Monterey Bay Aquarium Seafood Watch®

Large Pelagics

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North Pacific, South Pacific, Western Central Pacific

Drifting longlines

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Disclaimer

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Seafood Watch Standard used in this assessment: Standard for Fisheries vF3

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About Seafood Watch

Monterey Bay Aquarium's Seafood Watch program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from www.seafoodwatch.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Watch Assessment. Each assessment synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives" or "Avoid." This ethic is operationalized in the Seafood Watch standards, available on our website here. In producing the assessments, Seafood Watch seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch's sustainability recommendations and the underlying assessments will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Watch assessments in any way they find useful.

Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished[1] or farmed that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

The following guiding principles illustrate the qualities that fisheries must possess to be considered sustainable by the Seafood Watch program (these are explained further in the Seafood Watch Standard for Fisheries):

- Follow the principles of ecosystem-based fisheries management.
- Ensure all affected stocks are healthy and abundant.
- Fish all affected stocks at sustainable levels.
- Minimize bycatch.
- Have no more than a negligible impact on any threatened, endangered or protected species.
- Managed to sustain the long-term productivity of all affected species.
- Avoid negative impacts on the structure, function or associated biota of aquatic habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.

These guiding principles are operationalized in the four criteria in this standard. Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and rating

Once a rating has been assigned to each criterion, we develop an overall recommendation. Criteria ratings and the overall recommendation are color coded to correspond to the categories on the Seafood Watch pocket guide and online guide:

Best Choice/Green: Are well managed and caught in ways that cause little harm to habitats or other wildlife.

Good Alternative/Yellow: Buy, but be aware there are concerns with how they're caught.

Avoid/Red Take a pass on these for now. These items are overfished or caught in ways that harm other marine life or the environment.

[1] "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates

Summary

This report focuses on blue shark, shortfin mako shark, blue, black, and striped marlin, and opah caught in drifting longline fisheries within the western and central Pacific Ocean (WCPO), North Pacific and South Pacific that target that target tuna and swordfish. This report excludes all MSC certified fisheries that are Parties to the Nauru Agreement (PNA) operating in this region.

Populations of blue marlin throughout their range in the Pacific are healthy and fishing mortality rates are currently sustainable. Blue sharks in the WCPO and shortfin mako sharks in the North Pacific and WCPO also are healthy with sustainable fishing mortality rates. Blue and shortfin mako sharks in the South Pacific and striped marlin rangewide are overfished with overfishing occurring. There is no information on the stock status or fishing mortality of black marlin and opah, but their populations do not appear to be vulnerable to fishing mortality.

Tunas, other billfish, fish, sharks, seabirds, sea turtles, and marine mammals are incidentally caught in pelagic longline fisheries. Discard rates of these species vary from only 5% for tunas to 96% for sea turtles.

The Western and Central Pacific Fisheries Commission (WCPFC) manages tuna and tuna-like species, including billfish and sharks, in the WCPO. There are few management measures in place for target species included in this report, and no formally adopted reference points or harvest control rules are currently in place.

Pelagic longline gear typically has little to no contact with bottom habitats but does interact with ecologically important species, which could cause negative effects to the ecosystem.

Final Seafood Recommendations

SPECIES | FISHERY	CRITERION 1: Impacts on the Species	CRITERION 2: Impacts on Other Species	CRITERION 3: Management Effectiveness	CRITERION 4: Habitat and Ecosystem	OVERALL RECOMMENDATION
Black marlin /Western Central Pacific | Drifting longlines	Yellow (2.644)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (1.788)**
Black marlin /South Pacific | Drifting longlines	Yellow (2.644)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (1.788)**
Black marlin /North Pacific | Drifting longlines	Yellow (2.644)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (1.788)**
Blue marlin /North Pacific | Drifting longlines	Green (4.284)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (2.018)**
Blue marlin /South Pacific | Drifting longlines	Green (4.284)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (2.018)**
Blue marlin /Western Central Pacific | Drifting longlines	Green (4.284)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (2.018)**
Blue shark /North Pacific | Drifting longlines	Green (4.284)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (2.018)**
Blue shark /South Pacific | Drifting longlines	Red (1.000)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (1.402)**
Opah /North Pacific | Drifting longlines	Yellow (2.644)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (1.788)**

Opah /South Pacific | Drifting longlines	Yellow (2.644)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (1.788)**
Opah /Western Central Pacific | Drifting longlines	Yellow (2.644)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (1.788)**
Shortfin mako shark /North Pacific | Drifting longlines	Green (4.284)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (2.018)**
Shortfin mako shark /South Pacific | Drifting longlines	Red (1.000)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (1.402)**
Shortfin mako shark /Western Central Pacific | Drifting longlines	Green (4.284)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (2.018)**
Striped marlin /North Pacific | Drifting longlines	Red (1.000)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (1.402)**
Striped marlin /South Pacific | Drifting longlines	Red (1.732)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (1.609)**
Striped marlin /Western Central Pacific | Drifting longlines	Red (1.000)	Red (1.000)	Red (1.000)	Green (3.873)	**Avoid (1.402)**

Summary

All sharks, marlins and opah in the WCPO caught with drifting longlines have an avoid rating. Species include black marlin, blue marlin, striped marlin, shortfin mako shark, and blue shark. The avoid ratings are driven by bycatch of highly vulnerable taxa and either lack of management of the target species or have poor bycatch management and mitigation.

Eco-Certification Information

The following fisheries that target tuna, but may incidentally capture the species in this report, are certified as sustainable by the Marine Stewardship Council:

- Albacore tuna, handlines and hand-operated pole and lines from Japan
- Albacore tuna, trolling line, in the AAFA and WFOA North and South Pacific
- Albacore tuna, Longline, Cook Islands EEZ and Fiji
- Albacore and Yellowfin tuna, Longline, Fiji
- Albacore tuna, Trolling lines, New Zealand Albacore and Yellowfin tuna, Longlines, French Polynesia
- Bigeye and Yellowfin tuna, Longlines, SZLC CSFC and FZLC FSM EEZ
- Skipjack and Yellowfin tuna, purse seines, handlines and hand-operated pole and lines, Solomon Islands
- Skipjack and Yellowfin tuna, purse seines, PNA
- Skipjack and Yellowfin tuna, purse seines, WPSTA free school
- Skipjack tuna handlines and hand-operated pole and lines, japan
- Skipjack and Yellowfin tuna, purse seines, Tri Marine WCPO
- Skipjack tuna, purse seines, Talleys New Zealand
- Skipjack and Yellowfin tuna, hooks and lines, PT Citraraja Ampat, Sorong
- Yellowfin tuna, Longlines, Walker Seafood Australia

Scoring Guide

Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

- **Best Choice/Green** = Final Score >3.2, and no Red Criteria, and no Critical scores
- **Good Alternative/Yellow** = Final score >2.2-3.2, and neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern2, and no more than one Red Criterion, and no Critical scores
- **Avoid/Red** = Final Score ≤2.2, or either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern or two or more Red Criteria, or one or more Critical scores.

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[2] Because effective management is an essential component of sustainable fisheries, Seafood Watch issues an Avoid recommendation for any fishery scored as a Very High Concern for either factor under Management (Criterion 3).

Introduction

Scope of the analysis and ensuing recommendation

This report focuses on blue shark (*Prionace glauca*), shortfin mako shark (*Isurus oxyrinchus*), blue, black, and striped marlin (*Makaira nigricans, Makaira indica, Kajikia audax*), and opah (*Lampris guttatus*) caught in drifting longline fisheries within the western and central Pacific Ocean (WCPO), North Pacific and South Pacific that target that target tuna and swordfish.

There are several broadly defined categories of longline fisheries covered in this report. These fisheries may not all directly target the species included in this report but may retain them upon capture. These fisheries include the following:

South Pacific albacore fishery, which comprises domestic vessels from Pacific Island countries that operate in subtropical waters targeting albacore, and distant water vessels from Chinese-Taipei, China, and Vanuatu that fish south of 20° S.
South Pacific distant water swordfish fishery, which mostly comprises vessels from Spain.
Tropical offshore and distant water tuna fisheries; the offshore fishery includes vessels from Chinese-Taipei and China that are based in the Pacific Island countries, and the distant water fleet comprises vessels from Japan, Korean, Chinese-Taipei, China, and Vanuatu.
North Pacific distant water albacore and swordfish fisheries, made up of vessels from Japan, Chinese-Taipei, and Vanuatu. In addition to these fisheries, there are a number of domestic longline fisheries operating in the sub-tropical and temperate areas of the WCPO (SPC 2014).
We have included in this report the North and South Pacific pelagic longline fisheries along with more tropical (WCPO in this report) pelagic longline fisheries.

This report excludes all MSC certified fisheries that are Parties to the Nauru Agreement (PNA) operating in this region.

Species Overview

Marlins
Black marlin lives in tropical and subtropical waters of the Indian and Pacific Oceans. It is found in surface waters and often close to land. Black marlin is highly migratory and an apex predator, feeding on fish, squid, and octopods, among others (Froese and Pauly 2018).

Blue marlin is a circumglobal species found in tropical and semitropical waters. It is highly migratory and also an apex predator that feeds on small tuna and squids, among other prey. There is believed to be a single population of blue marlin in the Pacific Ocean (WCPFC 2019c), (ISC 2016).

Striped marlin is the most abundant and widely distributed Istiophorid billfish species. It is epipelagic found across the 85° latitude in the Pacific Ocean, with the largest abundance in the Eastern and North Central Pacific Ocean. Striped marlin also feeds on fish, squid, and other prey (Davies et al. 2012), (ISC 2019).

Sharks
Blue sharks are highly migratory, found throughout the world's oceans in epipelagic and mesopelagic waters. They are considered the most widely distributed shark species and most abundant, with abundance increasing with latitude. They are an apex predator, consuming a variety of fish and squid species (ISCSWG 2017) (Takeuchi et al. 2016).

Shortfin mako shark also is highly migratory, inhabiting coastal and oceanic epipelagic waters worldwide. Shortfin mako shark is found from 20° S to 40° N in the Pacific Ocean. This species feeds on fish and cephalopods, among other prey (Froese and Pauly 2018).

Opah

Opah is found worldwide in bathypelagic tropical and temperate waters, most commonly between 100 m and 500 m in depth. Opah also is a top predator, feeding on fish and squid among other prey (Froese and Pauly 2018). Opah are most frequently caught in longline sets targeting albacore (Molony 2008).

Globally, longlines are the most common method used to capture swordfish, albacore and bigeye tuna, and purse seines are the primary gear used to capture Pacific bluefin and yellowfin tuna.

The Western and Central Pacific Fisheries Commission (WCPFC) is in charge of management of these species.

Production Statistics

Marlins

The WCPFC reported that during 2018, longline vessels operating in the WCPFC Statistical Area caught 11,750 t of blue marlin, 969 t of black marlin, and 2,961 t of striped marlin (WCPFC 2018b). Blue marlin longline catches have declined since peaks during the early to mid-2000s. Black marlin longline catches have been variable over time, and in recent years have been lower than peak catches attained during the early to mid-2000s (peaks also occurred during the 1970s) (SPC-OFP 2018). Striped marlin longline catches also have varied over time. Peak catches occurred during the 1960s and again in 1993. Recently, catches have been low compared to catches from the 1990s and 2000s (SPC-OFP 2018).

Sharks

The WCPFC collects catch data on some shark species, including blue and mako sharks. There is under-reporting of shark catches, so the values reported may not be accurate. In the North Pacific, catches of blue sharks peaked between 1976 and 1989 (113,000 t in 1981). Catches have since declined. Over the most recent 10 years (2005-2015), average annual catches are around 41,000 t but have begun decreasing since.2011 The majority of blue sharks are caught by longlines (ISCSWG 2017).

Information on shortfin mako catches is more limited in the region. Member countries of the WCPFC reported an average annual catch of around 2,600 t of shortfin makos caught in the North Pacific in the most recent 10 years (2007-2016 inclusive) and 2,300 t of shortfin mako sharks caught during 2016, but these data are considered very uncertain (ISCSWG 2018).

Importance to the US/North American market.

Species-specific information on import and exports of sharks is not available through the National Marine Fisheries Service (NMFS). During 2019, imports of fresh shark primarily came from Canada and Mexico, with smaller amounts imported from Ecuador and Spain (NMFS 2020). Shark fins were imported from Brazil and China (NMFS 2020). Information on import and exports of other species included in this report is not available through the NOAA Fisheries.

Common and market names.

Blue, black, and striped marlin are also known as “marlin.” Opah sometimes is referred to as "moonfish." Blue shark is also known as “shark” and shortfin mako shark as “mako.”

Primary product forms

Black, blue and striped marlin, blue and shortfin mako sharks, and opah are sold in fresh and frozen forms.

Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Standard for Fisheries, available at www.seafoodwatch.org. The specific standard used is referenced on the title page of all Seafood Watch assessments.

Criterion 1: Impacts on the Species Under Assessment

This criterion evaluates the impact of fishing mortality on the species, given its current abundance. When abundance is unknown, abundance is scored based on the species' inherent vulnerability, which is calculated using a Productivity-Susceptibility Analysis. The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. The Criterion 1 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and ≤3.2=Yellow or Moderate Concern*
- *Score ≤2.2=Red or High Concern*

Rating is Critical if Factor 1.3 (Fishing Mortality) is Critical

Guiding Principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level.*

Criterion 1 Summary

BLACK MARLIN			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
Western Central Pacific | Drifting longlines	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
South Pacific | Drifting longlines	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
North Pacific | Drifting longlines	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)

BLUE MARLIN			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
North Pacific | Drifting longlines	3.67: Low Concern	5.00: Low Concern	Green (4.284)
South Pacific | Drifting longlines	3.67: Low Concern	5.00: Low Concern	Green (4.284)
Western Central Pacific | Drifting longlines	3.67: Low Concern	5.00: Low Concern	Green (4.284)

BLUE SHARK			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
North Pacific | Drifting longlines	3.67: Low Concern	5.00: Low Concern	Green (4.284)
South Pacific | Drifting longlines	1.00: High Concern	1.00: High Concern	Red (1.000)

OPAH			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
North Pacific | Drifting longlines	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
South Pacific | Drifting longlines	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Western Central Pacific | Drifting longlines	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)

SHORTFIN MAKO SHARK			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
North Pacific | Drifting longlines	3.67: Low Concern	5.00: Low Concern	Green (4.284)
South Pacific | Drifting longlines	1.00: High Concern	1.00: High Concern	Red (1.000)
Western Central Pacific | Drifting longlines	3.67: Low Concern	5.00: Low Concern	Green (4.284)

STRIPED MARLIN			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
North Pacific | Drifting longlines	1.00: High Concern	1.00: High Concern	Red (1.000)
South Pacific | Drifting longlines	1.00: High Concern	3.00: Moderate Concern	Red (1.732)
Western Central Pacific | Drifting longlines	1.00: High Concern	1.00: High Concern	Red (1.000)

The WCPFC overview of stocks as follows (updated 31 October 2019) {WCPFC 2019}:

Stock	Latest Assessment	Overfished[1]	Overfishing[1]	Next Assessment
WCPO Billfish				
Pacific striped marlin (*Kajikia audax*)	2019 (SC15)	Likely (50%)	No (56%)	2023
North Pacific striped marlin (*Kajikia audax*)	2019 (SC15)	Yes	Yes	2024
Pacific blue marlin (*Makaira nigricans*)	2016 (SC12)	No	No	TBD
WCPO Sharks				
Pacific blue shark (*Prionace glauca*)	2016 (SC12)	N/A	N/A	2021
Pacific blue shark (*Prionace glauca*)	2017 (SC13)	No	No	2022
Pacific shortfin mako (*Isurus oxyrinchus*)	2018 (SC14)	No (>50%)	No (50%)	2023

[1] The determination of overfished and overfishing is a likelihood not a firm statement – where a percentage is provided that indicates probability.

Criterion 1 Assessment

SCORING GUIDELINES

Factor 1.1 - Abundance

Goal: Stock abundance and size structure of native species is maintained at a level that does not impair recruitment or productivity.

- *5 (Very Low Concern) — Strong evidence exists that the population is above an appropriate target abundance level (given the species' ecological role), or near virgin biomass.*
- *3.67 (Low Concern) — Population may be below target abundance level, but is at least 75% of the target level, OR data-limited assessments suggest population is healthy and species is not highly vulnerable.*
- *2.33 (Moderate Concern) — Population is not overfished but may be below 75% of the target abundance level, OR abundance is unknown and the species is not highly vulnerable.*
- *1 (High Concern) — Population is considered overfished/depleted, a species of concern, threatened or endangered, OR abundance is unknown and species is highly vulnerable.*

Factor 1.2 - Fishing Mortality

Goal: Fishing mortality is appropriate for current state of the stock.

