not well understood.
- **PI 2.5.2 Ecosystem management strategy:** IATTC is developing a five-year strategic research plan that will incorporate several ecosystem components and improve integration of existing research programs and catch trophic levels for three purse-seine fishing methods are being monitored as a proxy of ecosystem integrity. WCPFC's current five-year strategic research plan includes research and data collection priorities, one of which is to monitor and assess the WCPO's pelagic ecosystems, and the evaluation of potential management options. However, there is a lack of evidence that the partial strategies are being implemented successfully.
- **PI 2.5.3 Ecosystem information:** RFMOs are working to collect data and monitor the ecosystem in order to support potential management measures. Information on the key elements of the ecosystem are broadly understood and the main functions of the ecosystem components are known, but further research is needed to be able to infer the UoAs' main impacts on the ecosystem, particularly with regard to FADs. There is also a lack of information on the UoAs' impacts of the UoA on these ecosystem components to allow for some of the main consequences to be inferred. There is also a need for the continued collection of data to be able to detect any increase in risk level.

Principle 3

- **PI 3.2.3 Monitoring, control and surveillance mechanisms:** There is effective cooperation between the IATTC and WCPFC, as well as strong domestic management for this fishery. While there are several regulations and conservation measures in place both nationally and internationally to prevent overfishing of these

stocks, it is unclear how consistently sanctions are applied and whether the fishery overall complies with management measures internationally. There is also no formal explanation that ensures that all parts of the decision-making process have been disclosed, nor is there evidence that the management decisions represent all the information presented.

6.3 Summary of likely PI scoring levels

Table 7. Simplified scoring sheet

Skipjack Tuna

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale/ Key points
1 **SKJ – EPO**	Outcome	1.1.1	Stock status	Y	**≥ 80**	There are no MSY-based reference points for this stock, but fishery indicators used by IATTC suggest that the stock is highly likely above PRI. Low average weight may indicate overexploitation. Without MSY ref. pts., and given similar susceptibilities from PSA, SKJ stock status can be inferred from BET: $B_{curr}>B_{MSY}$ and $F_{curr}<F_{MSY}$; effort and biomass have been constant in the past 10 yrs; thus the stock is at a level consistent with MSY.
		1.1.2	Stock rebuilding		**NA**	There is currently no information indicating that the stock is reduced or in need of rebuilding.
	Management	1.2.1	Harvest Strategy		**60-79**	IATTC Res C-16-02 sets HCRs for tropical tunas. The HCR focuses on the most vulnerable stock (YFT, BET, or SKJ) and is implemented via time/area closures and catch limits. SKJ is more resilient, but it is unclear how the HCR can be responsive to SKJ stock status without ref. pts. The HS for SKJ including stock assessments and ref. values, need to be reviewed, improved, and adapted to SKJ, so specific management action can be triggered if needed.
		1.2.2	Harvest control rules and tools		**60-79**	The HCR for EPO tropical tunas (IATTC Res C-16-02) is expected to maintain biomass above the LRP, above the PRI, and fluctuating around MSY level. The application of the HCR to skipjack is not clear because stock assessments have not provided reliable results or MSY-ref pts. The use of RBF or the status of more vulnerable stocks as a basis does not provide a 'well defined' HCR. Also, the main tools to implement HCR (closures and FAD limits per Res. C-17-02), are not linked to the HCR or SKJ status, so it is not clear that they will be effective. A trigger value for taking management action needs to be defined for SKJ.
		1.2.3	Information and monitoring		**≥ 80**	Sufficient information (on stock structure, stock productivity, fishery removals, fleet composition), is available to monitor and assess stock status and to

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale/ Key points
						support the harvest strategy. Good observer coverage allows estimation of discards and bycatch. However, the SKJ data are limited relative to estimates of stock productivity or to define MSY ref. pts., and reporting from some fleets is incomplete.
		1.2.4	Assessment of stock status		**≥ 80**	SKJ stock assessments through 2012 had been uncertain due to the difficulty in estimating absolute levels of biomass and exploitation rates or MSY reference points. Since then, IATTC has relied on 8 empirical fishery indicators, updated annually, to evaluate relative stock status. This method is adequate for the stock, although it doesn't allow a probabilistic evaluation in relation to reference points. Since the stock assessments and reference points for SKJ in the EPO are so uncertain, developing alternative methods to assess and manage the stock that are robust to these uncertainties would be beneficial. Full MSE would be the most comprehensive method to develop and test alternative assessment methods and harvest strategies for skipjack.
	Number of PIs less than 60					0
1 **SKJ – WCPO**	Outcome	1.1.1	Stock status		**≥ 80**	The latest (2016) stock assessment for WCPO tuna showed that the stock is above LRP (20% B_0), the default PRI, so there is a high degree of certainty that the stock is above the point where recruitment would be impaired. Sensitivity runs showed that despite a steady stock decline and an increase in fishing mortality, the stock was close to the target of 50%$SB_{F=0;}$ thus not overfished and overfishing not occurring 2015. There is a high degree of certainty that the stock has been fluctuating around MSY levels in recent years (2011-2015).
		1.1.2	Stock rebuilding		**NA**	The WCPO skipjack stock is not considered to be depleted or in need of rebuilding, so this indicator is not scored.
	Management	1.2.1	Harvest Strategy		**60-79**	The harvest strategy for skipjack (CMM 2016-01) states that F should be maintained at or below F_{MSY}. The current CMM 2018-01 states that spawning biomass of skipjack tuna should be maintained at a level consistent with the interim target reference point of 50% of the spawning biomass in the absence of fishing. This interim HS has been applied since 2013, but a formal HS and HCR for skipjack is in development, including an updated stock assessment,

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale/ Key points
						a review of TRPs, MSE and HCR evaluation. A robust and precautionary strategy for WCPO SKJ will be accomplished once the HCR is reviewed and improved (expected completion in 2020).
		1.2.2	Harvest control rules and tools		**60-79**	Only generally understood HCRs are available for SKJ (through CMM 2014-06), and have maintained the stock above the MSY level through 2015. These HCRs do not take uncertainties into account. Although there is some evidence that the main tools of the HS for SKJ (temporal/ spatial limits on purse seine setting on FADs, restrictions on effort (days)) are effective in controlling exploitation, the exploitation levels required are not yet established. Progress toward a formal harvest strategy and HCR need to be demonstrated.
		1.2.3	Information and monitoring		**≥ 80**	There is a comprehensive range of information (on stock structure, stock productivity, fleet composition) to monitor and assess stock status. Also, abundance indices, effort, fishery removals, and other removals are monitored at a level that is sufficient to support the harvest strategy. However, there are data gaps in the longline fishery and stock assessments are only carried out every 2-3 years.
		1.2.4	Assessment of stock status		**≥ 80**	The latest WCPO SKJ stock assessment in 2016 used the Multifan-CL model, including a range of model options and sensitivity analyses. The model is appropriate for the fishery, the biology of the species, and the available data. The assessment estimates SSB and F relative to MSY and depletion based reference points, and identifies key uncertainties through sensitivity tests and structural sensitivity analysis. Evaluation of stock status relative to reference points is presented in a probabilistic way. The stock assessment has been tested and shown to be robust. The assessment of stock status is adequate.
	Number of PIs less than 60					0

Yellowfin Tuna

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale/ Key points
1 **YFT – EPO**	Outcome	1.1.1	Stock status		**≥ 80**	The 2018 update assessment estimated SSB_{recent}/SSB_{MSY} at 1.08, indicating that the stock is not overfished, and the ratio of F_{recent}/F_{MSY} at 1.01, indicating that slight overfishing is occurring. Biomass appeared to be above the PRI under the base case and alternative h=0.75 scenarios, but evidence for a stock-recruitment relationship is weak. The base-case scenario showed that the stock has been fluctuating around MSY, but sensitivity runs show more pessimistic results. The stock just recovered to MSY levels recently, so fishing mortality should not increase.
		1.1.2	Stock rebuilding		**NA**	There is currently no information indicating that the EPO YFT stock is reduced or in need of rebuilding.
	Management	1.2.1	Harvest Strategy		**≥ 80**	IATTC Res C-16-02 sets HCRs for tropical tunas, and focuses on the stock requiring strictest management (YFT, BET, or SKJ; currently YFT) and is implemented via time/area closures and catch limits. The duration of the closure (i.e., reduction in effort) is adjusted according to the level of F_{mult} ($F_{MSY}/F_{current}$) for the most vulnerable stock. Thus, there is some linkage between stock status and the application of the harvest strategy. The rationale to adjust the duration of the closure is not explicit in the strategy resolutions (C-16-02 or C-17-02) and needs to be documented. Recent recovery of the EPO YFT stock provides evidence that the HS is achieving its objectives, but HCRs and interim reference points have not been fully reviewed. There are measures in place (C-17-02) to reduce mortality of unwanted catch, and research and controls are implemented to this effect.
		1.2.2	Harvest control rules and tools		**≥ 80**	The HCR for EPO tropical tunas (IATTC Res C-16-02) is expected to maintain biomass above the LRP, above the PRI, and fluctuating at or above a target (MSY) level. The fact that management is driven by the status of the stock requiring strictest management (currently YFT) is considered precautionary, but the use of MSY ref. pts. is not. The ecological role of the YFT stock could be taken into account to define more appropriate target levels.

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale/ Key points
		1.2.3	Information and monitoring		**≥ 80**	The IATTC and member countries and organizations produce information on EPO-YFT stock structure, stock abundance (catch, bycatch, CPUE, size/ age structure by fleet), fleet composition (vessel number, size, capacity, gears, etc.), migration and movement, trophic structure and other ecological relationships, early-life history and recruitment patterns, biological processes (growth, reproduction, feeding and predation), and oceanographic conditions. This information is sufficient to support the harvest strategy, although environmental data is not used, stock structure requires to be better defined, and there are gaps in reporting (longline fleet in particular). YFT stock abundance and fishery removals are monitored, indicators are available and are consistent with the HCR. Through the observer program, all catches and discards are estimated.
		1.2.4	Assessment of stock status		**≥ 80**	The latest EPO- YFT assessment was carried out in 2018, using as before, an integrated statistical age-structured assessment model ((Stock Synthesis Version 3.23b)). The assessment is appropriate for the stock and for the harvest control rule and evaluates stock status relative to MSY-reference points, addressing uncertainty through model configuration and sensitivity analyses, and providing probabilistic projections of stock trajectories. The model is robust to uncertainties and explores alternative hypotheses through sensitivity tests.
	Number of PIs less than 60					0
1 **YFT – WCPO**	Outcome	1.1.1	Stock status		**≥ 80**	The 2017 assessment for WCPO YFT showed that the median SB_{I2015} is at 37% of $SB_{F=0}$, where the default PRI is at 20%; thus, there is a ≥95% probability that the stock is above the PRI. Also, the median values of relative recent SB (2012-2015) and relative F over the uncertainty grid showed a high degree of certainty (90% probability) that the stock is above MSY. F has increased through time but has remained below F_{MSY}.
		1.1.2	Stock rebuilding		**NA**	There is currently no information indicating that the WCPO YFT stock is reduced or in need of rebuilding
	Management	1.2.1	Harvest Strategy		**60-79**	The objective of the current HS (CMM 2018-01) for WCPO YFT is to maintain the spawning biomass depletion ratio ($SB/SB_{F=0}$) at or above the average for

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale/ Key points
						2012-2015. Management measures (set for years 2018-2021) include limits of FAD sets and fishing days for the purse-seine fleet and catch limits on longlines. Since 2013 the HS has consisted of a series of ad hoc measures (focused more on bigeye) that are achieving the objectives, but the HS is not necessarily. responsive to the state of the stock, even if sufficient monitoring is in place. A harvest strategy for YFT needs to be adopted that includes management action responses to changes in (yellowfin) stock status and harvest control rules aimed at maintaining the stock at or near target reference points.
		1.2.2	Harvest control rules and tools		**60-79**	Only generally understood HCRs are available for WCPO-YFT (through CMM 2014-06), but they have maintained the stock above the MSY and the PRI, according to the 2017 assessment. However, biomass shows a consistent decline over the time series. Elements of the HCR for YFT are in progress, and CMM-2018-01 sets out the detail of interim management measures between 2018 - 2021, pending establishment of a HS. The interim HCR is not robust to uncertainties. The main tools of the HS for YFT (temporal/ spatial limits on purse seine setting on FADs, restrictions on effort (days), capacity limits, and longline limits on BET. The effect in controlling exploitation is not yet known, but biomass has shown a steady decline. Appropriate exploitation levels are not well defined.
		1.2.3	Information and monitoring		**≥ 80**	There is sufficient relevant information (on stock structure, stock productivity, fleet composition) to monitor and assess stock status. Also, abundance indices, effort, fishery removals, and other removals are monitored at a level that is sufficient to support the harvest strategy. However, catch monitoring in some areas needs improvement, there are gaps in the longline observer coverage, uncertainties remain in YFT stock boundaries and life history parameters, and stock assessments are only carried out every 3 years.
		1.2.4	Assessment of stock status		**≥ 80**	The latest Multifan-CL assessment of WCPO- YFT was carried out in 2017. The model is appropriate to the YFT stock. The assessment estimated biomass and fishing mortality relative to MSY reference points and depletion-based reference points. Also, different hypotheses, sensitivity tests, and structural analysis were used to evaluate the impacts of key data and model assumptions. There is an adequate assessment of the YFT stock status.

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale/ Key points
	Number of PIs less than 60					0

Bigeye Tuna

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale/ Key points
1 **BET – EPO**	Outcome	1.1.1	Stock status		**≥ 80**	The 2018 update assessment of EPO-BET estimated SSB_{recent}/SSB_{MSY} at 1.02, and the ratio of F_{recent}/F_{MSY} at 1.15, indicating that the stock is not overfished, but that overfishing was occurring in 2015-2017. Biomass was above the PRI. The default PRI is 20% SB_0, which is close to the estimated SB_{MSY}=21%B_0. Recent spawning biomass (SB) and total biomass (B) are above the MSY level, but F is below under both, the base-case model and the precautionary sensitivity run. The stock has recently recovered from below MSY level and has not been above this level in recent years.
		1.1.2	Stock rebuilding		**NA**	There is currently no information indicating that the EPO BET stock is reduced or in need of rebuilding.
	Management	1.2.1	Harvest Strategy		**≥ 80**	IATTC Res C-16-02 sets HCRs for tropical tunas, and focuses on the stock requiring strictest management (YFT, BET, or SKJ; currently YFT) and is implemented via time/area closures and catch limits. The duration of the closure (i.e., reduction in effort) is adjusted according to the level of F_{mult} ($F_{MSY}/F_{current}$) for the most vulnerable stock. Thus, there is some linkage between stock status and the application of the harvest strategy. The rationale to adjust the duration of the closure is not explicit in the strategy resolutions (C-16-02 or C-17-02) and needs to be documented. Recent recovery of the EPO BET stock provides evidence that the HS is achieving its objectives, but HCRs and interim reference points have not been fully reviewed. There are measures in place (C-17-02) to reduce mortality of unwanted catch, and research and controls are implemented.

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale/ Key points
		1.2.2	Harvest control rules and tools		≥ 80	The HCR for EPO tropical tunas (IATTC Res C-16-02) is expected to maintain biomass above the LRP, above the PRI, and fluctuating at or above a target (MSY) level. The fact that management is driven by the status of the stock requiring strictest management (currently YFT) is considered precautionary, but the use of MSY reference points is not. The ecological role of the BET stock could be taken into account to define more appropriate target levels. Preliminary MSE for BET indicated that the key uncertainties (and recruitment variability) have an impact on the probability of exceeding LRPs, but the HCR has effectively managed and rebuilt the BET stock. There are still uncertainties in stock dynamics. The tools to implement the HS (closures) are effective in controlling exploitation rates, but they need to be linked to stock-specific needs.
		1.2.3	Information and monitoring		≥ 80	The IATTC and member countries and organizations produce information on EPO-BET stock structure, stock abundance, fleet composition, migration and movement, trophic structure and other ecological relationships, early-life history and recruitment patterns, biological processes, and oceanographic conditions. BET stock structure has been reviewed recently, suggesting that the EPO and WCPO are separate stocks. This information is sufficient to support the harvest strategy, although environmental data is not used and there are gaps in reporting (longline fleet in particular). BET stock abundance and fishery removals are monitored, indicators are available and stock assessments are conducted regularly, supporting the HCR. Through the observer program, all catches and discards are estimated. Trial MSE was applied to BET (in 2015), but tests of the robustness of the harvest strategy to uncertainties need to be undertaken.
		1.2.4	Assessment of stock status		≥ 80	The latest EPO- BET assessment was carried out in 2017, using as before, an integrated statistical age-structured assessment model (Stock Synthesis Version 3.23b). The assessment is appropriate for the stock and for the HCR and evaluates stock status relative to MSY-reference points, addressing uncertainty through model configuration and sensitivity analyses, and providing probabilistic projections of stock trajectories. The model is robust to uncertainties and explores alternative hypotheses through sensitivity tests.

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale/ Key points
	Number of PIs less than 60					0
1 **BET – WCPO**	Outcome	1.1.1	Stock status		**≥ 80**	Based on the latest (2017) Multifan-CL stock assessment for WCPO BET, there is a high probability that the stock is above the PRI (the default is 20%$SB_{F=0}$). Median estimates of SB/SB_{MSY} and F/F_{MSY} showed a high degree of certainty that the stock is at a level consistent with MSY.
		1.1.2	Stock rebuilding		**NA**	There is currently no information indicating that the WCPO bigeye tuna stock is reduced or in need of rebuilding.
	Management	1.2.1	Harvest Strategy		**60-79**	The objective of the current HS (CMM 2018-01) for WCPO-BET is to maintain $SB/SB_{F=0}$ at or above the average for 2012-2015. Management measures (2018-2021) include limits of FAD sets and fishing days for the purse-seine fleet and catch limits on longlines. Since 2013 the HS has consisted of *ad hoc* measures targeted at BET. The BET status has improved, possibly due to different assumptions in growth and spatial structure in the assessment. Thus, the (*ad hoc*) HS is achieving the objectives, but it is not necessarily responsive to the state of the stock and it has not been evaluated. The HS has monitoring in place (recording catch, effort, estimation of CPUEs, stock assessment) to determine if it is working. The HS has provisions for annual review and improvement. CMM-14-06 sets out a plan to develop a formal HS for BET.
		1.2.2	Harvest control rules and tools		**60-79**	Only generally understood HCRs are available for WCPO-BET (through CMM 2014-06), but according to the 2018 assessment update, stock biomass has been above MSY throughout the time series, with a ~0% probability that SB<LRP. It is worth noting that the bigeye stock had been overfished up until the results of 2017 assessment, which put it in the green zone of the Kobe plot. This is a function of the new growth model assumptions rather than the effect of management action, which has not reduced fishing mortality and is still at record high levels (even if stable). Thus, the current HCR is not expected to reduce the exploitation rate as the PRI is approached. Elements of the HCR for BET are in progress, and CMM-2018-01 sets out the detail of interim management measures between 2018 - 2021, pending

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale/ Key points
						establishment of a formal HS. The effect in controlling exploitation is not yet known, but biomass has shown a steady decline and fishing mortality is high. Appropriate exploitation levels are not well defined under the current HCR.
		1.2.3	Information and monitoring		≥ 80	Sufficient data related to stock structure, productivity and fleet composition of WCPO-BET is available to support the HS. Recent work confirmed two separate EPO and WCPO bigeye tuna stocks. However, there are uncertainties related to gaps in the longline observer coverage, lack of a fishery-independent biomass indicator, and imprecise historical data. Stock abundance and removals are monitored with sufficient frequency to support the harvest strategy, but there are uncertainties in some key inputs for the stock assessment, particularly the growth models. Assessments could be carried out more frequently (annually, instead of every 3 years). There is good information on other removals, but potential under-reporting for BET was noted in 2017.
		1.2.4	Assessment of stock status		≥ 80	The latest Multifan-CL assessment of WCPO- BET was carried out in 2017, and updated in 2018 to include new growth models and regional structure. The model is appropriate to the BET stock, although age and growth in BET are uncertain and new growth models had a major impact on the 2017-18 assessment, resulting in a more optimistic stock status. The assessment estimated biomass and fishing mortality relative to MSY reference points and depletion-based reference points. Also, different hypotheses, sensitivity tests, and structural analysis were used to evaluate the impacts of key data and model assumptions. There is an adequate assessment of the BET stock status, but growth assumptions and the impact on the results need to be further investigated.
	Number of PIs less than 60					0

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale/ Key points
2	Primary Species	2.1.1	Outcome	N	≥ 80	There appear to be no main primary species.
		2.1.2	Management		≥ 80	A management strategy is not necessary since there are no main primary species.
		2.1.3	Information		≥ 80	Some quantitative information is available to assess the UoAs' impact on primary species – main and minor.
	Secondary species	2.2.1	Outcome	N	≥ 80	There appear to be no main secondary species.
		2.2.2	Management		≥ 80	A management strategy is not necessary since there are no main secondary species.
		2.2.3	Information		≥ 80	Some quantitative information is available to assess the UoAs' impact on secondary species – main and minor.
	ETP species	2.3.1	Outcome	N	60-79	More information is needed to determine which species' DPSs and/or stocks are relevant to be able to consider stock status compared to the UoAs' catch of that species, which species' have national and/or international limits to know which scoring issue (a or b) should be scored, and if there are combined effects of MSC UoAs to be considered.
		2.3.2	Management		60-79	More information is needed to determine which species have national and/or international limits to know which scoring issue (a or b) should be scored and accurately assess this PI.
		2.3.3	Information		60-79	More information is needed to determine whether or not there is a strategy that is adequately supported by information on the UoAs' impacts on ETP species.
	Habitats	2.4.1	Outcome	N	≥ 80	Purse seine FAD set impacts on pelagic habitats are negligible. FAD set impacts on VMEs are unknown and require more research; however, it is highly unlikely that the impacts are significant.
		2.4.2	Management		60-79	There is a lack of quantitative evidence that the partial strategies are being implemented successfully and that the UoA complies with other fisheries' measures to protect VMEs.
		2.4.3	Information		60-79	There is a lack of information on the distribution and impact of FADs and on any increases in risk to habitats, particularly VMEs.

Principle	Component	PI	Performance Indicator	RBF required? (y/n)	Likely scoring level	Rationale/ Key points
	Ecosystem	2.5.1	Outcome	N	**60-79**	Given that there is uncertainty regarding the level of FAD impact on the ecosystem, there is not enough evidence to state that the UoA is not altering the ecosystem's structure and function.
		2.5.2	Management		**60-79**	There is a lack of evidence that the partial strategies are being implemented successfully.
		2.5.3	Information		**60-79**	Additional research and information are needed on the role that FAD fishing plays in the ecosystem.
	Number of PIs less than 60:					0
3	Governance & policy	3.1.1	Legal and customary framework		**≥ 80**	There is effective policies and procedures both nationally and internationally that are consistent with the MSC Principles 1 and 2.
		3.1.2	Consultation, roles and responsibilities		**≥ 80**	Consultation processes are open and publicly available to interested parties.
		3.1.3	Long term objectives		**≥ 80**	There are clear long-term policies in place at both the national and international level, however it is unclear how the precautionary approach is applied over all policy.
	Fishery specific management system	3.2.1	Fishery specific objectives		**≥ 80**	The FEP has clear long and short-term objectives, consistent with the MSA and National Standards for this fishery.
		3.2.2	Decision making processes		**≥ 80**	Decision-making processes are in place both at the international and domestic level that respond to most serious issues.
		3.2.3	Compliance and enforcement		**60-79**	There is not enough evidence to ensure sanctions are consistently applied, nor that monitoring has demonstrated a consistent ability to enforce management measures.
		3.2.4	Management performance evaluation		**≥ 80**	External review occurs only occasionally at the international level, and it is unclear if all parts of the fishery-specific management system is evaluated.
	Number of PIs less than 60:					0

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Annex 1: Pre-assessment full scoring tables

Principle 1 – Eastern Pacific Ocean

A 1.1.1 SKIPJACK TUNA – EPO

Evaluation Table for PI 1.1.1 – Stock status

PI 1.1.1		**The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Stock status relative to recruitment impairment**			
	Guidepost	It is **likely** that the stock is above the point where recruitment would be impaired (PRI).	It is **highly likely** that the stock is above the PRI.	There is a **high degree of certainty** that the stock is above the PRI.
	Met?	Y	Y	N
b	**Stock status in relation to achievement of MSY**			
	Guidepost		The stock is at or fluctuating around a level consistent with MSY.	There is a **high degree of certainty** that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years.
	Met?		Y	N
Overall PI justification		**(a)** EPO skipjack stock assessments have had difficulty in estimating absolute levels of biomass and exploitation rates; thus, there are no MSY-based reference points available for this stock, but there are interim fishery indicators used by IATTC to monitor stock status. The updated (2018) indicators showed the following: • Total catch, CPUE, relative biomass and relative recruitment are above the upper reference level; • Standardized effort and relative exploitation rate are close to the historical mean level; • Average weight per fish is below the lower reference level. Previously, the main concern had been the consistent increase in the exploitation rate; but this has now levelled off. The low average weight may be an indicator of overexploitation but may also be a function of recent high recruitment and/or changes in selectivity or other factors. Overall, none of the indicators detect any risk from current levels of exploitation, except smaller average weight, which is unlikely to indicate any effect on recruitment. Based on these results and the resilient life history characteristics of skipjack, it is highly likely that the stock is above any PRI, meeting SG80. SG100 is not met because there is no recent stock assessment to be able to determine that the stock is above the PRI with high certainty. **(b)** There are no recent or reliable MSY reference points for this stock. As noted in (a) above, Indicators suggest that biomass and recruitment are high relative to historical levels. According to IATTC (2014, 2018), productivity and susceptibility analysis (PSA) shows that skipjack has higher productivity than bigeye tuna (for which stock assessment is possible), and therefore a lower B_{MSY} and a higher F_{MSY}. Assuming that both stocks have similar susceptibility		

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue	SG 60	SG 80	SG 100
	(overlap with fisheries), and susceptibility is related to fishing mortality, the status of skipjack can be inferred from the status of bigeye. Since for bigeye Bcurrent>B_{MSY} and Fcurrent<F_{MSY}, IATTC assumes the same would apply to skipjack, also because effort and skipjack biomass have been relatively constant over the past 10 years. On this basis, SG80 is met, but there are considerable uncertainties, and one of the indicators (average weight) gives some possible cause for concern, so SG100 is not met.		
References	IATTC Fishery Status Report 12 (2014) IATTC Stock Assessment Report (2018), Medley and Gascoinge (2017), Maunder (2016), Maunder (2017)		
RBF Required? (✓/×/)	**X** (PSA is performed by IATTC, 2014, as an additional method to inform stock assessment)	**Likely PI Scoring Level (<60, 60-79, ≥ 80)**	**Pass ≥ 80**
Stock Status relative to Reference Points			
	Type of reference point	**Value of reference point**	**Current stock status relative to reference point**
Reference point used in scoring stock relative to PRI (SIa)	NA	NA	NA
Reference point used in scoring stock relative to MSY (SIb)	NA	NA	NA

