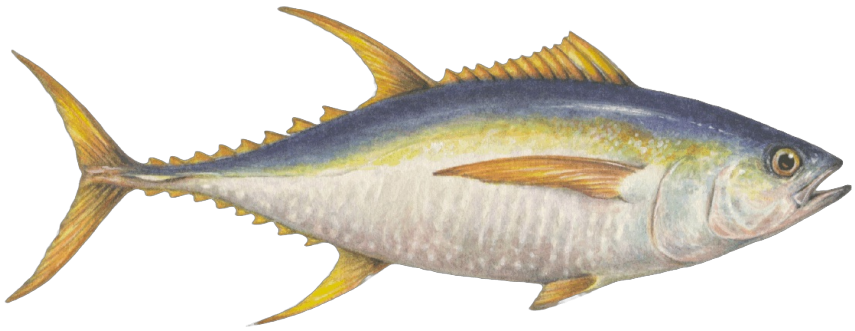
Monterey Bay Aquarium Seafood Watch®

Tunas and large pelagics



Hawaii: Western and Central Pacific, Eastern Central Pacific Longline (deep-set), Longline (shallow-set)

Seafood Watch Consulting Researcher
March 1, 2021

Disclaimer
Seafood Watch strives to have all Seafood Reports reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science and aquaculture.Scientific review, however, does not constitute an endorsement of the Seafood Watch program or its recommendations on the part of the reviewing scientists. Seafood Watch is solely responsible for the conclusions reached in this report.
Seafood Watch Standard used in this assessment: Fisheries Standard v3

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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 reviews four United States pelagic fisheries in the western and central Pacific Ocean (WCPO) and eastern Pacific Ocean (EPO): the Hawaii shallow-set longline fishery targeting swordfish (*Xiphias gladius*); the Hawaii deep-set longline fishery targeting bigeye tuna (*Thunnus obesus*) and yellowfin tuna (*Thunnus albacares*), some of which also is landed in California; the Hawaii handline and hand-operated pole and line fishery targeting dolphinfish (*Coryphaena hippurus*) and wahoo (*Acanthocybium solandri*); and the Hawaii trolling line fishery, which also targets dolphinfish and wahoo. Other species caught in these fisheries that are assessed in this report include albacore tuna (*Thunnus alalunga*) and skipjack tuna (*Katsuwonus pelamis*), black, blue, and striped marlin (*Makaira indica, Makaira nigricans, Kajikia audax*), blue and shortfin mako sharks (*Prionace glauca, Isurus oxyrinchus*), shortbill spearfish (*Tetrapturus angustirostris*), pomfrets (*Taractichthys spp.*), and opah (*Lampris guttatus*).

The Western Pacific Regional Fishery Management Council manages these fisheries under the Pelagic Fishery Ecosystem Plan in federal waters. Many of the fish managed under the Pelagic Fishery Ecosystem Plan are also managed under the international agreements governing the Western and Central Pacific Fisheries Commission (WCPFC) and/or the and the Inter-American Tropical Tuna Commission (IATTC), to which the US is a party.

There is uncertainty around stock assessments for bigeye, albacore and yellowfin tuna in the Eastern Pacific Ocean. Generally western North Pacific swordfish, yellowfin tuna, albacore tuna, bigeye tuna, and skipjack tuna stocks are fairly robust, and fishing mortality rates are likely within biological reference points. The Hawaii shallow-set longline fishery catches negligible amounts of swordfish south of 10^{o}N and east of 140^{o}W. Therefore, this report only includes the swordfish stock that is north of 10^{o}N and west of 140^{o}W, assessed by the ISC Billfish Working Group. A portion of this stock is managed by the WCPFC, which this report labeled as "Hawaii/Western and Central Pacific," and a much smaller portion is managed by the IATTC, which this report calls "Hawaii/Eastern Central Pacific." It is the same stock, but managed by two different RMFOs.

Pelagic longline, handline, and pole and line gears have minimal impact on bottom habitats because they fish at or near the surface. Management and bycatch mitigation measures for Hawaii shallow-set swordfish and tuna fishery ranged from Highly to Moderately Effective. The Hawaii shallow-set fishery has 100% observer coverage and utilizes Incidental Take Statements or hard caps for a number of species of concern, including sea turtles and marine mammals. Hawaii deep-set fishery scored Moderately Effective for Management and Bycatch Strategies. The Hawaii deep-set fishery has approximately 20% observer coverage, and takes of false killer whales in this fishery have resulted in a Category I listing. The pole and line fisheries score highly effective for bycatch management because most species are retained, and moderately effective for management of target species.

All fisheries receive a moderate concern score for ecosystem-based management because policies (e.g., area closures, turtle and marine mammal bycatch hard caps) are in place to protect ecosystem function, but the efficacy of these ecosystem-based measures are unknown for a number of vulnerable species, apex predators including sharks, turtles and some finfish, and baitfish species.

All fisheries reviewed in this assessment received a "Good Alternative" rating per Seafood Watch criteria.