- *5 (Low Concern) — Probable (>50%) that fishing mortality from all sources is at or below a sustainable level, given the species ecological role, OR fishery does not target species and fishing mortality is low enough to not adversely affect its population.*
- *3 (Moderate Concern) — Fishing mortality is fluctuating around sustainable levels, OR fishing mortality relative to a sustainable level is uncertain.*
- *1 (High Concern) — Probable that fishing mortality from all source is above a sustainable level.*

BLACK MARLIN

Factor 1.1 - Abundance

WESTERN CENTRAL PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
NORTH PACIFIC
Drifting Longlines

Moderate Concern

No assessment for black marlin has been conducted in the western and central Pacific Ocean. The International Union for Conservation of Nature (IUCN) has classified this species as "Data Deficient" with an unknown population trend (Collette et al. 2011b). Black marlin have a medium vulnerability to fishing (PSA=3.18 see detailed section below). We have awarded a score of "moderate" concern because abundance is unknown and they have a medium vulnerability to fishing.

Justification:

Average age at maturity	Unknown	*N/A*
Average maximum age	11 years (Sun et al. 2015a)	2
Fecundity	11,000,000 (Sun et al. 2015b)	1
Average maximum size (fish only)	400 cm (Sun et al. 2015a)	3
Average size at maturity (fish only)	209 cm (Sun et al. 2015b)	3
Reproductive strategy	Broadcast spawner	3
Trophic level	4.5 (Froese and Pauly 2018)	1
Productivity score		2.17

Susceptibility Attribute	**Relevant Information**	**Score (1 = low risk, 2 = medium risk, 3 = high risk)**
Areal overlap (Considers all fisheries)	There is areal overlap with black marlin	3
Vertical overlap (Considers all fisheries)	There is vertical overlap with black marlin	3

Selectivity of fishery (Specific to fishery under assessment)	Black marlin are selective to the fishery	2
Post-capture mortality (Specific to fishery under assessment)	Information on post-capture mortality is limited	3

Susceptibility score = 2.325

PSA Score = 3.178

Factor 1.2 - Fishing Mortality

WESTERN CENTRAL PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
NORTH PACIFIC
Drifting Longlines

Moderate Concern

No stock assessment has been conducted for black marlin in the western and central Pacific Ocean (WCPO), but there is information on catches and discard rates from observer programs. The International Union for Conservation of Nature (IUCN) notes that this species could be threatened by capture in longline fisheries, but fishing mortality rates in the WCPO are not available (Collette et al. 2011b). Reported catches of black marlin in longline fisheries in the WCPO ranged from 927 t to 2,734 t between 2000 and 2018 (WCPFC 2018b). These catches represent between 3% and 6% of the total longline catch of billfish during this time (WCPFC 2018b). Forty-five percent of black marlin were discarded between 1992 and 2009 and of these 60% were dead in the south Pacific albacore fishery. Discard rates in the tropical longline fishery ranged from 0 to 6%, with a mortality rate of 35-73% (OFP 2010). We have awarded a score of "moderate" concern because fishing mortality rates are unknown and the species suffers high discard mortality rates.

BLUE MARLIN

Factor 1.1 - Abundance

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

Low Concern

The most recent population assessment in the Pacific Ocean was completed in 2016. Despite recent declines in stock biomass, the female biomass is 25% above sustainable levels (SSB_{MSY}); therefore, blue marlin are not overfished (ISC 2016) and we have awarded a score of "low" concern.

Justification:

The International Union for Conservation of Nature (IUCN) has classified blue marlin as "Vulnerable" with a decreasing population trend (Collette et al. 2011c). There have been long-term declines in the stock biomass over time. The population has declined around 40% from virgin levels in 2014.

Factor 1.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

Low Concern

The last assessment for blue marlin was conducted in 2016. Fishing mortality rates (F = 0.28) estimated in this assessment are currently below levels needed to produce the maximum sustainable yield (F_{MSY} = 0.32). Based on these results, blue marlin are currently not subject to overfishing (ISC 2016). We have therefore awarded a score of "low" concern.

BLUE SHARK

Factor 1.1 - Abundance

NORTH PACIFIC
Drifting Longlines

Low Concern

An updated assessment of blue sharks in the North Pacific was completed during 2017. According to this assessment, the population of blue sharks in the North Pacific has increased since the lowest levels between 1990 and 1995 to near series highs in recent years (ISC 2017b). The female spawning biomass is estimated to be 71% above sustainable levels (SB_{2015}/SB_{MSY}) (ISC 2017b). This indicates that the population is not overfished and we have therefore awarded a score of "low" concern.

SOUTH PACIFIC
Drifting Longlines

High Concern

A stock assessment for blue sharks in the southern Pacific was conducted in 2016 (Takeuchi et al. 2016). However, due to a lack of data, poor model fit and high uncertainty, the authors do not recommend that management decisions rely on the stock status estimates (Takeuchi et al. 2016). Assessments are based on tagging data, differences in abundance, and evidence of pregnant females in high latitudes (in both the North and South Pacific Ocean). The population in the South Pacific is likely a separate population from the North

Pacific (Kleiber et al. 2009). The International Union for the Conservation of Nature (IUCN) considers blue sharks to be "Near Threatened" globally (Stevens 2009). We have awarded a score of "high" concern based on the "Near Threatened" IUCN status and high inherent vulnerability of sharks to fishing.

Factor 1.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines

Low Concern

Blue sharks are widely distributed throughout the North Pacific and dominate shark catches in that region. According to the 2017 updated assessment, the fishing mortality rate estimated in recent years ($F_{2012-2014}$) was around 37% of that needed to produce the maximum sustainable yield (F_{MSY}) (ISC 2017b). Therefore overfishing is not occurring and we have awarded a score of "low" concern.

SOUTH PACIFIC
Drifting Longlines

High Concern

Blue sharks are widely distributed throughout the Western and Central Pacific Ocean including in the South Pacific region. A stock assessment for blue sharks in the southern Pacific was conducted in 2016 (Takeuchi et al. 2016). However, due to a lack of data, poor model fit and high uncertainty, the authors do not recommend that management decisions rely on the stock status estimates (Takeuchi et al. 2016). Some trends in catch rates for various fisheries have been analyzed. We have awarded a score of "high" concern because there is little information on fishing mortality, they are highly susceptible to longline capture, and there are no management measures in place.

Justification:

In the South Pacific, catch rates declined until 2003 and have since increased to mid-1990's levels. There has been no trend in the size or sex of blue sharks in any part of the WCPO over time (Walsh et al. 2009) (Clarke 2011). Some information on catch levels is available. The estimated average annual longline catches between 1992 and 2009 was 1,611 t (Lawson 2001) (Clarke 2011), and from 1992 to 2009, blue sharks made up 10% of the total bycatch in the South Pacific albacore tuna longline fishery (OPF 2010). During this time period, 30% of blue sharks were observed discarded in this fishery and of those only 7% were dead (OFP 2010).

<u>OPAH</u>

Factor 1.1 - Abundance

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

Moderate Concern

The status of opah in the western and central Pacific Ocean is unknown. Opah have a medium vulnerability to fishing based on the SFW productivity and susceptability table (PSA=2.73 see detailed section). We have

awarded a score of "moderate" because the abundance is unknown and they have a medium vulnerability to fishing.

Justification:

Productivity Attribute	**Relevant Information**	**Score (1 = low risk, 2 = medium risk, 3 = high risk)**
Average age at maturity	*[Include and reference information needed to score each attribute as needed]*	*[Numerical score (1-3) for each attribute]*
Average maximum age		
Fecundity		
Average maximum size (fish only)	200 cm (Gon 1990)	2
Average size at maturity (fish only)		
Reproductive strategy	Broadcast spawner (Froese and Pauly 2018)	1
Trophic level	4.2 (Froese and Pauly 2018)	1
Density dependence (invertebrates only)		

Susceptibility Attribute	**Relevant Information**	**Score (1 = low risk, 2 = medium risk, 3 = high risk)**
Areal overlap (Considers all fisheries)	There is areal overalp with opah	3
Vertical overlap (Considers all fisheries)	There is vertical overlap with opah	3
Selectivity of fishery (Specific to fishery under assessment)	Opah are selective to the fishery	2
Post-capture mortality (Specific to fishery under assessment)	Information on post-capture mortality is limited	3

Factor 1.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

Moderate Concern

There is no information on fishing mortality rates for opah in the western and central Pacific Ocean. Between 1987 and 2001, observers recorded a total of 6,569 opahs caught by longliners in the Western and Central Pacific Ocean, primarily around Australia and New Zealand, representing 9.3% of the "other fish" catch. "Other fish" represented 7.6% of the total catch (Lawson 2001). From 1992 to 2009, 23% of opah caught in the South Pacific longline fishery were discarded and of these 25% were dead (OFP 2010). We have awarded a score of "moderate" concern because fishing mortality is unknown relative to reference points and impacts to the health of the stock.

SHORTFIN MAKO SHARK

Factor 1.1 - Abundance

NORTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

Low Concern

A stock assessment of shortfin mako sharks in the north Pacific was conducted in 2018 (ISC 2018c). The average (1975 to 2016) spawning abundance (SA) was estimated to be 910,000 sharks, and the current SA (2016) is estimated to be 860,200 sharks (ISC 2018c). This SA is estimated to be 36% above the estimated SA at the maximum sustainable yield (ISC 2018c). Based on these results it is likely (>50%) that shortfin mako sharks in the north Pacific are not overfished (ISC 2018c). The International Union for Conservation of Nature (IUCN) has listed this species globally as "Endangered," mainly due to steep population declines in the Atlantic Ocean (Rigby et al. 2019). We have awarded a score of "low" concern based on the assessment results.

SOUTH PACIFIC
Drifting Longlines

High Concern

No population assessment of shortfin mako sharks in the South Pacific region of the western and central Pacific Ocean has been conducted. The center of abundance for this species appears to be northwest of New Zealand (Lawson 2001). The International Union for the Conservation of Nature has assessed this species globally as "Endangered" (Rigby et al. 2019). According to the IUCN, the population in the south Pacific appears to be increasing. We have, however, awarded a score of "high" concern based on the IUCN listing and lack of a stock assessment to override the listing.

Factor 1.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

Low Concern

In 2018 a stock assessment of shortfin mako sharks in the North Pacific was conducted (ISC 2018c). Annual fishing intensity was estimated to be 0.16, which is 62% of fishing intensity at maximum sustainable yield levels (ISC 2018c). It is likely (>50%) that overfishing is not occurring and we have therefore awarded a score of "low" concern.

SOUTH PACIFIC
Drifting Longlines

High Concern

No assessment of shortfin mako sharks has been conducted in the South Pacific region. However, some information on catch and discard rates is available. For example, between 1994 and 2009, 1,047 t of mako sharks were observed caught in the Western and Central Pacific Ocean longline fisheries, representing 2.2% of the total catch. During this time period, 26% of shortfin mako sharks were discarded and of these 24% were dead (OFP 2010). We have awarded a score of "high" concern because information on fishing mortality rates in the South Pacific are not available, the population is depleted and susceptible to longline gear, and no management is place to protect the species.

STRIPED MARLIN

Factor 1.1 - Abundance

NORTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

High Concern

Striped marlin in the western and central North Pacific Ocean were assessed in 2019. The results of this model show a long-term decline in biomass (ISC 2019). There are no target or limit reference points but compared to maximum sustainable yield (MSY) based reference points, the spawning biomass in 2017 was 62% below that needed to attain MSY. Therefore striped marlin is overfished (ISC 2019); we have therefore awarded a score of "high" concern.

SOUTH PACIFIC
Drifting Longlines

High Concern

The most recent population assessment of striped marlin in the Southwestern Pacific Ocean was conducted in 2019 (Ducharme-Barth et al. 2019). Both the total and spawning biomass declined to at least half of their virgin levels by 1970. Despite high levels of uncertainty around certain input paramaters, 69% of 300 model runs showed SB is less than SB_{MSY}, suggesting striped marlin are overfished (Ducharme-Barth et al. 2019). The median value of SB_{RECENT} (2014-2017)/SB_{MSY} = 0.737 (0.152 – 3.312) and median value for

$SB_{LATEST}(2017)/SB_{MSY}$ = 0.898 (0.174 – 3.924) (Ducharme-Barth et al. 2019). We have awarded a score of "high" concern because the stock is likely overfished.

Factor 1.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

High Concern

There has been a long-term decline in catches of striped marlin in the western and central North Pacific Ocean (ISC 2019). Since the 1990s, longline fishing has accounted for over 60% of the total striped marlin catches in this region. Fishing mortality rates are high, F=0.64 from 2015 to 2017, about 7% above levels needed to produce the maximum sustainable yield (F_{MSY}) (ISC 2019). There are no target or limit reference points but compared to MSY-based reference points, overfishing is occurring (ISC 2019). We have therefore awarded a score of "high" concern.

SOUTH PACIFIC
Drifting Longlines

Moderate Concern

A population assessment of striped marlin in the southwest Pacific Ocean was conducted in 2019. The entire longline fleet has substantially affected the population size of striped marlin in the southwestern Pacific Ocean (Ducharme-Barth et al. 2019). Catches during recent years appear to be approaching MSY levels because of recent low recruitment levels (Ducharme-Barth et al. 2019). The fishing mortality based reference point $F_{RECENT(2014\text{-}2017)}/F_{MSY}$ = 0.991 (0.03-3.5) with 44% of the model runs greater than 1. This indicates the stock is close to undergoing overfishing. We have awarded a score of "moderate" concern because the stock is approaching overfishing.

Criterion 2: Impacts on Other Species

All main retained and bycatch species in the fishery are evaluated under Criterion 2. Seafood Watch defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. Species are evaluated using the same guidelines as in Criterion 1. When information on other species caught in the fishery is unavailable, the fishery's potential impacts on other species is scored according to the Unknown Bycatch Matrices, which are based on a synthesis of peer-reviewed literature and expert opinion on the bycatch impacts of each gear type. The fishery is also scored for the amount of non-retained catch (discards) and bait use relative to the retained catch. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard/bait score. The Criterion 2 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and ≤=3.2=Yellow or Moderate Concern*
- *Score ≤=2.2=Red or High Concern*

Rating is Critical if Factor 2.3 (Fishing Mortality) is Crtitical

Guiding Principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level.*
- *Minimize bycatch.*

Criterion 2 Summary

Only the lowest scoring main species is/are listed in the table and text in this Criterion 2 section; a full list and assessment of the main species can be found in Appendix A.