Evaluation Table for PI 1.1.2 – Stock rebuilding

PI 1.1.2		**Where the stock is reduced, there is evidence of stock rebuilding within a specified timeframe**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Rebuilding timeframes**			
	Guidepost	A rebuilding timeframe is specified for the stock that is **the shorter of 20 years or 2 times its generation time**. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.		The shortest practicable rebuilding timeframe is specified which does not exceed **one generation time** for the stock.
	Met?	NA		NA
b	**Rebuilding evaluation**			
	Guidepost	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is evidence that the rebuilding strategies are rebuilding stocks, **or it is likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.	There is **strong** evidence that the rebuilding strategies are rebuilding stocks, **or it is highly likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.
	Met?	NA	NA	NA
Overall PI justification		There is currently no information to indicate that the stock is reduced or in need of rebuilding.		
References		NA		
			Likely PI Scoring Level (<60, 60-79, ≥ 80)	NA

Evaluation Table for PI 1.2.1 – Harvest strategy

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	**Harvest strategy design**			
	Guidepost	The harvest strategy is **expected** to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy **work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80.
	Met?	Y	N	N
b	**Harvest strategy evaluation**			
	Guidepost	The harvest strategy is **likely** to work based on prior experience or plausible argument.	The harvest strategy may not have been fully **tested** but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been **fully evaluated** and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met?	Y	Y	N
c	**Harvest strategy monitoring**			
	Guidepost	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Y		
d	**Harvest strategy review**			
	Guidepost			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			N
e	**Shark finning**			
	Guidepost	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	NR	NR	NR
f	**Review of alternative measures**			
	Guidepost	There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
			are implemented as appropriate.	are implemented, as appropriate.
	Met?	Y	Y	N
Overall PI justification		**(a)** In 2016 IATTC adopted Resolution C-16-02 on Harvest Control Rules (HCR for tropical tunas), based on interim target and limit reference points. The HCR aims to prevent fishing mortality from exceeding the MSY level for the tropical tuna stock (bigeye, yellowfin or skipjack) that requires the strictest management. If fishing mortality or spawning biomass are approaching the corresponding limit reference point with a probability of 10% or greater, the HCR triggers the establishment of additional management measures to reduce fishing mortality and rebuild the stock. The HCR is implemented via time/area closures and catch limits which vary for different fleets (Resolutions C-17-01 and C-17-02). The duration of the closure is set according to the level of F_{mult} ($F_{MSY}/F_{current}$) for the stock requiring the strictest management (at present, yellowfin). Since skipjack is more resilient to exploitation than yellowfin and bigeye, the harvest strategy based on the above HCR can be expected to achieve stock management objectives so SG60 is met. However, it is unclear how the HCR can be responsive to the status of the stock, since there are no reference points for skipjack and the HCR assumes that yellowfin and bigeye will always require management first. SG80 is not met. **(b)** The analysis of indicators provides evidence that the biomass and recruitment are at a high level, while exploitation is close to the historical mean level. SG80 is met. However, the harvest strategy cannot be fully evaluated because traditional assessment of the stock is difficult and reference levels are set on an interim basis, so SG100 is not met. **(c)** The harvest strategy monitors the status of the stock and the catches and fishing mortality rates affecting status. Data are collected to estimate management quantities. The stock assessment (including indicators) provides estimates of biomass, which indicates whether the strategy is working or not. This issue meets SG60. **(d)** C-17-02 requires review of the harvest strategy during 2018, 2019, and 2020 (see para. 26), but the specific methods or timing for the review are unclear. Also, skipjack stock assessments have been unsuccessful. Even though fishery indicators are updated regularly and used for management, it is not clear that the strategy for skipjack is reviewed periodically or improved, so SG100 is not met. **(e)** Not relevant (NR), the target species (skipjack) is not a shark species. **(f)** The main concern with unwanted tuna catch applies to the purse seine fleet. Under IATTC resolutions (C-17-02, para. 24), all bigeye, skipjack and yellowfin tuna brought on board is required to be landed, except that unfit for human consumption. Research is ongoing to reduce catch of juvenile tunas and non-target species (see C-17-02, para. 23). On this basis, measures to minimise mortality of unwanted catch are subject to regular review and research and controls are being implemented, meeting SG80. It is not known whether the review is biennial. **FIP Recommendation-** In order to improve the overall PI score, and issue (a) in particular, the harvest strategy needs to incorporate a reference value that would trigger management action for skipjack in case of need. This cannot be F_{mult} as it is for yellowfin and bigeye, since F_{MSY} cannot be estimated for skipjack.		
References		IATTC Resolutions C-16-02 (2016), C-17-02 (2017b), Medley and Gascoigne (2017), Maunder 2012c		
			Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass with condition (60-79)**

Evaluation Table for PI 1.2.2 – Harvest control rules and tools

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
Scoring Issue		SG 60	SG 80	SG 100
a	**HCRs design and application**			
	Guide post	**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.	**Well defined** HCRs are **in place** that **ensure** that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock **fluctuating around** a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock **fluctuating at or above** a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, **most** of the time.
	Met?	Y	N	N
b	**HCRs robustness to uncertainty**			
	Guide post		The HCRs are likely to be robust to the main uncertainties.	The HCRs take account of a **wide** range of uncertainties including the ecological role of the stock, and there is **evidence** that the HCRs are robust to the main uncertainties.
	Met?		Y	N
c	**HCRs evaluation**			
	Guide post	There is **some evidence** that tools used **or available** to implement HCRs are appropriate and effective in controlling exploitation.	**Available evidence indicates** that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs.	**Evidence clearly shows** that the tools in use are effective in achieving the exploitation levels required under the HCRs.
	Met?	Y	Y	N
Overall PI justification		**(a)** The HCR for EPO tropical tunas is provided in IATTC Res. C-16-02: • If the probability that F>Flim is >10%, management measures shall be established such that there is at least a 50% probability that F will reduce to F_{MSY} or below, and with a probability of <10% of $F>F_{lim}$. • If the probability that SB<SBlim is >10%, management measures shall be established such that there is at least a 50% probability that SB will recover to SB_{MSY} or above, and with a probability of <10% that SB will decline to <SBlim within two generations or 5 years, whichever is greater. This HCR is expected to maintain biomass above the limit reference point, and most likely above the PRI (given that $B<B_{lim}$ is set as a trigger for management action) and fluctuating around MSY level. SG60 is met. The HCR is 'well-defined' but its application to skipjack is not clear because a fishing mortality multiplier (F_{mult}) cannot be estimated, considering that traditional stock assessments have not provided reliable results. Given that the PRI for skipjack is likely to be at a very low biomass, and given that various indicators, including recruitment, are monitored and have lower reference levels which could trigger management action, the HCR will likely ensure that the PRI is avoided. Based on PSA analyses comparing tropical tunas, the MSY for skipjack is at a level where reference points for yellowfin and bigeye would be exceeded, which by		

PI 1.2.2	There are well defined and effective harvest control rules (HCRs) in place
	default ensures that skipjack biomass is maintained at or above MSY. Using RBF methods and other more vulnerable species as a basis does not provide a 'well-defined' HCR; thus, SG80 is not met. **(b)** Considering that yellowfin and bigeye tuna are more vulnerable species, management of skipjack based on measures designed for those stocks is likely to be a robust strategy, despite the numerous uncertainties regarding the skipjack stock. SG80 is met. However, a robust stock assessment for skipjack has not been possible and uncertainties are not addressed directly for this species on the HCRs, thus SG100 is not met. **(c)** The tools to implement the HCR are specified in IATTC Res. C-17-02, with the main tools being a 72-day seasonal closure for purse seine vessels and specifications for the number of FADs permitted per vessel. However, tools have been selected on a pragmatic basis, rather than based on stock-specific needs. Thus, the closure is not explicitly linked to the HCR, and there a trigger value for skipjack is not well defined. The HCR relies on the (reasonable) assumption that yellowfin and bigeye are more vulnerable stocks which will always need management first. There is provision for review and adjustment according to outcome, and regular review of stock status indicators. On this basis, the available evidence indicates that the tools in place are likely to be effective controlling exploitation rates. SG80 is met. Since the tools are not linked either directly to the HCR or to skipjack stock status, the evidence does not show clearly that tools will be effective; thus, SG100 is not met. **FIP Recommendation:** According to ISSF (2017), to improve this scoring, the application of the HCR to skipjack (i.e. the trigger value for taking management action in relation to skipjack stock status) needs to be defined in terms of some parameter than can be estimated for this stock.
References	IATTC Resolutions C-16-02 (2016), C-17-02 (2017b); IATTC Stock Assessment Report (2018); Medley and Gascoigne (2017), Maunder 2012c

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass with condition (60-79)**

Evaluation Table for PI 1.2.3 – Information and monitoring

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	Range of information			
	Guide post	**Some** relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	**Sufficient** relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A **comprehensive range** of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Y	Y	N
b	Monitoring			
	Guide post	Stock abundance and UoA removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and UoA removals are **regularly monitored at a level of accuracy and coverage consistent with the harvest control rule**, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	**All information** required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent **uncertainties** in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Y	Y	N
c	Comprehensiveness of information			
	Guide post		There is good information on all other fishery removals from the stock.	
	Met?		Y	
Overall PI justification		**(a)** The IATTC, member countries, and other international organizations (SPC, NMFS, ISSF, and others) collaborate in research projects and data collection to support the harvest strategy. The information produced includes data on stock structure studied through various methods (including analyses of catch statistics, life history, tagging, biochemical, genetic analyses, and chemical composition of otoliths), stock abundance (catch, bycatch, CPUE, size/ age structure by fleet), fleet composition (vessel number, size, capacity, gears, etc.), migration and movement, trophic structure and other ecological relationships, early-life history and recruitment patterns, biological processes (growth, reproduction, feeding and predation), oceanographic conditions (temperature, wind, salinity) (2010 IATTC Annual Report, 2015). Skipjack stock status is monitored with a suite of indicators, covering stock abundance and exploitation. Recruitment cannot be well estimated but is an important driver for stock size in this short-lived species. Sufficient information (on stock structure, stock productivity, fleet composition), is available to monitor and assess stock status and to support the harvest strategy, but the (comprehensive) range of biological and environmental information available is not explicitly used.		

PI 1.2.3	Relevant information is collected to support the harvest strategy
	Also, the data are limited relative to direct estimates of stock productivity or to define accurate MSY reference points. For a precautionary harvest strategy, this only meets SG80. **(b)** Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the HCR, and indicators of catch and effort are available and monitored with sufficient frequency to support the HCR, including annual updates of the stock assessment and the fishery indicators. Substantial amounts of information are collected, including data on retained catches, discards, indices of abundance (CPUE), and the size compositions of the catches of the various fisheries. In addition, there is observer data which provides discard estimates. However, data from some fleets are incomplete. In general, however, there is good information on fishery removals from the stock. SG80 is met, but since reporting from some fleets is limited, SG100 is not met. **(c)** Catches are well monitored and are sufficient for estimation of abundance indices and to conduct stock assessments. The IATTC has had an observer program since 1993 for larger vessels, and the US since the 1970s. Observer coverage has allowed estimation of tuna discards and of bycatch of other species. Thus, there is good information on all other fishery removals, and SG80 is met.
References	IATTC 2015, 2017b, 2018; Medley and Gascoigne 2017

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass (≥ 80)**

Evaluation Table for PI 1.2.4 – Assessment of stock status

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Appropriateness of assessment to stock under consideration			
	Guide post		The assessment is appropriate for the stock and for the harvest control rule.	The assessment takes into account the major features relevant to the biology of the species and the nature of the UoA.
	Met?		Y	N
b	Assessment approach			
	Guide post	The assessment estimates stock status relative to generic reference points appropriate to the species category.	The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated.	
	Met?	Y	Y	
c	Uncertainty in the assessment			
	Guide post	The assessment **identifies major sources** of uncertainty.	The assessment **takes uncertainty into account**.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a **probabilistic** way.
	Met?	Y	Y	N
d	Evaluation of assessment			
	Guide post			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			N
e	Peer review of assessment			
	Guide post		The assessment of stock status is subject to peer review.	The assessment has been **internally and externally** peer reviewed.
	Met?		Y	N
Overall PI justification		**(a)** The last assessment for skipjack tuna in the EPO was in 2012, based on four alternative analyses performed by IATTC. This and previous assessments have shown a high degree of uncertainty because of the difficulty in estimating absolute levels of biomass and exploitation rates or MSY reference points. Since then, IATTC scientists have relied on 8 fishery indicators, updated annually, to evaluate relative stock status. The most recent update in 2018 evaluates stock status in 2017 through these indicators and their reference levels (historical mean with 90% CI). The indicators are: 1) total catch, 2) catch per day fished by floating objects, 3) catch per day fished by unassociated fisheries, 4) standardized effort, 5) average weight per fish, 6) relative exploitable biomass, 7) relative recruitment, and 8) relative exploitation rate		

PI 1.2.4	There is an adequate assessment of the stock status
	Given the likely exploitation level and risk for this stock (see 1.1.1), this method (data and model-based indicators) is appropriate and allows the implementation of the HCR, although with some adaptations (see 1.2.2), thus meeting SG80. However, this method to monitor stock status does not appear to take into account major features of the biology and fishery, so SG100 is not met. **(b)** The main method to monitor trends in stock over time is based on relative changes in 8 fishery indicators, with 5th and 95th percentiles of historical values. These proxy 'reference points' are appropriate to the stock and they are estimated and updated each year, thus meeting SG80. **(c)** The 8 empirical indicators used to monitor skipjack status take uncertainty into account because trends in the stock and the fishery are examined and variability is calculated. The choice of indicators rather than a model-based assessment followed a number of unsuccessful attempts with high uncertainty in the results. This meets SG80 but not SG100 because indicators do not allow a probabilistic evaluation in relation to reference points. **(d)** Since the stock assessments and reference points for skipjack in the EPO are so uncertain, developing alternative methods to assess and manage the species that are robust to these uncertainties would be beneficial. Since 2007, Maunder suggested that full management strategy evaluation (MSE) would be the most comprehensive method to develop and test alternative assessment methods and harvest strategies for skipjack. However, developing MSE is time-consuming, and has not yet been conducted for this species, which is also less vulnerable than yellowfin or bigeye. The assessment has been not been tested and shown to be robust, and many hypotheses exist without formal evaluation; thus, SG100 is not met. **(e)** The stock assessment is subject to review through internal review processes where model structure, data and research are examined. The review process has led to rejection of the previous assessment and to the interim adoption of fishery indicators to monitor the stock. There is no evidence of external peer review for this assessment, or whether the indicators are sufficient for the harvest strategy. SG80 is met but SG100 is not met. **FIP Recommendation:** This PI meets SG80, but more robust stock assessment methods should continue to be explored. In addition, the idea of conducting MSE for skipjack should be pursued to test the adequacy of data, assessment methods and the harvest strategy.
References	IATTC 2018, ISSF 2018

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass (≥ 80)**

A 1.1.2 YELLOWFIN TUNA- EPO

Evaluation Table for PI 1.1.1 – YFT-EPO- Stock status

PI 1.1.1		**The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Stock status relative to recruitment impairment**			
	Guidepost	It is **likely** that the stock is above the point where recruitment would be impaired (PRI).	It is **highly likely** that the stock is above the PRI.	There is a **high degree of certainty** that the stock is above the PRI.
	Met?	Y	Y	N
b	**Stock status in relation to achievement of MSY**			
	Guidepost		The stock is at or fluctuating around a level consistent with MSY.	There is a **high degree of certainty** that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years.
	Met?		Y	N

Overall PI justification

(a) The last update of the yellowfin tuna assessment in the EPO was conducted in 2018. The assessment used the same model as before, a statistical age-structured stock assessment model (Stock Synthesis Version 3.23b), which is based on the assumption that there is a single stock of yellowfin in the EPO. Results from this assessment show that the ratio of spawning biomass SSB_{recent}/SSB_{MSY} is estimated to be 1.08, indicating that the stock is not overfished. The ratio of F_{recent}/F_{MSY} is estimated to be 1.01, indicating that slight overfishing is occurring. MSY and related quantities for the base case and h=0.75 sensitivity analysis are shown below:

YFT	Base case Caso base	$h = 0.75$
MSY-RMS	264,283	278,584
B_{MSY}- B_{RMS}	376,696	560,713
S_{MSY}- S_{RMS}	3,634	6,080
B_{MSY}/B_0- B_{RMS}/B_0	0.31	0.37
S_{MSY}/S_0- S_{RMS}/S_0	0.27	0.35
C_{recent}/MSY- $C_{reciente}$/RMS	0.85	0.81
B_{recent}/B_{MSY}- $B_{reciente}/B_{RMS}$	1.35	0.89
S_{recent}/S_{MSY}-$S_{reciente}/S_{RMS}$	1.08	0.64
F multiplier-Multiplicador de *F*	0.99	0.64

In 2014, on an interim basis (per Res. C16-02), the IATTC agreed to an LRP, defined as the equilibrium spawning biomass corresponding to that which produces a 50% reduction in recruitment from the unfished level, with a steepness of h=0.75 in the stock-recruitment relationship ($SB_{0.5R0}$, assuming h = 0.75). This, by definition, is below the PRI. The PRI is equivalent to 2*LRP = 20%SB_0 = 0.50 SB_{MSY}. Under the 2017 base case scenario, SB_{2017}/2*LRP=2.16, and under the alternative h=0.75 scenario, SB_{2017}/2*LRP=1.28.

Recruitment showed many fluctuations since 1975, with above average recruitment in 2015-2017. Biomass also fluctuated, so estimating a single value for MSY reference points across the whole time series may not be valid. Biomass appears to be above the estimate for PRI under both assessment scenarios. However, evidence for a stock-recruitment relationship is weak and perhaps a result of regime shifts. For these reasons, it is highly likely that the stock is above the PRI, meeting SG80, but this cannot be stated with a high

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue	SG 60	SG 80	SG 100
	degree of certainty. **(b)** The 2018 base-case assessment estimated SB_{2017} at 108% of SB_{MSY} (range 95-118%) and B_{2017} at 135% of B_{MSY}. SB recovered from ~86% of SB_{MSY} since the last assessment, as was predicted in the 2016 analyses. Fishing mortality is approximately equal to F_{MSY} and has been fluctuating above or around this value throughout most of the time series (1975-2017), except in 2005. Thus, the stock has been fluctuating around a level consistent with MSY, but not with a high degree of certainty because sensitivity runs (with h=0.75) show more pessimistic scenarios for biomass ratios (SB_{2017} at 65%, B_{2017} at 89% of MSY) and fishing mortality (F_{2017} at 156% of F_{MSY}, F_{mult}=0.64). **FIP Recommendation-** This indicator would likely receive a pass when focusing on the base-case scenario results; however, it would be precautionary to keep in mind that sensitivity tests have showed more pessimistic stock status. Also, the stock has just recovered to MSY levels, and increasing fishing mortality would not produce a significant long-term increase in catches, but the spawning stock could be reduced considerably. Fishing mortality should not increase.		
References	Minte-Vera *et al.*, 2016, 2017, 2018; IATTC 2016 (Res. C-16-02); FCR GSA2.2.3.1; ISSF 2018		
RBF Required? (✓/×/)	×	**Likely PI Scoring Level (<60, 60-79, ≥ 80)**	**Pass ≥ 80**

Stock Status relative to Reference Points			
	Type of reference point	**Value of reference point**	**Current stock status relative to reference point**
Reference point used in scoring stock relative to PRI (SIa)	LRP= $SB_{0.5R0}$, assuming h = 0.75 2*LRP=0.50*SB_{MSY} (Res. C-16-02) $SSB_{current}/SSB_{MSY}$	Base case 2*LRP= 0.5*3634 LRP=908.5 MT Alternative scenario h=0.75 2*LRP= 0.5*6080 LRP=1520 MT	Base case SB_{2017}/2*LRP=2.16 Alternative scenario h=0.75 SB_{2017}/2*LRP=1.28
Reference point used in scoring stock relative to MSY (SIb)	SB_{MSY} F_{MSY}	Base case SB_{MSY}=3,634 MT spawning biomass F_{mult}=1.03	Base case SB_{2018}= SSB_{2017}/SSB_{MSY} 3,925 MT/ 3,634 MT= 1.08 F_{2017}/F_{MSY}= 1.01

Evaluation Table for PI 1.1.2 – YFT-EPO- Stock rebuilding

PI 1.1.2		Where the stock is reduced, there is evidence of stock rebuilding within a specified timeframe		
Scoring Issue		SG 60	SG 80	SG 100
a	**Rebuilding timeframes**			
	Guidepost	A rebuilding timeframe is specified for the stock that is **the shorter of 20 years or 2 times its generation time**. For cases where 2 generations are less than 5 years, the rebuilding timeframe is up to 5 years.		The shortest practicable rebuilding timeframe is specified which does not exceed **one generation time** for the stock.
	Met?	NA		NA
b	**Rebuilding evaluation**			
	Guidepost	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is evidence that the rebuilding strategies are rebuilding stocks, **or it is likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.	There is **strong** evidence that the rebuilding strategies are rebuilding stocks, **or it is highly likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.
	Met?	NA	NA	NA
Overall PI justification		There is currently no information to indicate that the yellowfin tuna stock is reduced or in need of rebuilding.		
References		Minte-Vera *et al.*, 2018		
			Likely PI Scoring Level (<60, 60-79, ≥ 80)	NA

Evaluation Table for PI 1.2.1 – YFT-EPO- Harvest strategy

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	**Harvest strategy design**			
	Guidepost	The harvest strategy is **expected** to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy **work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80.
	Met?	Y	Y	Y
b	**Harvest strategy evaluation**			
	Guidepost	The harvest strategy is **likely** to work based on prior experience or plausible argument.	The harvest strategy may not have been fully **tested** but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been **fully evaluated** and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met?	Y	Y	N
c	**Harvest strategy monitoring**			
	Guidepost	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Y		
d	**Harvest strategy review**			
	Guidepost			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			Y
e	**Shark finning**			
	Guidepost	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	NR	NR	NR
f	**Review of alternative measures**			
	Guidepost	There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
			are implemented as appropriate.	are implemented, as appropriate.
	Met?	Y	Y	N
Overall PI justification		**(a)** IATTC adopted Resolution C-16-02 on Harvest Control Rules (HCR for tropical tunas, based on interim target and limit reference points. The HCR aims to prevent fishing mortality from exceeding the MSY level for the tropical tuna stock (bigeye, yellowfin or skipjack) that requires the strictest management. If fishing mortality or spawning biomass are approaching the corresponding limit reference point with a probability of 10% or greater, the HCR triggers the establishment of additional management measures to reduce fishing mortality and rebuild the stock. The HCR is implemented via time/area closures and catch limits which vary for different fleets (Resolution C-17-02). The duration of the closure is set according to the level of F_{mult} ($F_{MSY}/F_{current}$) for the stock requiring the strictest management (at present, yellowfin). The current closure is 72 days each year (from 2018 to 2020) for the purse seine fleet. Thus, the strategy is responsive to the state of the stock, thus meeting SG80. However, it is not clear how the 62-day closure was initially determined or why it was extended by 10 days, considering that F_{mult} for yellowfin has remained close to 1.0. It appears that capacity increases are also taken into account. It is assumed that an additional 10 days of closure will reduce effort by the correct amount to obtain the target biomass, but this rationale is not expressed in Res. C-16-02 or C-17-02. Such adjustment indicates that there is a linkage between stock status and the duration of closure, and that there is a system, based on Fmult and other factors to estimate the appropriate duration. Thus, there is a designed harvest strategy to meet the stock management objectives. SG100 is met. **(b)** The 2018 stock assessment showed that the stock recently recovered from a slightly overfished condition and SB is now above SB_{MSY}, while exploitation is close to the MSY level. This is evidence that the harvest strategy is achieving its objectives, thus meeting SG80. Also, a new full stock assessment was conducted in 2018 and the main strategy (C-17-01) was reviewed and updated (C17-02). However, HCRs and interim reference points have not been reviewed. Thus, the whole harvest strategy (Res 16-02) has not been fully evaluated, so SG100 is not met. **(c)** The harvest strategy monitors the status of the stock and the catches and fishing mortality rates affecting status. Data are collected to estimate management quantities. The stock assessment is updated regularly and provides estimates of biomass, indicating whether the strategy is working or not, this issue meets SG60. **(d)** C-17-02 requires review of the harvest strategy during 2018, 2019, and 2020 (see para. 26), but the specific methods or timing for the review are unclear. IATTC has gone through a process of reviewing, evaluating and adjusting the harvest strategy for several years, has refined stock assessment methods and has defined reference points and HCRs. A review of the harvest strategy resulted in Res. C-17-02, thus SG100 is met. **(e)** Not relevant (NR), the target species (yellowfin) is not a shark species. **(f)** The purse seine fleet is the main concern for unwanted tuna catch. Under IATTC resolution (C-17-02, para. 24), all bigeye, skipjack and yellowfin tuna brought on board is required to be landed, except that unfit for human consumption. Research is ongoing to reduce catch of juvenile tunas and non-target species (see C-17-02, para. 23). On this basis, measures to minimise mortality of unwanted catch are subject to regular review and research and controls are being implemented, meeting SG80. It is not known whether the review is biennial, so SG100 is not met.		