Final Seafood Recommendations

SPECIES | FISHERY	CRITERION 1 TARGET SPECIES	CRITERION 2 OTHER SPECIES	CRITERION 3 MANAGEMENT	CRITERION 4 HABITAT	OVERALL RECOMMENDATION
Albacore | North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	4.284	1.000	3.000	3.873	**Good Alternative (2.656)**
Albacore | North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	4.284	1.000	3.000	3.873	**Good Alternative (2.656)**
Bigeye tuna | Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.644	1.000	3.000	3.873	**Good Alternative (2.354)**
Bigeye tuna | Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	4.284	1.000	3.000	3.873	**Good Alternative (2.656)**
Black marlin | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.644	1.000	3.000	3.873	**Good Alternative (2.354)**
Black marlin | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	2.644	1.000	3.000	3.873	**Good Alternative (2.354)**
Blue marlin | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	4.284	1.000	3.000	3.873	**Good Alternative (2.656)**
Blue marlin | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	4.284	1.000	3.000	3.873	**Good Alternative (2.656)**
Blue shark | North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	4.284	1.000	3.000	3.873	**Good Alternative (2.656)**
Blue shark | North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	4.284	1.732	3.000	3.873	**Good Alternative (3.047)**
Blue shark | North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	4.284	1.732	3.000	3.873	**Good Alternative (3.047)**
Blue shark | North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	4.284	1.000	3.000	3.873	**Good Alternative (2.656)**
Dolphinfish | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	3.413	1.000	3.000	3.873	**Good Alternative (2.509)**
Dolphinfish | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	3.413	1.000	3.000	3.873	**Good Alternative (2.509)**
Dolphinfish | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	3.413	1.732	3.000	3.873	**Good Alternative (2.879)**
Dolphinfish | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	3.413	1.732	3.000	3.873	**Good Alternative (2.879)**
Dolphinfish | Eastern Central Pacific | Trolling lines | United States | Hawaii	3.413	2.644	3.000	3.873	**Good Alternative (3.200)**
Dolphinfish | Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii	3.413	2.644	3.000	3.873	**Good Alternative (3.200)**
Opah | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	2.644	1.000	3.000	3.873	**Good Alternative (2.354)**
Opah | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.644	1.000	3.000	3.873	**Good Alternative (2.354)**

SPECIES | FISHERY	CRITERION 1 TARGET SPECIES	CRITERION 2 OTHER SPECIES	CRITERION 3 MANAGEMENT	CRITERION 4 HABITAT	OVERALL RECOMMENDATION
Shortbill spearfish | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.644	1.000	3.000	3.873	**Good Alternative (2.354)**
Shortbill spearfish | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	2.644	1.000	3.000	3.873	**Good Alternative (2.354)**
Shortbill spearfish | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	2.644	1.732	3.000	3.873	**Good Alternative (2.701)**
Shortbill spearfish | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	2.644	1.732	3.000	3.873	**Good Alternative (2.701)**
Shortfin mako shark | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	4.284	1.732	3.000	3.873	**Good Alternative (3.047)**
Shortfin mako shark | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	4.284	1.000	3.000	3.873	**Good Alternative (2.656)**
Shortfin mako shark | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	4.284	1.000	3.000	3.873	**Good Alternative (2.656)**
Shortfin mako shark | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	4.284	1.732	3.000	3.873	**Good Alternative (3.047)**
Sickle pomfret | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.644	1.000	3.000	3.873	**Good Alternative (2.354)**
Sickle pomfret | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	2.644	1.000	3.000	3.873	**Good Alternative (2.354)**
Skipjack tuna | Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	5.000	1.000	3.000	3.873	**Good Alternative (2.761)**
Skipjack tuna | Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	3.318	1.000	3.000	3.873	**Good Alternative (2.492)**
Striped marlin | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000	3.000	3.873	**Avoid (1.846)**
Striped marlin | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.644	1.000	3.000	3.873	**Good Alternative (2.354)**
Swordfish | Northwestern and Central Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	4.284	1.732	3.000	3.873	**Good Alternative (3.047)**
Swordfish | Northwestern and Central Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	4.284	1.732	3.000	3.873	**Good Alternative (3.047)**
Wahoo | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.644	1.000	3.000	3.873	**Good Alternative (2.354)**
Wahoo | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	2.644	1.000	3.000	3.873	**Good Alternative (2.354)**
Wahoo | Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii	2.644	2.644	3.000	3.873	**Good Alternative (3.002)**
Wahoo | Eastern Central Pacific | Trolling lines | United States | Hawaii	2.644	2.644	3.000	3.873	**Good Alternative (3.002)**

SPECIES | FISHERY	CRITERION 1 TARGET SPECIES	CRITERION 2 OTHER SPECIES	CRITERION 3 MANAGEMENT	CRITERION 4 HABITAT	OVERALL RECOMMENDATION
Yellowfin tuna | Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	5.000	1.000	3.000	3.873	**Good Alternative (2.761)**
Yellowfin tuna | Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	4.284	1.000	3.000	3.873	**Good Alternative (2.656)**