BLACK MARLIN North Pacific | Drifting Longlines					
Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**
Species | Stock	**Abundance**	**Fishing Mortality**	**Subscore**		
Pacific bluefin tuna	1.00:High Concern	1.00:High Concern	Red (1.000)		
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)		
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)		
black-footed albatross	1.00:High Concern	1.00:High Concern	Red (1.000)		
Striped marlin	1.00:High Concern	1.00:High Concern	Red (1.000)		
laysan albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Opah	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		
Swordfish	3.67:Low Concern	5.00:Low Concern	Green (4.284)		

Shortfin mako shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue marlin	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Albacore	3.67:Low Concern	5.00:Low Concern	Green (4.284)

BLACK MARLIN
South Pacific | Drifting Longlines

Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**

Species | Stock	Abundance	Fishing Mortality	Subscore
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Blue shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Shortfin mako shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
flesh-footed shearwater	1.00:High Concern	1.00:High Concern	Red (1.000)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Olive ridley turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Striped marlin	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
grey petrel	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
light-mantled albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Salvin's albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
wandering albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
white-chinned petrel	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Southern bluefin tuna	1.00:High Concern	5.00:Low Concern	Yellow (2.236)
Opah	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Black-browed albatross	3.67:Low Concern	3.00:Moderate Concern	Green (3.318)
Swordfish	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Albacore	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue marlin	3.67:Low Concern	5.00:Low Concern	Green (4.284)

BLACK MARLIN
Western Central Pacific | Drifting Longlines

Subscore:	1.000	Discard Rate:	1.00	C2 Rate:	1.000

Species | Stock	Abundance	Fishing Mortality	Subscore
Hawksbill turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Striped marlin	1.00:High Concern	1.00:High Concern	Red (1.000)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Olive ridley turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Opah	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Bigeye tuna	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Shortfin mako shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue marlin	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Yellowfin tuna	5.00:Very Low Concern	5.00:Low Concern	Green (5.000)

BLUE MARLIN
North Pacific | Drifting Longlines

Subscore:	1.000	Discard Rate:	1.00	C2 Rate:	1.000

Species | Stock	Abundance	Fishing Mortality	Subscore
Pacific bluefin tuna	1.00:High Concern	1.00:High Concern	Red (1.000)
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
black-footed albatross	1.00:High Concern	1.00:High Concern	Red (1.000)
Striped marlin	1.00:High Concern	1.00:High Concern	Red (1.000)
laysan albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Opah	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Black marlin	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Swordfish	3.67:Low Concern	5.00:Low Concern	Green (4.284)

Shortfin mako shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Albacore	3.67:Low Concern	5.00:Low Concern	Green (4.284)

BLUE MARLIN
South Pacific | Drifting Longlines

Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**

Species | Stock	Abundance	Fishing Mortality	Subscore
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Blue shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Shortfin mako shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
flesh-footed shearwater	1.00:High Concern	1.00:High Concern	Red (1.000)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Olive ridley turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Striped marlin	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
grey petrel	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
light-mantled albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Salvin's albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
wandering albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
white-chinned petrel	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Southern bluefin tuna	1.00:High Concern	5.00:Low Concern	Yellow (2.236)
Opah	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Black marlin	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Black-browed albatross	3.67:Low Concern	3.00:Moderate Concern	Green (3.318)
Swordfish	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Albacore	3.67:Low Concern	5.00:Low Concern	Green (4.284)

BLUE MARLIN
Western Central Pacific | Drifting Longlines

Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**

Species | Stock	Abundance	Fishing Mortality	Subscore
Hawksbill turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Striped marlin	1.00:High Concern	1.00:High Concern	Red (1.000)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Olive ridley turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Black marlin	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Opah	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Bigeye tuna	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Shortfin mako shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Yellowfin tuna	5.00:Very Low Concern	5.00:Low Concern	Green (5.000)

BLUE SHARK
North Pacific | Drifting Longlines

Subscore:	1.000	Discard Rate:	1.00	C2 Rate:	1.000

Species | Stock	Abundance	Fishing Mortality	Subscore
Pacific bluefin tuna	1.00:High Concern	1.00:High Concern	Red (1.000)
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
black-footed albatross	1.00:High Concern	1.00:High Concern	Red (1.000)
Striped marlin	1.00:High Concern	1.00:High Concern	Red (1.000)
laysan albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Opah	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Black marlin	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Swordfish	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Shortfin mako shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue marlin	3.67:Low Concern	5.00:Low Concern	Green (4.284)

Albacore	3.67:Low Concern	5.00:Low Concern	Green (4.284)

BLUE SHARK
South Pacific | Drifting Longlines

Subscore:	1.000	Discard Rate:	1.00	C2 Rate:	1.000

Species | Stock	Abundance	Fishing Mortality	Subscore
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Shortfin mako shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
flesh-footed shearwater	1.00:High Concern	1.00:High Concern	Red (1.000)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Olive ridley turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Striped marlin	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
grey petrel	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
light-mantled albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Salvin's albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
wandering albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
white-chinned petrel	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Southern bluefin tuna	1.00:High Concern	5.00:Low Concern	Yellow (2.236)
Opah	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Black marlin	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Black-browed albatross	3.67:Low Concern	3.00:Moderate Concern	Green (3.318)
Swordfish	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Albacore	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue marlin	3.67:Low Concern	5.00:Low Concern	Green (4.284)

OPAH
North Pacific | Drifting Longlines

Subscore:	1.000	Discard Rate:	1.00	C2 Rate:	1.000

Species | Stock	Abundance	Fishing Mortality	Subscore
Pacific bluefin tuna	1.00:High Concern	1.00:High Concern	Red (1.000)

Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
black-footed albatross	1.00:High Concern	1.00:High Concern	Red (1.000)
Striped marlin	1.00:High Concern	1.00:High Concern	Red (1.000)
laysan albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Black marlin	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Swordfish	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Shortfin mako shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue marlin	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Albacore	3.67:Low Concern	5.00:Low Concern	Green (4.284)

OPAH
South Pacific | Drifting Longlines

Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**

Species | Stock	Abundance	Fishing Mortality	Subscore
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Blue shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Shortfin mako shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
flesh-footed shearwater	1.00:High Concern	1.00:High Concern	Red (1.000)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Olive ridley turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Striped marlin	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
grey petrel	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
light-mantled albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Salvin's albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
wandering albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)

white-chinned petrel	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Southern bluefin tuna	1.00:High Concern	5.00:Low Concern	Yellow (2.236)
Black marlin	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Black-browed albatross	3.67:Low Concern	3.00:Moderate Concern	Green (3.318)
Swordfish	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Albacore	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue marlin	3.67:Low Concern	5.00:Low Concern	Green (4.284)

OPAH
Western Central Pacific | Drifting Longlines

Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**

Species | Stock	Abundance	Fishing Mortality	Subscore
Hawksbill turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Striped marlin	1.00:High Concern	1.00:High Concern	Red (1.000)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Olive ridley turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Black marlin	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Bigeye tuna	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Shortfin mako shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue marlin	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Yellowfin tuna	5.00:Very Low Concern	5.00:Low Concern	Green (5.000)

SHORTFIN MAKO SHARK
North Pacific | Drifting Longlines

Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**

Species | Stock	Abundance	Fishing Mortality	Subscore
Pacific bluefin tuna	1.00:High Concern	1.00:High Concern	Red (1.000)
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)

Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
black-footed albatross	1.00:High Concern	1.00:High Concern	Red (1.000)
Striped marlin	1.00:High Concern	1.00:High Concern	Red (1.000)
laysan albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Opah	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Black marlin	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Swordfish	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue marlin	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Albacore	3.67:Low Concern	5.00:Low Concern	Green (4.284)

SHORTFIN MAKO SHARK
South Pacific | Drifting Longlines

Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**

Species | Stock	Abundance	Fishing Mortality	Subscore
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Blue shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
flesh-footed shearwater	1.00:High Concern	1.00:High Concern	Red (1.000)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Olive ridley turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Striped marlin	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
grey petrel	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
light-mantled albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Salvin's albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
wandering albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
white-chinned petrel	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Southern bluefin tuna	1.00:High Concern	5.00:Low Concern	Yellow (2.236)

Opah	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Black marlin	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Black-browed albatross	3.67:Low Concern	3.00:Moderate Concern	Green (3.318)
Swordfish	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Albacore	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue marlin	3.67:Low Concern	5.00:Low Concern	Green (4.284)

SHORTFIN MAKO SHARK
Western Central Pacific | Drifting Longlines

Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**

Species | Stock	Abundance	Fishing Mortality	Subscore
Hawksbill turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Striped marlin	1.00:High Concern	1.00:High Concern	Red (1.000)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Olive ridley turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Black marlin	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Opah	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Bigeye tuna	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue marlin	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Yellowfin tuna	5.00:Very Low Concern	5.00:Low Concern	Green (5.000)

STRIPED MARLIN
North Pacific | Drifting Longlines

Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**

Species | Stock	Abundance	Fishing Mortality	Subscore
Pacific bluefin tuna	1.00:High Concern	1.00:High Concern	Red (1.000)
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)

Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
black-footed albatross	1.00:High Concern	1.00:High Concern	Red (1.000)
laysan albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Opah	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Black marlin	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Swordfish	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Shortfin mako shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue marlin	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Albacore	3.67:Low Concern	5.00:Low Concern	Green (4.284)

STRIPED MARLIN
South Pacific | Drifting Longlines

Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**

Species | Stock	Abundance	Fishing Mortality	Subscore
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Blue shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Shortfin mako shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
flesh-footed shearwater	1.00:High Concern	1.00:High Concern	Red (1.000)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Olive ridley turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
grey petrel	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
light-mantled albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Salvin's albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
wandering albatross	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
white-chinned petrel	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Southern bluefin tuna	1.00:High Concern	5.00:Low Concern	Yellow (2.236)
Opah	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)

Black marlin	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Black-browed albatross	3.67:Low Concern	3.00:Moderate Concern	Green (3.318)
Swordfish	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Albacore	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue marlin	3.67:Low Concern	5.00:Low Concern	Green (4.284)

STRIPED MARLIN
Western Central Pacific | Drifting Longlines

Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**

Species | Stock	Abundance	Fishing Mortality	Subscore
Hawksbill turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)
Whitetip shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Silky shark	1.00:High Concern	1.00:High Concern	Red (1.000)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Olive ridley turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Black marlin	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Opah	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Bigeye tuna	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Shortfin mako shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue marlin	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Blue shark	3.67:Low Concern	5.00:Low Concern	Green (4.284)
Yellowfin tuna	5.00:Very Low Concern	5.00:Low Concern	Green (5.000)

North Pacific
In the North Pacific longline fishery that operates in the western and central Pacific region, information on bycatch is limited due to low observer coverage rates (5%), although some fisheries have substantially higher coverage rates. Tunas, billfish, other fish, sharks, sea birds, sea turtles and marine mammals have been reported as bycatch species in these longline fisheries (OFP 2010). According to observer records north of 10°N, the majority of tuna species are kept, although skipjack tuna had a discard rate of 35% between 1994 and 2009. Swordfish are the most commonly discarded billfish species (44%), while blue and black marlin are primarily retained. Discard rates for sharks in the North Pacific are very high for the majority of species (OFP 2010). Laysan and black-footed albatross are incidentally captured in the North Pacific region, where they have a high breeding and non-breeding overlap with longline fisheries (Clarke et al. 2013) (ACP 2008). The area of most concern for seabird interactions in this region is between 20° to 40° N. Information on bycatch of sea turtles in the North Pacific longline fishery is limited (Work and Balazs 2002). The majority of sea turtles are

observed caught in the tropical longline fisheries outside of the North Pacific region (Molony 2005).

South Pacific

In the South Pacific, information on bycatch interactions is available through observer programs, primarily from those of Australia and New Zealand as well as from Marine Stewardship Council (MSC) assessments for several fisheries (i.e., Fiji and Cook Islands). Seabird interactions with pelagic longline gear are mostly recorded in EEZ waters in the South Pacific around New Zealand and Australia between 20° to 50° S (Clarke et al. 2013), (Baker and Wise 2005), (Baker and Finley 2008), (Anderson et al. 2011). A recent study in the South Pacific New Zealand longline fishery suggested total estimated annual potential seabird fatalities is 6,275 birds (Abraham et al. 2017). Observers often have a difficult time identifying birds to species level, so estimates based on observer data may under-report interactions (Molony 2005). The majority of sea turtles are observed caught in the tropical longline fisheries that occur west of 180° and interaction rates are much lower than in other ocean basins (Clarke et al. 2014). Marine mammal interactions and associated mortality rates with the South Pacific albacore tuna longline fishery are reported to be very low (Molony 2005).

Western and Central Pacific

In the western and central Pacific (WCPO) longline fishery, tunas, billfish, other fish, sharks, seabirds, sea turtles and marine mammals are incidentally caught as bycatch. Discard rates of these species vary from only 5% for tunas to 96% for sea turtles (OFP 2010), (OFP 2012a).

Sharks

Common shark species include blue, shortfin mako, silky, and oceanic whitetip sharks (ISC 2017b) (Clarke et al. 2018) (ISC 2018c) (Rice and Harley 2012b). Blue sharks represented 19.5%, silky shark 3.5%, mako sharks 2.2%, and oceanic whitetip sharks 1.4% of the total observed catch between 1994 and 2009 (OFP 2010).

Seabirds

An ecological risk assessment of seabirds in the WCPO indicated that populations of ten species (combined) of large and small albatross and petrels were most likely to be impacted by bycatch in longline fisheries operating in this region, primarily in the northern and southern regions, rather than the equatorial regions (separated in this report) (Waugh et al. 2012). Observer data from the region indicate a total of 991 seabirds caught in the WCPO region from 2007 to 2016, with black-footed and black-browed albatross as the two most commonly caught species (Peatman et al. 2017).

Sea Turtles

The majority of sea turtles are observed caught in the tropical longline fisheries that occur west of 180°, with the highest catch rates occurring in the tropical, shallow longline fishery (Wallace et al. 2013b) (Wallace et al. 2010). The majority of these are released alive, compared to the tropical, deepwater longline fishery, where most turtles are returned dead (Molony 2005). Overall between 4,000 and 15,000 turtles (all species) are estimated to have been caught annually by these longline fisheries. Mortality rates for sea turtles are low, less than 26% in all years and total annual mortalities for all turtle species ranged from 500 to 3,000 between 1980 and 2004 (Molony 2005).

Marine Mammals

Marine mammal catch rates are very low, although in general the tropical, shallow longline fishery has the highest catch rates. Observer records from 1980 to 2004 indicated many years where no marine mammal interactions with longline fisheries occurred. However, when observer estimates were extrapolated out to the entire fishery (not just the proportion observed), up to 2,200 marine mammal interactions are estimated to occur per year (Molony 2005) (Molony 2007). Between 2000 and 2004, both catch and mortality rates of marine mammals declined. In general, less than 200 marine mammal mortalities were estimated to have occurred between 2000 and 2004 (Molony 2005) (Molony 2007). There were 22 reported interactions between the US longline fishery and marine mammals between 2015 and 2016, mostly involving false killer whales (59%)

(NOAA 2018).

Criterion 2 Assessment

SCORING GUIDELINES

Factor 2.1 - Abundance
(same as Factor 1.1 above)

Factor 2.2 - Fishing Mortality
(same as Factor 1.2 above)

PACIFIC BLUEFIN TUNA

Factor 2.1 - Abundance

NORTH PACIFIC
Drifting Longlines

High Concern

An updated assessment for Pacific bluefin tuna was conducted in 2018. Based on the updated analysis, the ratio of the spawning stock biomass in 2015 to 2016 to that of unfished levels was 3.3%. Annual recruitment of North Pacific bluefin tuna is variable and unpredictable, which contributes to uncertainty in calculating abundance (ISC 2018). There are no defined reference points for Pacific bluefin tuna. However, the results were compared to other reference points and based on a reference point of $SSB_{20\%}$; the population would be considered overfished. In addition, based on this reference point, the population has been overfished for the majority of the assessed time period (1950 to 2015) (ISC 2018). We have therefore awarded a score of "high" concern.

Factor 2.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines

High Concern

Based on the updated 2018 assessment, current fishing mortality rates from all gears (2012 to 2014) (2015 to 2016) are higher than all potential biological reference points, except F_{MED} and F_{LOSS}. There are currently no defined reference points for Pacific bluefin tuna. However, the assessment results indicate overfishing is occurring relative to "most" of the potential reference points evaluated (ISC 2018). We have awarded a score of "high" concern because overfishing has been occurring for most of the assessed time period.

Justification:

	F_{max}	F0.1	Fmed	Floss	(1-SPR)/(1-SPRxx%)				Estimated SSB for terminal year of each reference period	Depletion ratio for terminal year of each reference period
					SPR10%	SPR20%	SPR30%	SPR40%		
2002-2004	1.77	2.47	1.04	0.78	1.07	1.21	1.38	1.61	40,707	6.3%
2012-2014	1.47	2.04	0.86	0.65	1.05	1.19	1.36	1.58	19,031	3.0%
2015-2016	1.32	1.85	0.78	0.58	1.02	1.15	1.32	1.54	21,311	3.3%

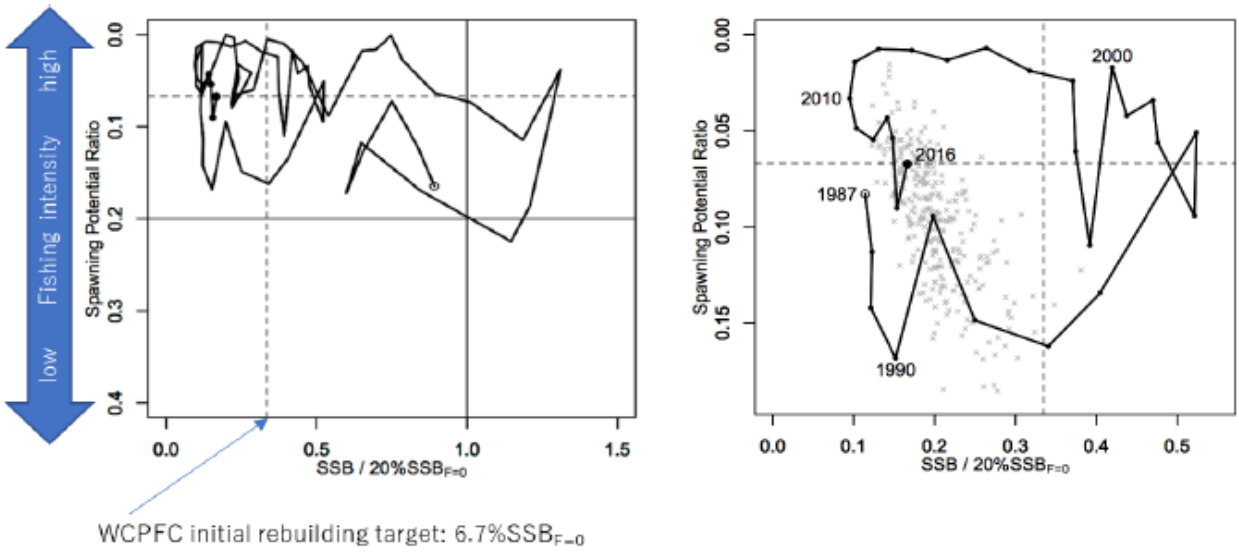

Figure 1 Ratios of the estimated fishing intensities mortalities (Fs and 1-SPRs for 2002-04, 2012-14, 2015- 16) relative to potential fishing intensity-based reference points, and terminal year SSB (t) for each reference period, and depletion ratios for the terminal year of the reference period for Pacific bluefin tuna (Thunnus orientalis) (ISC 2018).