PI 1.2.1	There is a robust and precautionary harvest strategy in place
	FIP Recommendation- Issue (a) may score ≥ 80, but it would be important for the IATTC to document how the main harvest strategy tools are defined or modified. For example, how is the most vulnerable tropical species selected to guide management actions, how was the original duration of the temporary closure (62 days) defined and criteria to modify, how is the duration linked to F_{mult}, how is F_{mult} adjusted for increased capacity, and what is the (quantitative) relationship between effort and closure duration (in number of days?)
References	IATTC Resolutions C-16-02 (2016), C-17-01 (2017c), C-17-02 (2017b), Medley and Gascoigne (2017), Maunder 2012c

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass (≥ 80)**

Evaluation Table for PI 1.2.2 – YFT-EPO- Harvest control rules and tools

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
Scoring Issue		SG 60	SG 80	SG 100
a	**HCRs design and application**			
	Guide post	**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.	**Well defined** HCRs are **in place** that **ensure** that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock **fluctuating around** a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock **fluctuating at or above** a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, **most** of the time.
	Met?	Y	Y	N
b	**HCRs robustness to uncertainty**			
	Guide post		The HCRs are likely to be robust to the main uncertainties.	The HCRs take account of a **wide** range of uncertainties including the ecological role of the stock, and there is **evidence** that the HCRs are robust to the main uncertainties.
	Met?		Y	N
c	**HCRs evaluation**			
	Guide post	There is **some evidence** that tools used **or available** to implement HCRs are appropriate and effective in controlling exploitation.	**Available evidence indicates** that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs.	**Evidence clearly shows** that the tools in use are effective in achieving the exploitation levels required under the HCRs.
	Met?	Y	Y	N
Overall PI justification		**(a)** The HCR for EPO tropical tunas is provided in IATTC Res. C-16-02: • If the probability that F>Flim is >10%, management measures shall be established such that there is at least a 50% probability that F will reduce to F_{MSY} or below, and with a probability of <10% of $F>F_{lim}$. • If the probability that $SB<SB_{lim}$ is >10%, management measures shall be established such that there is at least a 50% probability that SB will recover to SB_{MSY} or above, and with a probability of <10% that SB will decline to $<SB_{lim}$ within two generations or 5 years, whichever is greater. This HCR is expected to maintain biomass above the limit reference point, and most likely above the PRI (given that $B<B_{lim}$ is set as a trigger for management action) and fluctuating around the MSY level. SG60 is met. The HCR is well defined in Res. C-16-02. Also, the HCR triggers action to reduce the exploitation rate if the probability of SB or F exceeding the LRP > 10%. If $SB<SB_{MSY}$, the HCR requires at least a 50% probability that it will recover to a level $\geq SB_{MSY}$, but if the stock does not recover, this rule is triggered again until it does. The HCR thus aims to keep the stock fluctuating at or above the target level, meeting SG80. Also, management is driven by the status of the worst of the tropical stocks, which is precautionary. However, the use of MSY-based reference points is not very precautionary, and the ecological role of the stock is not taken into		

PI 1.2.2	There are well defined and effective harvest control rules (HCRs) in place
	account to define more appropriate target levels, so SG100 is not met. **(b)** Yellowfin stock assessments provide results for a base case assessment and sensitivity runs, including one that assumes a stock-recruitment relationship with h=0.75. The base case model results are more optimistic, but the HCR defines LRPs based on the model that assumes a S-R relationship, so this main source uncertainty is taken into account in the harvest strategy. In addition, the HCR requires action when p(SB<SBlim) reaches 10% (well above the actual LRP). Thus, there is considerable precaution built into the HCR. Also, the harvest strategy seems to be working since it has maintained both bigeye and yellowfin Fmult at or close to one. A preliminary MSE was conducted (Maunder et al, 2015) to evaluate reference points and the tropical-tuna HCR, with bigeye tuna as an example. Under all sensitivity scenarios, this exercise suggested that the key uncertainties (and recruitment variability) have an impact on the probability of exceeding LRPs, but the HCR effectively manages and rebuilds the (bigeye) stock at the MSY level and avoids a high risk of recruitment impairment. Based on this, SG80 is met, but SG100 is not because MSE has not been applied to yellowfin tuna and also, there remain large uncertainties in the stock dynamics that have an impact on the status, such as the stock definition, S-R relationship, natural mortality, recruitment, etc. **(c)** The tools to implement the HCR are specified in IATTC Res. C-17-02, with the main tools being a 72-day seasonal closure for purse seine vessels and specifications for the number of FADs permitted per vessel. However, tools have been selected on a pragmatic basis, rather than based on stock-specific needs. The closure is not explicitly linked to the HCR, but the duration of the closure has been adjusted according to Fmult (F_{MSY}/F) and increases in capacity). The HCR has a provision for review and adjustment; thus, the available evidence indicates that the tools are appropriate and effective in controlling exploitation rates, meeting SG80. In 2017 the closure was extended for 2017-2020 from 62 to 72 days (Res. C-17-01 and C-17-02), based on adjusting Fmult to increases in fishing capacity, however the link between the closure duration and exploitation rates is not defined. It appears that the duration of the closure is 'a matter of negotiation' within IATTC, rather than a clearly-defined element of the HCR, so SG100 is not met. **FIP Recommendation**- The overall PI would likely score ≥ 80, but it would be important for the IATTC to document how the HCR triggers practical measures, such as adjusting the duration of the closure. For example, it would be important for to describe how was the original duration of the temporary closure (62 days) defined, how is the duration linked to F_{mult} , how is F_{mult} adjusted for increased capacity, and what is the (quantitative) relationship between fishing mortality (capacity, exploitation rates, effort) and closure duration (e.g., what is the equivalence of exploitation rates or fishing effort in number of days).
References	IATTC Resolutions C-16-02 (2016), C-17-02 (2017b); Maunder *et al*., 2015; Minte-Vera *et al.,* 2018*;* Medley and Gascoigne 2017, Maunder 2012c

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass (≥ 80)**

Evaluation Table for PI 1.2.3 – YFT-EPO- Information and monitoring

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	Range of information			
	Guide post	**Some** relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	**Sufficient** relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A **comprehensive range** of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Y	Y	N
b	Monitoring			
	Guide post	Stock abundance and UoA removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and UoA removals are **regularly monitored at a level of accuracy and coverage consistent with the harvest control rule**, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	**All information** required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent **uncertainties** in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Y	Y	N
c	Comprehensiveness of information			
	Guide post		There is good information on all other fishery removals from the stock.	
	Met?		Y	
Overall PI justification		**(a)** The IATTC, member countries, and other international organizations (SPC, NMFS, ISSF, and others) collaborate in research projects and data collection to support the harvest strategy. The information produced includes data on stock structure studied through various methods (including analyses of catch statistics, life history, tagging, biochemical, genetic analyses, and chemical composition of otoliths), stock abundance (catch, bycatch, CPUE, size/ age structure by fleet), fleet composition (vessel number, size, capacity, gears, etc.), migration and movement, trophic structure and other ecological relationships, early-life history and recruitment patterns, biological processes (growth, reproduction, feeding and predation), oceanographic conditions (temperature, wind, salinity) (2010 IATTC Annual Report, 2015). Yellowfin tuna biology and life history is relatively well understood and fleet compositions are well monitored. The stock assessment requires a substantial amount of information. Data on retained catch, discards, CPUE, and size compositions of the catches from several different fisheries are analyzed. Several assumptions regarding processes such as growth, recruitment, movement, natural		

PI 1.2.3	Relevant information is collected to support the harvest strategy
	mortality (M), and fishing mortality (F), are made. Based on this, sufficient information is available to assess stock status and support the harvest strategy, so the fishery meets SG80. However, there is considerable environmental data, which is not used in the harvest strategy; key information on stock productivity is not well-estimated, particularly on growth and natural mortality; stock structure requires to be defined with more certainty; and there are gaps in data reporting from some fleets (particularly longline), so the information is not comprehensive enough to reach SG100. **(b)** Yellowfin stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the HCR, and indicators of catch and effort are available and monitored with sufficient frequency to support the HCR, including annual updates of the stock assessment. Substantial amounts of information are collected, including data on retained catches, discards, indices of abundance (CPUE), and the size compositions of the catches of the various fisheries. In addition, there is observer data which provides discard estimates. However, data from some fleets are incomplete. In general, there is good information on fishery removals from the stock. SG80 is met, but since reporting from some fleets is limited, there is not a high degree of certainty about all the information required for the HCR, so SG100 is not met. **(c)** Catches are well monitored and are sufficient for the stock assessment. The IATTC has had an observer program since 1993 for larger vessels, and the US since the 1970s. Observer coverage has allowed estimation of tuna discards and of bycatch of other species. Thus, there is good information on all other fishery removals, and SG80 is met.
References	Minte-Vera *et al.* 2018; IATTC 2017a, 2018; Medley and Gascoigne 2017

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass (≥ 80)**

Evaluation Table for PI 1.2.4 – YFT-EPO- Assessment of stock status

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Appropriateness of assessment to stock under consideration			
	Guide post		The assessment is appropriate for the stock and for the harvest control rule.	The assessment takes into account the major features relevant to the biology of the species and the nature of the UoA.
	Met?		Y	Y
b	Assessment approach			
	Guide post	The assessment estimates stock status relative to generic reference points appropriate to the species category.	The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated.	
	Met?	Y	Y	
c	Uncertainty in the assessment			
	Guide post	The assessment **identifies major sources** of uncertainty.	The assessment **takes uncertainty into account**.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a **probabilistic** way.
	Met?	Y	Y	Y
d	Evaluation of assessment			
	Guide post			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			Y
e	Peer review of assessment			
	Guide post		The assessment of stock status is subject to peer review.	The assessment has been **internally and externally** peer reviewed.
	Met?		Y	N
Overall PI justification		IATTC conducted the last update of the yellowfin tuna assessment in the EPO in 2018, using the same model as in previous assessments: an integrated statistical age-structured stock assessment model (Stock Synthesis Version 3.23b). The stock assessment requires a substantial amount of information. Data on retained catch, discards, CPUE, and size compositions of the catches from several different fisheries have been analyzed. Several assumptions regarding processes such as growth, recruitment, movement, natural mortality (M), fishing mortality (F), and stock structure have also been made. The assessment is able to use all available data and is well-adapted to take account of yellowfin biology. The assessment is appropriate for the stock and for the harvest control rule, and is evaluating stock status relative to reference points, taking into account the major features relevant to the biology of the species and the		

PI 1.2.4	There is an adequate assessment of the stock status
	nature of the UoA. This meets SG100. **(b)** The stock assessment has been used to estimate MSY-related reference points, and these have been used to determine stock status; thus, meeting SG80. **(c)** The assessment presents management quantities, trends, and projections with confidence intervals. Therefore, the assessment takes uncertainty into account, meeting SG100. The assessment also addresses uncertainties in model configuration and input parameters (model diagnostics and sensitivity analyses), evaluating stock status relative to reference points in a probabilistic way. Finally, the assessment also provides probabilistic projections of future stock trajectories under different model assumptions. This meets SG100. **(d)** The stock assessment model software (SS3) has been applied has been tested on many stocks worldwide. Additionally, SS3 provides considerable flexibility in modifying model structure based on diagnostics such as degree of fit to key data sources (catch at size, indices of abundance, etc.). Exploratory analyses during the original assessment with this software established appropriate spatial and fishery strata. In the current assessment the robustness of model results is evaluated through alternative hypotheses about productivity through the stock recruitment relationship and by testing sensitivity of parameters (steepness, natural mortality for adult fish, length of oldest fish). The assessment uses two main variations of the S-R relationship: no relationship *vs* a high steepness h=0.75. Management advise is based on the more optimistic (no S-R) scenario but uses the h=0.75 scenario to estimate LRP. Nevertheless, the assessment rigorously explores alternative hypotheses through sensitivity tests, thus meeting SG100. **(e)** The stock assessment is subject to review through internal review processes by the IATTC's SAC (Scientific Advisory Committee) where model structure, data and research are examined. Recent stock assessment reports show extensive discussion on model inputs, output uncertainties, stock structure and data gaps. IATTC periodically convenes external expert panels to peer review stock assessments, but it is not clear if a recent review of the yellowfin assessment has occurred, so SG80 is met. To meet SG100, it is important that the review of the latest assessment is conducted or documented. **FIP Recommendation**- Even though this indicator would likely obtain a high score, it would be recommended that the stock assessment is improved, by expanding sensitivity tests to include other S-R scenarios, such as alternative S-R curves or steepness values that are not extreme, but rather to use conventional, middle-ground values used in tuna fishery assessments. Also, the internal and external peer review of the assessment should be documented or made available through the IATTC website.
References	Aires-da-Silva *et al.* 2018, Medley and Gascoigne 2017

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass (≥ 80)**

A 1.1.3 BIGEYE TUNA- EPO

Evaluation Table for PI 1.1.1 – BET-EPO- Stock status

PI 1.1.1		**The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Stock status relative to recruitment impairment**			
	Guidepost	It is **likely** that the stock is above the point where recruitment would be impaired (PRI).	It is **highly likely** that the stock is above the PRI.	There is a **high degree of certainty** that the stock is above the PRI.
	Met?	Y	Y	N
b	**Stock status in relation to achievement of MSY**			
	Guidepost		The stock is at or fluctuating around a level consistent with MSY.	There is a **high degree of certainty** that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years.
	Met?		Y	N

Overall PI justification

(a) In 2018 the IATTC conducted an update assessment of the 2016 analysis of the bigeye tuna stock in the EPO, using an integrated statistical age-structured stock assessment model (Stock Synthesis 3.23b) and assuming a single stock in the EPO. Results are more pessimistic relative to the previous assessment and indicated that the stock is not overfished based on the ratio of spawning biomass SSB_{recent}/SSB_{MSY} estimated at 1.02. Also, the ratio of F_{recent}/F_{MSY} is estimated at 1.15 (range: 0.95-1.46), indicating that overfishing was occurring in the three most recent years (2015-2017). The IATTC noted that results could be unreliable due to the high levels of uncertainty in the model assumptions, the reliability of the recent longline data, and other issues that need to be improved.

MSY and related quantities for the base case and h=0.75 sensitivity analysis are shown below:

	Base case-Caso base	*h* = 0.75
MSY-RMS	95,491	97,766
B_{MSY}- B_{RMS}	371,078	718,860
S_{MSY}- S_{RMS}	93,329	200,723
B_{MSY}/B_0- B_{RMS}/B_0	0.26	0.33
S_{MSY}/S_0- S_{RMS}/S_0	0.21	0.30
C_{recent}/MSY- C_{recent}/RMS	1.15	1.13
B_{recent}/B_{MSY}- B_{recent}/B_{RMS}	0.91	0.85
S_{recent}/S_{MSY}-S_{recent}/S_{RMS}	1.02	0.92
F multiplier-Multiplicador de *F*	0.87	0.80

In 2014, on an interim basis (per Res. C16-02), the IATTC agreed to an LRP, defined as the equilibrium spawning biomass corresponding to that which produces a 50% reduction in recruitment from the unfished level, with a steepness of h=0.75 in the stock-recruitment relationship ($SB_{0.5R0}$, assuming h = 0.75). This, by definition, is below the PRI. The MSC's default PRI is 20% SB_0, which is close to the estimated SB_{MSY}=21%B_0. The 2018 update estimates SB_{2017}/SB_{MSY} at 1.02 (range: 0.56-1.47) and SB_{2017}/SB_0 ~0.26. The F ratio is above the MSY level: (F_{MSY}/ F_{mult}) = 1.15; F_{mult} has fluctuated close to 1 since the late 1990s. Under both, the base-case scenario and the hyper-sensitivity

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue	SG 60	SG 80	SG 100
	run (h=0.75), SB is above the MSY level. Recruitment has fluctuated without trend since the mid-90s at a level higher than the long-term average. On this basis, it is highly likely that the stock is above the PRI and SG80 is met. However, the lower 5% confidence interval for SB/SB_{MSY} for the base case model is at ~ $0.6SB_{MSY}$, which is above the LRP, but not necessarily above the PRI, so SG100 is not met. **(b)** The 2018 update assessment indicates that recent spawning biomass (SB) and total biomass (B) are above the MSY level, but F is below under both, the base-case model (no S-R relationship, with h=1) and the precautionary sensitivity run (SR relationship with h=0.75). The stock has recently recovered from below MSY level, so it has not been above this level in recent years and SG100 is not met.		
References	Xu *et al.*, 2018; IATTC 2016 (Res. C-16-02); MSC FCR GSA2.2.3.1; ISSF 2018		
RBF Required? (✓/×/)	×	**Likely PI Scoring Level (<60, 60-79, ≥ 80)**	**Pass ≥ 80**
Stock Status relative to Reference Points			
	Type of reference point	**Value of reference point**	**Current stock status relative to reference point**
Reference point used in scoring stock relative to PRI (SIa)	LRP= $SB_{0.5R0}$, assuming h = 0.75 (Res. C-16-02) $SSB_{current}/SSB_{MSY}$ PRI=20%SB_0	PRI~ SB_{MSY} =21%B_0.	SB_{2017}/SB_{MSY} =1.02 (SB_{2017}/SB_0 ~0.26).
Reference point used in scoring stock relative to MSY (SIb)	SB_{MSY} F_{MSY}	Base case SB_{MSY}=93,329 MT spawning biomass F_{mult}=0.87	Base case SB_{2017}/SB_{MSY} =95,195 MT/ 93,329 MT= 1.02 F_{2017}/F_{MSY}=1.15

Evaluation Table for PI 1.1.2 – BET-EPO- Stock rebuilding

PI 1.1.2		Where the stock is reduced, there is evidence of stock rebuilding within a specified timeframe		
Scoring Issue		SG 60	SG 80	SG 100
a	**Rebuilding timeframes**			
	Guidepost	A rebuilding timeframe is specified for the stock that is **the shorter of 20 years or 2 times its generation time**. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.		The shortest practicable rebuilding timeframe is specified which does not exceed **one generation time** for the stock.
	Met?	NA		NA
b	**Rebuilding evaluation**			
	Guidepost	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is evidence that the rebuilding strategies are rebuilding stocks, **or it is likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.	There is **strong** evidence that the rebuilding strategies are rebuilding stocks, **or it is highly likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.
	Met?	NA	NA	NA
Overall PI justification		There is currently no information to indicate that the bigeye tuna stock is reduced or in need of rebuilding. The results from the 2018 assessment actually indicate a recovering trend during 2005-2009, subsequent to IATTC conservation resolutions initiated in 2004. However, the rebuilding trend was not sustained between 2010-2013, and the SBR declined to a historically low level of 0.15 at the start of 2013. Thereafter, the SBR has increased markedly, from 0.15 in 2013 to 0.23 at the start of 2016, due mainly to the strong recruitment in 2012. In the model, the estimate is driven mainly by the recent increase in the catch per unit of effort (CPUE) of the longline fisheries that catch adult bigeye. It should be noted that after several years of recent increases, the SBR is estimated to have decreased to 0.21 at the start of 2017, due mainly to the decrease in the CPUE of the longline fisheries for bigeye from 2016 to 2017. There is uncertainty about recent and future levels of recruitment and biomass. At current levels of fishing mortality, and if effort and catchability continue at recent levels and average recruitment persists, the spawning biomass is predicted to decrease towards an SBR of 0.17. This level of spawning biomass is below that corresponding to the maximum sustainable yield (MSY) (0.21).		
References		Xu *et al.*, 2018		
			Likely PI Scoring Level (<60, 60-79, ≥ 80)	NA

Evaluation Table for PI 1.2.1 – BET-EPO- Harvest strategy

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	**Harvest strategy design**			
	Guidepost	The harvest strategy is **expected** to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy **work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80.
	Met?	Y	Y	Y
b	**Harvest strategy evaluation**			
	Guidepost	The harvest strategy is **likely** to work based on prior experience or plausible argument.	The harvest strategy may not have been fully **tested** but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been **fully evaluated** and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met?	Y	Y	N
c	**Harvest strategy monitoring**			
	Guidepost	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Y		
d	**Harvest strategy review**			
	Guidepost			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			Y
e	**Shark finning**			
	Guidepost	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	NR	NR	NR
f	**Review of alternative measures**			
	Guidepost	There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
			are implemented as appropriate.	are implemented, as appropriate.
	Met?	Y	Y	N
Overall PI justification		**(a)** In 2016 IATTC adopted Resolution C-16-02 on Harvest Control Rules (HCR for tropical tunas, based on interim target and limit reference points. The HCR aims to prevent fishing mortality from exceeding the MSY level for the tropical tuna stock (bigeye, yellowfin or skipjack) that requires the strictest management. If fishing mortality or spawning biomass are approaching the corresponding limit reference point with a probability of 10% or greater, the HCR triggers the establishment of additional management measures to reduce fishing mortality and rebuild the stock. The HCR is implemented via time/area closures and catch limits which vary for different fleets (Resolution C-17-02). The duration of the closure is set according to the level of F_{mult} ($F_{MSY}/F_{current}$) for the stock requiring the strictest management (at present, yellowfin). The current closure is 72 days each year (from 2018 to 2020) for the purse seine fleet. Thus, the strategy is responsive to the state of the stock, thus meeting SG80. However, it is not clear how the 62-day closure was initially determined or how it is modified, considering that F_{mult} for yellowfin has remained close to 1.0, but a 6.7% capacity increase was detected. It was assumed that an additional 10 days of closure will reduce effort by the correct amount to obtain the target biomass, but this rationale is not expressed in Res. C-16-02 or C-17-02. Such adjustment indicates that there is a linkage between stock status and the duration of the closure, and that there is a system, based on F_{mult} and other factors to estimate the appropriate duration. Thus, there is a designed harvest strategy to meet the stock management objectives and SG100 is met. **(b)** The 2018 stock assessment showed that a recovering trend during 2005-2009, subsequent to IATTC conservation resolutions initiated in 2004. This rebuilding trend was not sustained between 2010-2013, and the SBR declined to a historically low level of 0.15 at the start of 2013. Thereafter, the SBR increased markedly, to 0.23 at the start of 2016, due mainly to the strong recruitment in 2012. The stock has thus recovered above S_{BMSY}, which is evidence that the harvest strategy is achieving its objectives; meeting SG80. Also, the stock assessment was updated in 2018 and the main strategy (C-17-01) was reviewed and updated (C17-02). However, HCRs and interim reference points have not been reviewed. Although scheduled for 2018, the whole harvest strategy (Res 16-02) has not been fully evaluated, so SG100 is not met. **(c)** The harvest strategy monitors the status of the stock and the catches and fishing mortality rates affecting status. Data are collected to estimate management quantities. The stock assessment is updated regularly and provides estimates of biomass, indicating whether the strategy is working or not, this issue meets SG60. **(d)** C-17-02 requires review of the harvest strategy during 2018, 2019, and 2020 (see para. 26), but the specific methods or timing for the review are unclear. IATTC has gone through a process of reviewing, evaluating and adjusting the harvest strategy for several years, has refined stock assessment methods and has defined reference points and HCRs. A review of the harvest strategy resulted in Res. C-17-02. A full review of the harvest strategy was planned for 2018, and even though it didn't occur, there are periodic reviews and improvements, thus SG100 is met. **(e)** Not relevant (NR), the target species (yellowfin) is not a shark species. **(f)** The purse seine fleet is the main concern for unwanted tuna catch. Under IATTC resolution (C-17-02, para. 24), all bigeye, skipjack and yellowfin tuna brought on board is required to be landed, except that unfit for human		

PI 1.2.1	There is a robust and precautionary harvest strategy in place
	consumption. Research is ongoing to reduce catch of juvenile tunas and non-target species (see C-17-02, para. 23). On this basis, measures to minimise mortality of unwanted catch are subject to regular review and research and controls are being implemented, meeting SG80. It is not known whether the review of alternative measures to minimise bycatch is biennial, so SG100 is not met. **FIP Recommendation**- Issue (a) may score ≥ 80, but it would be important for the IATTC to document how the main harvest strategy tools are defined or modified. For example, how is the most vulnerable species selected to guide management actions for all tropical tunas, how was the original duration of the temporary closure (62 days) defined and criteria are used to modify it, how is the duration linked to F_{mult} , how is F_{mult} adjusted for increased capacity, and what is the (quantitative) relationship between effort and closure duration (in number of days?). The review of the harvest strategy scheduled for 2018 should be undertaken, particularly due to the high uncertainties associated with bigeye stock status, the increase in fishing effort, the decreasing mean weight of the fish, and the likelihood that overfishing is occurring.
References	Aires-da-Silva et al. 2017; IATTC Resolutions C-16-02 (2016), C-17-01 (2017c, C-17-02 (2017b); IATTC 2017a, 2018; Medley and Gascoigne 2017; Maunder, 2012c, Xu *et al.* 2018

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass (≥ 80)**

Evaluation Table for PI 1.2.2 – BET-EPO- Harvest control rules and tools

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
Scoring Issue		SG 60	SG 80	SG 100
a	HCRs design and application			
	Guide post	**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.	**Well defined** HCRs are **in place** that **ensure** that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock **fluctuating around** a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock **fluctuating at or above** a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, **most** of the time.
	Met?	Y	Y	N
b	HCRs robustness to uncertainty			
	Guide post		The HCRs are likely to be robust to the main uncertainties.	The HCRs take account of a **wide** range of uncertainties including the ecological role of the stock, and there is **evidence** that the HCRs are robust to the main uncertainties.
	Met?		Y	N
c	HCRs evaluation			
	Guide post	There is **some evidence** that tools used **or available** to implement HCRs are appropriate and effective in controlling exploitation.	**Available evidence indicates** that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs.	**Evidence clearly shows** that the tools in use are effective in achieving the exploitation levels required under the HCRs.
	Met?	Y	Y	N
Overall PI justification		**(a)** The HCR for EPO tropical tunas is provided in IATTC Res. C-16-02: • If the probability that F>Flim is >10%, management measures shall be established such that there is at least a 50% probability that F will reduce to F_{MSY} or below, and with a probability of <10% of $F>F_{lim}$. • If the probability that $SB<SB_{lim}$ is >10%, management measures shall be established such that there is at least a 50% probability that SB will recover to SB_{MSY} or above, and with a probability of <10% that SB will decline to $<SB_{lim}$ within two generations or 5 years, whichever is greater. This HCR is expected to maintain biomass above the limit reference point, and most likely above the PRI (given that $B<B_{lim}$ is set as a trigger for management action) and fluctuating around the MSY level. SG60 is met. The HCR is well defined in Res. C-16-02. Also, the HCR triggers action to reduce the exploitation rate if the probability of SB or F exceeding the LRP > 10%. If $SB<SB_{MSY}$, the HCR requires at least a 50% probability that it will recover to a level $\geq SB_{MSY}$, but if the stock does not recover, this rule is triggered again until it does. The HCR thus aims to keep the stock fluctuating at or above the target level, meeting SG80. Also, management is driven by the status the tropical stock that is in worst, which is precautionary. However, the use of MSY-based reference points is not very precautionary, and the ecological role of the stock is not taken into account		

PI 1.2.2	There are well defined and effective harvest control rules (HCRs) in place
	to define more appropriate target levels, so SG100 is not met. **(b)** Bigeye tuna stock assessments provide results for a base case assessment and sensitivity runs, including one that assumes a stock-recruitment relationship with h=0.75. The base case model results are more optimistic, but the HCR defines LRPs based on the model that assumes a S-R relationship, so this main source uncertainty is taken into account in the harvest strategy. In addition, the HCR requires action when p(SB<SBlim) reaches 10% (well above the actual LRP). Thus, there is considerable precaution built into the HCR. Also, the harvest strategy seems to be working since it has maintained both bigeye and yellowfin F_{mult} at or close to one. A preliminary MSE was conducted (Maunder *et al*, 2015) to evaluate reference points and the tropical-tuna HCR, with bigeye tuna as an example. Under all sensitivity scenarios, this exercise suggested that the key uncertainties (and recruitment variability) have an impact on the probability of exceeding LRPs, but the HCR effectively manages and rebuilds the (bigeye) stock at the MSY level and avoids a high risk of recruitment impairment. Based on this, SG80 is met, but SG100 is not because there remain large uncertainties in the stock dynamics that have an impact on the status, such as the stock definition, S-R relationship, natural mortality, recruitment, etc. **(c)** The tools to implement the HCR are specified in IATTC Res. C-17-02, with the main tools being a 72-day seasonal closure for purse seine vessels and specifications for the number of FADs permitted per vessel. However, tools have been selected on a pragmatic basis, rather than based on stock-specific needs. The closure is not explicitly linked to the HCR, but the duration of the closure has been adjusted according to F_{mult} (F_{MSY}/F) and increases in capacity. The HCR has a provision for review and adjustment; thus, the available evidence indicates that the tools are appropriate and effective in controlling exploitation rates, meeting SG80. In 2017 the closure was extended for 2018-2020 from 62 to 72 days (Res. C-17-01 and C-17-02), based on adjusting F_{mult} to increases in fishing capacity, however the link between the closure duration and exploitation rates is not defined. It appears that the duration of the closure is 'a matter of negotiation' within IATTC, rather than a clearly-defined element of the HCR, so SG100 is not met. **FIP Recommendation**- The overall PI would likely score ≥ 80, but it would be important for the IATTC to document how the HCR triggers practical measures, such as adjusting the duration of the closure. For example, it would be important for to describe how was the original duration of the temporary closure (62 days) defined, how is the duration linked to F_{mult} , how is F_{mult} adjusted for increased capacity, and what is the (quantitative) relationship between fishing mortality (capacity, exploitation rates, effort) and closure duration (e.g., what is the equivalence of exploitation rates or fishing effort in number of days).
References	IATTC Resolutions C-16-02 (2016), C-17-02 (2017b); Maunder *et al*., 2015; Xu *et al.,* 2018*;* Medley and Gascoigne 2017, Maunder 2012c