Summary

This report reviews four United States pelagic fisheries in the western and central Pacific Ocean (WCPO) and eastern Pacific Ocean (EPO): the Hawaii shallow-set longline fishery targeting swordfish (*Xiphias gladius*); the Hawaii deep-set longline fishery targeting bigeye tuna (*Thunnus obesus*) and yellowfin tuna (*Thunnus albacares*), some of which also is landed in California; the Hawaii handline and hand-operated pole and line fishery targeting dolphinfish (*Coryphaena hippurus*) and wahoo (*Acanthocybium solandri*); and the Hawaii trolling line fishery, which also targets dolphinfish and wahoo. Other species caught in these fisheries that are assessed in this report include albacore tuna (*Thunnus alalunga*) and skipjack tuna (*Katsuwonus pelamis*), black, blue, and striped marlin (*Makaira indica, Makaira nigricans, Kajikia audax*), blue and shortfin mako sharks (*Prionace glauca, Isurus oxyrinchus*), shortbill spearfish (*Tetrapturus angustirostris*), pomfrets (*Taractichthys spp.*), and opah (*Lampris guttatus*). All fisheries reviewed in this assessment received a "Good Alternative" rating with the exception of striped marlin caught in the deep set longline fishery in the Western Central Pacific Ocean, which has an "Avoid" recommendation due to impacts to the stock and bycatch.

Eco-Certification Information

The American Samoa Exclusive Economic Zone Albacore and Yellowfin Longline Fishery is Marine Stewardship Council certified.

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.

[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 reviews four United States pelagic fisheries in the western and central Pacific Ocean (WCPO) and eastern Pacific Ocean (EPO): the Hawaii shallow-set longline fishery targeting swordfish (*Xiphias gladius*); the Hawaii deep-set longline fishery targeting bigeye tuna (*Thunnus obesus*) and yellowfin tuna (*Thunnus albacares*), some of which also is landed in California; the Hawaii handline and hand-operated pole and line fishery targeting dolphinfish (*Coryphaena hippurus*) and wahoo (*Acanthocybium solandri*); and the Hawaii trolling line fishery, which also targets dolphinfish and wahoo. Other species caught in these fisheries that are assessed in this report include albacore tuna (*Thunnus alalunga*) and skipjack tuna (*Katsuwonus pelamis*), black, blue, and striped marlin (*Makaira indica, Makaira nigricans, Kajikia audax*), blue and shortfin mako sharks (*Prionace glauca, Isurus oxyrinchus*), shortbill spearfish (*Tetrapturus angustirostris*), pomfrets (*Taractichthys spp.*), and opah (*Lampris guttatus*).

Longline gear consists of three basic components: the mainline, the branch line, and the baited hook. Longline gear components are adaptable for targeting specific species through changes in materials, lengths, and deployment strategies. Pelagic longline gear is set mid-water column and is used worldwide to capture widely dispersed, pelagic species {Watson & Kerstetter 2006}.

Species Overview

Swordfish are a widely distributed billfish species found globally from 50-degrees N to 50-degrees S and at all longitudes in the Pacific Ocean. Swordfish are assessed as two populations in the North Pacific (Western and Central and Eastern Pacific), a single population in the Southwest Pacific, two populations in the Atlantic (South and North), and a single population in both the Indian Ocean and Mediterranean Sea (ISC 2018).

Tunas

Albacore, skipjack, bigeye and yellowfin tuna are widely distributed in temperate and tropical waters in all oceans. There are six managed populations of albacore tuna, North and South Pacific Ocean, North and South Atlantic Ocean, Indian Ocean and Mediterranean Sea (ISC 2017). There are four populations of yellowfin and bigeye and five populations of skipjack: Western and Central Pacific Ocean, EPO, Atlantic (eastern and western for skipjack) and Indian Ocean. Juvenile yellowfin tuna and juvenile bigeye tuna tend to form schools with skipjack tuna that are mostly found in surface waters. Larger tunas are found in subsurface waters where they also form schools (Mckechnie et al. 2017)(Tremblay-Boyer et al. 2017).

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 2019).

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 2019), (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). Recent genetic studies indicate the possibility of four populations of striped marlin in the Pacific (Mamoozadeh et al. 2019).

Pomfret and Short-billed Spearfish

Shortbill spearfish is a pelagic billfish that is found in most of the world's temperate and tropical oceans. It can be found between 40° N and 35° S in the Pacific Ocean. Shortbill spearfish prefer deeper waters and are not often found in coastal areas. Little is known about the stock structure of this species (Froese and Pauly 2019).

Pomfret is a pelagic species found worldwide. It can be live down to depths of 1,000 m and in waters between 12 and 24 degrees C. Pomfret migrate in small schools, which move related to water temperature, and feed on a variety of animals including small fish and cephalopods (Froese and Pauly 2019).

Sharks

Blue sharks are highly migratory, found throughout the world's oceans in epipelagic and mesopelagic waters. Blue sharks reach sexual maturity at a late age, grow and reproduce slowly. Compared with other shark species, however, blue sharks are highly productive (Aires-da-Silva and Gallucci 2007). Their productivity depends on survival rates of juveniles (Aires-da-Silva and Gallucci 2007). It is the most widely distributed shark species and the most abundant, with abundance increasing with latitude. Blue sharks are apex

predators, consuming a variety of fish and squid species (ISCSWG 2017).

Shortfin mako sharks are highly migratory found in coastal and oceanic epipelagic waters worldwide (from 20° S to 40° N). It is an apex predator, feeding on fish and cephalopods, among other prey. Like other shark species, sexual maturity is reached at a late age, growth is slow, and shortfin mako shark produces only a small number of young (Froese and Pauly 2019).