Factor 2.3 - Modifying Factor: Discards and Bait Use

Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

RATIO OF BAIT + DISCARDS/LANDINGS	FACTOR 2.3 SCORE
<100%	1
>=100	0.75

NORTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%. In the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). Information from observer records collected in the North Pacific indicate 36% of the total

catch is discarded. Specifically, in the area north of 10°N, discard rates for tuna ranged from 0 to 35%, for billfish from 3 to 44%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, and 100% for marine mammals, sea birds and turtles (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

LEATHERBACK TURTLE

Factor 2.1 - Abundance

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

High Concern

Leatherback sea turtles have been listed as "Endangered" by the United States Endangered Species Act (ESA) since 1970 (FR 1970). The International Union for Conservation of Nature (IUCN) classified leatherback turtles as "Vulnerable" with a decreasing population trend in 2000 (Wallace 2013). Wallace et al. identified the West Pacific leatherback RMU to be at a high risk of population declines (Wallace et al. 2010) (Wallace et al. 2011) (Wallace et al. 2013). Leatherback turtles have been listed in the Convention on International Trade in Endangered Species (CITES) since 1975 and are currently listed on CITES Appendix 1, meaning they are threatened with extinction and international trade is prohibited. Over the past 25 years the population of leatherbacks in the Pacific Ocean has decreased significantly (Wallace et al. 2013). Recent estimates from the eastern and western central Pacific Ocean suggest a population size of 294,068 turtles and out of these 6,199 are adults (Jones et al. 2012). We have awarded a score of "high" concern based on the ESA, IUCN and CITES listings and RMU status.

Factor 2.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

High Concern

Fishing mortality is thought to be a major threat to leatherback turtles, especially for juveniles and adults that can be incidentally captured in fisheries along their migration routes (Wallace et al. 2013) (Zug and Parham 1996) (Roe et al. 2014). The available data in the Western and Central Pacific Ocean are spotty, due to low reporting by some nations and low observer coverage. In addition, due to this low reporting, there is a high amount of uncertainty surrounding current estimates (Brouwer and Bertram 2009) (Williams et al. 2009). Some fleets within the WCPO have adopted management measures to aid in reducing the incidental capture of sea turtles but others have not complied with mandated bycatch mitigation methods (WCPFC 2016). We have awarded a score of "high" concern because the population is depleted, bycatch mortality appears to be a factor in this depletion, and management measures may not be currently effective.

Justification:

Interactions with leatherbacks are typically higher in sub-tropical and temperate areas (Williams et al. 2009). For example, a recent study indicated that nesting leatherback turtles have a high risk of bycatch in several areas within the North and Central Pacific Ocean (Roe et al. 2014). Other research has estimated that leatherback turtles suffer a 12% annual mortality rate from pelagic longline fisheries in the WCPO and based on these estimates, bycatch mortality in longline fisheries, along with other factors such as coastal mortality, should be reduced to avoid extinction (Kaplan 2005). Other estimates suggest 20,000 leatherback turtles were caught in longlines throughout the entire Pacific Ocean during 2000, with 1,000 to 3,200 of these being killed as a result. These results also suggest that continued bycatch in longline fisheries will have major consequences for leatherback turtles in the Pacific Ocean and that the mortality threshold for this species in the Pacific may have been exceeded (Lewison et al. 2004). Other analyses have suggested leatherback turtles have a high population risk but low bycatch threat throughout the western Pacific Ocean (Wallace et al. 2013).

Factor 2.3 - Modifying Factor: Discards and Bait Use

Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

RATIO OF BAIT + DISCARDS/LANDINGS	FACTOR 2.3 SCORE
<100%	1
>=100	0.75

NORTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%. In the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). Information from observer records collected in the North Pacific indicate 36% of the total catch is discarded. Specifically, in the area north of 10°N, discard rates for tuna ranged from 0 to 35%, for billfish from 3 to 44%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, and 100% for marine mammals, sea birds and turtles (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard

rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.

WESTERN CENTRAL PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). In the WCPO pelagic longline fisheries around 5% of targeted tuna (bigeye, yellowfin, and albacore) were estimated to have been discarded between 1994 and 2011 (OFP 2012a). Discard rates of skipjack tuna are higher (20%) (OFP 2010). Earlier estimates through 2009 indicated the total discard rate of targeted tunas was around 5%. Discard rates for non-targeted species between 1994 and 2009 were 11% for billfish, 54% for other bony fish, 49% for elasmobranchs, 73% for seabirds, 94% for marine mammals, and 96% for turtles (OFP 2010). According to this second study, based on observer data, the overall discard rate for the WCPO longline fishery is 15% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

LOGGERHEAD TURTLE

Factor 2.1 - Abundance

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

High Concern

The International Union for Conservation of Nature (IUCN) classified loggerhead turtles in the North Pacific Regional Management Unit (RMU) as "Least Concern" with an increasing population trend (Casale and Matsuzawa 2015), and loggerheads in the South Pacific RMU as "Critically Endangered" with a decreasing population trend. Wallace et al. identified the North Pacific RMU of loggerhead sea turtles as among the 11 most endangered sea turtle RMUs in the world, and that loggerheads are at a high risk of population declines and have high threat levels in the North and South Pacific Ocean (Wallace et al. 2010) (Wallace et al. 2011). Loggerheads are listed in Appendix 1 of the Convention on International Trade in Endangered Species (CITES). In the North Pacific Ocean, loggerheads have been listed as "Endangered" on the United States Endangered Species Act list since 1978 (FR 2011). We have therefore awarded a score of "high" concern.

Factor 2.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

High Concern

The incidental capture of loggerhead turtles has historically been considered a primary threat to their populations (Casale and Tucker 2017). Juvenile loggerheads are susceptible to bycatch in the North Pacific region, especially by shallow-set longline fisheries targeting swordfish (Lewison and Crowder 2003). However, data related to incidental captures is typically scarce due to low reporting by some countries and low observer coverage rates (~1%) (Brouwer and Bertram 2009) (Williams et al. 2009). Some estimates, based on extrapolation from data sets, from the entire Pacific Ocean suggested that 67,000 loggerhead sea turtles were incidentally captured throughout the Pacific Ocean during 2000 and of these, 2,600 to 6,000 were killed by this incidental capture. Based on these estimates, it is possible their mortality threshold was exceeded in this region (Lewison et al. 2004). Other studies from the Pacific Ocean suggest there is a low impact from bycatch but high risk to the population (Wallace et al. 2011) (Clarke et al. 2014). Bycatch mitigation methods are mandated by the Western and Central Pacific Fisheries Commission, but their effectiveness is unknown and there are issues of compliance with these measures (Clarke et al. 2014). We have therefore awarded a score of "high" concern.

Factor 2.3 - Modifying Factor: Discards and Bait Use

Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

RATIO OF BAIT + DISCARDS/LANDINGS	FACTOR 2.3 SCORE
<100%	1
>=100	0.75

NORTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%. In the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). Information from observer records collected in the North Pacific indicate 36% of the total catch is discarded. Specifically, in the area north of 10°N, discard rates for tuna ranged from 0 to 35%, for billfish from 3 to 44%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, and 100% for marine mammals, sea birds and turtles (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.

WESTERN CENTRAL PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). In the WCPO pelagic longline fisheries around 5% of targeted tuna (bigeye, yellowfin, and albacore) were estimated to have been discarded between 1994 and 2011 (OFP 2012a). Discard rates of skipjack tuna are higher (20%) (OFP 2010). Earlier estimates through 2009 indicated the total discard rate of targeted tunas was around 5%. Discard rates for non-targeted species between 1994 and 2009 were 11% for billfish, 54% for other bony fish, 49% for elasmobranchs, 73% for seabirds, 94% for marine mammals, and 96% for turtles (OFP 2010). According to this second study, based on observer data, the overall discard rate for the WCPO longline fishery is 15% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

WHITETIP SHARK

Factor 2.1 - Abundance

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

High Concern

The International Union for the Conservation of Nature (IUCN) considers oceanic whitetip sharks to be "Vulnerable" globally (Baum et al. 2015). The most recent stock assessment of oceanic whitetip sharks in the western and central Pacific Ocean (WCPO) was conducted in 2019 (Tremblay-Boyer et al. 2019). It is the first stock assessment since the implementation of CMM2011-04, which became active in 2013, enacting a no-

retention measure for this species for WCPFC members, cooperating non-members, and participating territories. Although results are reported in relation to maximum sustainable yield (MSY) reference points, reference points to manage this stock have not yet been identified by the scientific committee or Commission. According to the assessment, the median spawning biomass (mature fish) of 648 model runs is estimated to be far below the level needed to produce the maximum sustainable yield (SB_{RECENT}/SB_{MSY} = 0.09), indicating the stock is overfished (Tremblay-Boyer et al. 2019). We have awarded a score of "high" concern because of the severely overfished stock status.

Factor 2.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

High Concern

Fishing mortality relative to F_{MSY} has declined dramatically since the 2012 stock assessment and the implementation of CMM2011-04, which became active in 2013, enacting a no-retention measure for this species for WCPFC members, cooperating non-members, and participating territories. The most recent stock assessment estimates that fishing mortality still exceeds levels needed to produce the maximum sustainable yield, with median F_{RECENT}/F_{MSY} = 3.92 (Tremblay-Boyer et al. 2019). Therefore, overfishing is occurring (Tremblay-Boyer et al. 2019). We have awarded a score of "high" concern because overfishing is occurring.

Justification:

Oceanic whitetip sharks are caught as bycatch by purse seine vessels that primarily fish in equatorial waters between 10°N to 10°S. Sharks as a group are reported to have an observed bycatch ratio of 1.1% on purse seine sets made on fish aggregating devices (FAD) in the western and central Pacific Ocean (Dagorn et al. 2012). Research conducted in other oceans, however, suggests that the entanglement mortality from purse seine gear of other shark species may be 5 to 10 times the known bycatch (Filmalter et al. 2013). Recently the Western and Central Pacific Fisheries Commission banned the capture and sale of oceanic whitetip sharks (WCPFC 2012g).

Factor 2.3 - Modifying Factor: Discards and Bait Use

Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

RATIO OF BAIT + DISCARDS/LANDINGS	FACTOR 2.3 SCORE
<100%	1
>=100	0.75

NORTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%. In the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). Information from observer records collected in the North Pacific indicate 36% of the total catch is discarded. Specifically, in the area north of 10°N, discard rates for tuna ranged from 0 to 35%, for billfish from 3 to 44%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, and 100% for marine mammals, sea birds and turtles (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.

WESTERN CENTRAL PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). In the WCPO pelagic longline fisheries around 5% of targeted tuna (bigeye, yellowfin, and albacore) were estimated to have been discarded between 1994 and 2011 (OFP 2012a). Discard rates of skipjack tuna are higher (20%) (OFP 2010). Earlier estimates through 2009 indicated the total discard rate of targeted tunas was around 5%. Discard rates for non-targeted species between 1994 and 2009 were 11% for billfish, 54% for other bony fish, 49% for elasmobranchs, 73% for seabirds, 94% for marine mammals, and 96% for turtles (OFP 2010). According to this second study, based on observer data, the overall discard rate for the WCPO longline fishery is 15% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

SILKY SHARK

Factor 2.1 - Abundance

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

High Concern

The IUCN considers silky sharks to be "Vulnerable" globally (Rigby et al. 2017). The first assessment of silky sharks in the WCPO was conducted in 2012 and updated during 2013 (Rice and Harley 2013). A Pacific-wide assessment was conducted in 2018 (Clarke et al. 2018). The results of this assessment are considered highly uncertain and not sufficient enough to provide an assessment of silky shark stock status in the Pacific Ocean (Clarke et al. 2018). However, it should be noted that there were several indications that the population has likely declined considerably over the past twenty years (Clarke et al. 2018) (Rigby et al. 2017). The previous 2013 assessment showed that the spawning biomass (abundance of mature fish) levels consistently declined over the modeled time period (1995 to 2009) by 67% since 1995. The spawning biomass in 2009 was far below target levels needed to produce the maximum sustainable yield ($SB_{CURRENT}/SB_{MSY}$=0.70 95% CI 0.51-1.23) and therefore the stock is overfished. We have awarded a score of "high" concern based on the IUCN assessment.

Factor 2.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

High Concern

A new Pacific-wide stock assessment of silky sharks was conducted in 2018 (Clarke et al. 2018). The results of the assessment are not considered robust enough to determine the status of silky sharks in the Pacific Ocean (Clarke et al. 2018). However, there is some indication that fishing mortality has increased considerably over the past twenty years and this may have resulted in population declines (Clarke et al. 2018). The previous assessment, conducted in 2013, indicated that fishing mortality rates in 2009 (the last year of the modeled period) exceeded levels needed to produce the maximum sustainable yield ($F_{CURRENT}/F_{MSY}$=4.48 (1.41-7.96)). This indicates that overfishing is occurring (Rice and Harley 2013). Bycatch from the associated purse seine fishery has had a large impact on the stock, second only to the longline fishery, even though catches are much higher in the longline fishery (Rice 2012). For example, in the associated purse seine fishery, F increased to 0.15 by 2009, which is above F_{MSY} (0.077) (Rice and Harley 2013). It should also be noted that in other oceans, entanglement mortality rates of silky sharks in purse seine fisheries is estimated to be 5 to 10 times the reported bycatch levels (Filmalter et al. 2013). We have awarded a score of "high" concern based on previous indications that fishing mortality rates are too high combined with recent analysis that also suggests increased fishing mortality may have resulted in biomass decreases (Rice and Harley 2013) (Clarke et al. 2018).

Factor 2.3 - Modifying Factor: Discards and Bait Use

Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

RATIO OF BAIT + DISCARDS/LANDINGS	FACTOR 2.3 SCORE
<100%	1
>=100	0.75

NORTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%. In the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). Information from observer records collected in the North Pacific indicate 36% of the total catch is discarded. Specifically, in the area north of 10°N, discard rates for tuna ranged from 0 to 35%, for billfish from 3 to 44%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, and 100% for marine mammals, sea birds and turtles (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.

WESTERN CENTRAL PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40%

(Kelleher 2005). In the WCPO pelagic longline fisheries around 5% of targeted tuna (bigeye, yellowfin, and albacore) were estimated to have been discarded between 1994 and 2011 (OFP 2012a). Discard rates of skipjack tuna are higher (20%) (OFP 2010). Earlier estimates through 2009 indicated the total discard rate of targeted tunas was around 5%. Discard rates for non-targeted species between 1994 and 2009 were 11% for billfish, 54% for other bony fish, 49% for elasmobranchs, 73% for seabirds, 94% for marine mammals, and 96% for turtles (OFP 2010). According to this second study, based on observer data, the overall discard rate for the WCPO longline fishery is 15% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

BLACK-FOOTED ALBATROSS

Factor 2.1 - Abundance

NORTH PACIFIC
Drifting Longlines

High Concern

According to the International Union for Conservation of Nature (IUCN), black-footed albatross is classified as "Near Threatened" with a stable to increasing population trend (BirdLife International 2017b) (Arata et al. 2009). The breeding season population is estimated to be 69,404 pairs (ACAP 2012). Despite the stable/increasing population, the "Near Threatened" IUCN status and high vulnerability to fishing interactions leads to a Seafood Watch score of "high" concern.

Factor 2.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines

High Concern

Black-footed albatross is one of the more commonly observed bird species in the western and central Pacific Ocean (WCPO) with interactions primarily occurring in the North Pacific longline fisheries (BirdLife International 2017b). Some studies have suggested the mortality associated with North Pacific tuna longline fisheries may threaten black-footed albatross. We have awarded a score of "high" concern because seabirds are considered highly vulnerable and their stock status is of high concern; current mortality rates are unknown but could be high and have population level impacts.