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass (≥ 80)**

Evaluation Table for PI 1.2.3 – BET-EPO- Information and monitoring

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	Range of information			
	Guide post	**Some** relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	**Sufficient** relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A **comprehensive range** of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Y	Y	N
b	Monitoring			
	Guide post	Stock abundance and UoA removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and UoA removals are **regularly monitored at a level of accuracy and coverage consistent with the harvest control rule**, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	**All information** required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent **uncertainties** in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Y	Y	N
c	Comprehensiveness of information			
	Guide post		There is good information on all other fishery removals from the stock.	
	Met?		Y	
Overall PI justification		**(a)** There is a long history of biological and environmental research on EPO tuna stocks. The IATTC, member countries, and other international organizations (SPC, NMFS, ISSF, and others) collaborate in research projects and data collection to support the harvest strategy. The information produced includes data on stock structure studied through various methods (including analyses of catch statistics, life history, tagging, biochemical, genetic analyses, and chemical composition of otoliths), stock abundance (catch, bycatch, CPUE, size/ age structure by fleet), fleet composition (vessel number, size, capacity, gears, etc.), migration and movement, trophic structure and other ecological relationships, early-life history and recruitment patterns, biological processes (growth, reproduction, feeding and predation), oceanographic conditions (temperature, wind, salinity) (2010 IATTC Annual Report, 2015). Bigeye tuna are distributed across the Pacific Ocean and it has been questioned whether the current division of stock assessment and management into the EPO and the WCPO is appropriate; joint stock assessments have been attempted but not considered to be an improvement on the current system. Bigeye tuna biology		

PI 1.2.3	Relevant information is collected to support the harvest strategy
	and life history is relatively well understood and fleet compositions are well monitored. Sufficient information is available to assess stock status and support the harvest strategy, so the fishery meets SG80. However, there is considerable environmental data, which is not used in the harvest strategy; key information on stock productivity is not well-estimated, particularly on growth and natural mortality; and there are gaps in the information for some fleets so the information is not comprehensive enough to reach SG100. **(b)** Bigeye stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the HCR, and indicators of catch and effort are available and monitored with sufficient frequency to support the HCR, including annual updates of the stock assessment. Substantial amounts of information are collected, including data on retained catches, discards, indices of abundance (CPUE), and the size compositions of the catches of the various fisheries. In addition, there is observer data which provides discard estimates. However, data from some fleets are incomplete. In general, there is good information on fishery removals from the stock. SG80 is met, but since reporting from some fleets is limited, there is not a high degree of certainty about all the information required for the HCR, and although trial MSE was applied to bigeye (in 2015), current tests of the robustness of the harvest strategy to uncertainties need to be undertaken. SG100 is not met. **(c)** Catches are well monitored and are sufficient for the stock assessment. The IATTC has had an observer program since 1993 for larger vessels, and the US since the 1970s. Observer coverage has allowed estimation of tuna discards and of bycatch of other species. Thus, there is good information on all other fishery removals, and SG80 is met.
References	Xu *et al.* 2018; IATTC 2017a, 2018; Medley and Gascoigne 2017

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass (≥ 80)**

Evaluation Table for PI 1.2.4 – BET-EPO- Assessment of stock status

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Appropriateness of assessment to stock under consideration			
	Guide post		The assessment is appropriate for the stock and for the harvest control rule.	The assessment takes into account the major features relevant to the biology of the species and the nature of the UoA.
	Met?		Y	Y
b	Assessment approach			
	Guide post	The assessment estimates stock status relative to generic reference points appropriate to the species category.	The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated.	
	Met?	Y	Y	
c	Uncertainty in the assessment			
	Guide post	The assessment **identifies major sources** of uncertainty.	The assessment **takes uncertainty into account**.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a **probabilistic** way.
	Met?	Y	Y	Y
d	Evaluation of assessment			
	Guide post			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			Y
e	Peer review of assessment			
	Guide post		The assessment of stock status is subject to peer review.	The assessment has been **internally and externally** peer reviewed.
	Met?		Y	Y
Overall PI justification		IATTC conducted the last bigeye tuna assessment in the EPO in 2017, using the same model as in previous assessments: an integrated statistical age-structured stock assessment model (Stock Synthesis Version 3.23b). The stock assessment requires a substantial amount of information. Data on retained catch, discards, CPUE, and size compositions of the catches from several different fisheries have been analyzed. Several assumptions regarding processes such as growth, recruitment, movement, natural mortality (M), fishing mortality (F), and stock structure have been made. The assessment is able to use all available data and is well-adapted to take account of bigeye biology. The assessment is appropriate for the stock and for the harvest control rule, and evaluates stock status relative to reference points, taking into account the major features relevant to the biology of the species and the nature of the UoA. This meets SG100.		

PI 1.2.4	There is an adequate assessment of the stock status
	(b) The stock assessment has been used to estimate MSY-related reference points, and these have been used to determine stock status; thus, meeting SG80. **(c)** The assessment presents management quantities, trends, and projections with confidence intervals, thus taking uncertainty into account. The assessment also addresses uncertainties in model configuration and input parameters (model diagnostics and sensitivity analyses), evaluating stock status relative to reference points in a probabilistic way. Finally, the assessment also provides probabilistic projections of future stock trajectories under different model assumptions. This meets SG100. **(d)** The stock assessment model software (SS3) has been applied has been tested on many stocks worldwide. Additionally, SS3 provides considerable flexibility in modifying model structure based on diagnostics such as degree of fit to key data sources (catch at size, indices of abundance, etc.). Exploratory analyses during the original assessment with this software established appropriate spatial and fishery strata. In the current assessment the robustness of model results is evaluated through alternative hypotheses about productivity through the stock recruitment relationship and by testing sensitivity of parameters (steepness, mortality rates). The assessment uses two main variations of the S-R relationship: no relationship *vs* a high steepness h=0.75. Management advise is based on the more optimistic (no S-R) scenario but uses the h=0.75 scenario to estimate LRP. The assessment rigorously explores alternative hypotheses through sensitivity tests, thus meeting SG100. **(e)** The stock assessment is subject to review through internal review processes by the IATTC's SAC (Scientific Advisory Committee) where model structure, data and research are examined. Recent stock assessment reports show extensive discussion on model inputs, output uncertainties, stock structure and data gaps. IATTC periodically convenes external expert panels to peer review stock assessments. The bigeye assessment was externally reviewed in 2012 (Silbert *et al.*, 2012*)*. SG100 is met. **FIP Recommendation**- Even though this indicator would likely obtain a very high score, it would be recommended that the stock assessment is improved, by expanding sensitivity tests to include other S-R scenarios, such as alternative S-R curves or steepness values that are not extreme, but rather to use conventional, middle-ground values used in tuna fishery assessments. Also, the internal and external peer review of the assessment should be documented or made available through the IATTC website. A new external review is recommended, considering that the last one occurred in 2012.
References	Aires-da-Silva *et al.*, 2016, 2017; Medley and Gascoigne 2017; McKechnie *et al.,* 2015; Silbert *et al.,* 2012; Xu *et al.* 2018

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass (≥ 80)**

Principle 1 – Western Central Pacific Ocean

A 1.2.1 SKIPJACK TUNA – WCPO

Evaluation Table for PI 1.1.1 – SKJ- WCPO Stock status

PI 1.1.1		**The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Stock status relative to recruitment impairment**			
	Guidepost	It is **likely** that the stock is above the point where recruitment would be impaired (PRI).	It is **highly likely** that the stock is above the PRI.	There is a **high degree of certainty** that the stock is above the PRI.
	Met?	Y	Y	Y
b	**Stock status in relation to achievement of MSY**			
	Guidepost		The stock is at or fluctuating around a level consistent with MSY.	There is a **high degree of certainty** that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years.
	Met?		Y	Y
Overall PI justification		**(a)** No stock assessment was conducted for WCPO skipjack tuna in 2017 or 2018. Therefore, the stock status description from SC12 (2016) is still current. The 2016 skipjack assessment used the MULTIFAN-CL statistical stock assessment software. Results showed that the stock had a very low probability of recruitment overfishing, since the spawning biomass across sensitivity runs was calculated at a median (5% and 95% quantiles): $SB_{2015}/SB_0 = 0.62$ (0.43-0.71). This indicates that the stock is above the LRP (20%B_0), which is the default PRI. Thus, there is a high degree of certainty that the stock is above the point where recruitment would be impaired, and SG100 is met. **(b)** The main results from the 2016 assessment showed that across sensitivity runs, the latest (2015) median estimate of biomass was well above the level that supports MSY: $B_{2015}/B_{MSY} = 2.56$ (1.6-3.08, 5%-95% quantiles). Fishing mortality of all age-classes was estimated to have increased significantly since the beginning of industrial tuna fishing, but it has remained below the level that would result in MSY: median $F_{recent}/F_{MSY} = 0.45$ (0.38-0.64, 5% - 95% quantiles, where recent is the period 2011-2014), and was estimated to have decreased moderately in the last several years. Despite a steady decline of the stock and an increase in fishing mortality, the stock is still estimated to be healthy and close to the target reference point of 50%$SB_{F=0}$ (median $SB_{2015}/SB_{F=0} = 0.58$ (0.41-0.65, 5% - 95% quantiles). This indicates that the stock is not overfished, and overfishing was not occurring for the WCPO skipjack tuna stock in 2015. There is a high degree of certainty that the stock has been fluctuating around MSY levels in recent years (2011-2015), thus meeting SG100.		
References		McKechnie *et al.,* 2016; WCPFC 2018b		
RBF Required? (✓/×/)		×	**Likely PI Scoring Level (<60, 60-79, ≥ 80)**	**Pass ≥ 80**
Stock Status relative to Reference Points				

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue	SG 60	SG 80	SG 100
	Type of reference point	**Value of reference point**	**Current stock status relative to reference point**
Reference point used in scoring stock relative to PRI (SIa)	PRI= 20% SB_0	SB_0=6,764,000 t 20% SB_0= 1,352,800 t	SB_{2015}/ SB_0 = 0.62 SB_{2015}/20%SB_0=2.41
Reference point used in scoring stock relative to MSY (SIb)	SB_{MSY} F_{MSY}	SB_{MSY}= 1,626,000 t F_{MSY}= 0.24	SB_{2015}/ SB_{MSY} = 2.56 F_{2015}/F_{MSY}= 0.45

Evaluation Table for PI 1.1.2 – SKJ- WCPO Stock rebuilding

PI 1.1.2		**Where the stock is reduced, there is evidence of stock rebuilding within a specified timeframe**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Rebuilding timeframes**			
	Guidepost	A rebuilding timeframe is specified for the stock that is **the shorter of 20 years or 2 times its generation time**. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.		The shortest practicable rebuilding timeframe is specified which does not exceed **one generation time** for the stock.
	Met?	N/A		N/A
b	**Rebuilding evaluation**			
	Guidepost	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is evidence that the rebuilding strategies are rebuilding stocks, **or it is likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.	There is **strong** evidence that the rebuilding strategies are rebuilding stocks, **or it is highly likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.
	Met?	N/A	N/A	N/A
Overall PI justification		The WCPO skipjack stock is not considered to be depleted or in need of rebuilding, so this indicator is not scored.		
References		N/A		
			Likely PI Scoring Level (<60, 60-79, ≥ 80)	N/A

Evaluation Table for PI 1.2.1 – SKJ- WCPO- Harvest strategy

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	**Harvest strategy design**			
	Guidepost	The harvest strategy is **expected** to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy **work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80.
	Met?	Y	N	N
b	**Harvest strategy evaluation**			
	Guidepost	The harvest strategy is **likely** to work based on prior experience or plausible argument.	The harvest strategy may not have been fully **tested** but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been **fully evaluated** and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met?	Y	Y	N
c	**Harvest strategy monitoring**			
	Guidepost	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Y		
d	**Harvest strategy review**			
	Guidepost			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			N
e	**Shark finning**			
	Guidepost	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	NR	NR	NR
f	**Review of alternative measures**			
	Guidepost	There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
			are implemented as appropriate.	are implemented, as appropriate.
	Met?	Y	Y	N
Overall PI justification		**(a)** The main objective of the WCPFC is to maintain tunas and tuna-like fish populations at MSY levels. Through CMM 2014-06, the Commission agreed to a work plan for the adoption of harvest strategies, including the development of management objectives, target reference points, harvest control rules, and other elements. The harvest strategy for skipjack (CMM 2016-01) stated that the fishing mortality rate should be maintained at a level at or below F_{MSY} (i.e. $F/F_{MSY} \leq 1$). The current CMM 2018-01 states that spawning biomass of skipjack tuna is to be maintained on average at a level consistent with the interim target reference point of 50% of the spawning biomass in the absence of fishing, adopted in accordance with CMM 2015-06. This CMM established an interim target equal to 50% of the equilibrium spawning biomass that would be expected in the absence of fishing (most recent 10 years of the current assessment, excluding the last year) ($50\%SB_{current,\ F=0}$). The 2016 assessment estimated biomass to be close to this level (see PI 1.1.1). The current management measures for tropical tunas are described in CMM 2018-01, an include effort limits in major purse seine fisheries, FAD closures, high seas closures, and a discard ban in purse seine fisheries. Purse seine effort controls are in place in the coastal states EEZs. These measures are not specific for skipjack tuna and are more directed to bigeye tuna. The harvest strategy contained in CMM 2016-01 was intended to be a one-year interim measure but has been renewed since 2013. A formal harvest strategy and harvest control rule for tropical tunas is in development. The updated work plan for the adoption of HS under CMM 2014-06 indicates that the MSE and HCR evaluation for skipjack are ongoing but were not completed in 2018 as planned. An updated stock assessment and a review of TRPs for skipjack are scheduled in 2019. At present, the harvest strategy is expected to achieve stock management objectives, according to the 2016 stock assessment results, so SG60 is met. It is not clear, however, that the strategy is responsive to stock status or that all its components are working together effectively, so SG80 is not met. **(b)** The management objectives are to ensure that the spawning stock does not fall to the LRP ($20\%SB_{F=0}$), to ensure fishing mortality does not exceed F_{MSY} ($F/F_{MSY}<1$), and that the stock is maintained at least as high as B_{MSY} (implicit TRP). The 2016 stock assessment showed that the harvest strategy, even in the absence of harvest control rules, is achieving its objectives: SB_{latest}/SB_{MSY} = 1.74 and $F_{current}/F_{MSY}$ = 0.61. Thus, there is evidence that the limits on fishing mortality are adequate to maintain the stock above B_{MSY}, and SG80 is met. However, the performance of harvest strategy has not been fully evaluated, thus SG100 is not met. **(c)** The WCPFC has systems in place for recording catch and effort for all vessels catching WCPO skipjack tuna in the WCPO. Standardized abundance indices are regularly monitored by the WCPFC Scientific Committee. Estimates of stock abundance are obtained through the MULTIFAN-CL stock assessment. Abundance indices monitored include catch-per-unit effort (CPUE) for purse seine and pole-and-line fisheries. Skipjack stock assessments are carried out every 2-3 years (2014, 2016, plan for 2019). SG60 is met. **(d)** A review of the existing harvest strategy set out in CMM 2016-01 has not		

PI 1.2.1	There is a robust and precautionary harvest strategy in place
	occurred, although CMM-14-06 has a provision for periodic review. SG100 is not met. **(e)** The target species is not a shark, so this issue is not scored. **(f)** The purse seine fleet represents the main risk for tuna discards. A number of CMMs address discarding and aim to reduce unwanted catch of juvenile tunas (bigeye in particular) through effort control on FADs. Thus, there is a regular review of measures to minimize mortality of unwanted catch, meeting SG80, but not SG100 because it is not known if the review is biannual. **FIP Recommendations**- (a) Reference points need to be reviewed, and performance of candidate HCRs against agreed reference points should be evaluated through MSE. Per the updated work plan, adoption of an HCR is expected by 2020. (d) If the harvest strategy for skipjack proves to require improvement, it should be reviewed and changed as necessary.
References	WCPFC 2016, 2017, 2018; McKechnie et al 2016; MRAG Americas 2016

Likely PI Scoring Level (<60, 60-79, ≥ 80)	Pass with condition (60-79)

Evaluation Table for PI 1.2.2 – SKJ- WCPO- Harvest control rules and tools

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
Scoring Issue		SG 60	SG 80	SG 100
a	HCRs design and application			
	Guide post	**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.	**Well defined** HCRs are **in place** that **ensure** that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock **fluctuating around** a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock **fluctuating at or above** a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, **most** of the time.
	Met?	Y	N	
b	HCRs robustness to uncertainty			
	Guide post		The HCRs are likely to be robust to the main uncertainties.	The HCRs take account of a **wide** range of uncertainties including the ecological role of the stock, and there is **evidence** that the HCRs are robust to the main uncertainties.
	Met?		N	N
c	HCRs evaluation			
	Guide post	There is **some evidence** that tools used **or available** to implement HCRs are appropriate and effective in controlling exploitation.	**Available evidence indicates** that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs.	**Evidence clearly shows** that the tools in use are effective in achieving the exploitation levels required under the HCRs.
	Met?	Y	N	N
Overall PI justification		**(a)** For a harvest control rule to be 'available' (SG60), the MSC requires that the following two conditions are met: 1. Stock biomass has not previously been reduced below the MSY level or has been maintained at that level for a recent period of time that is at least longer than 2 generation times of the species and is not predicted to be reduced below BMSY within the next 5 years. According to the 2016 assessment, stock biomass has not been reduced below the MSY level. Short-term projections suggested that biomass would decline below the TRP in 2018, but then increase again and continue fluctuating around MSY. 2. HCRs are effectively used in other stocks by the same management body or an agreement or framework is in place requiring the management body to adopt HCRs before the stock declines below BMSY. This is met for skipjack through CMM 2014-06, which sets out the objectives and principles by which to establish a Harvest Strategy for key fisheries in the WCPO, including a work plan for developing management objectives, adoption of reference points, and development of harvest control rules, and other elements of the HS. The conditions are met for the skipjack HCRs to be considered as available, thus SG60 is likely to be met, but SG80 is not because HCRs are not yet in place.		

PI 1.2.2	There are well defined and effective harvest control rules (HCRs) in place
	(b) The 'available' harvest control rules are not sufficiently articulated to allow an evaluation of the extent to which they take uncertainties into account. SG80 requirements are not met. **(c)** CMM 2016-01 outlines the main tools of the HS for skipjack, including temporal/ spatial limits on purse seine setting on FADs, and restrictions on effort (days). The harvest strategy has only been in place since 2016, but assessment results and projections suggest that there is some evidence that the tools used are effective in controlling exploitation, so SG60 is met. With no formal HCRs in place, the exploitation levels required are not yet established, so SG80 is not met. **FIP Recommendations**- (a) To improve this score, demonstrable progress is required towards a formal harvest strategy and HCR (as per CMM 2014-06) such that it is clear that appropriate actions will be taken to reduce the exploitation rate if PRI is approached, and to keep the stock fluctuating around a target level consistent with MSY. **(c)** To improve these score, demonstrable progress is required towards a formal harvest strategy (as per CMM 2014-06) such that it is more clear that management tools are likely to be effective in maintaining a stable biomass at or above reference levels and controlling fishing mortality. (b) HCRs should be designed taking the main uncertainties into account.
References	McKechnie et al. 2016; WCPFC 2014a, 2014b; Pilling *et al*. 2014, 2016; Rice *et al.* 2014

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass with condition 60-79**

Evaluation Table for PI 1.2.3 – SKJ- WCPO – Information and monitoring

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	Range of information			
	Guide post	**Some** relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	**Sufficient** relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A **comprehensive range** of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Y	Y	Y
b	Monitoring			
	Guide post	Stock abundance and UoA removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and UoA removals are **regularly monitored at a level of accuracy and coverage consistent with the harvest control rule**, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	**All information** required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent **uncertainties** in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Y	Y	N
c	Comprehensiveness of information			
	Guide post		There is good information on all other fishery removals from the stock.	
	Met?		Y	
Overall PI justification		**(a)** Monitoring of the WCPO skipjack stock consists of collecting data on fishery removals, effort, size composition, and tagging. Additionally, the Scientific Committee coordinates biological research needs (age and growth, stock structure, genetics, etc.) and disseminates research results and statistics to cooperating scientists and the management bodies. All this information is incorporated into the stock assessment. Thus, there is a comprehensive range of information (on stock structure, stock productivity, fleet composition) to monitor and assess stock status including; tagging data for stock identification, catch reporting and size-frequency sampling by each fleet and detailed catch-per-unit-effort data from these fleets from observers, as well as port sampling and transshipment monitoring. SG100 is met. **(b)** Standardized abundance indices are regularly monitored by the WCPFC Scientific Committee. Estimates of stock abundance are obtained through the MULTIFAN-CL stock assessment. Abundance indices monitored include catch-per-unit effort (CPUE) for purse seine and pole-and-line fisheries. The WCPFC has systems in place for recording catch and effort for all vessels catching WCPO skipjack tuna. Purse seine catch data are estimated by 10 latitude, 10 longitude,		

PI 1.2.3	Relevant information is collected to support the harvest strategy
	month flag, and set type. Catch, effort, and stock status are monitored at a level that is sufficient to support the harvest strategy. SG60 and SG80 are met. However, there are issues of non-provision of operational catch and effort by four Commission members for the longline fishery. There are a number of impacts of these data gaps. Stock assessments are only carried out every 2-3 years. SG100 is not met. **(c)** There is good information on fishery removals from long-line, purse seine and pole and-line fisheries and other fisheries in the WCPFC convention area. Catches of tunas are measured and monitored well enough by most CPCs and are sufficient for the stock assessment and the harvest strategy. Although monitoring of catches in some areas (e.g., Indonesia, Philippines, Vietnam) still needs improvement, these do not pose an unacceptable risk to the harvest strategy. There are a number of on-going initiatives to strengthen data collection of member states. SG80 is met.
References	McKechnie et al. 2016, Pilling et al. 2016, WCPFC 2018b

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass ≥ 80**

Evaluation Table for PI 1.2.4 – SKJ- WCPO- Assessment of stock status

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Appropriateness of assessment to stock under consideration			
	Guide post		The assessment is appropriate for the stock and for the harvest control rule.	The assessment takes into account the major features relevant to the biology of the species and the nature of the UoA.
	Met?		Y	Y
b	Assessment approach			
	Guide post	The assessment estimates stock status relative to generic reference points appropriate to the species category.	The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated.	
	Met?	Y	Y	
c	Uncertainty in the assessment			
	Guide post	The assessment **identifies major sources** of uncertainty.	The assessment **takes uncertainty into account**.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a **probabilistic** way.
	Met?	Y	Y	Y
d	Evaluation of assessment			
	Guide post			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			Y
e	Peer review of assessment			
	Guide post		The assessment of stock status is subject to peer review.	The assessment has been **internally and externally** peer reviewed.
	Met?		Y	N
Overall PI justification		**(a)** The 2016 assessment model was conducted using the Multifan-CL model, an age and spatially structured model, utilizing biological, catch, effort, size composition, CPUE and tagging data. It fits the data of 23 fisheries to five regions in quarterly time steps from 1952-2014. The assessment included a range of model options and sensitivities to investigate key structural assumptions and sources of uncertainty in the assessment. The model is continuously updated and adapted to account for major features of the fishery, the biology of the species, and the available data. SG80 and SG 100 are met. **(b)** The assessment estimates spawner biomass and fishing mortality relative to a range of reference points which can be estimated, including MSY reference points (F_{MSY}, SB_{MSY}) and depletion-based reference points ($SB_{F=0}$, SB_0). SG80 is		

PI 1.2.4	There is an adequate assessment of the stock status
	likely met. **(c)** A reference case model, sensitivity models, and structural sensitivity analyses were conducted in 2016 skipjack assessment, to explore the impact of all possible combinations of model assumptions on assessment results and in the development of management advice. The key uncertainties identified and explored were the assumed level of steepness of the stock-recruitment relationship, the growth function, the weighting of the length composition data, and the tag mixing period. Uncertainty is thus taken into account, meeting SG80. Evaluation of stock status relative to reference points is presented in a probabilistic way, including Kobe plots. SG 100 requirements are met. **(d)** The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored through sensitivity analysis and an analysis of structural uncertainty. Uncertainties were examined in a grid of 54 combination of factors. SG100 is likely met. **(e)** The skipjack stock assessment is internally peer reviewed in the Scientific Committee meeting and in a pre-assessment workshop held at SPC. SG80 is met. While the skipjack assessment has not been directly reviewed externally, skipjack assessments have addressed many of the recommendations provided by the external review of the bigeye assessment. In addition, external review of the purse seine fishery species and size composition estimation has been conducted. However, since there are clear differences between skipjack and bigeye assessments, and no formal external reviews have been conducted for the latest stock assessment, SG100 is not met.
References	Ianelli *et al.* 2011, Pilling and Brouwer 2017, McKechnie *et al.* 2016, WCPFC 2018b

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass** **≥ 80**

A 1.2.2 YELLOWFIN TUNA- WCPO

Evaluation Table for PI 1.1.1 – YFT-WCPO- Stock status

PI 1.1.1		**The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Stock status relative to recruitment impairment**			
	Guidepost	It is **likely** that the stock is above the point where recruitment would be impaired (PRI).	It is **highly likely** that the stock is above the PRI.	There is a **high degree of certainty** that the stock is above the PRI.
	Met?	Y	Y	Y
b	**Stock status in relation to achievement of MSY**			
	Guidepost		The stock is at or fluctuating around a level consistent with MSY.	There is a **high degree of certainty** that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years.
	Met?		Y	Y
Overall PI justification		**(a)** The latest stock assessment for WCPO yellowfin was carried out in 2017 (SC13), including data up to 2015. The WCPFC has adopted 20% of the unfished spawning potential (20%$SB_{F=0}$) as an LRP for yellowfin, which is the default PRI within the MSC guidance. Across the model grid, the median value of SB_{latest} is at 37% $SB_{F=0}$ (where the latest year is 2015), with a <5% probability that it is below the LRP. Recruitment is estimated to have increased in recent years, perhaps as a result of favorable environmental conditions. On this basis there is a 'high degree of certainty' (≥95% probability) that the stock is above the PRI and SG100 is met. **(b)** SC13 used the median values of relative recent spawning biomass (2012-2015) and relative recent fishing mortality over the uncertainty grid to measure the central tendency of stock status. The upper 90th and lower 10th percentiles of the empirical distributions were used to characterize the probable range of stock status. SB_{recent} (2012-15)/SB_{MSY} = 1.41 and SB_{latest} (2015) /SB_{MSY} = 1.39, with the 10th percentiles estimated at 1.05/1.02. Fishing mortality has increased through the time series but has remained below F_{MSY}. The median estimate of F_{recent} (2012-2015)/F_{MSY}= 0.74 and the 90th percentile at 0.97. There is a high degree of certainty (even though with approx. a 90% probability) that the stock is above MSY, thus SG100 is met.		
References		WCPFC 2018c, Medley and Gascoigne 2017		
RBF Required? (✓/×/)		×	**Likely PI Scoring Level (<60, 60-79, ≥ 80)**	**Pass ≥ 80**
Stock Status relative to Reference Points				
		Type of reference point	**Value of reference point**	**Current stock status relative to reference point**
Reference point used in scoring stock relative to PRI (SIa)		Limit reference point SSB_{latest}/SB_0	20%$SB_{F=0}$ (0.20)	SB_{2015}/SB_0 = 0.37