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 2019). Opah are most frequently caught in longline sets targeting albacore (Molony 2008).

Dolphinfish (Mahi mahi)

Dolphinfish is one of two species in the family Coryphaenidae, along with the pompano dolphinfish (*C. equiselis*) {Olson and Galván-Magaña 2002}, {Uchiyama and Boggs 2006}, (Polovina et al. 2009), {Whoriskey et al. 2011}. Both species have a global distribution and, though pompano dolphinfish are typically smaller than mahi mahi, they share a similar morphology and coloration. Accordingly, pompano dolphinfish are often mistaken for juvenile mahi mahi (Froese and Pauly 2019) and are sometimes sold as mahi mahi. Mahi mahi are mid-trophic level predators, feeding primarily on other fishes and occasionally, crustaceans and squid (Froese and Pauly 2019). They are found worldwide in tropical and subtropical waters warmer than 20°C (Palko et al. 1982). This species is extremely fast growing and reaches sexual maturity in the first year of life. Size at maturity varies throughout its range (for a summary, see (Collette et al. 2011)). Dolphinfish are sexually dimorphic, with males significantly larger than females. They school in feeding aggregations, which are commonly associated with floating objects;.

Wahoo

Wahoo is the only extant member of the genus Acanthocybium and is a member of the family Scombridae, along with tunas and mackerels. Wahoo also are mid-trophic level predators, feeding primarily on other fishes and occasionally cephalopods (Froese and Pauly 2019), (Polovina et al. 2009). They are found worldwide in tropical and subtropical waters between 20° and 30°C {Zischke et al. 2012}. Wahoo are not sexually dimorphic. Both males and females reach sexual maturity in the first year of life (Jenkins and McBride 2009), (Brown-Peterson et al. 2000). They grow to at least 200 cm FL (Hogarth 1976, as cited in (Collette et al. 2011c)) and females are highly fecund, producing as many as 1.7 million eggs per spawning event (Jenkins and McBride 2009). Estimates of wahoo lifespan range from 5 to 10 years (for review see {Zischke et al. 2012}. Wahoo often are associated with floating debris and targeted near fish aggregation devices (Collette et al. 2011c).

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

The Western Pacific Regional Fishery Management Council (WPRFMC), in conjunction with the National Marine Fisheries Service (NMFS), manages these species in the federal waters of the US Exclusive Economic Zone (EEZ) off Hawaii. The United Nations Straddling and Highly Migratory Fish Stocks Agreement (1995) established Regional Fisheries Management Organizations (RFMOs) to manage straddling and highly migratory fish stocks. Two RFMOs, the Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC), manage international swordfish and tuna fisheries in the WCPO and EPO, respectively. The US is an active member in both RFMOs (see Figure).

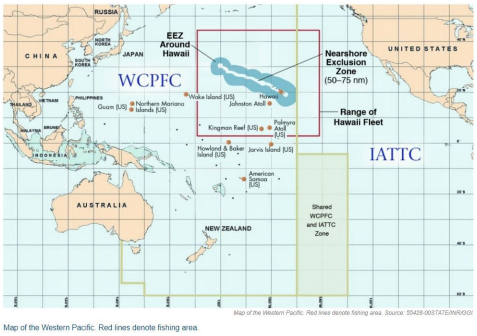

Figure 1: Fishing area of the Hawaii deep- and shallow-set longline fisheries and handline, hand-operated pole and line and trolling line fisheries (Hawaii-seafood.org; *Source: 55428-00STATE/INR/GGI)..*

Production Statistics

Hawaii Fisheries

The Hawaii longline fleet uses two modes of fishing: 1) deep-set longlines that fish in deeper water, with floats spread farther apart and with more hooks between floats, that typically target tunas; and 2) shallow-set longlines that are buoyed to the surface, with fewer hooks between floats, which typically target swordfish (WPRFMC 2014). The fleet primarily operates in the Western and Central Pacific Ocean but also fishes in the Eastern Pacific Ocean. It accounts for 90% of the ex-vessel value of total commercial landings in Hawaii and in 2019, the deep-set fleet caught 87% of all pelagic species in the fishery by volume (WPRFMC 2019). The shallow-set fleet caught only 2% of pelagic species by volume, while the trolling line fishery accounted for 7% of total catch, and the handline fleet (Main Hawaiian Islands and offshore) accounted for 3% of total catch by volume (WPRFMC 2019). The majority of the 3,124 pelagic Hawaii fishing licenses issued in 2019 went to longline and troll fishermen (46% and 40% respectively) (WPRFMC 2019).