Justification:

The population could probably sustain a maximum mortality rates of 10,000 to 12,000 birds per year but mortality from pelagic longline fisheries may exceed this (Lewison and Crowder 2003) (Crowder and Myers 2001) (Arata and Naughton 2009). From 1992 to 2009, 100% of black-footed albatross caught in longline fisheries north of 10°N were discarded dead (OFP 2010). The total estimated mortality of this species in the central north Pacific between 1994 and 2000 ranged from 5,200 to 13,800 birds (Gilman 2001). Observer data collected from the WCPO region between 2007 and 2016 indicated 247 black-footed albatross were observed to be incidentally captured (Peatman et al. 2017). Reducing sea-bird interactions in this region could improve their IUCN listing status.

Factor 2.3 - Modifying Factor: Discards and Bait Use

Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For

fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

RATIO OF BAIT + DISCARDS/LANDINGS	FACTOR 2.3 SCORE
<100%	1
>=100	0.75

NORTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%. In the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). Information from observer records collected in the North Pacific indicate 36% of the total catch is discarded. Specifically, in the area north of 10°N, discard rates for tuna ranged from 0 to 35%, for billfish from 3 to 44%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, and 100% for marine mammals, sea birds and turtles (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

HAWKSBILL TURTLE

Factor 2.1 - Abundance

WESTERN CENTRAL PACIFIC
Drifting Longlines

High Concern

The International Union for Conservation of Nature (IUCN) has classified hawksbill turtles as "Critically Endangered" with a decreasing population trend (Mortimer and Donnelly 2008). The North Central, West Central and West Pacific hawksbill RMUs are at a high risk of population decline with high threats (Wallace et al. 2011) (Wallace et al. 2013). Hawksbill turtles have been listed in CITES since 1977 and are currently listed in CITES Appendix 1, meaning they are threatened with extinction and international trade is prohibited. It has been estimated that populations in the Pacific Ocean have declined by over 75% over three generations (Mortimer and Donnelly 2008). In the Western Pacific, 7 out of 10 nesting locations have depleted or declining populations (Mortimer and Donnelly 2008). We have awarded a score of "high" concern based on the IUCN listing and because more than one RMU is at high risk with high threats.

Factor 2.2 - Fishing Mortality

WESTERN CENTRAL PACIFIC
Drifting Longlines

High Concern

Interactions between hawksbill turtles and pelagic longline gear in the Western and Central Pacific Ocean (WCPO) do occur but do not appear to be frequent in nature. Recorded interactions are more frequent

in tropical and subtropical waters compared to temperate (Williams et al. 2009). Between 1980 and 2004, only 12 hawksbill turtles were observed incidentally caught in tuna longline fisheries in the WCPO (Molony 2005), although mortality rates associated with this capture are high (OFP 2010). A meta data analysis indicated this population had a high risk but low bycatch impact (Wallace et al. 2013b). Bycatch mitigation measures are being used by some fleets, but there are issues with compliance (WCPFC 2016). We have awarded a high concern score because the population is depleted, the fishery impact is not fully known, and mitigation methods may not be effective.

Factor 2.3 - Modifying Factor: Discards and Bait Use

Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

RATIO OF BAIT + DISCARDS/LANDINGS	FACTOR 2.3 SCORE
<100%	1
>=100	0.75

WESTERN CENTRAL PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). In the WCPO pelagic longline fisheries around 5% of targeted tuna (bigeye, yellowfin, and albacore) were estimated to have been discarded between 1994 and 2011 (OFP 2012a). Discard rates of skipjack tuna are higher (20%) (OFP 2010). Earlier estimates through 2009 indicated the total discard rate of targeted tunas was around 5%. Discard rates for non-targeted species between 1994 and 2009 were 11% for billfish, 54% for other bony fish, 49% for elasmobranchs, 73% for seabirds, 94% for marine mammals, and 96% for turtles (OFP 2010). According to this second study, based on observer data, the overall discard rate for the WCPO longline fishery is 15% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

BLUE SHARK

Factor 2.1 - Abundance

NORTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

Low Concern

An updated assessment of blue sharks in the North Pacific was completed during 2017. According to this assessment, the population of blue sharks in the North Pacific has increased since the lowest levels between

1990 and 1995 to near series highs in recent years (ISC 2017b). The female spawning biomass is estimated to be 71% above sustainable levels (SB_{2015}/SB_{MSY}) (ISC 2017b). This indicates that the population is not overfished and we have therefore awarded a score of "low" concern.

Factor 2.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

Low Concern

Blue sharks are widely distributed throughout the North Pacific and dominate shark catches in that region. According to the 2017 updated assessment, the fishing mortality rate estimated in recent years ($F_{2012-2014}$) was around 37% of that needed to produce the maximum sustainable yield (F_{MSY}) (ISC 2017b). Therefore overfishing is not occurring and we have awarded a score of "low" concern.

Factor 2.3 - Modifying Factor: Discards and Bait Use

Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

RATIO OF BAIT + DISCARDS/LANDINGS	FACTOR 2.3 SCORE
<100%	1
>=100	0.75

WESTERN CENTRAL PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). In the WCPO pelagic longline fisheries around 5% of targeted tuna (bigeye, yellowfin, and albacore) were estimated to have been discarded between 1994 and 2011 (OFP 2012a). Discard rates of skipjack tuna are higher (20%) (OFP 2010). Earlier estimates through 2009 indicated the total discard rate of targeted tunas was around 5%. Discard rates for non-targeted species between 1994 and 2009 were 11% for billfish, 54% for other bony fish, 49% for elasmobranchs, 73% for seabirds, 94% for marine mammals, and 96% for turtles (OFP 2010). According to this second study, based on observer data, the overall discard rate for the WCPO longline fishery is 15% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

FLESH-FOOTED SHEARWATER

Factor 2.1 - Abundance

SOUTH PACIFIC
Drifting Longlines

High Concern

According to the International Union for Conservation of Nature (IUCN), flesh-footed shearwater are classified as "Near Threatened," with a decreasing population trend (BirdLife International 2017c). This is a change from the previous "Least Concern" IUCN status (BirdLife International 2012). The change in classification is due to the realization that previous estimates were too high and the current population is substantially smaller, with 74,000 breeding pairs (Lavers 2014). We have awarded a score of "high" concern due to the IUCN classification.

Factor 2.2 - Fishing Mortality

SOUTH PACIFIC
Drifting Longlines

High Concern

Flesh-footed shearwaters have a large range and subsequently a large overlap with this fishery. High bycatch rates have been observed in the Australian Eastern Tuna and Billfish Fishery and this species is the third most at-risk species in New Zealand fisheries (Baker and Wise 2005), (Richard and Abraham 2013). This species has a high susceptibility to the fishery and fishing mortality rates are unknown. Mitigation measures have been adopted by many fleets in the southwest Pacific Ocean (Clarke et al. 2014), but compliance is often lacking (WCPFC 2017b) (WCPFC 2016). Therefore, we have awarded a score of "high" concern.

Justification:

Flesh-footed shearwaters appear to be incidentally caught in pelagic longline fisheries operating in the South Pacific (BirdLife International 2017c). For example, between 1980 and 2004, 124 flesh-footed shearwater interactions with pelagic longline gear were observed in waters south of 31°S (Molony 2005). From 1992 to 2009, 92% of flesh-footed shearwaters captured in the albacore South Pacific longline fishery were discarded and of those 85% were dead (OFP 2010). Observer data collected from the WCPO region between 2007 and 2016 indicated 8 flesh-footed shearwaters were observed to be incidentally captured (Peatman et al. 2017).

Factor 2.3 - Modifying Factor: Discards and Bait Use

Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

RATIO OF BAIT + DISCARDS/LANDINGS	FACTOR 2.3 SCORE
<100%	1
>=100	0.75

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.

Criterion 3: Management Effectiveness

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective,' 'moderately effective,' 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

- *5 (Very Low Concern) — Meets the standards of 'highly effective' for all five factors considered.*
- *4 (Low Concern) — Meets the standards of 'highly effective' for 'management strategy and implementation' and at least 'moderately effective' for all other factors.*
- *3 (Moderate Concern) — Meets the standards for at least 'moderately effective' for all five factors.*
- *2 (High Concern) — At a minimum, meets standards for 'moderately effective' for Management Strategy and Implementation and Bycatch Strategy, but at least one other factor is rated 'ineffective.'*
- *1 (Very High Concern) — Management Strategy and Implementation and/or Bycatch Management are 'ineffective.'*
- *0 (Critical) — Management Strategy and Implementation is 'critical'.*

The Criterion 3 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and ≤3.2=Yellow or Moderate Concern*
- *Score ≤2.2 = Red or High Concern*

Rating is Critical if Management Strategy and Implementation is Critical.

GUIDING PRINCIPLE

- The fishery is managed to sustain the long-term productivity of all impacted species.

Criterion 3 Summary

Fishery	Management Strategy	Bycatch Strategy	Research and Monitoring	Enforcement	Stakeholder Inclusion	Score
Fishery 1: North Pacific | Drifting longlines	Ineffective	Ineffective				Red (1.000)
Fishery 2: South Pacific | Drifting longlines	Moderately Effective	Ineffective				Red (1.000)
Fishery 3: Western Central Pacific | Drifting longlines	Moderately Effective	Ineffective				Red (1.000)

The United Nations Straddling and Highly Migratory Fish Stocks Agreement (1995) indicated that the management of straddling and highly migratory fish stocks should be carried out through regional fisheries management organizations (RFMOs). RFMOs are the only legally mandated fishery management body on the high seas and within EEZ waters. There are currently 18 RFMOs (www.fao.org) and they cover nearly all of the world's waters. Member countries must abide by the management measures set forth by individual RFMOs in order to fish in their waters {Cullis-Suzuki and Pauly 2010}. Some RFMOs manage all marine living resources within their authority (i.e., General Fisheries Commission for the Mediterranean [GFCM]), while others manage a group of species such as tunas (i.e., Inter-American Tropical Tuna Commission [IATTC]).

WCPFC members are as follows: Australia, China, Canada, Cook Islands, European Union, Federated States of Micronesia, Fiji, France, Indonesia, Japan, Kiribati, Republic of Korea, Republic of Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Philippines, Samoa, Solomon Islands, Chinese Taipei, Tonga, Tuvalu, United States of America, Vanuatu.

IATTC members are as follows: Belize, Canada, China, Colombia, Costa Rica, Ecuador, El Salvador, European Union, France, Guatemala, Japan, Kiribati, Korea, Mexico, Nicaragua, Panama, Peru, Chinese Taipei, United States, Vanuatu, Venezuela.

CCSBT members include the following countries: Australia, Japan, New Zealand, Republic of Korea, Indonesia, Taiwan, and the European Union. Cooperating non-members include South Africa and the Philippines.

Criterion 3 Assessment

Factor 3.1 - Management Strategy and Implementation

Considerations: What type of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? Do manages follow scientific advice? To achieve a highly effective rating, there must be appropriately defined management goals, precautionary policies that are based on scientific advice, and evidence that the measures in place have been successful at maintaining/rebuilding species.

NORTH PACIFIC
Drifting Longlines

Ineffective

Marlins, Opah
There are no management measures in place for opah, and blue and black marlins in the North Pacific. A phased-in reduction of catches of North Pacific striped marlin was initiated in 2011. Countries were to reduce their catches by 10%, 15%, and 20% in 2011, 2012, and 2013 respectively from the highest catches recorded between 2000 and 2003 (ISC 2019)(WCFPC 2019a)(WCPFC 2006). However, there are "no agreed-upon limit reference points, measures on catch limits, and reductions in fishing mortality to allow rebuilding of this stock." (WCFPC 2019a).

Sharks
There are no management measures in place for shortfin mako shark and blue shark specifically. Shark finning is prohibited (WCPFC 2019b). As of 2015, member countries are required to create shark management plans that include licenses and TACs and longline fisheries targeting tuna and billfish are prohibited from using either wire branchlines and leaders, or shark lines (branchlines running directly off the longline floats) (Clarke 2016), (WCPFC 2019b). Clarke (2013) identified that compliance with implementing WCPFC-adopted management measures specific to sharks is at best 60% and lower for some measures (Clarke 2013). There are no reference points in place for any of these species and no harvest control rule.

Pacific Bluefin tuna
The management structure has allowed severe declines of Pacific bluefin tuna and only responded with an appropriate rebuilding plan when abundance got to less than 3% of virgin levels, biomass remains very low despite the adoption of a rebuilding plan, the short-term, initial rebuild goal of the plan is very low, and there are no enforcement mechanisms within the RFMO to ensure compliance (ISC 2018).

We have scored management of this fishery as “ineffective” because there are no management measures in

place for many of the retained species covered in this report and management for Pacific bluefin tuna has proven ineffective.

Justification:

Albacore
There are few management measures in place for albacore tuna in the North Pacific Ocean. Measures were adopted by the Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC) in 2005, 2013 (IATTC), and 2018 (IATTC). Those management measures included maintaining current catch levels in order to maintain the long-term sustainability of the stock, and the WCPFC was to work with members of the IATTC to agree on consistent management measures for the North Pacific population (IATTC 2005) (WCPFC 2005). In 2013, IATTC adopted a new resolution requiring member countries to report the average catches of North Pacific albacore tuna between 2007 and 2012 by gear type, along with a list of vessels that fish for albacore in the North Pacific. In 2018 a new measure (amendment to the 2013 measure) requires new data reporting standards (IATTC 2018). In addition, the Commissions both plan to work toward the development of target and limit reference points, as well as the development of harvest control rules for this species (IATTC 2018) (WCPFC 2015).

Bluefin Tuna
In the Eastern Pacific Ocean, the Inter-American Tropical Tuna Commission (IATTC) implemented a catch limit of 6,600 t during 2017 and 2018 (3,300 t/year) for Pacific bluefin tuna caught in the Convention Area. In the western and central Pacific Ocean, the Western and Central Pacific Fisheries Commission (WCPFC) has limited fishing effort for Pacific bluefin tuna. Vessels fishing north of 20°N must stay below 2002 to 2004 fishing effort. In addition, catches of bluefin tuna less than 30 kg in weight shall be reduced by 50% of the 2002 to 2004 average level (WCPFC 2016b). There is also a recently developed Catch Documentation Scheme that has yet to be implemented (WCPFC 2013a). In 2017, the IATTC and WCPFC worked together to develop a new rebuilding plan, which includes a plan for implementing the harvest strategy agreed on by the Northern Committee, which included a target to rebuild the population to 20% of virgin levels by 2024. If the chances of meeting this rebuilding target fall below 60%, additional catch limitations will be put into place (NC 2017) (WCPFC 2017g). However, the initial, short-term rebuild goal of the plan is low (6% SSB) (ISC 2018).

Swordfish
There are no measures in place for swordfish in the north Pacific Ocean but the stock is currently considered to be healthy.

SOUTH PACIFIC
Drifting Longlines

Moderately Effective

There are no management measures in place for blue or black marlins or opah in the South Pacific. Striped marlin is managed through effort restrictions (Ducharme-Barth et al. 2019)(WCPFC 2006). There are no biomass-based reference points for these species and no harvest control rules..

Sharks
There are no management measures in place for shortfin mako shark and blue shark specifically. Shark finning is prohibited (WCPFC 2019b). As of 2015, member countries are required to create shark management plans that include licenses and TACs and longline fisheries targeting tuna and billfish are prohibited from using either wire branchlines and leaders, or shark lines (branchlines running directly off the longline floats) (Clarke 2016), (WCPFC 2019b). Clarke (2013) identified that compliance with implementing WCPFC-adopted management measures specific to sharks is at best 60% and lower for some measures (Clarke 2013). There are no reference points in place for blue sharks or shortfin mako sharks and no harvest control rules.

We have awarded a score of "moderately effective" because some management measures are in place for some of the retained species and regarding southern bluefin tuna, the Pacific fishery catches only a small portion of the total catch, there is a management procedure that helps inform the TAC, and management has been fairly effective for the other species.

Justification:

Albacore
Few management measures have been enacted for albacore tuna in the South Pacific. The Western and Central Pacific Fisheries Commission (WCPFC) has limited the number of fishing vessels actively fishing for albacore to not exceed 2005 levels or historical levels (2000 to 2004). WCPFC member countries shall work to ensure the long-term sustainability of albacore tuna in this region, which includes collaborative research (WCPFC 2010b). Biomass based limit reference points have been adopted by the WCPFC for albacore tuna and are used to determine the status of their populations, and the WCPFC has recently agreed to implement interim target reference points (WCPFC 2018a). However, there are no harvest control rules (WCPFC 2015) (WCPFC 2018). We have awarded a score of "moderately effective" based on the current management scheme, which includes some management but does not currently include harvest control rules.

Swordfish and other retained species
In 2009, the WCPFC limited the number of vessels targeting swordfish and catches to levels from any year between 2000 and 2005 and required this information to be reported to the Commission (WCPFC 2009). Management measures adopted for other retained species include effort restrictions for striped marlin (WCPFC 2006).