PI 1.1.1	**The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing**		
Scoring Issue	SG 60	SG 80	SG 100
Reference point used in scoring stock relative to MSY (SIb)	SB_{recent}/SB_{MSY}	Median SB_{MSY}=581,400 MT	Median SB_{recent} (2012-15)/SB_{MSY} =1.41 SB_{latest} (2015) /SB_{MSY} = 1.39

Evaluation Table for PI 1.1.2 – YFT-WCPO- Stock rebuilding

PI 1.1.2		**Where the stock is reduced, there is evidence of stock rebuilding within a specified timeframe**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Rebuilding timeframes**			
	Guidepost	A rebuilding timeframe is specified for the stock that is **the shorter of 20 years or 2 times its generation time**. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.		The shortest practicable rebuilding timeframe is specified which does not exceed **one generation time** for the stock.
	Met?	NA		NA
b	**Rebuilding evaluation**			
	Guidepost	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is evidence that the rebuilding strategies are rebuilding stocks, **or it is likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.	There is **strong** evidence that the rebuilding strategies are rebuilding stocks, **or it is highly likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.
	Met?	NA	NA	NA
Overall PI justification		There is currently no information to indicate that the yellowfin tuna stock is reduced or in need of rebuilding.		
References		Medley and Gascoigne 2017, Tremblay-Boyer *et al.* 2017; WCPFC 2018c		
			Likely PI Scoring Level (<60, 60-79, ≥ 80)	NA

Evaluation Table for PI 1.2.1 – YFT-WCPO- Harvest strategy

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	**Harvest strategy design**			
	Guidepost	The harvest strategy is **expected** to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy **work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80.
	Met?	Y	N	N
b	**Harvest strategy evaluation**			
	Guidepost	The harvest strategy is **likely** to work based on prior experience or plausible argument.	The harvest strategy may not have been fully **tested** but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been **fully evaluated** and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met?	Y	Y	N
c	**Harvest strategy monitoring**			
	Guidepost	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Y		
d	**Harvest strategy review**			
	Guidepost			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			Y
e	**Shark finning**			
	Guidepost	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	NR	NR	NR
f	**Review of alternative measures**			
	Guidepost	There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
			are implemented as appropriate.	are implemented, as appropriate.
	Met?	Y	Y	N
Overall PI justification		**(a)** The yellowfin fishery in the Western Pacific is made up of 52% (by weight of catch) purse-seine, 15-20% long-line, and the remainder is a variety of small-scale domestic fisheries (WCPFC 2017a). Different measures are applied to each fleet. The general objective of the WCPFC is to maintain tuna and tuna-like stocks at MSY levels. Conservation & Management Measure (CMM) 2014-06 sets out the objective and principles by which to establish a Harvest Strategy for key fisheries in the WCPO, including a work plan for developing management objectives, adoption of reference points, and development of harvest control rules, and other elements of the HS. In 2017 the Commission adopted an Updated Harvest Strategy Workplan, with a new discussion of management objectives and subsequent development of candidate TRPs for BET and YFT. The objective of the current Harvest strategy (CMM 2018-01) for yellowfin tuna is to maintain the spawning biomass depletion ratio ($SB/SB_{F=0}$) at or above the average for 2012-2015. Management measures (set for years 2018-2021) include limits of FAD sets and fishing days for the purse-seine fleet and catch limits on longlines. Since 2013 the HS has consisted of a series of ad hoc measures targeted more at bigeye, but the WCPFC is putting together a formal and responsive HS and HCR for the tropical tuna stocks. The HS is achieving the objectives, but it cannot be argued yet that it is responsive to the state of the stock or that elements are working together toward the objectives, since it consists of a series of ad hoc measures. Thus, SG60 is likely to be met, but SG80 is not. **(b)** The 2017 SC13 assessment estimated a median F_{recent}/F_{MSY}= 0.74 with a probability <10% that F is above F_{MSY}, showing that the harvest strategy is achieving its objectives. Projections from the stock assessment predict that it is very unlikely (<1%) that the stock would fall below the limit reference point by 2032 and relatively unlikely (<10%) that the stock would fall below B_{MSY} over the same period. The harvest strategy, however, has not been tested or evaluated. SG 80 is likely to be met. **(c)** The WCPFC has systems in place for recording catch and effort for all vessels catching yellowfin tuna in the WCPO. Standardized abundance indices are regularly monitored by the WCPFC Scientific Committee. Estimates of stock abundance are obtained through stock assessments conducted every three years. Abundance indices monitored every year include CPUE for each fleet. The HS includes reducing capacity, increasing the mean size, and reducing catches from the main fisheries. Data to estimate these quantities is also collected. Monitoring is expected to be able to determine whether the HS is working, SG60 is likely to be met. **(d)** According to CMM 14-06, a formal harvest strategy for yellowfin should be put in place. This has, however, not yet been achieved. The current HS (CMM 2017-01) and its precursors have provisions for an annual review to ensure that measures are having the intended effect. The commission meets annually to review the current catch and effort and considers advice from the Scientific Committee on necessary changes to management. SG100 is likely to be met. **(e)** Not applicable, the target species (YFT) is not a shark species. **(f)** Juvenile yellowfin fishing mortality has shown a steady increase since the		

PI 1.2.1	There is a robust and precautionary harvest strategy in place
	1970s due to an increase in purse-seine fishing on FADs. WCPFC should consider measures to reduce fishing mortality from fisheries that take juveniles, with the goal to increase to maximum fishery yields and reduce any further impacts on the spawning potential for this stock in the tropical regions. CMM 2009-02 sets out the WCPFC's rules for catch retention in the high seas, aims to limit discard mortality, and requires reporting of discard events. All purse-seine vessels are required to retain on board all yellowfin tuna caught. Other recent CMMs aim to reduce undesirable catch of juvenile bigeye and purse seine through control of effort on FADs. CCMs and the Commission are encouraged to conduct and promote research to identify ways for purse seine vessels to minimize the mortality of juvenile yellowfin tuna (C-17-01). UoA related mortality of unwanted catch is clearly subject to discussion and review and controls are being implemented, therefore SG80 is likely to be met, but the review is not explicitly biennial, so SG100 is not met. **FIP Recommendation:** A harvest strategy for yellowfin needs to be adopted that includes management action responses to changes in (yellowfin) stock status and harvest control rules aimed at maintaining the stock at or near target reference points.
References	WCPFC 2014a, 2018c, d; Medley and Gascoigne 2017

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass with condition 60-79**

Evaluation Table for PI 1.2.2 – YFT-WCPO- Harvest control rules and tools

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
Scoring Issue		SG 60	SG 80	SG 100
a	HCRs design and application			
	Guide post	**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.	**Well defined** HCRs are **in place** that **ensure** that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock **fluctuating around** a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock **fluctuating at or above** a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, **most** of the time.
	Met?	Y	N	
b	HCRs robustness to uncertainty			
	Guide post		The HCRs are likely to be robust to the main uncertainties.	The HCRs take account of a **wide** range of uncertainties including the ecological role of the stock, and there is **evidence** that the HCRs are robust to the main uncertainties.
	Met?		N	N
c	HCRs evaluation			
	Guide post	There is **some evidence** that tools used **or available** to implement HCRs are appropriate and effective in controlling exploitation.	**Available evidence indicates** that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs.	**Evidence clearly shows** that the tools in use are effective in achieving the exploitation levels required under the HCRs.
	Met?	Y	N	N
Overall PI justification		**(a)** For a harvest control rule to be 'available' (SG60), the MSC requires that the following two conditions are met: 1. Stock biomass has not previously been reduced below the MSY level or has been maintained at that level for a recent period of time that is at least longer than 2 generation times of the species and is not predicted to be reduced below BMSY within the next 5 years. According to the 2017 assessment, stock biomass has not previously been reduced below the MSY level. The assessment did not provide short-term projections, so predicted trajectories over the next five years are unknown; however, current status relative to PRI and MSY (PI 1.1.1 and PI 1.2.1) indicated that the probability of SB or F being below the MSY level is very small, and therefore it is not likely that the biomass will decline below the MSY level in the next 5 years. However, the biomass trajectory has declined consistently throughout the time series. 2. HCRs are effectively used in other stocks by the same management body or an agreement or framework is in place requiring the management body to adopt HCRs before the stock declines below BMSY. This is met for yellowfin through CMM 2014-06, which sets out the objectives and principles by which to establish a Harvest Strategy for key fisheries in the WCPO,		

PI 1.2.2	There are well defined and effective harvest control rules (HCRs) in place
	including a work plan for developing management objectives, adoption of reference points, and development of harvest control rules, and other elements of the HS. In addition, there is progress in the development of elements of the HCR. Notably, limit and interim target reference points have been set for the yellowfin stock. The LRP is 20% of the estimated recent average spawning biomass in the absence of fishing, and, pending agreement on a target reference point, the spawning biomass depletion ratio ($SB/SB_{F=0}$) is to be maintained at or above the average $SB/SB_{F=0}$ for 2012-2015 (CMM 2015-06). The SC shall review this aim by the end of 2018. CMM-2017- 01 sets out the detail of interim management measures between 2018 - 2021, pending a Harvest Strategy being established Also, it recognizes that 'interactions occur between the fisheries for bigeye, yellowfin, and skipjack tuna'. There has been discussion of taking into account the bigeye stock when setting the target reference point, and taking into account socio-economic factors, however, this TRP has not been set yet. The full ecological role of yellowfin may not be taken into account, but the mixed nature of the fishery is being recognized. Harvest control rules are not in place yet, the above elements of the harvest strategy are only interim until 2021. The effort limits are aimed at maintaining the *status quo*, and set out a static effort limit, but do not set out how the effort would be reduced as the LRP is approached. For the HCRs to be well-defined, a long-term harvest strategy should be in place which is explicit about what would happen if the stock were to decrease to the LRP. SG60 is likely to be met, but SG80 is not because HCRs are not yet in place. **(b)** Since the HCR is available rather than in place, it cannot be robust to the main uncertainties. SG80 is not met. **(c)** The main tools by which CMM 2018-01 is implemented for yellowfin are: a 3-5 month ban per year for purse-seine vessels setting on FADs; effort (days) and capacity limits (number of vessels); and longline limits on bigeye (which may limit effort on YFT too). The 2017 assessment used a catch-effort time series through 2015, and the interim HS was implemented in 2014, so the impact through 2018 is still unknown. However, the trajectory in stock biomass has steadily declined, and fishing mortality has not changed despite the tools implemented. Considering that there is some evidence that the tools available to implement the HCR are controlling exploitation, only SG60 is met. SG80 is not met because appropriate exploitation levels are not yet well-defined in the HS. **FIP Recommendations-** (a) To improve this score, demonstrable progress is required towards a formal harvest strategy and HCR (as per CMM 2014-06) such that it is clear that appropriate actions will be taken to reduce the exploitation rate if PRI is approached, and to keep the stock fluctuating around a target level consistent with MSY. (b) HCRs should be designed taking the main uncertainties into account. (c) Progress is required towards the development and adoption of a formal harvest strategy (as per CMM 2014-06) such that it is more clear that management tools are likely to be effective in maintaining a stable biomass at or above reference levels and controlling fishing mortality.
References	MSC 2014; Tremblay-Boyer et al. 2017; WCPFC 2014, 2017, 2018

Likely PI Scoring Level (<60, 60-79, ≥ 80)	Pass with condition 60-79

Evaluation Table for PI 1.2.3 – YFT-WCPO- Information and monitoring

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	Range of information			
	Guide post	**Some** relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	**Sufficient** relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A **comprehensive range** of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Y	Y	N
b	Monitoring			
	Guide post	Stock abundance and UoA removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and UoA removals are **regularly monitored at a level of accuracy and coverage consistent with the harvest control rule**, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	**All information** required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent **uncertainties** in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Y	Y	N
c	Comprehensiveness of information			
	Guide post		There is good information on all other fishery removals from the stock.	
	Met?		Y	
Overall PI justification		**(a)** Catch and effort data are reported and CPUE calculated. Tagging data and size frequency data is also used. (WCPFC 2017a). Fleet composition data is also reported by each CPC. In the 2017 assessment, they have improved purse seine catch estimates, reviewed the catch statistics of the component fisheries, standardized CPUE analyses of operational level catch and effort data, and prepared the tagging data and size composition data (WCPFC 2017a) This data is sufficient to support the harvest strategy, but uncertainties persist, and SG80 is likely to be met. Main uncertainties relate to gaps in the longline observer coverage, the definition of stock boundaries, yellowfin age, growth and maturity, so SG100 is not met. **(b)** A log must be kept of every day fishing, catch and set/haul effort. Other activities must also be recorded such as searching and FAD deployment. This must go to the national authority within 15 days. Fishery removals and effort are monitored per CPC via logsheets from the vessels and submitted to the		

PI 1.2.3	Relevant information is collected to support the harvest strategy
	Commission annually. This is frequent and detailed enough to support the Harvest Strategy, meeting SG80. However, yellowfin stock assessments are only performed every 3 years, and considering that there are still uncertainties in some key inputs, SG100 is not met. (WCPFC 2018c). **(c)** Catches of tunas are measured and monitored well enough by most CPCs and are sufficient for the stock assessment and the harvest strategy. Although monitoring of catches in some areas (e.g., Indonesia, Philippines, Vietnam) still needs improvement, these do not pose an unacceptable risk to the harvest strategy. There are a number of on-going initiatives to strengthen data collection of member states. SG80 is met.
References	Tremblay-Boyer *et al.* 2017; Medley and Gascoigne 2017; Williams 2017; WCPFC 2017, 2018c

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass ≥ 80**

Evaluation Table for PI 1.2.4 – YFT-WCPO- Assessment of stock status

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Appropriateness of assessment to stock under consideration			
	Guide post		The assessment is appropriate for the stock and for the harvest control rule.	The assessment takes into account the major features relevant to the biology of the species and the nature of the UoA.
	Met?		Y	Y
b	Assessment approach			
	Guide post	The assessment estimates stock status relative to generic reference points appropriate to the species category.	The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated.	
	Met?	Y	Y	
c	Uncertainty in the assessment			
	Guide post	The assessment **identifies major sources** of uncertainty.	The assessment **takes uncertainty into account**.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a **probabilistic** way.
	Met?	Y	Y	Y
d	Evaluation of assessment			
	Guide post			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			Y
e	Peer review of assessment			
	Guide post		The assessment of stock status is subject to peer review.	The assessment has been **internally and externally** peer reviewed.
	Met?		Y	N
Overall PI justification		**(a)**The latest (2017) assessment for yellowfin tuna used a Multifan-CL model, which is a size-based, age-structured (28 quarterly age classes) and spatially-structured (9 regions) population model that is able to combine a range of datasets and to model several components. The catch, effort, size composition and tagging data used in the model are classified by 32 fisheries and quarterly time steps from 1952 to 2015. The assessment included a range of model options and sensitivities that were applied to investigate key structural assumptions and sources of uncertainty. The model has undergone multiple reviews and continues to be adapted and refined. The dynamics of the fish population as well as the fishery are taken into account, therefore SG100 is likely to be met. **(b)** Biomass and fishing mortality relative to MSY reference points (F_{MSY}, SB_{MSY}) and		

PI 1.2.4	There is an adequate assessment of the stock status
	depletion-based reference points ($SB_{F=0}$, SB_0) is estimated for this stock, therefore SG80 is met. **(c)** Since the 2014 stock assessments, various recommendations were addressed, such as investigating alternative regional structures, exploring uncertainties in the assessment model, particularly in response to the inclusion of additional years of data, and improving diagnostic weaknesses of previous assessments (WCPFC 2017a). Aging studies have been highlighted as being an area that could still be improved for yellowfin (WCPFC 2017a). For the 2017 stock assessment, over 100 sensitivity runs were conducted to explore the relative impacts of key data and model assumptions for the diagnostic case model on the stock assessment results and conclusions. The grid was used to estimate median and 10% and 90% estimates of parameter values and stock status relative to various reference points. The stock assessment scientists also undertook a structural uncertainty analysis, and estimated probabilities that the biomass is below the LRP and that F is above F_{MSY} to provide management advice (WCPFC 2017a). SG100 is likely to be met. **(d)** The stock assessment tested a range of alternative model structures and inputs, including software, different approaches to CPUE standardization, a different regional structure and different approaches to estimating recruitment, as well as a number of sensitivity tests. These used different assumptions of steepness, tag mixing period, weighting of length- vs. weight-frequency, growth, maturity, and natural mortality: Alternative hypotheses and assessment approaches have been explored and the assessment provides robust results. SG100 is likely to be met. **(e)** An independent review of the bigeye assessment in 2011 has provided developments which have fed into this stock assessment, as well as the 2014 yellowfin assessment recommendations, which had been addressed. The 2017 yellowfin assessment also benefitted from recommendations from the pre-assessment workshop. There have also been internal reviews of the data inputs. Therefore, the current assessment model has been internally reviewed throughout its development and use, and SG80 is likely to be met. However, there has been no formal external review since 2009, so SG100 is not met.
References	Ianelli *et al.* 2011; Medley and Gascoigne 2017; McKechnie *et al* 2016; Pilling *et al.* 2016; WCPFC 2017a, 2018c

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass ≥ 80**

A 1.2.3 BIGEYE TUNA- WCPO

Evaluation Table for PI 1.1.1 – BET-WCPO- Stock status

PI 1.1.1		**The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Stock status relative to recruitment impairment**			
	Guidepost	It is **likely** that the stock is above the point where recruitment would be impaired (PRI).	It is **highly likely** that the stock is above the PRI.	There is a **high degree of certainty** that the stock is above the PRI.
	Met?	Y	Y	Y
b	**Stock status in relation to achievement of MSY**			
	Guidepost		The stock is at or fluctuating around a level consistent with MSY.	There is a **high degree of certainty** that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years.
	Met?		Y	Y
Overall PI justification		**(a**) The latest stock assessment for WCPO bigeye tuna was carried out in 2017 using an integrated assessment model Multifan-CL, with data through 2015. This assessment incorporated an updated growth curve and adjusted the regional structure. A base case assessment was not conducted, but SC14 constructed a grid of 36 model outputs to provide management advice. The main conclusions of the stock assessment are • All models with the updated new growth function resulted in SB estimates above the limit reference point. • All models with the new growth function estimate that recent recruitment has increased spawning potential in the last few years. • The new growth curve and incorporation of a regional structure resulted in more optimistic assessments in 2017/2018 than in 2014. • All models estimated a substantial decline in bigeye abundance and an increase in fishing mortality over the time series. The WCPFC has adopted 20% of the unfished spawning potential (20%$SB_{F=0}$) as a default LRP for bigeye. This is probably a conservative estimate of the PRI, considering that it is ~70% of the median estimate of SB_{MSY} (28%of SB_0). The median and 90/10 percentile values of SB and F from the SC14 uncertainty grid suggest that there is a high probability (36 out of 36 models) that the SB is above the LRP. Thus, SC14 characterized the probability of SB<LRP as 0%. Taking this to be the default PRI (although it is probably higher than the actual PRI), there is a high degree of certainty (≥95% probability) that the stock is above the PRI and SG100 is likely to be met. **(b)** SC14 used the median values of relative recent spawning biomass (2012-2015) and relative recent fishing mortality over the uncertainty grid to measure the central tendency of stock status. The upper 90th and lower 10th percentiles of the empirical distributions were used to characterize the probable range of stock status. The median $SB_{recent\ (2012\text{-}15)}/SB_{MSY}$ = 1.38 (10th percentile= 1.12, Min=0.96). Min is ~2.8% (1/36). Thus, there is a high probability (between 90-97%) that the stock is around MSY. The median estimate of $F_{recent\ (2012\text{-}2015)}/F_{MSY}$= 0.77 (90th percentile=0.93, Max=1.06), with a probability of ~ 6% (or 2 models in 36) that F > F_{MSY}. Median MSY= 159,000 t, Catch (2015) = 152,000 t; current catch is		

PI 1.1.1	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue	SG 60	SG 80	SG 100
	slightly below MSY. There is a high degree of certainty (with approx. a 95% probability) that the stock is at a level consistent with MSY ($SB>SB_{MSY}$, $F<F_{MSY}$, C=~MSY) thus SG80 and SG100 are met.		
References	Medley and Gascoigne 2017; McKechnie *et al.* 2017a, 2017b; Vincent *et al.* 2018; WCPFC 2017a, 2017b, 2018a		
RBF Required? (✓/×/)	×	**Likely PI Scoring Level (<60, 60-79, ≥ 80)**	**Pass ≥ 80**
Stock Status relative to Reference Points			
	Type of reference point	**Value of reference point**	**Current stock status relative to reference point**
Reference point used in scoring stock relative to PRI (SIa)	Limit reference point $SSB_{recent}/SB_{F=0}$ $SSB_{latest}/SB_{F=0}$	$20\%SB_{F=0}$ (0.2)	Median $SB_{recent} = 36\%SB_{F=0} = 1.8LRP$; $SB_{latest} = 42\%SB_{F=0} = 2.1LRP$
Reference point used in scoring stock relative to MSY (SIb)	SB_{recent}/SB_{MSY}	SB_{MSY}=476,050MT	Median SB_{recent}/SB_{MSY} =1.38 SB_{latest}/SB_{MSY} = 1.62

Evaluation Table for PI 1.1.2 – BET-WCPO- Stock rebuilding

PI 1.1.2		**Where the stock is reduced, there is evidence of stock rebuilding within a specified timeframe**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Rebuilding timeframes**			
	Guidepost	A rebuilding timeframe is specified for the stock that is **the shorter of 20 years or 2 times its generation time**. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.		The shortest practicable rebuilding timeframe is specified which does not exceed **one generation time** for the stock.
	Met?	NA		NA
b	**Rebuilding evaluation**			
	Guidepost	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is evidence that the rebuilding strategies are rebuilding stocks, **or it is likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.	There is **strong** evidence that the rebuilding strategies are rebuilding stocks, **or it is highly likely** based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.
	Met?	NA	NA	NA
Overall PI justification		There is currently no information to indicate that the WCPO bigeye tuna stock is reduced or in need of rebuilding.		
References		WCPFC 2018a		
			Likely PI Scoring Level (<60, 60-79, ≥ 80)	NA

Evaluation Table for PI 1.2.1 – BET-WCPO- Harvest strategy

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	**Harvest strategy design**			
	Guidepost	The harvest strategy is **expected** to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy **work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80.
	Met?	Y	N	N
b	**Harvest strategy evaluation**			
	Guidepost	The harvest strategy is **likely** to work based on prior experience or plausible argument.	The harvest strategy may not have been fully **tested** but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been **fully evaluated** and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met?	Y	Y	N
c	**Harvest strategy monitoring**			
	Guidepost	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Y		
d	**Harvest strategy review**			
	Guidepost			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			Y
e	**Shark finning**			
	Guidepost	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	NR	NR	NR
f	**Review of alternative measures**			
	Guidepost	There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
			are implemented as appropriate.	are implemented, as appropriate.
	Met?	Y	Y	N
Overall PI justification		**(a)** The general objective of the WCPFC is to maintain tuna and tuna-like stocks at MSY levels. CMM 2014-06 sets out the objective and principles by which to establish a Harvest Strategy for key fisheries in the WCPO, including a work plan for developing management objectives, adoption of reference points, and development of harvest control rules, and other elements of the HS. In 2017 the Commission adopted an Updated Harvest Strategy Workplan, with a new discussion of management objectives and subsequent development of candidate TRPs for BET and YFT. The objective of the current Harvest strategy (CMM 2018-01) for bigeye tuna is to maintain the spawning biomass depletion ratio ($SB/SB_{F=0}$) at or above the average for 2012-2015. Management measures (set for years 2018-2021) include limits of FAD sets and fishing days for the purse-seine fleet and catch limits on longlines. Since 2013 the HS has consisted of a series of ad hoc measures targeted at bigeye, but the WCPFC is putting together a formal and responsive HS and HCR for all the tropical tuna stocks. The 2017 stock assessment suggests that the status quo is an acceptable short-term biological target for bigeye. SC13 had recommended as a precautionary approach that the fishing mortality should not be increased from current level until an appropriate target reference point (TRP) was agreed. However, the new tropical tuna bridging measures (2017-01 and 2018-01) have weakened management provisions for bigeye compared to the previous measure (2016-01), which was aimed at rebuilding the stock. It is likely that the improved stock status of bigeye tuna is a function of a changed view of the biology of bigeye (growth function and spatial structure in particular), rather than any actual increase in biomass. Thus, the HS is achieving the objectives, but it cannot be argued that it is responsive to the state of the stock or that elements are working together toward the objectives, since it consists of a series of ad hoc measures. Thus, SG60 is likely to be met, but SG80 is not. **(b)** The 2017 stock assessment estimated that $F<F_{MSY}$ with a 77% probability and that B>LRP (20% $SB_{F=0}$) with a probability of 90-97%. Projections from the stock assessment predict that it is relatively unlikely (in the range of 0-18%) that the stock would fall below the LRP by 2045. This suggests that the harvest strategy is achieving its objectives, meeting SG80. Management measures have been adjusted (strengthened from 2013-01 through 2016-01 and then weakened in 2017-01), but it is not clear that they have had a significant impact on the stock (positive or negative) through 2015 (the last year included in the assessment). Although these changes have been implemented, the current HS has not been evaluated, and projections suggest that in the longer term, depending on recruitment, there is a risk that F would increase to unsustainable levels. SG100 is not met. **(c)** The WCPFC has systems in place for recording catch and effort for all vessels catching bigeye tuna in the WCPO. Standardized abundance indices are regularly monitored by the WCPFC Scientific Committee. Estimates of stock abundance are obtained through stock assessments conducted every three years (most recently for Bigeye 2014 and 2017). Abundance indices monitored every year include CPUE for each fleet. The HS includes reducing capacity, increasing the mean size, and reducing catches from the main fisheries. Data to estimate these quantities is also collected. Monitoring is expected to be able to determine whether the HS is working, SG60 is likely to		

PI 1.2.1	There is a robust and precautionary harvest strategy in place
	be met. **(d)** The current harvest strategy (CMM 2018-01) and its precursors have provisions for an annual review to ensure that measures are having the intended effect, but changes are implemented in an ad hoc fashion, rather than based on a formal evaluation of the HS. The commission meets annually to review the current catch and effort and considers advice from the SC on necessary changes to management. The current CMM has been very similar for several years, even though previous stock assessments concluded that the stock was depleted. According to CMM 14-06, a formal harvest strategy for bigeye should be put in place by the WCPFC, with provision for periodic review. This has not occurred yet, but the HS is periodically reviewed and improved. SG100 is likely to be met. **(e)** Not applicable, the target species (bigeye tuna) is not a shark species. **(f)** Juvenile yellowfin and bigeye fishing mortality has shown a steady increase since the 1970s due to an increase in purse-seine fishing on FADs. WCPFC should consider measures to reduce fishing mortality from fisheries that take juveniles, with the goal to increase to maximum fishery yields and reduce any further impacts on the spawning potential for this stock in the tropical regions. According to the stock assessment, overall discarding rates for bigeye are minimal, since it is a valuable target species and here are no requirements for landing sizes or quotas that would result in any unwanted catch. CMM 2009-02 sets out the WCPFC's rules for catch retention in the high seas, aims to limit discard mortality, and requires reporting of discard events. All purse-seine vessels are required to retain on board all bigeye tuna caught. Other recent CMMs aim to reduce undesirable catch of juvenile bigeye and purse seine through control of effort on FADs. CCMs and the Commission are encouraged to conduct and promote research to identify ways for purse seine vessels to minimize the mortality of juvenile yellowfin and bigeye tuna (C-18-01). UoA related mortality of unwanted catch is clearly subject to discussion and review and controls are being implemented, therefore SG80 is likely to be met, but the review is not explicitly biennial, so SG100 is not met. **FIP Recommendation:** A harvest strategy for bigeye tuna needs to be adopted that includes management action responses to changes in (bigeye) stock status and harvest control rules aimed at maintaining the stock at or near target reference points.
References	Medley and Gascoigne 2017; WCPFC 2014a, 2016, 2017a, 2018a, 2018d