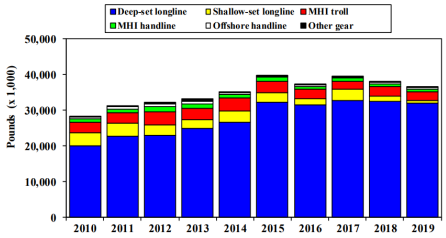

Figure 2: Hawaii total commercial pelagics catch by gear, 2010-2019 (WPRFMC 2019)

Swordfish

Catches of swordfish in the western and central north Pacific Ocean have varied over time, peaking during the late 1950s and again during the early to mid 1990s. The majority of swordfish are caught by longlines. Total catch of swordfish in the Pacific in 2017 was estimated to be 38,315 t (average from 2008-2017 was 39,061 t) (WPRFMC 2018). Catches of swordfish in the Hawaii longline fisheries have fluctuated somewhat since the fishery was reopened in 2005. In 2019, approximately 813 t of swordfish were landed by the Hawaiian longline fleet (WPRFMC 2019), (average of 1,183 t between 2000-2018)(PIFSC 2020). Catches of swordfish outside of the US EEZ account for the majority of Pacific swordfish harvests (see Figure).

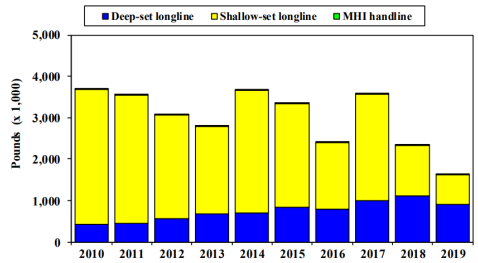

Figure 3: Hawaii swordfish catch, 2010-2019 (WPRFMC 2019).

Tunas

The total catches of albacore tuna in the Pacific Ocean in 2017 were 148,310 t (average 154,250 t from 2008-2017) (WPRFMC 2018). Longline fisheries catch the majority of albacore tuna in the Pacific Ocean (WCPFC 2017). In Hawaii, longline landings of albacore tuna peaked during the mid-to-late 1990s and early 2000s. Peak landings were 1,805 t in 1999, and in 2019 roughly 128 t of albacore tuna were landed by the Hawaii pelagic fleet (WPRFMC 2019).

Total catches of bigeye tuna in the western and central Pacific Ocean have increased over time, peaking in the mid-2000s at just under 200,000 t. Total catch of bigeye in the Pacific Ocean in 2017 was estimated to be 216,680 t (average 240,736 2008-2017) (WPRFMC 2018). The majority of bigeye catches occur within equatorial regions of the western and central Pacific Ocean. In 2019, approximately 8,879 t of bigeye were landed by the Hawaiian longline fleet, which is greater than the recent 18-year average of 6,025 t (WPRFMC 2018), {PIFSC 2019} (WPRFMC 2019).

Total catches of yellowfin tuna in the Pacific Ocean have increased moderately since 2008 and peaked in 2018 at 926,968 t (WPRFMC 2018). The majority of this catch is by purse seiners (WCPFC 2017). Total Hawaii longline catches of yellowfin tuna in 2019 were

2,976 t. Hawaii longline catches of yellowfin tuna have varied over time, averaging 2,280 t from 2000-2018 (PIFSC 2020).

Skipjack tuna are predominantly caught with purse seine gear in the Pacific. Catches of skipjack in the Pacific Ocean were approximately 1.97 million t in 2018, which is very close to the average 2008-2017 (WPRFMC 2018). The Hawaii longline fishery accounts for a small portion of this, and 2019 landings of skipjack were approximately 414 t (WPRFMC 2019).

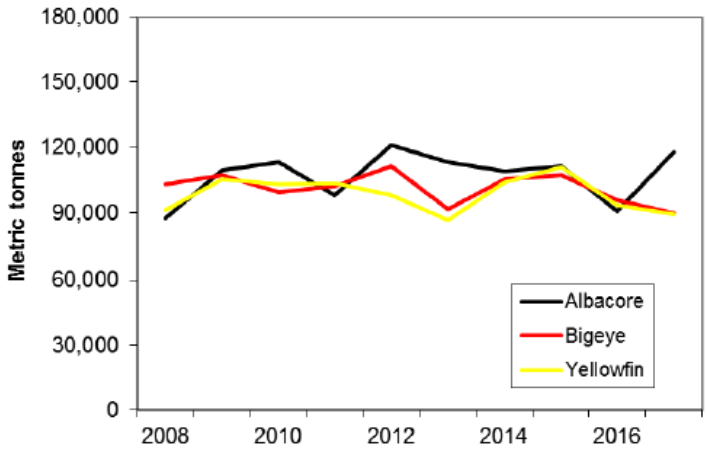

Figure 4: Reported longline tuna catches in the Pacific Ocean (WPRFMC 2018).

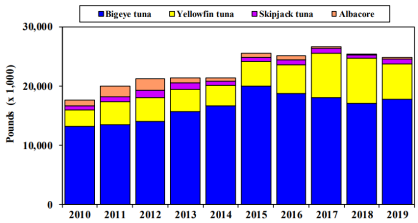

Figure 5: Hawaii tuna catch by gear, 2010-2019 (WPRFMC 2019).