Bluefin tuna
Management measures adopted by the Commission for the Conservation of Southern Bluefin Tuna (CCSBT), which is responsible for the management of southern bluefin tuna throughout their range, include a total allowable catch (TAC) set on a three-year cycle, divided between eight countries and the European Community, and a Management Procedure (MP), which the CCSBT uses to aid in the setting of the TAC. The MP has been in place since 2012. In addition, there is a meta-rule process that the CCSBT can use to deal with certain situations such as untested recruitment or abundance estimates or "substantial" improvements with regard to unknown or missing data (CCSBT 2017b).

WESTERN CENTRAL PACIFIC
Drifting Longlines

Moderately Effective

Marlins and Opah
There are no management measures in place for blue or black marlins or opah in the WCPO. Striped marlin in the South Pacific is managed through effort restrictions (WCPFC 2006). There are no biomass-based reference points for these species and no harvest control rules.

Sharks
There are no management measures in place for shortfin mako shark and blue shark specifically. Shark finning is prohibited (WCPFC 2019b). As of 2015, member countries are required to create shark management plans that include licenses and TACs and longline fisheries targeting tuna and billfish are prohibited from using either wire branchlines and leaders, or shark lines (branchlines running directly off the longline floats) (Clarke 2016), (WCPFC 2019b). Clarke (2013) identified that compliance with implementing WCPFC-adopted management measures specific to sharks is at best 60% and lower for some measures (Clarke 2013). There are no reference points in place for blue sharks or shortfin mako sharks and no harvest control rules.

Tuna
Management measures for targeted tuna species in the Western and Central Pacific Ocean (WCPO) longline fisheries have been adopted by the Western and Central Pacific Fisheries Commission (WCPFC). At the most recent Commission meeting (2017) a tropical tuna bridging measure was adopted, which increased the bigeye catch limits for the longline fishery, which is not inline with the scientific advice for maintaining the biomass of bigeye tuna (WCPFC 2017). It is too early to determine if compliance with the new measures has been good. Biomass-based limit reference points have been adopted by the WCPFC for bigeye, and yellowfin tuna and are used to determine the status of tuna populations (WCPFC 2015). Target reference points are not yet in place for any of these species, and there are no harvest control rules, although there is a plan and timeline in place for the adoption of harvest control rules (WCPFC 2015).

We have awarded a score of "moderately effective" because measures currently in place for many retained species have had mixed results in preventing overfishing; however improvements are still needed.

Factor 3.2 - Bycatch Strategy

Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and when applicable, to minimize ghost fishing? How successful are these management measures? To achieve a Highly Effective rating, the fishery must have no or low bycatch, or if there are bycatch or ghost fishing concerns, there must be effective measures in place to minimize impacts.

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

Ineffective

Low observer coverage in the WCPO (max 5%) has hampered the ability of assessing whether adopted management measures have been effective (Gilman 2011). Thus, we do not know actual bycatch levels. Clarke identified that compliance with implementing WCPFC-adopted management measures specific to sharks is at best 60% and lower for some measures (Clarke 2013). There are additional compliance issues with the implementation of sea turtle, shark, and seabird management measures (WCPFC 2016). We have awarded a score of "ineffective" because there are no bycatch limits for non-target species, there is limited mandated mitigation measures for sea turtles and seabirds, and it is unclear if current management measures are effective at maintaining population levels of bycatch species.

Justification:

The Western and Central Pacific Fisheries Commission (WCPFC) and Inter-American Tropical Tuna Commission (IATTC) have adopted management measures to protect vulnerable bycatch species. For example, WCPFC and IATTC members are asked to implement the International Plan of Action for Reducing Incidental Catches of Seabirds in Longline Fisheries. Vessels fishing north of 23°N in the western and central Pacific Ocean (WCPO) and eastern Pacific Ocean (EPO) are required to use at least two mitigation measures including at least one of the following: side setting, night setting, tori line or weighted branch line. Members must submit annual reports detailing the mitigation measures used and are encouraged to undertake additional mitigation research (IATTC 2011b) (WCPFC 2012e) (WCPFC 2017b). In the WCPO, small longliners fishing north of 23° N must use one of these mitigation measures (WCPFC 2017b). Even in these zones, however, the management system provides only a menu of mitigation methods from which to choose.

Some of those methods are known to be effective only under certain conditions, but because the fishers can choose which to use, they can choose the least costly and likely least effective method. Therefore, even meeting the mitigation requirements to the letter does not mean that effective mitigation methods are being used.

Members of both the WCPFC and IATTC must implement the FAO Guidelines to Reduce Sea Turtle Mortality in Fishing Operations. Proper handling and release guidelines should be used when hard-shell turtles are incidentally captured, and longline vessels must carry line cutters and de-hookers to allow for the safe handling and release of turtles. Longline fisheries are also urged to research mitigation techniques such as the use of circle hooks (WCPFC 2008) (IATTC 2007).

Vessels conducting shallow set fishing targeting swordfish also must comply with mitigation measures (i.e., circle hooks, whole bait or other reviewed technique) (WCPFC 2008b) (IATTC 2006). In addition, fisheries observers record and report interactions with seabirds and turtles (IATTC 2011c) (WCPFC 2012e) (WCPFC 2008b).

Members of both the WCPFC and IATTC are prohibited from retaining, transshipping, storing or landing oceanic whitetip and silky sharks; any incidentally caught sharks should be released, the incident recorded and reported (IATTC 2011d) (WCPFC 2012f) (WCPFC 2013f). Vessels must comply with one of the following mitigation measures to reduce shark interactions: 1) prohibit carrying/using wire trace as branch lines or leaders or 2) prohibit use of branch lines running directly off the longline floats, known as "shark lines" (WCPFC 2014). Members must also implement the FAO International Plan of Action for the Conservation and Management of Sharks, and National Plans of Action should have policies in place to reduce waste and discarding of sharks. Information on catch and effort for key species should be reported and shark finning is banned (5% ratio) (IATTC 2005b) (WCPFC 2010a).

Factor 3.3 - Scientific Research and Monitoring

Considerations: How much and what types of data are collected to evaluate the fishery's impact on the species? Is there adequate monitoring of bycatch? To achieve a Highly Effective rating, regular, robust population assessments must be conducted for target or retained species, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are met.

Factor 3.4 - Enforcement of Management Regulations

Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.

Factor 3.5 - Stakeholder Inclusion

Considerations: Are stakeholders involved/included in the decision-making process? Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g., fishermen, conservation groups, etc.). A Highly Effective rating is given if the management process is transparent, if high participation by all stakeholders is encouraged, and if there a mechanism to effectively address user conflicts.

Criterion 4: Impacts on the Habitat and Ecosystem

This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment. The final score is the geometric mean of the impact of fishing gear on habitat score (factor 4.1 + factor 4.2) and the Ecosystem Based Fishery Management score. The Criterion 4 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and ≤3.2=Yellow or Moderate Concern*
- *Score ≤2.2=Red or High Concern*

GUIDING PRINCIPLES

- Avoid negative impacts on the structure, function or associated biota of marine habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.
- Follow the principles of ecosystem-based fisheries management.

Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

Region | Method	Gear Type and Substrate	Mitigation of Gear Impacts	EBFM	Score
North Pacific | Drifting longlines	5	0	Moderate Concern	Green (3.873)
South Pacific | Drifting longlines	5	0	Moderate Concern	Green (3.873)
Western Central Pacific | Drifting longlines	5	0	Moderate Concern	Green (3.873)

Criterion 4 Assessment

SCORING GUIDELINES

Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate

Goal: The fishery does not adversely impact the physical structure of the ocean habitat, seafloor or associated biological communities.

- *5 - Fishing gear does not contact the bottom*
- *4 - Vertical line gear*
- *3 - Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap)*

and is not fished on sensitive habitats. Or bottom seine on resilient mud/sand habitats. Or midwater trawl that is known to contact bottom occasionally. Or purse seine known to commonly contact the bottom.

- *2 - Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Or gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Or bottom seine except on mud/sand. Or there is known trampling of coral reef habitat.*
- *1 - Hydraulic clam dredge. Or dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 - Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl)*
  Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Goal: Damage to the seafloor is mitigated through protection of sensitive or vulnerable seafloor habitats, and limits on the spatial footprint of fishing on fishing effort.

- *+1 —>50% of the habitat is protected from fishing with the gear type. Or fishing intensity is very low/limited and for trawled fisheries, expansion of fishery's footprint is prohibited. Or gear is specifically modified to reduce damage to seafloor and modifications have been shown to be effective at reducing damage. Or there is an effective combination of 'moderate' mitigation measures.*
- *+0.5 —At least 20% of all representative habitats are protected from fishing with the gear type and for trawl fisheries, expansion of the fishery's footprint is prohibited. Or gear modification measures or other measures are in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing that are expected to be effective.*
- *0 —No effective measures are in place to limit gear impacts on habitats or not applicable because gear used is benign and received a score of 5 in factor 4.1*

Factor 4.3 - Ecosystem-Based Fisheries Management

Goal: All stocks are maintained at levels that allow them to fulfill their ecological role and to maintain a functioning ecosystem and food web. Fishing activities should not seriously reduce ecosystem services provided by any retained species or result in harmful changes such as trophic cascades, phase shifts or reduction of genetic diversity. Even non-native species should be considered with respect to ecosystem impacts. If a fishery is managed in order to eradicate a non-native, the potential impacts of that strategy on native species in the ecosystem should be considered and rated below.

- *5 — Policies that have been shown to be effective are in place to protect species' ecological roles and ecosystem functioning (e.g. catch limits that ensure species' abundance is maintained at sufficient levels to provide food to predators) and effective spatial management is used to protect spawning and foraging areas, and prevent localized depletion. Or it has been scientifically demonstrated that fishing practices do not have negative ecological effects.*
- *4 — Policies are in place to protect species' ecological roles and ecosystem functioning but have not proven to be effective and at least some spatial management is used.*
- *3 — Policies are not in place to protect species' ecological roles and ecosystem functioning but detrimental food web impacts are not likely or policies in place may not be sufficient to protect species' ecological roles and ecosystem functioning.*
- *2 — Policies are not in place to protect species' ecological roles and ecosystem functioning and the likelihood of detrimental food impacts are likely (e.g. trophic cascades, alternate stable states, etc.), but conclusive scientific evidence is not available for this fishery.*
- *1 — Scientifically demonstrated trophic cascades, alternate stable states or other detrimental food web impact are resulting from this fishery.*

Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

5

Although pelagic longlines are surface fisheries, contact with the seabed can occur in shallow-set fisheries, such as the Hawaiian shallow-set fishery (Passfield and Gilman 2010). However, these effects are still considered to be a low risk to bottom habitats (Gilman et al. 2013) so we have awarded a score of "no impact."

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

0

Pelagic longline gear typically does not come into contact with bottom habitats.

Factor 4.3 - Ecosystem-Based Fisheries Management

NORTH PACIFIC
Drifting Longlines
SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

Moderate Concern

The pelagic longline fishery in the western and central Pacific Ocean catches a number of ecologically important species including other tunas, billfish, and sharks. Sharks are top predators in many ecosystems and play a critical role in how these ecosystems are structured and function (Piraino et al. 2002) (Stevens et al. 2000). The loss of these predators can lead to changes in prey abundances that can cascade throughout the foodweb (Myers et al. 2007) (Duffy 2003) (Ferretti et al. 2010) (Schindler et al. 2002), and also lead to behavioral changes (Heithaus et al. 2007). In the North Pacific Ocean, the removal of blue sharks and tunas by longline fisheries has caused an increase in the number of short-lived fast growing species such as mahi mahi (Polovina 2009).

The Western and Central Pacific Fisheries Commission has begun identifying key shark species impacted by fisheries in the Convention Area and has to date completed stock assessments on two species (oceanic white tip and silky sharks) and adopted several management measures to protect bycatch species (Rice and Harley 2013) (Rice and Harley 2012b). In addition, the WCPFC has initiated studies to monitor changes to the

food-web and to examine predator-prey relationships (Allain 2010) (Allain et al. 2012).

We have awarded a score of "moderate" concern because this fishery catches exceptional species, but there are some efforts to incorporate their ecological role into management.

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Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

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Appendix A: Extra By Catch Species

SWORDFISH

Factor 2.1 - Abundance

NORTH PACIFIC
Drifting Longlines

Low Concern

An assessment for swordfish in the North Pacific was conducted in 2018. Although there are no agreed-upon reference points, the female biomass in 2016 was estimated to be 29,403 MT, which is around 87% above the maximum sustainable yield (MSY) level (ISC 2018b). The spawning potential ratio of the stock is currently estimated at 45% (ISC 2018b). Model sensitivity analysis revealed a few runs that indicated the stock was overfished, and the assessment does not incorporate model uncertainty (ISC 2018b). Swordfish in the North Pacific likely are not overfished, but because the base case model does not incorporate uncertainty and there is a lack of reference points, we score abundance as "low" concern, rather than "very low" concern.

Justification:

This assessment considered one of the populations in the western and central Pacific (WCPO) (ISC 2018b). According to this assessment, the population has been fairly stable with a slight decline until the mid-1990s followed by a slight increase since 2000 (ISC 2018b). The spawning stock biomass has remained above MSY levels throughout the time series of the assessment (ISC 2018b).

SOUTH PACIFIC
Drifting Longlines

Low Concern

The most recent assessment for swordfish in the southwestern Pacific Ocean was conducted in 2017 (Takeuchi et al. 2017). There are no reference points adopted for this population. The assessment indicated that the stock biomass is above limit reference points (20%SB*F=0) used for tuna. The median estimate was 0.35 (Takeuchi et al. 2017). The ratio of the latest spawning biomass to that needed to produce the maximum sustainable yield ($SB_{LATEST}SB_{MSY}$) was 1.61 (Takeuchi et al. 2107). It is likely the stock is not overfished, but because there are no reference points in place, we have awarded a score of "low" concern, rather than a score of "very low" concern.

Factor 2.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines

Low Concern

An assessment for swordfish in the North Pacific was conducted in 2018. Exploitation rates in this region peaked in the 1960s and have declined since. The current fishing mortality rate ($H_{2013\text{-}2015}$) is 0.08, which is around 45% lower than the level necessary to produce the maximum sustainable yield (H_{MSY}=25%). It is very unlikely (<1%) that fishing mortality rates (H) are unsustainable and therefore overfishing is not occurring (ISC 2018b). We have therefore awarded a score of "low" concern.

SOUTH PACIFIC
Drifting Longlines

Low Concern

According to the updated 2017 stock assessment of swordfish in the South Pacific, fishing mortality rates are sustainable. The ratio of recent fishing mortality rates to those needed to produce the maximum sustainable yield (MSY) was estimated to be 0.86 (0.42 to 1.46) (Takeuchi et al. 2017). Overfishing is not currently occurring, so we have awarded a score of "low" concern.

Factor 2.3 - Discard Rate

NORTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%. In the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). Information from observer records collected in the North Pacific indicate 36% of the total catch is discarded. Specifically, in the area north of 10°N, discard rates for tuna ranged from 0 to 35%, for billfish from 3 to 44%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, and 100% for marine mammals, sea birds and turtles (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.

LAYSAN ALBATROSS

Factor 2.1 - Abundance

NORTH PACIFIC
Drifting Longlines

High Concern

The International Union for Conservation of Nature (IUCN) lists the Laysan albatross as "Near Threatened" but with a stable population trend (BirdLife International 2017e). Globally, there are an estimated 800,000 breeding pairs or 1.6 million mature birds (Arata et al. 2009). We have awarded a score of "high" concern due to the IUCN listing.

Factor 2.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines

Moderate Concern

Laysan albatross have a very high overlalp within the northern region of the western and central Pacific Ocean (ACAP 2010). Pelagic longline vessels fishing in the North Pacific Ocean may kill around 8,000 laysan albatross a year, although in recent years these numbers have been reduced due to the use of mitigation measures (BirdLife International 2017e). Between 1992 and 2009, 100% of incidentally captured Laysan albatross from the North Pacific albacore tuna fishery were discarded and of these 67% were dead (OFP 2010). Observer data collected from the WCPO region between 2007 and 2016 indicated 77 laysan albatross were observed to be incidentally captured (Peatman et al. 2017). We have awarded a score of "moderate" concern because fishing mortality rates are unknown but there are mitigation measures in place (Clarke et al. 2014).