Likely PI Scoring Level (<60, 60-79, ≥ 80)	Pass with condition 60-79

Evaluation Table for PI 1.2.2 – BET-WCPO- Harvest control rules and tools

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
Scoring Issue		SG 60	SG 80	SG 100
a	HCRs design and application			
	Guide post	**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.	**Well defined** HCRs are **in place** that **ensure** that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock **fluctuating around** a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock **fluctuating at or above** a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, **most** of the time.
	Met?	Y	N	
b	HCRs robustness to uncertainty			
	Guide post		The HCRs are likely to be robust to the main uncertainties.	The HCRs take account of a **wide** range of uncertainties including the ecological role of the stock, and there is **evidence** that the HCRs are robust to the main uncertainties.
	Met?		N	N
c	HCRs evaluation			
	Guide post	There is **some evidence** that tools used **or available** to implement HCRs are appropriate and effective in controlling exploitation.	**Available evidence indicates** that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs.	**Evidence clearly shows** that the tools in use are effective in achieving the exploitation levels required under the HCRs.
	Met?	Y	N	N
Overall PI justification		**(a)** For a harvest control rule to be 'available' (SG60), the MSC requires that the following two conditions are met: 1. Stock biomass has not previously been reduced below the MSY level or has been maintained at that level for a recent period of time that is at least longer than 2 generation times of the species and is not predicted to be reduced below BMSY within the next 5 years. 2. HCRs are effectively used in other stocks by the same management body or an agreement or framework is in place requiring the management body to adopt HCRs before the stock declines below B_{MSY}. The first condition is met because in the 2017 stock assessment, only the model set with the old growth model and the 2014 regional structure resulted in stock biomass below SB_{MSY}. According to the 2018 update (SC14 uncertainty grid), stock biomass has been above the estimated MSY level throughout the time series. The probability of $SB<SB_{MSY}$ is estimated to be <10%, and the probability that SB<LRP is estimated to be ~0%. The probability of $F>F_{MSY}$ is low, estimated at ~6%. The biomass trajectory is stable or (possibly) increasing in the terminal year and F is fairly stable. The second condition is met for bigeye through CMM 2014-06, which sets out the objectives and principles by which to establish a Harvest Strategy for key fisheries		

PI 1.2.2	There are well defined and effective harvest control rules (HCRs) in place
	in the WCPO, including a work plan for developing management objectives, adoption of reference points, development of harvest control rules, and other elements of the HS. On the basis of these two premises, an HCR can be considered to be 'available' and SG60 is met. However, it is worth noting that the bigeye stock had been overfished up until the results of 2017 assessment, which put it in the green zone of the Kobe plot. This is a function of the new growth model assumptions rather than the effect of management action, which has not actually reduced fishing mortality and is still at record high levels (even if stable). Thus, the current HCR is not expected to reduce the exploitation rate as the PRI is approached. Since HCRs are not 'in place', SG80 is not met. Considering the above arguments, the fishery is likely to receive a marginal conditional pass or to fail. **(b)** Since the HCR is available rather than in place, it cannot be robust to the main uncertainties. SG80 is not met. **(c)** The main tools by which CMM 2018-01 is implemented for bigeye tuna are: a 3-5 month ban per year for purse-seine vessels setting on FADs; effort (days) and capacity limits (number of vessels); and longline catch limits on bigeye. The 2017 assessment used a catch-effort time series through 2015, and the interim HS was implemented in 2014, so the impact through 2018 is still unknown. However, the trajectory in stock biomass has steadily declined, while fishing mortality has apparently stabilized very recently, but is still at a record high despite the tools implemented. Considering that there is some evidence that the tools available to implement the HCR are controlling exploitation, only SG60 is met (marginally). SG80 is not met because appropriate exploitation levels are not yet well-defined under the current HCR. **FIP Recommendations-** (a) To improve this score, demonstrable progress is required towards a formal harvest strategy and HCR (as per CMM 2014-06) such that it is clear that appropriate actions will be taken to reduce the exploitation rate if PRI is approached, and to keep the stock fluctuating around a target level consistent with MSY. (b) HCRs should be designed taking the main uncertainties into account. (c) Similar to (a) progress is required towards the development and adoption of a formal harvest strategy (as per CMM 2014-06) such that becomes clear that management tools are likely to be effective in maintaining a stable biomass at or above reference levels and controlling fishing mortality.
References	McKechnie et al., 2017a, 2017b; WCPFC, 2014a, 2017a, 2018a, 2018d

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass with condition 60-79**

Evaluation Table for PI 1.2.3 – BET-WCPO- Information and monitoring

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	Range of information			
	Guide post	**Some** relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	**Sufficient** relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A **comprehensive range** of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Y	Y	N
b	Monitoring			
	Guide post	Stock abundance and UoA removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and UoA removals are **regularly monitored at a level of accuracy and coverage consistent with the harvest control rule**, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	**All information** required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent **uncertainties** in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Y	Y	N
c	Comprehensiveness of information			
	Guide post		There is good information on all other fishery removals from the stock.	
	Met?		Y	
Overall PI justification		**(a)** Catch and effort data are reported and CPUE calculated. Fleet composition data is also reported by each CPC. In regards of fishery-independent data for bigeye, biological data, tagging and size composition data are incorporated in the assessment, as well as recent age and growth information which has resulted in a major change in the conclusions of the stock assessment (from the red zone of the Kobe plot in the 2011 and 2014 assessments, to the green zone according to the 2017 assessment). Recent work conducted on stock structure has concluded that the assumption of two separate bigeye stocks in the WCPO and the EPO is appropriate. This data is sufficient to support the harvest strategy and SG80 is likely to be met. However, uncertainties persist, particularly related to gaps in the longline observer coverage. Also, there is no fishery-independent biomass indicator, and historical data are imprecise. SG100 is not met. **(b)** A log must be kept of every day fishing, catch and set/haul effort. Other activities must also be recorded such as searching and FAD deployment. This must		

PI 1.2.3	Relevant information is collected to support the harvest strategy
	go to the national authority within 15 days. Fishery removals and effort are monitored per CPC via logsheets from the vessels and submitted annually and used to develop standardized abundance indicators. Formal bigeye stock assessments are carried out approximately every 3 years (2011, 2014, 2017 updated 2018). In between assessments, SPC provide some information on trends in fishery indicators (total catch, nominal CPUE, catch at length and at weight), to guide management. Thus, stock abundance and removals are monitored with sufficient frequency to support the harvest strategy, meeting SG80. However, there are still uncertainties in some key inputs for the stock assessment, particularly the growth models. The SC has emphasized that the 2017 assessment is more uncertain, although more correct in the growth assumptions than previous iterations. Assessments could be carried out more frequently (annually). SG100 is not met. **(c)** Catches of tunas are measured and monitored well enough by most CPC and are sufficient for the stock assessment and the harvest strategy. Although monitoring of catches in some areas (e.g., Indonesia, Philippines, Vietnam) still needs improvement, these do not pose an unacceptable risk to the harvest strategy. There are a number of ongoing initiatives to strengthen data collection of member states. Potential for under-reporting of bigeye catch was noted at the 2017 pre-assessment workshop (PAW), and SPC were requested to add this potential IUU to the catch history. This sensitivity test did not have a significant impact on the assessment. Overall, there is good information on all other fishery removals from the stock and SG80 is met.
References	McKechnie *et al.* 2017a, 2017b; Medley and Gascoigne 2017; Williams 2017; WCPFC 2017a, 2018a, 2018d

Likely PI Scoring Level (<60, 60-79, ≥ 80)	Pass ≥ 80

Evaluation Table for PI 1.2.4 – BET-WCPO- Assessment of stock status

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Appropriateness of assessment to stock under consideration			
	Guide post		The assessment is appropriate for the stock and for the harvest control rule.	The assessment takes into account the major features relevant to the biology of the species and the nature of the UoA.
	Met?		Y	N
b	Assessment approach			
	Guide post	The assessment estimates stock status relative to generic reference points appropriate to the species category.	The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated.	
	Met?	Y	Y	
c	Uncertainty in the assessment			
	Guide post	The assessment **identifies major sources** of uncertainty.	The assessment **takes uncertainty into account**.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a **probabilistic** way.
	Met?	Y	Y	Y
d	Evaluation of assessment			
	Guide post			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			N
e	Peer review of assessment			
	Guide post		The assessment of stock status is subject to peer review.	The assessment has been **internally and externally** peer reviewed.
	Met?		Y	N
Overall PI justification		**(a)** The most recent full stock assessment for WCPO bigeye was in 2017, using an integrated assessment model Multifan-CL. It was updated in 2018, primarily to include new growth data. The assessment incorporated an updated growth curve, resulting from an 8-year age and growth research project for bigeye. The regional structure was also adjusted, by shifting the boundary between the northern temperate regions (regions 1 and 2) and tropical/equatorial regions (regions 3 and 4) from 20°N to 10°N. The new (2017) vs old (2014) growth models and regional structures were used in sensitivity trials. Multifan-CL is able to combine a range of datasets and to model several components, including (i) the dynamics of the fish population (growth, natural mortality, maturity and fecundity, recruitment); (ii) the fishery dynamics; (iii) the dynamics of tagged fish; (iv) the observation models for the data. The data used are		

PI 1.2.4	There is an adequate assessment of the stock status
	classified by 32 fisheries and quarterly time steps from 1952 to 2015. The model stratifies the population into 9 spatial regions and 40 quarterly age-classes, with each fishery having constant selectivity and catchability. The assessment included a range of model options and sensitivities that were applied to investigate key structural assumptions and sources of uncertainty. Two alternative approaches to modelling growth were considered: the 2014 and 2017 growth curve. The assessment model has undergone multiple reviews and continues to be adapted and refined. The dynamics of the fish population as well as the fishery are taken into account in the assessment, thus meeting SG80. However, age and growth of bigeye are quite uncertain, and the growth curve had a major impact on the 2017-18 results. Growth assumptions need to be further investigated, so SG100 is not met. **(b)** Biomass and fishing mortality relative to MSY reference points (F_{MSY}, SB_{MSY}) and depletion-based reference points ($SB_{F=0}$, SB_0) are estimated for the bigeye stock, therefore SG80 is met. **(c)** Since the 2014 stock assessment, various recommendations were addressed, such as investigating alternative regional structures and including results from 8-year age and growth studies for bigeye ("Project 35", "Project 81", and "Project 82"). The 2017 assessment included a range of model options and sensitivities that were applied to investigate key structural assumptions and sources of uncertainty. The main sensitivities retained by SC14 for the uncertainty grid (36 models) were steepness, tag overdispersion, size-frequency weighting, and regional structure. Most importantly, two alternative approaches to modelling growth were considered: the 2014 and 2017growth curve. The grid was used to estimate median and 10% and 90% estimates of parameter values and stock status relative to various reference points. The stock assessment scientists also undertook a structural uncertainty analysis, and estimated probabilities that the biomass is below the LRP and that F is above F_{MSY} to provide management advice. The assessment takes into account uncertainty, meeting SG80. Also, stock status is evaluated relative to reference points in a probabilistic way, so SG100 is likely to be met. **(d)** The stock assessment tested a range of alternative model structures and inputs, including software, different approaches to CPUE standardization, a different regional structure, different approaches to estimating recruitment, and different age models. Sensitivity tests were carried different assumptions of steepness, tag mixing period, weighting of length- vs. weight-frequency, growth, maturity, and natural mortality: Alternative hypotheses and assessment approaches have been explored rigorously and the assessment provides generally robust results. SG100 is not met because the new growth curve has changed radically the perception of stock status (from overfished in 2014 to healthy in 2017), so robustness of the model to changes in the growth assumption remains questionable until this aspect is further examined, and data are updated for a few more years. **(e)** The proposed data and approach from SPC are reviewed in a pre-assessment workshop. The final assessment is then evaluated by the Scientific Committee, who makes a decision on the composition of the uncertainty grid to be used for providing advice. This meets SG80. An external peer review was conducted for the 2011 bigeye assessment, but external reviews for the 2014 or 2017 assessments have not occurred, so SG100 is not met.

PI 1.2.4	There is an adequate assessment of the stock status	
References	Ianelli *et al.* 2011; Medley and Gascoigne 2017; McKechnie *et al.* 2017a, 2017b; Farley *et al.* 2018, Pilling *et al.* 2016; Pilling and Brouwer, 2017, WCPFC, 2017a, 2018a, 2018d; Vincent *et al.* 2018	
	Likely PI Scoring Level (<60, 60-79, ≥ 80)	**Pass ≥ 80**

Principle 2

Evaluation Table for PI 2.1.1 – Primary species outcome

PI 2.1.1		**The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Main primary species stock status**			
	Guide post	Main primary species are **likely** to be above the PRI OR If the species is below the PRI, the UoA has measures in place that are **expected** to ensure that the UoA does not hinder recovery and rebuilding.	Main primary species are **highly likely** to be above the PRI OR If the species is below the PRI, there is either **evidence of recovery** or a demonstrably effective strategy in place **between all MSC UoAs which categorise this species as main**, to ensure that they collectively do not hinder recovery and rebuilding.	There is a **high degree of certainty** that main primary species are above the PRI **and are** fluctuating around a level consistent with MSY.
	Met?	Y	Y	N
b	**Minor primary species stock status**			
	Guide post			Minor primary species are highly likely to be above the PRI OR If below the PRI, there is evidence that the UoA does not hinder the recovery and rebuilding of minor primary species
	Met?			N
Overall PI justification		WCPO: Based on the provided observer data for the WCPO, the 12-year average (2006-2017) total retained catch was 38722.5 MT, with 5% of that at 1936.12 MT. Therefore, there appear to be no main primary species; however, logbook data would likely be needed to confirm this during a full assessment. EPO: The data provided by the client for the EPO does not provide catch data for non-target species by weight but rather by number. To determine the primary species accurately, catch totals by weight would be needed. However, given the low catch numbers, it is likely that there are no primary species. This too would need to be confirmed with additional data during a full assessment.		
References				
RBF		×	**Likely PI Scoring Level**	**≥ 80**

PI 2.1.1	The UoA aims to maintain primary species above the PRI and does not hinder recovery of primary species if they are below the PRI.		
Required? (✓/×/)		(<60, 60-79, ≥ 80)	

Evaluation Table for PI 2.1.2 – Primary species management strategy

PI 2.1.2		There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.		
Scoring Issue		SG 60	SG 80	SG 100
a	**Management strategy in place**			
	Guide post	There are **measures** in place for the UoA, if necessary, that are expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are likely to above the point where recruitment would be impaired.	There is a **partial strategy** in place for the UoA, if necessary, that is expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are highly likely to be above the point where recruitment would be impaired.	There is a **strategy** in place for the UoA for managing main and minor primary species.
	Met?	Y	Y	N
b	**Management strategy evaluation**			
	Guide post	The measures are considered **likely** to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some **objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the fishery and/or species involved.	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Y	Y	N
c	**Management strategy implementation**			
	Guide post		There is **some evidence** that the measures/partial strategy is being **implemented successfully**.	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its overall objective as set out in scoring issue (a).
	Met?		Y	N
d	**Shark finning**			
	Guide post	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	Y	Y	N
e	**Review of alternative measures**			
	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species and they are implemented as appropriate.	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of all primary species, and they are implemented, as appropriate.
	Met?	Not relevant	Not relevant	Not relevant

PI 2.1.2	**There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.**
Overall PI justification	Since there appear to be no main primary species, a strategy is not necessary. However, RFMOs have (or are creating) FAD management plans, which include elements to limit environmental impacts: • Collect and report data on FAD type, usage, and catch per effort (via logbooks and observers) • Enhance monitoring of FAD use and associated bycatch • Improve FAD designs that reduce entanglement and minimize bycatch and marine debris • Implement FAD recovery policies • Adopt management measures, such as limits on the overall number of FADs used and/or FAD sets made • Adopt effective bycatch mitigation measures Both WCPFC and IATTC have and continue to consider various FAD management options. Logbook and observer data show that this fishery regularly interacts with several shark species. The team does not have enough information to assess the likelihood that shark finning is not occurring, and a full assessment would need to consider this in more detail. However, the WCPFC's Conservation and Management Measure (CMM) 2010-07 outlines several requirements relevant to shark finning.
References	Hall and Román-Verdesoto, 2017; ISSF, 2018; Restrepo and Justel-Rubio, 2018; WCPFC, 2016

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**≥ 80**

Evaluation Table for PI 2.1.3 – Primary species information

PI 2.1.3		**Information on the nature and extent of primary species is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Information adequacy for assessment of impact on main primary species**			
	Guide post	Qualitative information is **adequate to estimate** the impact of the UoA on the main primary species with respect to status. OR **If RBF is used to score PI 2.1.1 for the UoA**: Qualitative information is adequate to estimate productivity and susceptibility attributes for main primary species.	Some quantitative information is available and is **adequate to assess** the impact of the UoA on the main primary species with respect to status. OR **If RBF is used to score PI 2.1.1 for the UoA:** Some quantitative information is adequate to assess productivity and susceptibility attributes for main primary species.	Quantitative information is available and is **adequate to assess with a high degree of certainty** the impact of the UoA on main primary species with respect to status.
	Met?	Y	Y	N

PI 2.1.3		Information on the nature and extent of primary species is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species		
b	Information adequacy for assessment of impact on minor primary species			
	Guide post			Some quantitative information is adequate to estimate the impact of the UoA on minor primary species with respect to status.
	Met?			Y
c	Information adequacy for management strategy			
	Guide post	Information is adequate to support **measures** to manage **main** primary species.	Information is adequate to support a **partial strategy** to manage **main** Primary species.	Information is adequate to support a **strategy** to manage **all** primary species, and evaluate with a **high degree of certainty** whether the strategy is achieving its objective.
	Met?	Y	Y	N
Overall PI justification		Some quantitative data are available to assess the UoAs' impact on primary species – main and minor. The information is adequate to determine that a partial strategy is not necessary since there appear to be no main primary species.		
References				
			Likely PI Scoring Level (<60, 60-79, ≥ 80)	≥ 80

Evaluation Table for PI 2.2.1 – Secondary species outcome

PI 2.2.1		The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit.		
Scoring Issue		SG 60	SG 80	SG 100
a	Main secondary species stock status			
	Guide post	Main Secondary species are **likely** to be within biologically based limits. OR If below biologically based limits, there are measures in place expected to ensure that the UoA does not hinder recovery and rebuilding.	Main secondary species are **highly likely** to be above biologically based limits OR If below biologically based limits, there is either **evidence of recovery** or a **demonstrably effective partial strategy** in place such that the UoA does not hinder recovery and rebuilding. AND Where catches of a main secondary species	There is a **high degree of certainty** that main secondary species are within biologically based limits.

PI 2.2.1		The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit.		
			outside of biological limits are considerable, there is either evidence of recovery or a, demonstrably effective strategy in place between those MSC UoAs that also have considerable catches of the species, to ensure that they collectively do not hinder recovery and rebuilding.	
	Met?	Y	Y	N
b	**Minor secondary species stock status**			
	Guide post			Minor secondary species are highly likely to be above biologically based limits. OR If below biologically based limits', there is evidence that the UoA does not hinder the recovery and rebuilding of secondary species
	Met?			N
Overall PI justification		WCPO: Based on the provided observer data for the WCPO, the 12-year average (2006-2017) total retained catch was 38722.5 MT, with 5% of that at 1936.12 MT. Therefore, there appear to be no main secondary species; however, logbook data would likely be needed to confirm this during a full assessment. EPO: The data provided by the client for the EPO does not provide catch data for non-target species by weight but rather by number. To determine the secondary species accurately, catch totals by weight would be needed. However, given the low catch numbers, it is likely that there are no secondary species. This too would need to be confirmed with additional data during a full assessment.		
References				
RBF Required? (✓/×/)		×	**Likely PI Scoring Level (<60, 60-79, ≥ 80)**	**≥ 80**

Evaluation Table for PI 2.2.2 – Secondary species management strategy

PI 2.2.2		There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.		
Scoring Issue		SG 60	SG 80	SG 100
a	**Management strategy in place**			
	Guide post	There are **measures** in place, if necessary, which are expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be within biologically based limits or to ensure that the UoA does not hinder their recovery.	There is a **partial strategy** in place, if necessary, for the UoA that is expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be within biologically based limits or to ensure that the UoA does not hinder their recovery.	There is a **strategy** in place for the UoA for managing main and minor secondary species.
	Met?	Y	Y	N
b	**Management strategy evaluation**			
	Guide post	The measures are considered **likely** to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/species).	There is **some objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the UoA and/or species involved.	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the UoA and/or species involved.
	Met?	Y	Y	N
c	**Management strategy implementation**			
	Guide post		There is **some evidence** that the measures/partial strategy is being **implemented successfully**.	There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a).
	Met?		Y	N
d	**Shark finning**			
	Guide post	It is **likely** that shark finning is not taking place.	It is **highly likely** that shark finning is not taking place.	There is a **high degree of certainty** that shark finning is not taking place.
	Met?	Y	Y	N
e	**Review of alternative measures to minimise mortality of unwanted catch** [Scoring issue need not be scored if are no unwanted catches of secondary species]			
	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of main secondary species.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of main secondary species and	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of all secondary species, and

PI 2.2.2		There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch.		
			they are implemented as appropriate.	they are implemented, as appropriate.
	Met?	Not relevant	Not relevant	Not relevant
Overall PI justification		Since there appear to be no main secondary species, a strategy is not necessary. However, RFMOs have (or are creating) FAD management plans, which include elements to limit environmental impacts: • Collect and report data on FAD type, usage, and catch per effort (via logbooks and observers) • Enhance monitoring of FAD use and associated bycatch • Improve FAD designs that reduce entanglement and minimize bycatch and marine debris • Implement FAD recovery policies • Adopt management measures, such as limits on the overall number of FADs used and/or FAD sets made • Adopt effective bycatch mitigation measures Both WCPFC and IATTC have and continue to consider various FAD management options. Logbook and observer data show that this fishery regularly interacts with several shark species. The team does not have enough information to assess the likelihood that shark finning is not occurring, and a full assessment would need to consider this in more detail. However, the WCPFC's Conservation and Management Measure (CMM) 2010-07 outlines several requirements relevant to shark finning.		
References		Hall and Román-Verdesoto, 2017; ISSF, 2018; Restrepo and Justel-Rubio, 2018; WCPFC, 2016		
			Likely PI Scoring Level (<60, 60-79, ≥ 80)	**≥ 80**

Evaluation Table for PI 2.2.3 – Secondary species information

PI 2.2.3		Information on the nature and amount of secondary species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage secondary species.		
Scoring Issue		SG 60	SG 80	SG 100
a	**Information adequacy for assessment of impacts on main secondary species**			
	Guide post	Qualitative information is **adequate to estimate** the impact of the UoA on the main secondary species with respect to status. OR **If RBF is used to score PI 2.2.1 for the UoA:** Qualitative information is adequate to estimate productivity and susceptibility attributes for main secondary species.	Some quantitative information is available and **adequate to assess** the impact of the UoA on main secondary species with respect to status. OR **If RBF is used to score PI 2.2.1 for the UoA:** Some quantitative information is adequate to assess productivity and susceptibility attributes for main secondary species.	Quantitative information is available and **adequate to assess with a high degree of certainty** the impact of the UoA on main secondary species with respect to status.
	Met?	Y	Y	N
b	**Information adequacy for assessment of impacts on minor secondary species**			
	Guide post			Some quantitative information is adequate to estimate the impact of the UoA on minor secondary species with respect to status.
	Met?			Y
c	**Information adequacy for management strategy**			
	Guide post	Information is adequate to support **measures** to manage **main** secondary species.	Information is adequate to support a **partial strategy** to manage **main** secondary species.	Information is adequate to support a **strategy** to manage **all** secondary species, and **evaluate** with a **high degree of certainty** whether the strategy is **achieving its objective**.
	Met?	Y	Y	N
Overall PI justification		Some quantitative data are available to assess the UoAs' impact on secondary species – main and minor. The information is adequate to determine that a partial strategy is not necessary since there appear to be no main secondary species.		
References				
			Likely PI Scoring Level (<60, 60-79, ≥ 80)	**≥ 80**

Evaluation Table for PI 2.3.1 – ETP species outcome

PI 2.3.1		**The UoA meets national and international requirements for the protection of ETP species** **The UoA does not hinder recovery of ETP species**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Effects of the UoA on population/stock within national or international limits, where applicable** [Scoring issue need not be scored if there are no national or international requirements that set limits for ETP species].			
	Guide post	Where national and/or international requirements set limits for ETP species, the effects of the UoA on the population/stock are known and **likely** to be within these limits.	Where national and/or international requirements set limits for ETP species, the **combined effects of the MSC UoAs** on the population/stock are known and **highly likely** to be within these limits.	Where national and/or international requirements set limits for ETP species, there is a **high degree of certainty** that the **combined effects of the MSC UoAs** are within these limits.
	Met?	Y	N	N
b	**Direct effects**			
	Guide post	Known direct effects of the UoA are likely to not **hinder recovery** of ETP species.	Known direct effects of the UoA are **highly likely** to not **hinder recovery** of ETP species.	There is a high degree of confidence that there are no significant detrimental direct effects of the UoA on ETP species.
	Met?	Y	N	N
c	**Indirect effects**			
	Guide post		Indirect effects have been considered and are thought to be **highly likely** to not create unacceptable impacts.	There is a high degree of confidence that there are no significant detrimental indirect effects of the fishery on ETP species.
	Met?		N	N
Overall PI justification		The MSC Standard requires the consideration of the UoAs' catches of ETP species with regard to national and international catch limits. Where such limits do not exist, the team must consider the likelihood of the UoAs' effect on the species ability to recover (i.e., is the UoA hindering recovery). Without knowing the exact fishing range of the UoAs, the team cannot accurately score this PI since it cannot determine: • Which species' DPSs and/or stocks are relevant to be able to consider stock status compared to the UoAs' catch of that species • Which species have national and/or international limits to know which scoring issue (a or b) to score • If there are combined effects of MSC UoAs (scoring issue a at SG80 and SG100) to be considered However, the UoAs' catch numbers appear to be relatively low so it is likely that its impact on these species is low, but the team feels it is appropriate to score this PI precautionarily so a high likelihood cannot be assigned to any of the scoring issues. Therefore, this PI is likely to score 60-79.		
References				
RBF Required? (✓/×/)		×	**Likely PI Scoring Level (<60, 60-79, ≥ 80)**	**60-79**