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 in the WCPFC have declined since peaks during the early to mid-2000s. In the EPO, annual blue marlin catches averaged 4,382 t between 2014 and 2018 (IATTC 2018) (IATTC 2019d). Black marlin longline catches in the WCPO 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). In the EPO, annual black marlin catches between 2013 and 2017 averaged 246 t, with lowest catches reported in 2016 (143 t) (IATTC 2019d). Striped marlin longline catches also have varied over time. Peak catches in the WCPO occurred during the 1960s and again in 1993. Recently, catches have been low compared to catches from the 1990s and 2000s (SPC-OFP 2018). In the EPO, average annual catches between 2013 and 2017 were 1,889 t, which is a fraction of peak catches that occurred in late-1960s (IATTC 2019d). The 2019 marlin catches in the Hawaii permitted fleet were as follows: 1,168 t of blue marlin, 619 t of striped marlin, and 25 t of other marlins (WPRFMC 2019). Black marlin catch was not reported (PIFC 2020).

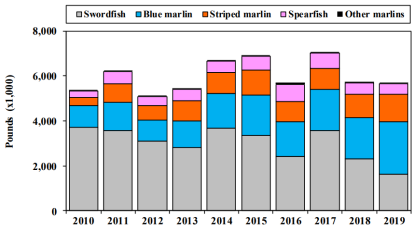

Figure 6: Annual Hawaii billfish catch 2010-2019 (WPRFMC 2019).

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). In 2019, the Hawaii longline fishery caught 58 t of unidentified shark species (WPRFMC 2019). The fishery caught over 114,000 blue sharks, all but two of which were released alive.

Information on shortfin mako shark 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). In 2019, the Hawaii longline fleet caught 5,082 mako sharks (255 lb), but only retained 560 sharks (WPRFMC 2019), (PIFSC 2020).

Dolphinfish and Wahoo

In 2019, the Hawaii commercial pelagic fishery landed 500 t of dolphinfish and 796 t wahoo (NMFS 2020).

Opah

The 2019 opah landings for the Hawaii pelagic fleet were roughly 1,128 t (23,394 fish), which was less than the 2018 landings (WPRFMC 2019), (PIFSC 2020).

Pomfret and Short-billed Spearfish

In 2019, the Hawaii fishery landed 226 t of short-billed spearfish and nearly 375 t of pomfrets, both of which were less than the 2018 reported landings (WPRFMC 2019) (PIFSC 2020).

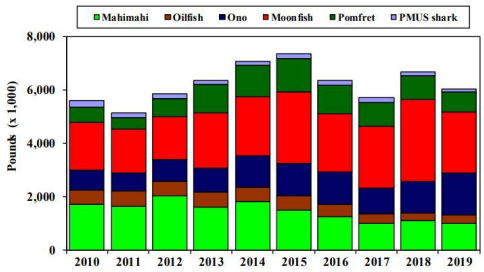

Figure 7: Other Hawaii Pacific Pelagic Management Unit catch by species, 2010-2019 (WPRFMC 2019).

Importance to the US/North American market.

In 2019, the US landed approximately 3,408 t of swordfish (Atlantic and Pacific), and imported approximately 11,500 t. Swordfish imports into the US were primarily from Ecuador (36.9%), Brazil (14.1%), Costa Rica (7.9%) and Canada (7.1%), which could include processing nations (NMFS 2020).

In 2019, the U.S imported 150,469 t of fresh and frozen tuna, down 19,850 tons (11.7%) from 2016 but the value of fresh and frozen tuna imports increased by 2.2% to $1.0 billion. Imports of canned tuna were 141,480 tons, up 8,882 tons (6.7%) from 2016. The value of canned tuna imports also increased by $108.9 million (20.8%) from 2016. Tuna is also re-exported from the US (1,066 tons valued at $7.4 million) as fresh and frozen products (NMFS 2020). Bigeye tuna within the IATTC Convention Area are primarily imported from Panama and Ecuador (33% each). Skipjack tuna are primarily imported from Mexico (99%). The majority of yellowfin tuna were imported from Mexico (31%) and Venezuela (28%) (NMFS 2020).

In 2017, US fishermen landed 475 million pounds of tuna at ports in United States, American Samoa, other US territories and foreign

ports, which was valued at almost $427.3 million—an increase of 507,000 pounds (less than 1%) but a decrease of $5.5 million (over 1%) compared with 2016. The average ex-vessel price per pound of all species of tuna in 2017 was $0.90 compared with $0.91 in 2016. Bigeye landings in 2017 increased by 10% from 2016 at 26.2 million pounds. The average ex-vessel price per pound was $2.99 in 2017 compared to $3.44 in 2016. Skipjack landings in 2017 were more than 25,000 pounds (7%) less than those in 2016. The average ex-vessel price per pound was $0.63 in 2017 compared to $0.66 in 2016. Yellowfin landings were 75.8 million pounds—an increase of 30.4 million pounds (67%) compared with 2016. The average ex-vessel price per pound was $1.04 in 2017 compared with $1.06 in 2016.

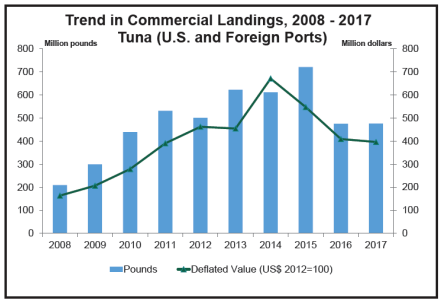

Figure 8: Trends in commercial tuna landings (NMFS 2017).

Common and market names.

See Table 1 below.