Factor 2.3 - Discard Rate

NORTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%. In the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). Information from observer records collected in the North Pacific indicate 36% of the total catch is discarded. Specifically, in the area north of 10°N, discard rates for tuna ranged from 0 to 35%, for billfish from 3 to 44%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, and 100% for marine mammals, sea birds and turtles (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

ALBACORE

Factor 2.1 - Abundance

NORTH PACIFIC
Drifting Longlines

Low Concern

The most recent stock assessment for albacore tuna in the North Pacific Ocean was conducted in 2017. The population of albacore in the north Pacific has never dropped below the adopted (by the WCPFC) limit reference point (20% of the current spawning stock biomass (SSB) when F=0). According to this assessment, the estimated spawning potential ratio (SPR) was 0.53 in 2015, which is considered a moderate exploitation intensity (ISC 2017). The SSB in 2015 was estimated to be 80,168 t, which is 2.47 times larger than the limit reference point threshold (32,614 t). The population is therefore not overfished (ISC 2017). The stock has fluctuated around the current SSB level for decades. We have awarded a score of "low" concern because the

population is not overfished and biomass is above limit reference points.

Justification:

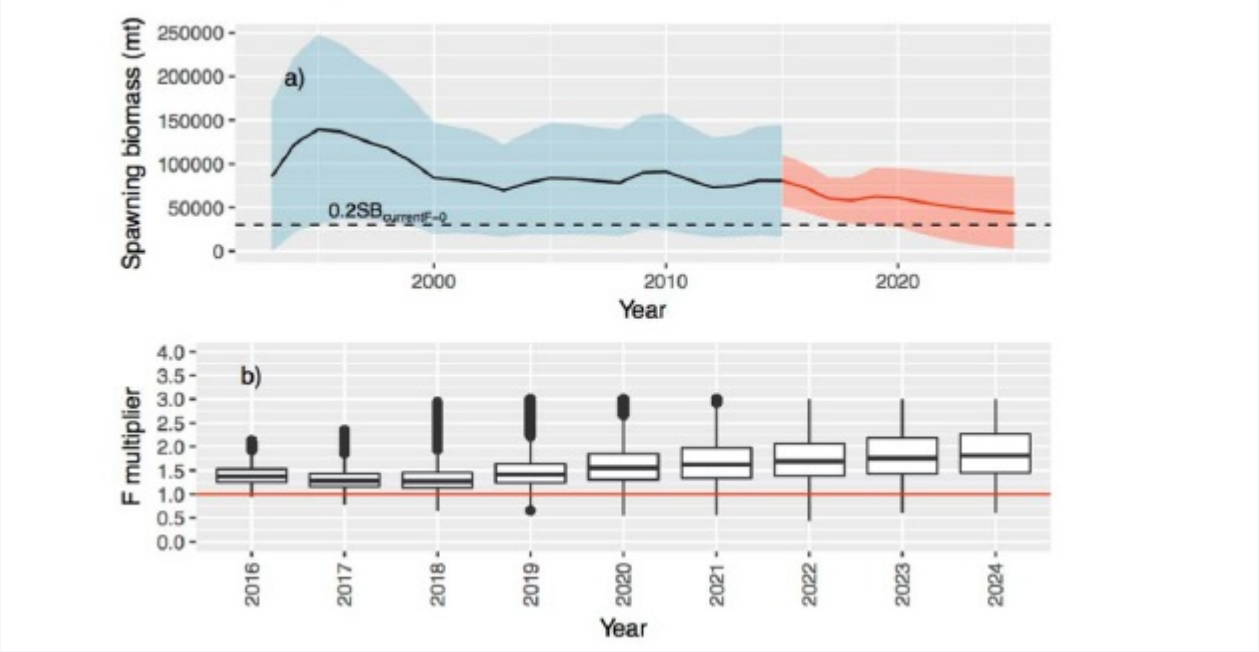

Figure 2 A) historical and future trajectory of north Pacific albacore female spawning biomass under constant catch harvest scenario. Dashed line indicates average limit reference point for 2012-2014. Black line and blue area indicate maximum likelihood estimates and 95% confidence intervals of historical female SSB. Red line and red area indicate mean value and confidence interval of projected female SSB, which only includes future recruitment variability and SSB uncertainty in the terminal year and B) projected fishing intensity relative to the current fishing intensity (2012-2014) under constant catch scenario (average 2010-2014) (ISC 2017)

SOUTH PACIFIC
Drifting Longlines

Low Concern

Albacore tuna in the South Pacific was last assessed in 2018 (WCPFC 2018). According to the stock assessment model, the median spawning biomass depletion is estimated at 52% (32% to 72%) of unfished levels ($SB_{RECENT}/SB_{F=0}$) (Tremblay-Boyer et al. 2018) (WCPFC 2018). The recent (2013 to 2016) median spawning potential is above the limit reference point of $20\%SB_{F=0}$, indicating the population is likely not overfished (Tremblay-Boyer et al. 2018) (WCPFC 2018). The WCPFC recently agreed to use 56% of spawning biomass in the absence of fishing ($0.56SB_{F=0}$) as a target reference point (WCPFC 2018a). Since $SB_{RECENT}/SB_{F=0}$ is above the limit reference point, and more than 75% of the target reference point, we have awarded a score of "low" concern.

Justification:

Based on bio-economic modelling described in (Pilling et al. 2016), the range of $SB_{F=0}$ that would support break-even or 10% profits is $0.65–0.80SB_{F=0}$, which is greater than the current median estimated $SB_{RECENT}/SB_{F=0}$ of 0.52 and greater than the target reference point of 0.56 (WCPFC 2018a). The objective of the new TRP is to increase CPUE in the longline fishery by 8% from 2013 levels. If the new, interim TRP does not result in the desired increase in CPUE, the WCPFC will revise the TRP (WCPFC 2018a). The TRP will be reviewed every 3 years.

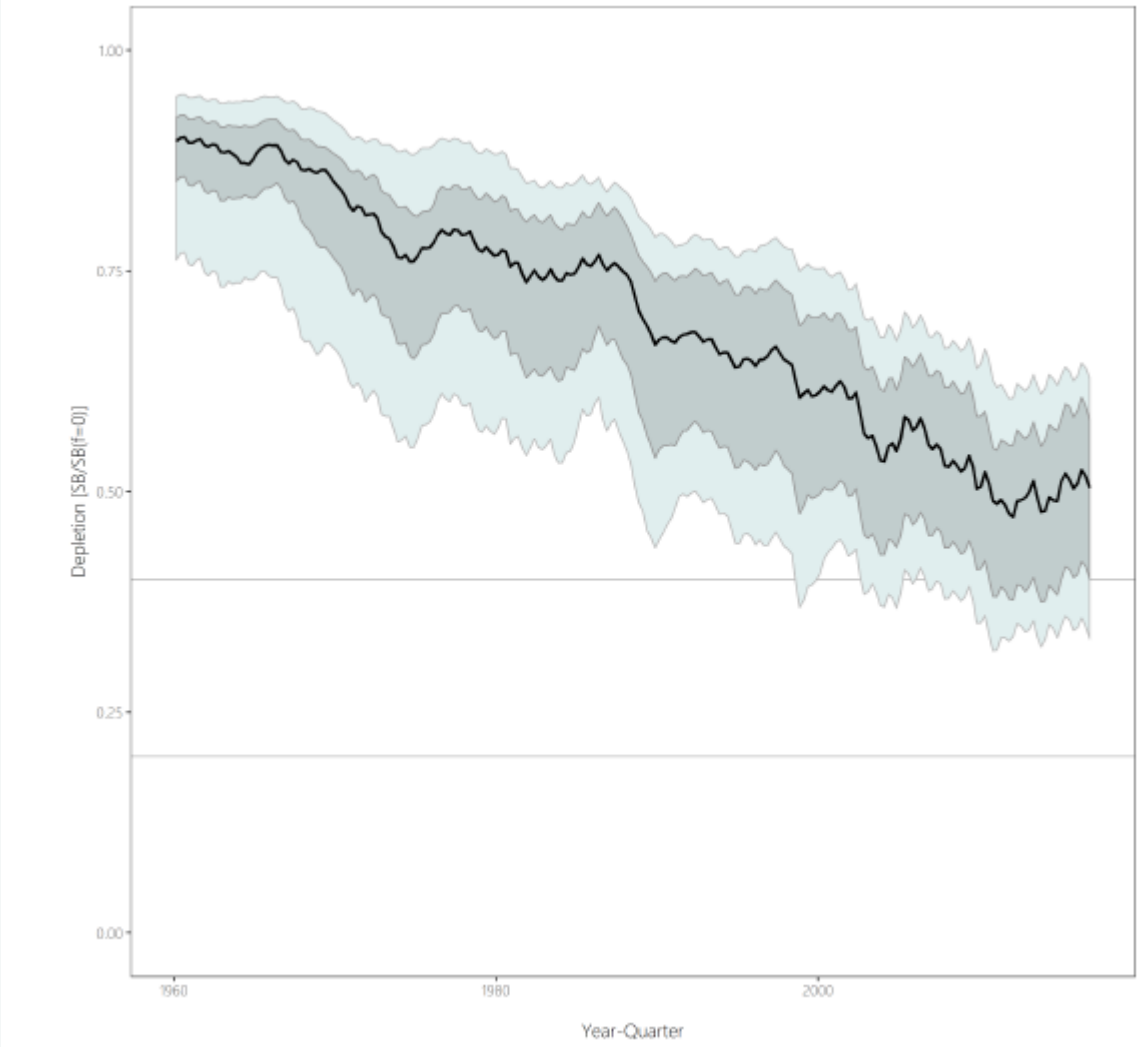

Figure 3 Distribution of time series depletion across the structural uncertainty grid (i.e., analysis of model structural uncertainty). Black line represents the median trajectory, dark gray = 50th percentile range, light gray = 90th percentile region (from (WCPFC 2018)).

Factor 2.2 - Fishing Mortality

NORTH PACIFIC
Drifting Longlines

Low Concern

The current fishing mortality rate ($F_{2012\text{-}2014}$) for albacore tuna in the North Pacific Ocean is below potential F-based reference points (F_{MSY} $F_{0.1}$ and $F_{10\text{-}40\%}$ (fishing mortality that gives 10 to 40% reduction in the spawning potential ratio)) except for $F_{50\%}$. Albacore tuna in the North Pacific Ocean are therefore not currently undergoing overfishing. However, increases in fishing mortality rates will significantly reduce the spawning biomass (ISC 2017). We have awarded a score of "low" concern because overfishing is likely not occurring.

SOUTH PACIFIC
Drifting Longlines

Low Concern

According to the most recent stock assessment (2018), which does not include catches made in the IATTC Convention Area, the ratio of the current fishing mortality rate to that needed to produce the maximum sustainable yield was less than 1 ($F_{CURRENT}/F_{MSY}$ = 0.2 (0.08-0.41)). There is a low risk that overfishing is occurring (Tremblay-Boyer et al. 2018). We have therefore awarded a score of "low" concern.

Factor 2.3 - Discard Rate

NORTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%. In the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). Information from observer records collected in the North Pacific indicate 36% of the total catch is discarded. Specifically, in the area north of 10°N, discard rates for tuna ranged from 0 to 35%, for billfish from 3 to 44%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, and 100% for marine mammals, sea birds and turtles (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.

SOUTHERN BLUEFIN TUNA

Factor 2.1 - Abundance

SOUTH PACIFIC
Drifting Longlines

High Concern

According to the latest stock assessment conducted in 2017, the current spawning biomass of southern bluefin tuna has improved slightly since the last stock assessment (2014) but is still only 13% of the initial spawning stock biomass. It is currently below SSB_{MSY} (SSB/SSB_{MSY} = 0.49), and also below the 20% interim management target (CCSBT 2017). However, abundance has been increasing since the 2011 implementation of management measures (CCSBT 2017). The stock is still currently overfished, so we have awarded a score of "high" concern.

Factor 2.2 - Fishing Mortality

SOUTH PACIFIC
Drifting Longlines

Low Concern

Fishing mortality rates have decreased for southern bluefin tuna and are now below those needed to produce the maximum sustainable yield ($F_{CURRENT}/F_{MSY}$ = 0.50 (0.38-0.66)). In addition, reported catches are below the maximum sustainable yield (MSY) levels and current exploitation rates are considered moderate (CCSBT 2017). The latest advice was that the current total allowable catch quota should continue (CCBST 2017). We have awarded a score of "low" concern because fishing mortality rates are below MSY levels.

Factor 2.3 - Discard Rate

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.

GREEN SEA TURTLE

Factor 2.1 - Abundance

SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

High Concern

The International Union for Conservation of Nature (IUCN) has classified green sea turtles worldwide as "Endangered" with a decreasing population trend (Seminoff 2004). Wallace et al. identified the Northwest

Pacific Regional Management Unit (RMU) of green sea turtles as at high risk of population decline, but with low threats (i.e., combination of bycatch, take, coastal development, pollution/pathogens and climate change) (Wallace et al. 2011) (Wallace et al. 2013). The southwest Pacific RMU had low risk, but high threats, while the Coral Triangle had high risk and high threats and a critical need for data. Finally, the West Central Pacific RMU had low risk and low threats. (Wallace et al. 2011). We have awarded a score of "high" because more than one RMU is at high risk of population decline and some have high threat levels.

Justification:

Green sea turtles have been listed in the Convention on International Trade of Endangered Species (CITES) since 1975, and are currently listed as CITES Appendix 1, meaning they are threatened with extinction and international trade is prohibited. The mean annual number of nesting turtles worldwide have decreased between 48% to 67% over the past 100 to 150 years (Seminoff 2004). Out of 27 known nesting sites in Oceania, 3 had an increasing trend, 2 had decreasing trends, and 2 had stable trends, and trends at the remaining sites were unknown (Maison et al. 2010).

Factor 2.2 - Fishing Mortality

SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

Moderate Concern

The incidental capture of green sea turtles is considered a major threat to their populations worldwide (Seminoff 2004). Although green sea turtles are one of the more commonly caught turtle species in the South Pacific region (Williams et al. 2009), the impact from bycatch to the population is low in the south central Pacific and western and central Pacific Ocean and those populations are considered to be at low risk (Wallace et al. 2011) (Wallace et al. 2013b) (Wallace et al. 2010). Bycatch mitigation methods have been adopted by the Western and Central Pacific Fisheries Commission, but their use and effectiveness is unknown and there are issues with compliance (Clarke et al. 2014). Also, bycatch monitoring and reporting is very low in much of this region We have awarded a score of "moderate" concern because bycatch in this fishery does not appear to be threatening the population, but impacts are not fully known.

Factor 2.3 - Discard Rate

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined

discards and bait use are greater than 100% of the total landings.

WESTERN CENTRAL PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). In the WCPO pelagic longline fisheries around 5% of targeted tuna (bigeye, yellowfin, and albacore) were estimated to have been discarded between 1994 and 2011 (OFP 2012a). Discard rates of skipjack tuna are higher (20%) (OFP 2010). Earlier estimates through 2009 indicated the total discard rate of targeted tunas was around 5%. Discard rates for non-targeted species between 1994 and 2009 were 11% for billfish, 54% for other bony fish, 49% for elasmobranchs, 73% for seabirds, 94% for marine mammals, and 96% for turtles (OFP 2010). According to this second study, based on observer data, the overall discard rate for the WCPO longline fishery is 15% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

OLIVE RIDLEY TURTLE

Factor 2.1 - Abundance

SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

High Concern

The International Union for Conservation of Nature (IUCN) considers Olive Ridley sea turtles to be "Vulnerable" globally with a decreasing population trend (Abreu-Grobis and Plotkin 2008). Olive Ridley turtles have been listed as "Threatened" on the United States Endangered Species Act (ESA) since 1978 (FR 1978). Overall, in the western and central Pacific Ocean there has been a decrease in annual nesting females of 92%, from 1,412 to 108 (Abreu-Grobis and Plotkin 2008). More recent information by Wallace et al., however, shows that the West Pacific olive ridley sea turtle RMU is at low risk of population decline but has high threats (Wallace et al. 2010) (Wallace et al. 2011). Despite historic declines, they are highly abundant and largely stable (B. P. Wallace, personal communication). We have awarded a score of "high" concern, however, because abundance is unknown, and sea turtles are highly vulnerable to the effects of fishing mortality.

Justification:

Along several beaches in Thailand, current estimates of the number of nests/km/day are around 20, while in Indonesia this number is 230. It is estimated that the annual nesting sub-population on these Thai beaches has decreased from 97 to 98% over time, while in Indonesia they have increased substantially.

Factor 2.2 - Fishing Mortality

SOUTH PACIFIC
Drifting Longlines
WESTERN CENTRAL PACIFIC
Drifting Longlines

Moderate Concern

The incidental capture of olive ridley turtles occurs worldwide, although the impact from other fisheries such as trawls and gillnets appear to have a larger negative impact compared to longlines (Wallace et al. 2013b) (Abreu-Grobois and Plotkin 2008). Data related to incidental captures is scarce due to low reporting by some countries and low observer coverage rates (~1%) (Brouwer and Bertram 2009) (Williams et al. 2009). However, bycatch of olive ridleys is reported to be especially high in some albacore fisheries operating in the South Pacific region (Huang 2014) but not others (Akroyd et al. 2017). Bycatch is a high threat to the West Pacific RMU, although the population currently is at low risk of population declines (Wallace et al. 2011). Bycatch mitigation methods have been put into place by some fisheries operating in the Western and Central Pacific Fisheries Commission, but there are issues with compliance and the effectiveness of these measures is unknown (Clarke 2013). We have awarded a score of "moderate" concern because population is not at high risk of decline, but threats to the RMU are high.