Evaluation Table for PI 2.3.2 – ETP species management strategy

PI 2.3.2		**The UoA has in place precautionary management strategies designed to:** • **meet national and international requirements;** • **ensure the UoA does not hinder recovery of ETP species.** **Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species.**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Management strategy in place (national and international requirements)** [Scoring issue need not be scored if there are no requirements for protection or rebuilding provided through national ETP legislation or international agreements].			
	Guide post	There are **measures** in place that minimise the UoA-related mortality of ETP species, and are expected to be **highly likely to achieve** national and international requirements for the protection of ETP species.	There is a **strategy** in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to be **highly likely to achieve** national and international requirements for the protection of ETP species.	There is a **comprehensive strategy** in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to **achieve above** national and international requirements for the protection of ETP species.
	Met?	Y	N	N
b	**Management strategy in place (alternative)** [Scoring issue need not be scored if there are requirements for protection or rebuilding provided through national ETP legislation or international agreements].			
	Guide post	There are **measures** in place that are expected to ensure the UoA does not hinder the recovery of ETP species.	There is a **strategy** in place that is expected to ensure the UoA does not hinder the recovery of ETP species.	There is a **comprehensive strategy** in place for managing ETP species, to ensure the UoA does not hinder the recovery of ETP species
	Met?	Y	N	N
c	**Management strategy evaluation**			
	Guide post	The measures are **considered likely** to work, based on **plausible argument** (e.g., general experience, theory or comparison with similar fisheries/species).	There is an **objective basis for confidence** that the measures/strategy will work, based on **information** directly about the fishery and/or the species involved.	The strategy/comprehensive strategy is mainly based on information directly about the fishery and/or species involved, and a **quantitative analysis** supports **high confidence** that the strategy will work.
	Met?	Y	N	N
d	**Management strategy implementation**			
	Guide post		There is some **evidence** that the measures/strategy is being implemented successfully.	There is **clear evidence** that the strategy/comprehensive strategy is being implemented successfully and is achieving its objective as set out in

PI 2.3.2		**The UoA has in place precautionary management strategies designed to:** • **meet national and international requirements;** • **ensure the UoA does not hinder recovery of ETP species.** **Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species.**		
				scoring issue (a) or (b).
	Met?		Y	N
e	**Review of alternative measures to minimize mortality of ETP species**			
	Guide post	There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of ETP species.	There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of ETP species and they are implemented as appropriate.	There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality ETP species, and they are implemented, as appropriate.
	Met?	Y	N	N
Overall PI justification		The combination of the MMPA and the ESA as well as several relevant CMMs and Resolutions and Recommendations likely constitute measures if not a strategy or even a comprehensive strategy for managing the UoAs' impact on ETP species. Several of the CMMs and Resolutions and Recommendations are specific to minimizing mortality. However, without knowing the exact fishing range of the UoA, the team cannot accurately score this PI since it cannot determine which species have national and/or international limits to know which scoring issue (a or b) should be scored and which SGs are met. Without more information directly about the fishery and/or the species involved, it cannot be said that there is an objective basis for confidence that the measures/strategy will work. However, there is some evidence that the measures/strategy is being implemented successfully. The logbook and observer data show a relatively low level of interaction and subsequent impact on the ETP species. Some CMMs and Resolutions and Recommendations speak to the review and attempts to implement alternative measures (e.g., gear modifications). However, more information is needed to determine the frequency and breadth of the review. Therefore, this PI is likely to score 60-79.		
References				
			Likely PI Scoring Level (<60, 60-79, ≥ 80)	**60-79**

Evaluation Table for PI 2.3.3 – ETP species information

PI 2.3.3		**Relevant information is collected to support the management of UoA impacts on ETP species, including:** • **Information for the development of the management strategy;** • **Information to assess the effectiveness of the management strategy; and** • **Information to determine the outcome status of ETP species.**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Information adequacy for assessment of impacts**			
	Guide post	Qualitative information is **adequate to estimate** the UoA related mortality on ETP species. OR If RBF is used to score PI 2.3.1 for the UoA: Qualitative information is **adequate to estimate productivity and susceptibility** attributes for ETP species.	Some quantitative information is **adequate to assess** the UoA related mortality and impact and to determine whether the UoA may be a threat to protection and recovery of the ETP species. OR If RBF is used to score PI 2.3.1 for the UoA: Some quantitative information is adequate to assess productivity and susceptibility attributes for ETP species.	Quantitative information is available to assess with a high degree of certainty the **magnitude of UoA-related impacts, mortalities and injuries and the consequences for the status** of ETP species.
	Met?	Y	Y	N
b	**Information adequacy for management strategy**			
	Guide post	Information is adequate to support **measures** to manage the impacts on ETP species.	Information is adequate to measure trends and support a **strategy** to manage impacts on ETP species.	Information is adequate to support a **comprehensive strategy** to manage impacts, minimize mortality and injury of ETP species, and evaluate with a **high degree of certainty** whether a strategy is achieving its objectives.
	Met?	Y	N	N
Overall PI justification		There is some quantitative information, which is adequate to assess the UoA-related mortality and impact and to determine whether the UoA may be a threat to ETP species recovery. Logbook and observer coverage data show that the UoA has relatively low impact with ETP species. The available information does not speak to the magnitude of UoA-related impacts, mortalities, and injuries and the consequences for the status of ETP species though. Since it cannot be said that there is a strategy in place given the provided level of information, the SG80 cannot be met for scoring issue b. The information is adequate to support the measures in place to manage the UoAs' impacts on ETP species. Therefore, this PI is likely to score 60-79.		
References				
			Likely PI Scoring Level	**60-79**

PI 2.3.3	**Relevant information is collected to support the management of UoA impacts on ETP species, including:** • **Information for the development of the management strategy;** • **Information to assess the effectiveness of the management strategy; and** • **Information to determine the outcome status of ETP species.**		
		(<60, 60-79, ≥ 80)	

Evaluation Table for PI 2.4.1 – Habitats outcome

PI 2.4.1		The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates.		
Scoring Issue		SG 60	SG 80	SG 100
a	**Commonly encountered habitat status**			
	Guide post	The UoA is **unlikely** to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.	The UoA is **highly unlikely** to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm.
	Met?	Y	Y	N
b	**VME habitat status** [Scoring issue need not be scored if there are no VMEs].			
	Guide post	The UoA is **unlikely** to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.	The UoA is **highly unlikely** to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm.
	Met?	Y	Y	N
c	**Minor habitat status**			
	Guide post			There is **evidence** that the UoA is highly unlikely to reduce structure and function of the minor habitats to a point where there would be serious or irreversible harm.
	Met?			N
Overall PI justification		This fishery operates in deep oceanic waters and uses purse seine gear that is both unassociated and associated with FADs. As noted above, these two types are being assessed as one – the most impacting gear type, which is FADs. Overall, purse seines do not physically impact the seafloor during its operation. Therefore, the effect on pelagic waters would be negligible. Ghost fishing due to lost or discarded gear would impact seafloor habitat. However, since tuna vessels actively attempt to avoid gear loss due to the high cost of replacement, ghost fishing and its effects are also likely to be negligible. In the case of FAD sets, the FADs themselves form part of the habitat so interactions through FAD fishing include changes to naturally occurring FADs caused by fishing as well as the addition of artificial FAD to the pelagic habitat. A number of factors suggest that fishing on FADs or deploying FADs does not have serious or irreversible impacts, including (i) the short residency and aggregation times of fish under FADs imply they are part of a temporary and dynamic process; (ii) in most cases, natural logs are removed from the purse seine, followed by smaller fish to recolonize the logs immediately upon release; and (iii) the number of FADs naturally fluctuate, being created by processes such as storms and eventually sinking. Because the FAD population is not stable, the processes linking populations to FADs are likely to be opportunistic and robust, implying the FAD		

PI 2.4.1	**The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates.**		
	fishery's habitat impact is low. While the fishery overlaps with VMEs, such as coral reefs and seamounts, they would not be affected directly by fishing activities since the fishery operates near the surface in deep oceanic waters. Lost gear and/or FADs could sink or drift onshore and therefore impact coral reefs, mangroves, and seagrass beds. While the overall impact of this has not been quantified, it is likely to be minimal. This PI would likely be scored at ≥80. The SG100 is unlikely to be met because not enough is known about these processes to claim there is evidence with regard to the level of harm.		
References	Medley et al. 2018		
RBF Required? (✓/×/)	×	**Likely PI Scoring Level (<60, 60-79, ≥ 80)**	**≥ 80**

Evaluation Table for PI 2.4.2 – Habitats management strategy

PI 2.4.2		There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.		
Scoring Issue		SG 60	SG 80	SG 100
a	Management strategy in place			
	Guide post	There are **measures** in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a **partial strategy** in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a **strategy** in place for managing the impact of all MSC UoAs/non-MSC fisheries on habitats.
	Met?	Y	Y	N
b	Management strategy evaluation			
	Guide post	The measures are **considered likely** to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/habitats).	There is some **objective basis for confidence** that the measures/partial strategy will work, based on **information directly about the UoA and/or habitats** involved.	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on **information directly about the UoA and/or habitats** involved.
	Met?	Y	Y	N
c	Management strategy implementation			
	Guide post		There is **some quantitative evidence** that the measures/partial strategy is being implemented successfully.	There is **clear quantitative evidence** that the partial strategy/strategy is being implemented successfully and is achieving its objective, as outlined in scoring issue (a).
	Met?		N	N
d	Compliance with management requirements and other MSC UoAs'/non-MSC fisheries' measures to protect VMEs [Scoring issue need not be scored if there are no VMEs].			
	Guide post	There is **qualitative evidence** that the UoA complies with its management requirements to protect VMEs.	There is **some quantitative evidence** that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant.	There is **clear quantitative evidence** that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant.
	Met?	Y	N	N
Overall PI justification		In general, pelagic fisheries do not have habitat management measures and/or a strategy; they are not deemed necessary since the fisheries do not interact with seafloor habitats or VMEs. However, fisheries utilizing FADs should have management measures/strategies so RFMOs have (or are creating) FAD management plans, which include elements to limit environmental impacts: • Collect and report data on FAD type, usage, and catch per effort (via logbooks and observers) • Enhance monitoring of FAD use and associated bycatch • Improve FAD designs that reduce entanglement and minimize bycatch and marine debris		

PI 2.4.2	There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats.
	• Implement FAD recovery policies • Adopt management measures, such as limits on the overall number of FADs used and/or FAD sets made • Adopt effective bycatch mitigation measures Both WCPFC and IATTC have and continue to consider various FAD management options. IATTC requires the use of non-entangling FADs and has provisions in place for FAD recovery. WCPFC promotes the use of non-entangling and biodegradable FADs. These measures can be considered partial strategies for both RFMOs. There is an objective basis for confidence that these partial strategies will work. Several scientists, scientific committees, and organizations (e.g., ISSF) have been involved in the formulation of these measures. The PI is likely to score 60-79 since there is a lack of quantitative evidence that the partial strategies are being implemented successfully and that the UoA complies with other fisheries' measures to protect VMEs.
References	Hall and Román-Verdesoto, 2017; ISSF, 2018; Restrepo and Justel-Rubio, 2018; WCPFC, 2016

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**60-79**

Evaluation Table for PI 2.4.3 – Habitats information

PI 2.4.3		Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.		
Scoring Issue		SG 60	SG 80	SG 100
a	**Information quality**			
	Guide post	The types and distribution of the main habitats are **broadly understood**. OR **If CSA is used to score PI 2.4.1 for the UoA:** Qualitative information is adequate to estimate the types and distribution of the main habitats.	The nature, distribution and **vulnerability** of the main habitats in the UoA area are known at a level of detail relevant to the scale and intensity of the UoA. OR **If CSA is used to score PI 2.4.1 for the UoA:** Some quantitative information is available and is adequate to estimate the types and distribution of the main habitats.	The distribution of all habitats is known over their range, with particular attention to the occurrence of vulnerable habitats.
	Met?	Y	Y	N
b	**Information adequacy for assessment of impacts**			
	Guide post	Information is adequate to broadly understand the	Information is adequate to allow for identification of	The physical impacts of the gear on all habitats

PI 2.4.3		Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat.		
		nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear. OR **If CSA is used to score PI 2.4.1 for the UoA:** Qualitative information is adequate to estimate the consequence and spatial attributes of the main habitats.	the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear. OR **If CSA is used to score PI 2.4.1 for the UoA:** Some quantitative information is available and is adequate to estimate the consequence and spatial attributes of the main habitats.	have been quantified fully.
	Met?	Y	N	N
c	**Monitoring**			
	Guide post		Adequate information continues to be collected to detect any increase in risk to the main habitats.	Changes in habitat distributions over time are measured.
	Met?		N	N
Overall PI justification		The physical, chemical, and biological properties of the pelagic environment within the RFMOs' jurisdictions are monitored, and the habitat itself is adequately mapped in terms of depth and main oceanographic features. Further, the fishing operations and their location are also accurately recorded in relation to those features via VMS and observer coverage. All larger vessels operate a VMS, and thus there is accurate, near real-time monitoring of the spatial extent of interaction and the timing and location of use of the fishing gear. WCPFC and IATTC require 100% coverage for large-scale purse seine vessels. Information on the use and distribution of FADs is not complete, making their level of impact on habitat, especially VMEs, uncertain. More research and data collection are needed in this area. FAD monitoring has been proposed but has not yet been fully implemented. The PI is likely to score 60-79 since there is a lack of information on the distribution and impact of FADs and on any increases in risk to habitats, particularly VMEs.		
References		Medley et al. 2018		
			Likely PI Scoring Level (<60, 60-79, ≥ 80)	**60-79**

Evaluation Table for PI 2.5.1 – Ecosystem outcome

PI 2.5.1		**The UoA does not cause serious or irreversible harm to the key elements of ecosystem structure and function.**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Ecosystem status**			
	Guide post	The UoA is **unlikely** to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	The UoA is **highly unlikely** to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	There is **evidence** that the UoA is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
	Met?	Y	N	N
Overall PI justification		The key impact of the UoA is the removal of high-level predators from the ecosystem. The removal of these tuna species likely influences and alters lower-level species composition, which may lead to reduced growth rates and increase the direct predation of the lower-level species. However, the removal of higher-level predators is thought to be less significant and appears to be creating less of an impact. FAD fishing may impact the ecosystem by selectively removing fish species and sizes that frequently interact with FADs. Additionally, fishing on FADs has significantly expanded the geographical range of purse seine fisheries, potentially impacting portions of the stock that may have previously been unfished, and it may modify species' natural movement and migration patterns (geographically, spatially, and temporally). Due to the congregation of potential prey around FADs, they may also affect the diet of fish since fish may not need to search as much for prey. found that the catch weight of most non-target fish species was higher around FADs. Since man-made FADs are often made of non-natural products such as plastic, they could become marine debris when they breakdown. Plastic can remain in the marine ecosystem for decades, be eaten by marine species, and become entangled in marine species or benthic structures. Ecosystem impacts from FADs are thought to be minimal but are uncertain. Natural FADs (e.g., logs) are unlikely to cause serious or irreversible harm since they have a limited lifespan since they become waterlogged and sink. It is unclear if and how these impacts vary for man-made FADs since they have a longer lifespan through the use of floats and PVC frames to keep them buoyant. Overall, tropical tuna purse seine fisheries probably do not cause significant changes in marine ecosystems. However, the potential of FADs to act as ecological traps', as well as the potential impact of derelict FADs on ecosystem components are still not well understood. Therefore, this PI is likely to score 60-79 since the potential for the UoA to disrupt the key elements underlying the ecosystem structure and function is unclear based on available information.		
References		Bromhead et al., 2003; Connell, 2002; Dagorn et al., 2010; Dempster and Taquet, 2004; Donohue, 2005; Fonteneau et al., 2000; Hallier and Gaertner, 2008; Heithaus et al., 2008; Leroy et al., 2012; Marsac et al., 2000; MRAG, 2014; National Research Council, 2009; Nicol et al., 2009; Romanov, 2002; Taquet et al., 2007		
RBF Required? (✓/×/)		×	**Likely PI Scoring Level (<60, 60-79, ≥ 80)**	**60-79**

Evaluation Table for PI 2.5.2 – Ecosystem management strategy

PI 2.5.2		There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function.		
Scoring Issue		SG 60	SG 80	SG 100
a	**Management strategy in place**			
	Guide post	There are **measures** in place, if necessary which take into account the **potential impacts** of the fishery on key elements of the ecosystem.	There is a **partial strategy** in place, if necessary, which takes into account **available information and is expected to restrain impacts** of the UoA on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	There is a **strategy** that consists of a **plan**, in place which contains measures to **address all main impacts of the UoA** on the ecosystem, and at least some of these measures are in place.
	Met?	Y	Y	N
b	**Management strategy evaluation**			
	Guide post	The **measures** are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ ecosystems).	There is **some objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the UoA and/or the ecosystem involved	**Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the UoA and/or ecosystem involved
	Met?	Y	Y	N
c	**Management strategy implementation**			
	Guide post		There is **some evidence** that the measures/partial strategy is being **implemented successfully**.	There is **clear evidence** that the partial strategy/strategy is being **implemented successfully and is achieving its objective as set out in scoring issue (a)**.
	Met?		N	Y
Overall PI justification		The WCPFC has a conservation and management measure (CMM 2009-02) that enforces a FAD closure in the high-sea areas between 20°S and 20°N, and vessels are prohibited from fishing within one nautical mile of any floating object in this area. This CMM has an indirect effect on the ecosystem since its objective is to reduce catches of juvenile tuna as well as limit effort on target species. IATTC has two relevant resolutions (C-18-05 and C-17-02) that likely have direct and indirect effects on the ecosystem. Additionally, the IATTC requirement to use non-entangling FADs, which are constructed using natural or biodegradable materials, aims to reduce the ecosystem impact of synthetic marine debris. These measures can be considered partial strategies for both RFMOs. In 2017, the RFMOs held a joint meeting on the implementation of an ecosystem-based approach to fisheries management. While the RFMOs see the value in such an approach, there are several issues to work through before full implementation could occur. In the interim, the RFMOs each have some level of ecosystem management. IATTC is developing a five-year strategic research plan that will incorporate several ecosystem components and improve integration of existing research programs and catch trophic levels for three purse-seine fishing methods		

PI 2.5.2	There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function.
	are being monitored as a proxy of ecosystem integrity. Additionally, on an annual basis, IATTC reviews any new ecosystem concepts, data, and research. WCPFC's current five-year strategic research plan (2012-2016) includes research and data collection priorities, one of which is to monitor and assess the WCPO's pelagic ecosystems, and the evaluation of potential management options. There is an objective basis for confidence that these partial strategies will work. Several scientists, scientific committees, and organizations (e.g., FAO, ISSF) have been involved in the formulation of these measures. The PI is likely to score 60-79 since there is a lack of evidence that the partial strategies are being implemented successfully.
References	FAO, 2017; Moreno et al., 2018; Restrepo and Justel-Rubio, 2018

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**60-79**

Evaluation Table for PI 2.5.3 – Ecosystem information

PI 2.5.3		There is adequate knowledge of the impacts of the UoA on the ecosystem.		
Scoring Issue		SG 60	SG 80	SG 100
a	Information quality			
	Guide post	Information is adequate to **identify** the key elements of the ecosystem.	Information is adequate to **broadly understand** the key elements of the ecosystem.	
	Met?	Y	Y	
b	Investigation of UoA impacts			
	Guide post	Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, but **have not been investigated** in detail.	Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, and **some have been investigated in detail**.	Main interactions between the UoA and these ecosystem elements can be inferred from existing information, and **have been investigated in detail**.
	Met?	Y	N	N
c	Understanding of component functions			
	Guide post		The main functions of the components (i.e., P1 target species, primary, secondary and ETP species and Habitats) in the ecosystem are **known**.	The impacts of the UoA on P1 target species, primary, secondary and ETP species and Habitats are identified and the main functions of these components in the ecosystem are **understood**.
	Met?		Y	N
d	Information relevance			
	Guide post		Adequate information is available on the impacts of the UoA on these components to allow some of the main consequences for the ecosystem to be inferred.	Adequate information is available on the impacts of the UoA on the components **and elements** to allow the main consequences for the ecosystem to be inferred.
	Met?		N	N
e	Monitoring			
	Guide post		Adequate data continue to be collected to detect any increase in risk level.	Information is adequate to support the development of strategies to manage ecosystem impacts.
	Met?		N	N
Overall PI justification		Various models are being developed or used to analyze predator-prey relationships, to investigate the influence of different fishing and environmental effects on spatial tuna population dynamics, and to investigate whether climate variability can be estimated. Stomach-content sampling is also being conducted in WCPO and EPO to help understand predator-prey relationships. RFMOs are working to collect data and monitor the ecosystem in order to support potential management measures. With regard to FADs, their distribution is not monitored directly but is often times noted via vessel interaction records, which can		

PI 2.5.3	There is adequate knowledge of the impacts of the UoA on the ecosystem.
	allow for the monitoring of distribution changes over time. The collection of data on species composition around FADs would form a useful part of a FAD management plan to allow for the monitoring of catch composition changes (MRAG, 2014). Information on the key elements of the ecosystem are broadly understood and the main functions of the ecosystem components are known, but further research is needed to be able to infer the UoAs' main impacts on the ecosystem, particularly with regard to FADs. There is also a lack of information on the UoAs' impacts of the UoA on these ecosystem components to allow for some of the main consequences to be inferred. There is also a need for the continued collection of data to be able to detect any increase in risk level. Therefore, this PI is likely to score 60-79.
References	MRAG, 2014

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**60-79**

Principle 3

Evaluation Table for PI 3.1.1 – Legal and/or customary framework

PI 3.1.1		**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainability in the UoA(s); and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Compatibility of laws or standards with effective management**			
	Guide post	There is an effective national legal system **and a framework for cooperation** with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2	There is an effective national legal system and **organised and effective cooperation** with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2.	There is an effective national legal system and **binding procedures governing cooperation with other parties** which delivers management outcomes consistent with MSC Principles 1 and 2.
	Met?	Y	Y	Y
b	**Resolution of disputes**			
	Guide post	The management system incorporates or is subject by law to a **mechanism** for the resolution of legal disputes arising within the system.	The management system incorporates or is subject by law to a **transparent mechanism** for the resolution of legal disputes which is **considered to be effective** in dealing with most issues and that is appropriate to the context of the UoA.	The management system incorporates or is subject by law to a **transparent mechanism** for the resolution of legal disputes that is appropriate to the context of the fishery and has been **tested and proven to be effective**.
	Met?	Y	Y	N
c	**Respect for rights**			
	Guide post	The management system has a mechanism to **generally respect** the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to **observe** the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to **formally commit** to the legal rights created explicitly or established by custom of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.
	Met?	Y	Y	N
Overall PI justification		Article 64 of the United Nations Law of the Sea Convention mandates States to cooperate directly, or through appropriate international organizations, to ensure the conservation of tunas, both within and beyond the EEZ. The WCPFC and the IATTC are responsible for the management and conservation of fisheries for tunas taken by tuna-fishing vessels both outside and within areas of national jurisdiction. The WCPFC Convention, Article 5, states that measures should be adopted that		

PI 3.1.1	**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainability in the UoA(s); and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**
	are designed to restore stocks at levels capable of producing maximum sustainable yield, assess the impacts of fishing, other human activities and environmental factors on target stocks, non-target species, and species belonging to the same ecosystem associated with the HMS stocks. It also states that biodiversity should be protected in the marine environment, and measures should be taken to eliminate over-fishing, reduce waste, discards, pollution from fishing vessels, and catch of non-target species. In Sec. 102 of the Reauthorized MSA 2007, it states that "the United States shall cooperate directly or through appropriate international organizations with those nations involved in fisheries for highly migratory species with a view to ensuring conservation and shall promote the achievement of optimum yield of such species throughout their range, both within and beyond the EEZ." The MSA also states that conservation and management refer to all the regulations that are required to rebuild, restore, or maintain any fishery resource and the marine environment, and assure that irreversible or long-term adverse effects on fishery resources and the marine environment are avoided. NOAA/NMFS is the US government agency responsible for all aspects of the conservation and management of US fisheries. NOAA/NMFS is responsible for carrying out the US policies to manage and conserve marine protected resources. Section 302 of the 1976 Magnuson-Stevens Fishery Conservation and Management Act created eight Regional Fishery Management Councils. The Councils develop fishery management plans and management measures for the US fisheries operating within their adjacent EEZs and for US-flagged fisheries operating on the high seas outside the EEZ. NOAA/NMFS approves and implements these plans and measures in accordance with MSC Principles 1 and 2. The fishery meets the SG 100 level for this scoring issue (3.1.1a). The WCPFC promotes the peaceful settlement of disputes through the Commission but may seek additional dispute resolution mechanisms (legal arbitration) when necessary. Article XXI of the WCPFC Convention states that "the Commission shall promote transparency in its decision-making process and other activities." WCPFC *Convention Annex II* establishes the authority to set up a Review Panel to review decisions made by the Commission to settle disputes among members of the Commission. At the domestic level, NOAA has an extensive Dispute Resolution Process, defined by the Administrative Dispute Resolution Act of 1996, Pub. L. No. 104-320. They have an Alternative Dispute Resolution (ADR) process that consists of several approaches used to resolve conflict other than litigation if possible. The ADR process uses mediation, consultation and facilitated problem solving to resolve disputes in a confidential manner www.wfm.noaa.gov/adr/). The domestic and international level management have a transparent mechanism for dispute resolution and decision-making processes. At the domestic level, this has proven to be tested and effective in other fisheries. At the international level, it is unclear whether this management mechanism has been tested and proven to be effective, therefore the SG 100 level is not met for this scoring issue 3.1.1b). The MSA states that "Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks) take into account the importance of

PI 3.1.1	**The management system exists within an appropriate legal and/or customary framework which ensures that it:** • **Is capable of delivering sustainability in the UoA(s); and** • **Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and** • **Incorporates an appropriate dispute resolution framework.**
	fishery resources to fishing communities by utilizing economic and social data to provide for the sustained participation of such communities and to the extent practicable, minimize adverse economic impacts on such communities." The WPRFMC has developed a FEP that incorporates consideration of community participation and includes an Indigenous Program encouraging participation in Council processes (SCS 2016). WCPFC *Convention Article V takes into account the interests of artisanal and subsistence fishers, Article X* specifies the needs of small developing States, territories, etc. whose economies, food supplies, and livelihoods are dependent of the exploitation of marine resources must be taken in to account, *inter alia,* in developing criteria for allocation of TACs or total level of fishing effort or other management actions; *Article XXX* recognizes the special requirements of developing states. There is little evidence that suggests that the management system has a mechanism to **formally commit** to the legal rights created explicitly or established by custom on people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2. The IATTC and WCPFC have not yet adopted a formal procedure to allocate fishing opportunities to all its Members. This scoring issue is met at the 80 level, but not met at the 100 level (3.1.1c).
References	MSA 2007; MRAG Americas 2018; UNCLOS 1982; WCPFC 2004; U.S Treaty, WPFRMC 2018a; http://www.nmfs.noaa.gov/pr/pdfs/laws/apa.pdf

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**≥ 80**

Evaluation Table for PI 3.1.2 – Consultation, roles and responsibilities

PI 3.1.2		**The management system has effective consultation processes that are open to interested and affected parties.** **The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Roles and responsibilities**			
	Guide post	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **generally understood**.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **explicitly defined and well understood for key areas** of responsibility and interaction.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **explicitly defined and well understood for all areas** of responsibility and interaction.
	Met?	Y	Y	N
b	**Consultation processes**			
	Guide post	The management system includes consultation processes that **obtain relevant information** from the main affected parties, including local knowledge, to inform the management system.	The management system includes consultation processes that **regularly seek and accept** relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.	The management system includes consultation processes that **regularly seek and accept** relevant information, including local knowledge. The management system demonstrates consideration of the information and **explains how it is used or not used**.
	Met?	Y	Y	N
c	**Participation**			
	Guide post		The consultation process **provides opportunity** for all interested and affected parties to be involved.	The consultation process provides **opportunity and encouragement** for all interested and affected parties to be involved, and **facilitates** their effective engagement.
	Met?		Y	Y
Overall PI justification		The IATTC and WCPFC formulate overarching resolutions based on recommendations from scientific committees or staff. Member states negotiate agreements on management mechanisms and, once agreed upon, the actual implementation is left to the individual member and cooperating countries. Articles IX-XVI and XXIII-XXIV of the WCPFC Convention clearly identify individuals involved in the management process and their respective functions. The subsidiary committees formed in the WCPFC Convention also have roles and responsibilities explicitly defined. After further review, there have been some minor issues with the different flag states and how they enforce the different control measures for their vessels. This seems to be related to lack of understanding of the requirements, and therefore the areas of responsibility and interaction are well understood for some,		

PI 3.1.2	**The management system has effective consultation processes that are open to interested and affected parties.** **The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties**
	but not all parts of the management system. The MSA and amendments to the MSA, in addition to other relevant Acts, mandate that the functions, roles and responsibilities are well understood and explicitly defined for key areas of responsibility and interaction. As a member of the Commission, the U.S. is responsible for ensuring that management measures applied within U.S. waters are compatible with those of the WCPFC, and that fishing by US-flagged vessels is carried out in accordance with any measures put in place by WCPFC. The roles of the management process are defined at the domestic and international level of management; however, it is difficult to state that the functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction. Therefore, this fishery meets the SG80 level, but not the SG 100 level (3.1.2a) NOAA has several councils within their organization that regularly seek and accept relevant information, including local knowledge. NOAA Fisheries partners with federal agencies and federally-recognized tribes to advise and collaborate on activities that might impact endangered and threatened species, marine mammals, and important marine habitats. NMFS has also developed a Public Consultation Tracking System (PCTS), which is an information management system covering National Marine Fisheries Service (NOAA Fisheries) consultations under the Endangered Species Act (ESA) and under the Magnuson-Stevens Fishery Conservation and Management Act sections 305(b)(2) & 305(b)(4) Essential Fish Habitat (EFH). Information is publicly available that explains how information and management decisions are made, consultations with the various agencies and inter-agency sectors, council representation, etc. The WCPFC Convention *Article XXII* states that the Commission will consult, cooperate and collaborate with other relevant organizations, particularly those with related objectives and which can contribute to the attainment of the objectives of the Convention. The WCPFC has annual meetings that includes consultation processes with its subsidiary committees and CCMs that regularly seek and accept information. Scientific reports state exactly what information is being used, and justification is provided for all information which is rejected. It is not so clearly reported how other information is used that is not 'scientific', therefore this fishery does not meet the SG 100 level for this scoring issue. The fishery meets the SG80 level for this scoring issue, but not the SG100 (3.1.2b). *Article XXI* of the WCPFC Convention states that The Commission shall promote transparency in the implementation of this Convention in its decision-making process and other activities through facilitating consultations with, and the effective participation of NGOs and IGOs, and shall be afforded the opportunity to participate in the meeting of the Commission and its subsidiary bodies as observers or otherwise appropriate. It also states that such NGOS and IGOs shall have access to pertinent information subject to Commission rules and procedures; and, are permitted to give oral presentations and distribute papers through the Secretariat. Agendas for all meetings related to consultative processes are published in advance on the WCPFC website and other media (MRAG 2018).