Primary product forms

In Hawaii, swordfish, albacore, bigeye, skipjack and yellowfin tuna are typically landed and sold fresh for both cooking and for sushi and sashimi.

Table 1. Common, market and primary product forms of tuna and swordfish

Tuna species	Common/Market Name	Product forms
Albacore tuna	ʻAhi palaha, Tombo, Germon, albecore, T. germo, albacore	Fresh, frozen, canned, filet, rounds
Bigeye tuna	ʻAhi poʻonui, Mabachi, bigeye	Fresh, sashimi, frozen, canned, filet, rounds
Black marlin	A'u, Makaira	Fresh, frozen, filet
Blue marlin	A'u, Kajiki	Fresh, frozen, filet
Blue shark, Shortfin mako shark	Mano	Fresh, frozen, filet
Dolphinfish	Mahi mahi, dorado	Fresh, frozen, filet
Opah	Moonfish, opah	Fresh, frozen, filet
Pomfret	Monchong	Fresh, frozen, filet
Short-billed spearfish	Hebi	Fresh, frozen, filet
Striped marlin	Nairagi	Fresh, frozen, filet
Skipjack tuna	Bonito, lesser tuna, Aku	Fresh, frozen, canned, filet, rounds
Swordfish	Aʻuku, broadbilled, broadbill, espada, emperado, mekajiki, shutome	Fresh, frozen, canned, filet, rounds
Wahoo	Ono	Fresh, frozen, filet
Yellowfin tuna	'Ahi shibi	Fresh, frozen, canned, filet, rounds

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

ALBACORE			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)

BIGEYE TUNA			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)
Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)

BLACK MARLIN			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)

BLUE MARLIN			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)

BLUE SHARK			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)
North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)

DOLPHINFISH			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.330: Moderate Concern	5.000: Low Concern	Best Choice (3.413)
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	2.330: Moderate Concern	5.000: Low Concern	Best Choice (3.413)
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	2.330: Moderate Concern	5.000: Low Concern	Best Choice (3.413)
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	2.330: Moderate Concern	5.000: Low Concern	Best Choice (3.413)
Eastern Central Pacific | Trolling lines | United States | Hawaii	2.330: Moderate Concern	5.000: Low Concern	Best Choice (3.413)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii	2.330: Moderate Concern	5.000: Low Concern	Best Choice (3.413)

OPAH			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)

SHORTBILL SPEARFISH			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**

SHORTBILL SPEARFISH			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)

SHORTFIN MAKO SHARK			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)

SICKLE POMFRET			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)

SKIPJACK TUNA			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	5.000: Very Low Concern	5.000: Low Concern	Best Choice (5.000)
Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	3.670: Low Concern	3.000: Moderate Concern	Best Choice (3.318)

STRIPED MARLIN			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000: High Concern	1.000: High Concern	Avoid (1.000)
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)

SWORDFISH			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Northwestern and Central Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)
Northwestern and Central Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)

WAHOO			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)
Eastern Central Pacific | Trolling lines | United States | Hawaii	2.330: Moderate Concern	3.000: Moderate Concern	Good Alternative (2.644)

YELLOWFIN TUNA			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	5.000: Very Low Concern	5.000: Low Concern	Best Choice (5.000)
Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	3.670: Low Concern	5.000: Low Concern	Best Choice (4.284)

Criterion 1 Assessments

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.*

Albacore

Factor 1.1 - Abundance

North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Low Concern
The north Pacific albacore stock is not overfished (ISC 2017). The most recent stock assessment for albacore tuna in the eastern north Pacific Ocean was conducted in 2017 using data through 2015 and a length-based, sex-structured modeling approach. The SSB has been relatively stable since 2000 (Figure A), and the SSB_{2015} was estimated to be 80,618 t, which is 2.47 times larger than the WCPFC LRP threshold (32,614 t)(IATTC 2018)(ISC 2017). We have, therefore, scored this as low concern based on the SSB, but not a very low concern due to uncertainty in the models.

Justification:
Albacore tuna in the Pacific Ocean are divided into two stocks (north and south) based on fishery, tagging, ecological and genetic data. The northern stock of albacore is managed by the WCPFC in the WCPO and the IATTC in the EPO. It is important to note that this assessment includes eastern and western North Pacific albacore. The population of albacore in the north Pacific has not dropped below the WCPFC-adopted limit reference point (LRP; 20% of the current spawning stock biomass (SSB) when F=0) since 1993. According to the 2017 assessment (using data through 2015), the estimated 2015 spawning potential ratio (SPR; equilibrium spawning stock biomass per recruit that would result from the current year's pattern and intensity of fishing mortality) was 0.53, which is considered reflective of moderate exploitation intensity (ISC 2017).