Factor 2.3 - Discard Rate

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.

WESTERN CENTRAL PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). In the WCPO pelagic longline fisheries around 5% of targeted tuna (bigeye, yellowfin, and albacore) were estimated to have been discarded between 1994 and 2011 (OFP 2012a). Discard rates of skipjack tuna are higher (20%) (OFP 2010). Earlier estimates through 2009 indicated the total discard rate of targeted tunas was around 5%. Discard rates for non-targeted species between 1994 and 2009 were 11% for billfish, 54% for other bony fish, 49% for elasmobranchs, 73% for seabirds, 94% for marine mammals, and 96% for turtles (OFP 2010). According to this second study, based on observer data, the overall discard rate for the WCPO longline fishery is 15% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

YELLOWFIN TUNA

Factor 2.1 - Abundance

WESTERN CENTRAL PACIFIC
Drifting Longlines

Very Low Concern

The biomass based reference points for the reference model used in the 2017 assessment (SB_{RECENT}/SB_{MSY} - the median ratio of the current (2011 to 2014) spawning (mature fish) biomass to that needed to produce the maximum sustainable yield) was 1.39. The median ratio of the latest (2015) spawning biomass to the level needed to produce the maximum sustainable yield (SB_{LATEST}/SB_{MSY}) also was 1.39. The median ratio of the recent spawning biomass to the biomass with no fishing mortality is 0.32, which is higher than the limit reference point (0.20). Therefore, yellowfin tuna are not in an overfished state (Tremblay-Boyer et al. 2017) and biomass is well above appropriate target levels such as SB_{MSY}. We have subsequently awarded ascore of "very low" concern.

Factor 2.2 - Fishing Mortality

WESTERN CENTRAL PACIFIC
Drifting Longlines

Low Concern

The current fishing mortality rate is below levels needed to produce the maximum sustainable yield (F_{RECENT}/F_{MSY} = 0.79) for the most realistic models. Therefore overfishing is not occurring (Tremblay-Boyer et al. 2017) and we have awarded a score of "low" concern.

Factor 2.3 - Discard Rate

WESTERN CENTRAL PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). In the WCPO pelagic longline fisheries around 5% of targeted tuna (bigeye, yellowfin, and albacore) were estimated to have been discarded between 1994 and 2011 (OFP 2012a). Discard rates of skipjack tuna are higher (20%) (OFP 2010). Earlier estimates through 2009 indicated the total discard rate of targeted tunas was around 5%. Discard rates for non-targeted species between 1994 and 2009 were 11% for billfish, 54% for other bony fish, 49% for elasmobranchs, 73% for seabirds, 94% for marine mammals, and 96% for turtles (OFP 2010). According to this second study, based on observer data, the overall discard rate for the WCPO longline fishery is 15% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

BIGEYE TUNA

Factor 2.1 - Abundance

WESTERN CENTRAL PACIFIC
Drifting Longlines

Low Concern

Bigeye tuna in the western and central Pacific Ocean (WCPO) were most recently assessed in 2018, using a new age and growth curve (Vincent et al. 2018). According to the "updated new growth" model, the median ratio of the current average (2012 to 2015) spawning biomass to that needed to produce the maximum sustainable yield (SB_{RECENT}/SB_{MSY}) was 1.311 and the ratio of the latest (2015) spawning biomass (mature fish) to that needed to produce the maximum sustainable yield (SB_{LATEST}/SB_{MSY}) was 1.624 (Vincent et al. 2018). The median ratio of the recent spawning biomass to that spawning biomass with no fishing is 0.358, which is above the limit reference point of 0.20, indicating that the population is not overfished (Vincent et al. 2018). There is, however a lot of uncertainty regarding which growth model(s) is best and there is some movement between the eastern and western management areas.

We have awarded a score of "low" concern because bigeye tuna are not considered overfished and the spawning stock biomass is above that needed to produce maximum sustainable yield. We have not awarded a score of "very low" concern because of the high amount of uncertainty in the models.

Justification:

In 2018, the assessment was updated with additional new age and growth information and the status re-evaluated (Vincent et al. 2018). Models that used only the new growth model estimated a depletion value between 0.295 and 0.412, all above the limit reference point. When a 3:1 weighting for the updated:old growth model were used, the depletion estimates ranged from 0.157 to 0.403 (14% estimated a ratio below the limit reference point (Vincent et al. 2018).

Factor 2.2 - Fishing Mortality

WESTERN CENTRAL PACIFIC
Drifting Longlines

Low Concern

The median ratio of recent (2012 to 2015) fishing mortality rates to those that produce the maximum sustainable yield (F_{RECENT}/F_{MSY}) was 0.768, indicating overfishing is not occurring (Vincent et al. 2018). This appears to be a substantial improvement from the last assessment (Harley et al. 2014). However, the status of the stock may not have changed, but rather the new models may suggest that perhaps the stock was not in such bad shape as previously estimated. We have awarded a score of "low" concern based on the assessment results that overfishing is not occurring.

Justification:

In 2018, an updated assessment was conducted that included additional new age and growth information, with the status being re-evaluated (Vincent et al. 2018). Thirty-two of the one hundred forty two models indicated a ratio larger than 1 (Vincent et al. 2018).

Factor 2.3 - Discard Rate

WESTERN CENTRAL PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). In the WCPO pelagic longline fisheries around 5% of targeted tuna (bigeye, yellowfin, and albacore) were estimated to have been discarded between 1994 and 2011 (OFP 2012a). Discard rates of skipjack tuna are higher (20%) (OFP 2010). Earlier estimates through 2009 indicated the total discard rate of targeted tunas was around 5%. Discard rates for non-targeted species between 1994 and 2009 were 11% for billfish, 54% for other bony fish, 49% for elasmobranchs, 73% for seabirds, 94% for marine mammals, and 96% for turtles (OFP 2010). According to this second study, based on observer data, the overall discard rate for the WCPO longline fishery is 15% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. It's unlikely combined discards and bait use are greater than 100% of the total landings.

BLACK-BROWED ALBATROSS

Factor 2.1 - Abundance

SOUTH PACIFIC
Drifting Longlines

Low Concern

The International Union for Conservation for Nature (IUCN) has classified black-browed albatross as "Least Concern" with an increasing population trend (BirdLife International 2018a). This is a change from previous designations as "Near Threatened" with a decreasing population trend (BirdLife International 2018a). The total population of mature birds is estimated to be 1,400,000 (Birdlife International 2018a). The status in the western and central Pacific Ocean is unknown. We have awarded a score of "low" concern based on the population size and trend.

Factor 2.2 - Fishing Mortality

SOUTH PACIFIC
Drifting Longlines

Moderate Concern

Interactions between black-browed albatross and the South Pacific albacore tuna fishery, although low in number, have been reported and the species is considered at medium to high risk of bycatch in western and central Pacific and New Zealand longline fisheries; (Waugh et al., 2012) and (Rowe 2013) considered it moderate-to-high risk in New Zealand fisheries. Management measures have been adopted by most fleets to mitigate the incidental capture of seabirds in longline fisheries operating in the South Pacific region of the western and central Pacific Ocean (Clarke et al. 2014). We have therefore awarded a score of "moderate" concern.

Justification:

From 1980 to 2004, 22 black-browed albatross interactions with pelagic longline gear were observed south of 31°S (Molony 2005). Between 1992 and 2009, 95% of black-browed albatross captured in the albacore South Pacific longline fishery were discarded and of those 71% were dead (Molony 2005). Observer data collected from the WCPO region between 2007 and 2016 indicated 79 black-browed albatross were observed to be incidentally captured (Peatman et al. 2017).

Factor 2.3 - Discard Rate

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.

GREY PETREL

Factor 2.1 - Abundance

SOUTH PACIFIC
Drifting Longlines

High Concern

The International Union for Conservation of Nature (IUCN) classifies grey petrels as "Near Threatened" with a decreasing population trend (BirdLife International 2017d). The global population is estimated to be 80,000 pairs worldwide (BirdLIfe International 2017d). We have awarded a score of "high" concern to account for the IUCN rating.

Factor 2.2 - Fishing Mortality

SOUTH PACIFIC
Drifting Longlines

Moderate Concern

Between 1980 and 2004, 126 grey petrel interactions with pelagic longline gear were observed, primarily south of 31°S (Molony 2005), and from 1992 to 2009 100% of incidentally capture grey petrels in the south Pacific albacore tuna fishery were discarded and all of them were dead (OFP 2010). In New Zealand waters of the South Pacific, it has historically been one of the most commonly killed bird species in the tuna longline fishery, with estimates of 45,000 birds being caught during a the 1980s and 1990s (BirdLIfe International 2017d). However, New Zealand has implemented the use of several bycatch mitigation measures in tuna fisheries (NZG 2018). Incidental mortality in fisheries off the coast of Australia have also been reported (BirdLife International 2017d). We have awarded a score of "moderate" concern because, although bycatch has been reduced in New Zealand waters, information gaps in other areas suggest that this species should remain a "moderate" concern.

Factor 2.3 - Discard Rate

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.

LIGHT-MANTLED ALBATROSS

Factor 2.1 - Abundance

SOUTH PACIFIC
Drifting Longlines

High Concern

The International Union for Conservation of Nature (IUCN) classifies light-mantled albatross as "Near Threatened" with a decreasing population trend (BirdLife International 2018). The total breeding population is estimated to be 19,000 to 24,000 pairs or about 58,000 individuals (BirdLife International 2018). We have awarded a score of "high" concern based on the IUCN listing.

Factor 2.2 - Fishing Mortality

SOUTH PACIFIC
Drifting Longlines

Moderate Concern

Specific longline fleets in the South Pacific that have reported this species as incidentally caught (in small amounts) in tuna fisheries include New Zealand and Australia (BirdLife International 2018) (ACAP 2009). Unfortunately, the information quality is low. The species is at high-to-medium risk in longline fisheries despite mitigation measures adopted by New Zealand (Waugh et al. 2012). Interactions are infrequent, breeding areas have all adopted bycatch avoidance methods since 2000 and the majority of its foraging range is within the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) region (ACAP 2009). However, they have a medium-to-high susceptibility to bycatch and given their small population numbers, bycatch impacts to the population could be high, so we have awarded a score of "moderate" concern.

Justification:

Between 1980 and 2004, 38 interactions between light-mantled albatross and pelagic longline gear, primarily south of 31°S, were observed (Molony 2005) and from 1992 and 2009, 100% of light-mantled albatross were discarded dead in the South Pacific albacore tuna fishery (OFP 2010).

Factor 2.3 - Discard Rate

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.

SALVIN'S ALBATROSS

Factor 2.1 - Abundance

SOUTH PACIFIC
Drifting Longlines

High Concern

According to the International Union for Conservation of Nature (IUCN), Salvin's albatross are considered "Vulnerable" and it is unknown whether their populations are increasing or decreasing (BirdLife International 2017f). It is estimated there are 79,900 mature individuals or around 110,000 total birds (Baker et al. 2014). We have awarded a score of "high" concern based on the IUCN listing.

Factor 2.2 - Fishing Mortality

SOUTH PACIFIC
Drifting Longlines

Moderate Concern

Salvin's albatross are more commonly reported as incidentally caught by New Zealand tuna longliners than in other areas of the western and central Pacific Ocean (WCPO). For example, between 1996 and 2005, observers reported 150 interactions with this species aboard New Zealand longliners (BirdLife International 2017g). Observer data collected from the WCPO region between 2007 and 2016 indicated 9 Salvin's albatross were incidentally captured (Peatman et al. 2017). We have awarded a score of "moderate" (rather than "high") concern because bycatch mitigation measures have been adopted by the New Zealand fleet (NZG 2018) and almost all of the breeding and foraging areas for this species occur in New Zealand waters (ACAP 2010).

Factor 2.3 - Discard Rate

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.

WANDERING ALBATROSS

Factor 2.1 - Abundance

SOUTH PACIFIC
Drifting Longlines

High Concern

The International Union for Conservation of Nature (IUCN), considers the wandering albatross population to be "Vulnerable" with a decreasing population trend (BirdLife International 2017h). The global population is around 20,100 mature individuals but the status of this species in the western and central Pacific Ocean is unknown (BirdLife International 2017h). We have awarded a score of "high" concern based on the IUCN classification.

Factor 2.2 - Fishing Mortality

SOUTH PACIFIC
Drifting Longlines

Moderate Concern

Wandering albatross are threatened by longline fisheries, which have been identified as a leading cause of their global declines. This is primarily a factor of their large range, which makes them susceptible to capture by a variety of fleets (BirdLife International 2017h). Between 1980 and 2004, 107 interactions between wandering albatrosses and pelagic longline gear, primarily south of 31S, were observed (Molony 2005), and from 1992 to 2009 53% of incidentally captured seabirds died (OFP 2010). Observer data collected from the WCPO region between 2007 and 2016 indicated 25 wandering albatross were observed to be incidentally captured (Peatman et al. 2017). Wandering albatross are impacted by even low bycatch rates due to their small population size (ACAP 2009a). The majority of breeding area for this species occurs in South African territories (ACAP 2009a). Management measures have been adopted by many fleets in the southwestern Pacific Ocean to reduce the incidental capture of seabirds. However, these measures have not been adopted by all fleets operating in their breeding region (ACAP 2009a). Due to the impact from even low bycatch rates, combined with the fact that bycatch mitigation measures have not been fully adopted by all fleets, we have awarded a score of "moderate" concern.

Factor 2.3 - Discard Rate

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.

WHITE-CHINNED PETREL

Factor 2.1 - Abundance

SOUTH PACIFIC
Drifting Longlines

High Concern

The International Union for Conservation of Nature (IUCN), has listed white-chinned petrel as "Vulnerable" and their populations are decreasing (BirdLife International 2017a). The global population is estimated to have declined from 1,430,000 pairs in the 1980s to 1,200,000 breeding pairs currently. There are around 3 million mature birds (Brooke 2004) (BirdLife International 2017a). We have awarded a score of "high" concern based on the IUCN listing.

Factor 2.2 - Fishing Mortality

SOUTH PACIFIC
Drifting Longlines

Moderate Concern

White-chinned petrels are one of the most vulnerable bird species to bycatch in fisheries operating in the southern hemisphere (ACAP 2009b). Estimates from the 1990s in the Australian longline fishery suggest over 800 white-chinned petrels were incidentally caught per year. In the New Zealand longline fishery, 14.5% of incidentally caught birds in longline (and trawl) fisheries between 2003 and 2005 were white-chinned petrels (BirdLife International 2017a). Observer data collected from the WCPO region between 2007 and 2016 indicated 20 white-chinned petrels were observed to be incidentally captured (Peatman et al. 2017). White-chinned petrels also have a very high mortality rate as a result of this incidental capture (OFP 2010). White-chinned petrels have a high areal and vertical overlap with pelagic longline gear (BirdLife International 2017a), and many fisheries outside of this region may also be contributing to a cumulative effect on population size

(ACAP 2009b). However, management measures to reduce the incidental capture of seabirds have been adopted by many fleets in the south Pacific (Clarke et al. 2014), but compliance with these measures is mixed (WCPFC 2016). Therefore, we have awarded a score of "moderate" concern.

Factor 2.3 - Discard Rate

SOUTH PACIFIC
Drifting Longlines

< 100%

The average overall discard rate in tuna longline fisheries worldwide is 22%, but in the western and central Pacific Ocean (WCPO), distant water longline vessels may have a discard rate as high as 40% (Kelleher 2005). According to observer data from the Fiji pelagic longline fishery in the South Pacific, discard rates very by species but are around 6% of the total catch for all species combined (Akroyd et al. 2012). For example, tuna, mahi mahi, and opah have very low discard rates, <5%, but sharks have very high discard rates, >95% (Akroyd et al. 2012). However, it should be noted that Fiji bans the retention of sharks and therefore discard rates may be skewed. Observer data from the South Pacific albacore fishery indicates discard rates for tuna ranged from 3 to 100%, for billfish from 4 to 45%, for sharks and rays from 0 to 100%, 0 to 100% for other bony fish, 100% for marine mammals, 0 to 100% for seabirds, and 71 to 100% for turtles (OFP 2010). The overall discard rate, according to observer records, is around 18% (OFP 2010). Bait is used in this fishery but information on the percentage of bait to total landings is not available. Its unlikely combined discards and bait use are greater than 100% of the total landings.