PI 3.1.2	**The management system has effective consultation processes that are open to interested and affected parties.** **The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties**
	At the domestic level, the MSA mandates that a transparent process for vetting domestic regulations and related actions be followed that includes all interested stakeholders. The WCPFC, IATTC, WPRFMC and NMFS websites have past and future meetings listed, downloadable agendas, meeting minutes, etc. The fishery meets the SG100 level for this scoring issue (3.1.2c)
References	

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**≥ 80**

Evaluation Table for PI 3.1.3 – Long term objectives

PI 3.1.3		**The management policy has clear long-term objectives to guide decision-making that are consistent with MSC fisheries standard, and incorporates the precautionary approach.**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Objectives**			
	Guide post	Long-term objectives to guide decision-making, consistent with the MSC fisheries standard and the precautionary approach, are **implicit** within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC fisheries standard and the precautionary approach are **explicit** within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC fisheries standard and the precautionary approach, are **explicit** within **and required by** management policy.
	Met?	Y	Y	Partial
Overall PI justification		[The IATTC *Antigua Convention, Article II* of the states that the objective is to ensure the long-term conservation and sustainable use of the fish stocks covered by this Convention, in accordance with the relevant rules of international law. In addition, the Convention states that the members of the Commission shall be cautious, or apply a precautionary approach, in cases where information is uncertain, unreliable or inadequate, regarding conservation and management. The Commission shall revise measures regularly as new scientific information becomes available. The IATTC *Antigua Convention, Article IX* explains the established decision-making process. Consensus of all the members of the Commission is required for decisions on adoptions of most amendments. The *WCPFC Convention* states that the objective is to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean in accordance with the 1995 UN Fish Stocks Agreement (UN 1995) and the 1982 United Nations Convention on the Law of the Sea UNCLOS 1982. The Convention also states that effective management and conservation require the application of the precautionary approach and the best scientific information available. The *WCPFC Convention, Article 20* outlines the established decision-making policies for this area. Again, the general rule for decision making in the Commission shall be by consensus. If all efforts to reach a decision by consensus have been exhausted, the decisions by voting on questions of procedure shall be taken by a majority of those present and voting. While the precautionary approach is a stated requirement for WCPFC, it is less clear how that approach is applied over all policy. Recent stock assessments indicated that bigeye fishing mortality exceeded levels consistent with MSY (SCS 2016). Precautionary limit reference points have been set and CMMs updated, however there is little evidence of precautionary action that has reduced exploitation levels (SCS 2016). The OFP also has clear objectives outlined, which include high-quality scientific information and advice for regional and national fisheries management on the status of, and fishery impacts on, stocks targeted or impacted by regional oceanic fisheries; accurate and comprehensive scientific data and improved understanding of pelagic ecosystems in the western and central Pacific Ocean. On a domestic level, the MSA, National Standards and other legislation include explicit, well-defined short- and long-term objectives for sustainable fishing and conservation. NMFS incorporated precautionary concepts to ensure compliance with the Sustainable Fisheries Act 1996 that includes National Standards for conservation and management of fisheries in the U.S. (MRAG 2018).		
References		MRAG Americas 2018; WCPFC 2014; UNCLOS 1982; MSA 2007; SCS 2016		

PI 3.1.3	**The management policy has clear long-term objectives to guide decision-making that are consistent with MSC fisheries standard, and incorporates the precautionary approach.**		
		Likely PI Scoring Level (<60, 60-79, ≥ 80)	**≥ 80**

Evaluation Table for PI 3.2.1 Fishery-specific objectives

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.		
Scoring Issue		SG 60	SG 80	SG 100
a	**Objectives**			
	Guide post	**Objectives**, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **implicit** within the fishery-specific management system.	**Short and long-term objectives**, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **explicit** within the fishery-specific management system.	**Well defined and measurable short and long-term objectives**, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery-specific management system.
	Met?	Y	Y	Y
Overall PI justification		The MSA authorizes fishery management councils to create FMPs. The WPRFMC developed a FEP, consistent with MSA and the National Standards for fishery management and conservation. The overall goal of the Pacific Pelagic FEP is to establish a framework under which the Council will improve its abilities to realize the goals of the MSA through the incorporation of ecosystem science and principles. To achieve this goal the WPRFMC has developed the following objectives (summarized below): • To maintain biological diversity and productive marine ecosystems and foster the long-term sustainable use of marine resources in an ecologically and culturally sensitive manner using science-based ecosystem approach in management. • To provide adaptive management systems that can quickly address new scientific information, changes in environmental conditions or human use patterns. • To improve public and government awareness of the marine environment in order to reduce unsustainable human impacts and foster support for responsible stewardship. • To encourage and provide for the sustained participation of local communities in the development, conservation and management of marine resources. • To minimize fishery bycatch and waste to the extent practicable. • To manage and comanage protected species, habitats and areas. • To promote the safety of human life at sea. • To encourage and support compliance and enforcement with all applicable local and federal regulations. • To increase collaboration with domestic and foreign regional fishery management and other non-governmental organizations to successfully manage marine ecosystems. • To improve the quantity and quality of available information to support marine ecosystem management. The *WCPFC Convention, Article 5,* states that the objective is to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks. The WCPFC exercise management control into the high seas' zones outside national EEZs. The United States has supported efforts by the IATTC and WCPFC by implementing conservation and management measures adopted by RFMOs. These efforts include mirroring the IATTC to control effort in the tuna purse seine fishery		

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.
	and reduce impacts to other species such as sea turtles, sharks, seabirds, and juvenile tunas. Other efforts include time/area closures to reduce the catch of juvenile tunas and required retention of tuna caught in the purse seine fishery. In the WCPFC, these conservation and management measures include limits on the number of days purse seiners can spend fishing in certain areas, seasonal prohibition of the use of FADs by purse seine vessels, closure of specific high seas area in the Western and Central Pacific to purse seine vessels, requirement for purse seine vessels to retain certain tuna species, as well as observer requirements and handling requirements in case the catch a sea turtle (www.fisheries.noaa.gov). WCPFC CMM 2017-01, CMM 2008-01, IATTC C-18-05, IATTC C-17-02 are examples of conservation measures implemented to meet these objectives for this fishery.
References	IATTC 2003; WCPFC 2004; WCPFC CMMs; SCS 2016; MRAG Americas 2018; MSA 2007

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**≥ 80**

Evaluation Table for PI 3.2.2 – 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.		
Scoring Issue		SG 60	SG 80	SG 100
a	**Decision-making processes**			
	Guide post	There are some decision-making processes in place that result in measures and strategies to achieve the fishery-specific objectives.	There are **established** decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	
	Met?	Y	Y	
b	**Responsiveness of decision-making processes**			
	Guide post	Decision-making processes respond to **serious issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	Decision-making processes respond to **serious and other important issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	Decision-making processes respond to **all issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
	Met?	Y	Y	N
c	**Use of precautionary approach**			
	Guide post		Decision-making processes use the precautionary approach and are based on best available information.	
	Met?		Y	
d	**Accountability and transparency of management system and decision-making process**			
	Guide post	Some information on the fishery's performance and management action is generally available on request to stakeholders.	**Information on the fishery's performance and management action is available on request**, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	Formal reporting to all interested stakeholders **provides comprehensive information on the fishery's performance and management actions** and describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
	Met?	Y	Y	N
e	**Approach to disputes**			
	Guide	Although the management authority or	The management system or fishery is attempting to	The management system or fishery acts proactively

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.		
	post	fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery.	comply in a timely fashion with judicial decisions arising from any legal challenges.	to avoid legal disputes or rapidly implements judicial decisions arising from legal challenges.
	Met?	Y	Y	Y
Overall PI justification		The WCPFC and the IATTC are responsible for the management and conservation of fisheries for tunas taken by tuna-fishing vessels both outside and within areas of national jurisdiction. These two RFMOs agree to establish and maintain consultation, cooperation and collaboration in areas involving exchange of data and information, collaboration on research efforts relating to stocks and species of mutual interest and conservation and management measures (Memorandum of Understanding IATTC and WCPFC). The IATTC *Antigua Convention, Article IX* explains the established decision-making process. Consensus of all the members of the Commission is required for decisions on adoptions of most amendments. The *WCPFC Convention, Article 20* outlines the established decision-making policies for this area. In addition to the WCPFC and IATTC collaboration, the management of tuna fisheries across the WCPO involves several national and international agreements and bodies. The key components to the U.S. purse seine tuna fishery include: • The Parties to the Nauru Agreement (PNA) • South Pacific Tuna Treaty (SPTT) • The Pacific Islands Forum Fisheries Agency (FFA) (not a regulatory body but plays a crucial role in providing technical assistance to members) (SCS 2016). The fishery meets the SG 100 level for this scoring issue (3.2.2a). Decision-making processes are in place at both the international and domestic level. Advice is received from several different scientific bodies and experts, including local participation, and relevant research and monitoring are evaluated regularly in order to ensure the effective monitoring and conservation of the bigeye, yellowfin and skipjack species of tuna. Although the decision-making processes are in place and respond to most serious issues at both the national and international level, it is not clear that these processes respond to ALL issues for the U.S. purse seine tuna fishery. There is not enough evidence to meet the '100' level for this scoring issue. The fishery meets the SG80 level, but not the SG 100 level for this scoring issue (3.2.2b). Precautionary management is the primary theme in managing HMS species and is called for by the MSA, FAO's Code of Conduct for Responsible Fisheries (FAO 1995), United Nations' "Highly Migratory Species and Straddling Stocks Agreement" and regional agreements, such as the Multi-Lateral High-Level Conference for Conservation and Management of Highly Migratory Species of the Central and Western Pacific (MHLC) (PFMC 2018). The fishery meets the SG80 level for this scoring issue (3.2.2c). The WPRFMC, IATTC and WCPFC maintain public websites with reports, scientific papers and data, meeting minutes and upcoming meetings all available for		

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.
	download. The RFMOs also have a published IUU list and a record of eligible fishing vessels. Interested stakeholders are able to access information in a number of ways on the management actions and the overall performance of the fishery. Even though meeting minutes, reports and agendas are available, there is no formal explanation that ensures that all parts of the decision-making process have been disclosed, nor is there evidence that the management decisions represent all the information presented. The fishery meets the SG 80 level for this scoring issue, but not the SG 100 level (3.2.2d). At the domestic level, NOAA has an extensive Dispute Resolution Process, defined by the Administrative Dispute Resolution Act of 1996, Pub. L. No. 104-320. They have an Alternative Dispute Resolution (ADR) process that consists of several approaches used to resolve conflict other than litigation if possible. The ADR process uses mediation, consultation and facilitated problem solving to resolve disputes in a confidential manner www.wfm.noaa.gov/adr/). Both the IATTC and the WCPFC operate under charters specifying voting rules and procedures. However, decisions are usually made by consensus of the member states. There also are dispute resolution mechanisms. Additionally, dispute resolution through litigation and the courts is available. Any such disputes are to be well documented and readily available to appropriate parties. The management system at the international level incorporates transparent mechanisms in decision making processes and other activities. WCPFC Convention Annex II establishes the authority to set up a Review Panel to review decisions made by the Commission to settle disputes among members of the Commission. It should be noted that, to the assessment team's knowledge, no current legal disputes are occurring in the skipjack, yellowfin and bigeye U.S. purse seine fishery, nor is there evidence of non-compliance that threatens the conservation and sustainability objectives. The U.S. purse seine is managed with transparency, uses a precautionary approach and the management processes are responsive to issues identified through monitoring, evaluation and consultation. Both the international and national level of management meet the SG100 level for this scoring issue (3.3.3e).
References	SCS 2016; MRAG Americas 2018; IATTC 2003; WCPFC 2004; UNCLOS 1982

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**≥ 80**

Evaluation Table for PI 3.2.3 – Compliance and enforcement

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.		
Scoring Issue		SG 60	SG 80	SG 100
a	MCS implementation			
	Guide post	Monitoring, control and surveillance **mechanisms** exist, and are implemented in the fishery and there is a reasonable expectation that they are effective.	A monitoring, control and surveillance **system** has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.	A **comprehensive** monitoring, control and surveillance system has been implemented in the fishery and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.
	Met?	Y	Y	N
b	Sanctions			
	Guide post	Sanctions to deal with non-compliance exist and there is some evidence that they are applied.	Sanctions to deal with non-compliance exist, **are consistently applied** and thought to provide effective deterrence.	Sanctions to deal with non-compliance exist, are consistently applied and **demonstrably** provide effective deterrence.
	Met?	Y	N	N
c	Compliance			
	Guide post	Fishers are **generally thought** to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.	**Some evidence exists** to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.	There is a **high degree of confidence** that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery.
	Met?	Y	Y	N
d	Systematic non-compliance			
	Guide post		There is no evidence of systematic non-compliance.	
	Met?		Y	
Overall PI justification		The vessels pursing skipjack, bigeye and yellowfin in this fishery are considered large-scale purse seiners. All fishers pursing HMS species in the U.S. must have a permit to harvest tuna and must keep logbooks documenting their catch. Gear restrictions and operational requirements are in place to minimize bycatch, and all large purse seine vessels are required to have 100% observer coverage. There are several regulations and permit requirements in place both nationally and internationally regarding skipjack, yellowfin and bigeye tuna, as well as additional regulations required for fishing on FADs. Currently the U.S. purse seine fleet in the Pacific is managed as part of international agreements with the RFMOs and is regulated by NMFS High Seas Fishing Compliance Act. The High Seas Fishing Compliance Act, adopted in March 1996, requires that all U.S. commercial fishing vessels that fish on the high seas (outside the U.S EEZ, or 200nm) have a High Seas Fishing Compliance Act Permit (HSFCA). HMS vessels that have this permit for fishing beyond 200 nm of the U.S. are required to have VMS tracking. The		

PI 3.2.3	Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.
	WPRFMC has also developed management measures applicable to the purse seine fishery in the Western Pacific Region. In EEZ waters around American Samoa, vessels over 50 ft. in length are prohibited from fishing within 50 nm of shore. Many of the CMMs established by WCPFC and IATTC put clear obligations on parties as the flag states. Ultimately, it is the flag State that is responsible to the relevant RFMO for any failure to ensure that its measures are implemented and for the resulting violations of those measures by that State's vessels. The FEP for the Pelagic Fisheries of the Western Pacific requires fishermen to have a permit to harvest tuna and keep logbooks documenting their catch. A Foreign EEZ Form is also required for U.S. Vessels used for Commercial Fishing for HMS in the WCPFC in Areas under the Jurisdiction of any Nation other than the United States (NOAA Fisheries 50 CFR Part 300 Subpart O). A valid WCPFC Area Endorsement is required for any fishing vessel of the United States used for commercial fishing for HMS on the high seas in the WCPFC. The WCPFC Area Endorsement expires upon the expiration of the HSFCA permit (NOAA 2018). All vessels fishing HMS are required to fill out logbooks and return them to the Southwest Fisheries Science Center within 30 days if landed in the United States. In the IATTC, all U.S. commercial vessels that fish for tuna or tuna-like species in the IATTC Convention must be listed as active or authorized on the Regional Vessel Register (RVR) (NOAA 2017). An AIDCP approved observer is required when fishing in all areas of the IATTC Convention Area including the area of overlap between the IATTC and WCPFC (NOAA 2017). *FAD Regulations* NMFS issued identification regulations under the authority of the Tuna Conventions Act of 1950, to implement two Resolutions adopted by the IATTC in 2016, which became effective January 1, 2017 (NOAA 50 CFR 300.25). These regulations are listed below and apply to all U.S. commercial purse seine vessels used to fish for tuna or tuna-like species: 1. *For each FAD deployed or modified on or after January 1, 2017, in the IATTC Convention Area (except the Overlap Area), the vessel owner or operator must either: obtain a unique code from NMFS West Coast Region, Highly Migratory Species Branch); or use an existing unique identifier associated with the FAD (e.g., the manufacturer identification code for the attached buoy).* 2. *U.S. purse seine vessel owners and operators shall ensure the characters of the unique code or unique identifier be marked indelibly at least five centimeters in height on the upper portion of the attached radio or satellite buoy in a location that does not cover the solar cells used to power the equipment. For FADs without attached radio or satellite buoys, the characters shall be on the uppermost or emergent top portion of the FAD. The vessel owner or operator shall ensure the marking is visible at all times during daylight. In circumstances where the on-board observer is unable to view the code, the captain or 3 crew shall assist the observer (e.g., by providing the FAD identification code to the observer).* a. *FAD data reporting for purse seine vessels. U.S. vessel owners and operators must ensure that any interaction or activity with a FAD is reported using a standard format provided by the NMFS West Coast Region, Highly Migratory Species Branch* Monitoring, control and surveillance are carried out across the fishing sectors to ensure observance of regulatory and statute requirements. Monitoring, control and

PI 3.2.3	Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.
	surveillance actions include: • Fishing permit requirements • Fishing permit and fishing vessel registers • Vessel and gear marking requirements • Fishing gear and method restrictions • Reporting requirements for catch, effort, and catch disposition • Vessel inspections • Record keeping requirements • Auditing of licensed fish buyers • Control of transshipment • Monitored unloads of fish • Information management and intelligence analysis • Analysis of catch and effort reporting and comparison with landing and trade data to confirm accuracy • Boarding and inspection by fishery officers at sea • Aerial and surface surveillance, • Any other measures agreed by WCPFC • VMS/EMTU for vessels with High Seas Permits under the High Seas Fisheries Compliance Act The fishery meets the SG 100 level for this scoring issue (3.2.3a). Penalties for fisheries related fisheries related violations include fines; forfeiture of fish, vessels, other property and quota; and imprisonment. With respect to permit sanctions, where applicable, the statutes that NOAA enforces generally provide broad authority to suspend or revoke permits. The IATTC *Antigua Convention, Article XVIII* states that the IATTC shall take appropriate measures to ensure the implementation of and compliance with this Convention and any conservation and management measures adopted, including the adoption of the necessary laws and regulations. Each party, through the Director, shall inform the Committee for the review of legal and administrative provisions, including those regarding infractions and sanctions, as well as actions taken to ensure compliance with conservation and management. *WCPFC Convention Article XXV* establishes that each member of the Commission shall enforce the provisions of the Convention and any conservation and management measures issued by the Commission, Article XXVI establishes boarding and inspection procedures, Article XXVII establishes port-state inspection procedures which allows the port-state to prohibit landings and transshipment of catch and transshipment of catch taken through non-compliance, and Article XXIX outlines procedures for in-port and at-sea transshipment. Members of both RFMOs shall not grant a vessel authorization to fish if it is on the respective Convention's IUU vessel list. A range of sanctions exist to deal with non-compliance for the IATTC and WCPFC. Conservation measures are set by the RFMOs, but enforcement is carried out by national authorities. The 'blacklisting' of vessels on IUU lists has become common practice among all RFMOs, including the IATTC and WCPFC. There are sanctions in place both at the national and international level, however there is not enough evidence to say that these sanctions are consistently applied, especially internationally. The SG 60 level is met, however the SG 80 or SG100 is met

PI 3.2.3	Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with.
	(3.2.3b). Logbook data are supplied as part of license requirements; VMS and observer reports also provide evidence of general compliance. In 2017, the WCPFC released the Compliance Monitoring Scheme (CMS) to ensure that CCMs implement and comply with obligations arising under the Convention and CMMs. The CMS is designed to: assess compliance; identify areas in which technical assistance or capacity building may be needed to attain compliance; respond to non-compliance through remedial options; and monitor and resolve outstanding instances of non-compliance (WCPFC 2017b). The Commission, specifically the Technical Compliance Committee (TCC) has the role of reviewing and monitoring compliance of the Commission's conservation measures. Evaluations of a member's compliance are done annually with respect to spatial and temporal closures, observer and VMS coverage and provision of scientific data, and catch and effort limits and reporting for target species. Identified infringements are reported. Not all fisheries comply and clearly there is some noncompliance by some vessels as reported by the TCC. ISSF's PVR database and routine audits for the large-scale purse seine fishery is a tool that helps ensure compliance with the tuna regulations nationally and internationally. The fishery meets the SG80 level for this scoring issue, however it cannot be said with a high degree of confidence that fishers comply with the management system, thus the SG100 level is not met (3.3.3c). To the assessment team's knowledge, there is no evidence that there is systematic non-compliance at the domestic or international management level; thus, this fishery meets the SG80 level for this scoring issue (3.2.3d).
References	SCS 2016, MRAG Americas 2018; IATTC 2003; WCPFC 2004

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**60-79**

Evaluation Table for PI 3.2.4 – Monitoring and management performance evaluation

PI 3.2.4		**There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives.** **There is effective and timely review of the fishery-specific management system.**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Evaluation coverage**			
	Guide post	There are mechanisms in place to evaluate **some** parts of the fishery-specific management system.	There are mechanisms in place to evaluate **key** parts of the fishery-specific management system	There are mechanisms in place to evaluate **all** parts of the fishery-specific management system.
	Met?	Y	Y	N
b	**Internal and/or external review**			
	Guide post	The fishery-specific management system is subject to **occasional internal** review.	The fishery-specific management system is subject to **regular internal** and **occasional external** review.	The fishery-specific management system is subject to **regular internal** and **external** review.
	Met?	Y	Y	N
Overall PI justification		The WCPFC Commission supports three subsidiary bodies where evaluation occurs: 1) Scientific Committee, 2) the Technical and Compliance Committee, and 3) Northern Committee, which each meet annually. Stakeholder input and external scientific experts are also a part of the evaluation process. The IATTC includes a Scientific Advisory Committee, Committee for the Review of Implementation of Measure, external scientific experts and stakeholder testimony. The U.S. identifies research and management priorities through its own NMFS and WPRFMC processes. There are mechanisms in place to evaluate key parts of the fishery-specific management system, however it is not evident that there are mechanisms in place for evaluation of all parts of the management system. The SG80 level is met, but not the SG 100 level for this scoring issue (3.2.4a). U.S. fisheries management systems also have systems in place that enable regular review, in particular through regional management councils. For the WCPFC, management is subject to numerous internal and external reviews including: 1) those by the Scientific Committee established by WPCFC Convention *Article XII*, the IATTC, and frequently other scientific experts to review stock assessments, status of target, non-target and associated stocks, and scientific information and advice that may be provided by the Commission; 2) the Technical and Compliance Committee provides the Commission with information, technical advice, and recommendations related to the implementation and compliance with CMMs; 3) Convention Article XIII provides for the Commission to engage external scientific experts to carry out periodic peer reviews of scientific information and advice provided by the Commission; 4) Members transmit to the Commission an annual statement of compliance measures, including imposition of sanctions it has taken for any violations; 5) the business and meetings of the WCPFC are transparent and conducted annually and as a consequence, the status of conservation and management objectives are the subject of review of public opinion and subsequent political ramifications; and 6) scientific advice and review specific to North Pacific albacore are provided by the ISC to the Northern Committee. The IATTC also has numerous internal and occasional external reviews including: 1) comprehensive review functions and responsibilities of the Scientific Advisory Committee (established under Antigua Convention Article XI); 2) review functions and responsibilities of the Committee for the Review of Implementation of Measures (established under Antigua Convention Article XVIII) are set forth in Annex 3 of the		

PI 3.2.4	**There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives.** **There is effective and timely review of the fishery-specific management system.**
	Antigua Convention; 3) the Commission may engage external scientific experts to carry out periodic peer reviews of scientific information and advice provided by the Commission may; and 4) the business and meetings of the IATTC are transparent and conducted annually and as a consequence, the status of conservation and management objectives are the subject of review of public opinion and subsequent political ramifications. The fishery-specific management system is subject to regular internal review, however only occasional external review occurs at the international level. This does not meet the SG 100 Level (3.2.4b).
References	IATTC 2003; WCPFC 2004; UNCLOS 1982; SCS 2016; MSA, WPFRMC 2018a

Likely PI Scoring Level (<60, 60-79, ≥ 80)	**≥ 80**