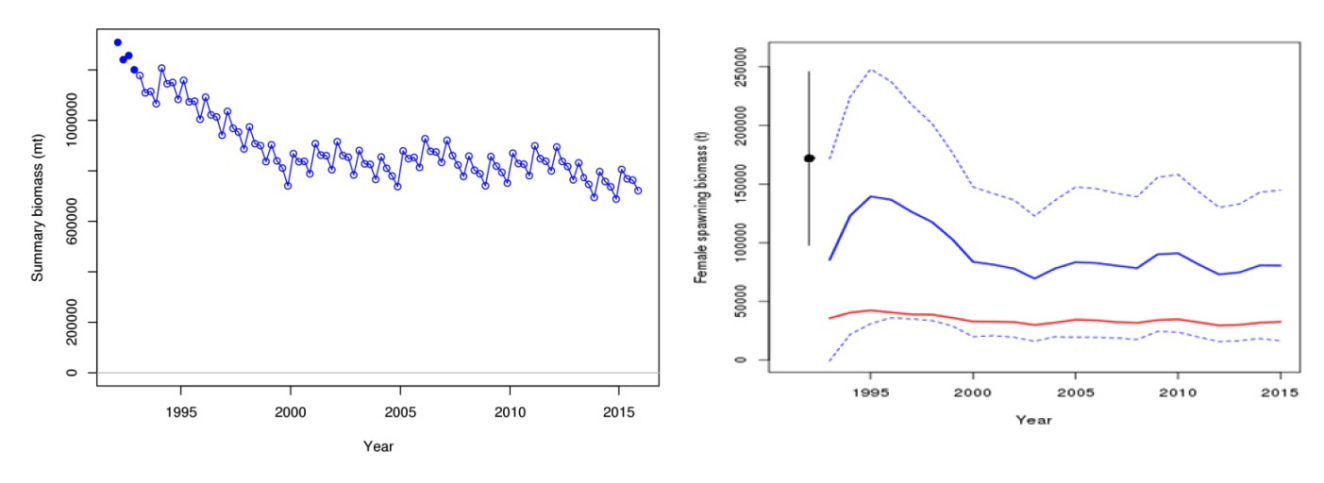

Figure 9: Maximum likelihood estimates of (A) total age-1+ biomass (open circles) (B), female spawning biomass (SSB) (solid blue line) of north Pacific albacore tuna (Thunnus alalunga). Dashed lines (B) indicate 95% confidence intervals of the female SSB and recruitment estimates respectively. Red line indicates the 20%SSBcurrent, F=0 limit reference point, which is based on dynamic SSB0. Closed black circle and error bars in (B) are the maximum likelihood estimate and 95% confidence intervals of unfished female spawning biomass, SSB0 (ISC 2017).

Factor 1.2 - Fishing Mortality

North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Low Concern

The ratio of $F_{2012\text{-}2014}$:F_{MSY} was 0.61 and below the management reference point (0.65), suggesting that that overfishing is not occurring for albacore (IATTC 2018)(ISC 2017). North Pacific albacore therefore receive a low concern score for fishing mortality in the Hawaii longline fisheries.

Justification:

North Pacific albacore are taken in longline, troll and pole-and-line fisheries (Figure A). In the Hawaiian fisheries in 2018, albacore were primarily taken by American Samoa (312,000 lbs) and Hawaii (287,000 lbs) longline fisheries (WPRFMC 2018).

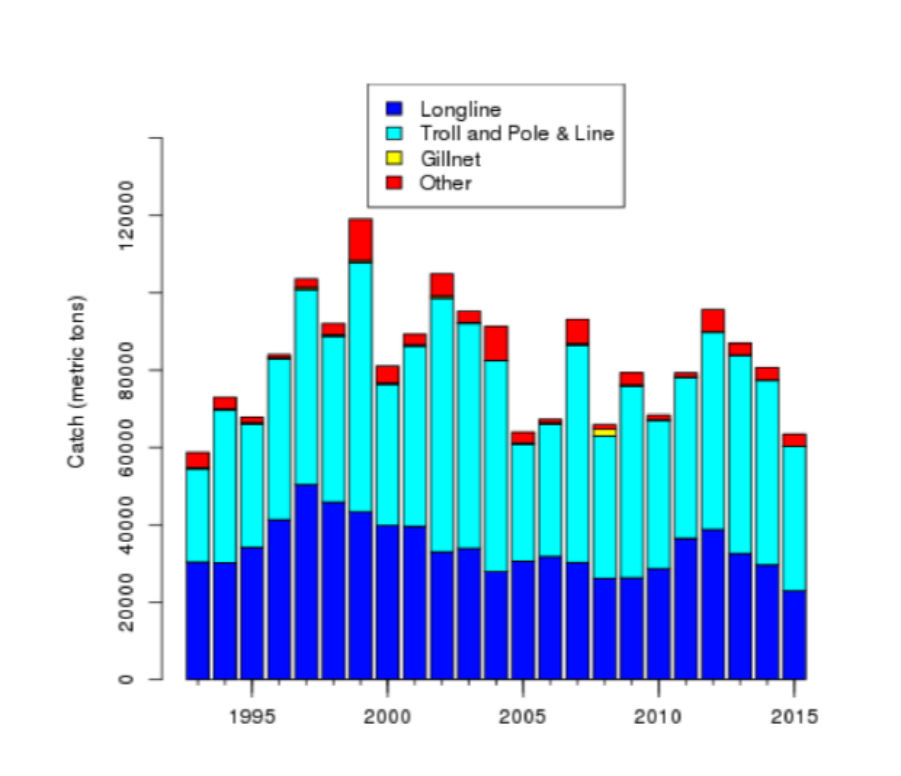

Figure 10: Estimated catches of north Pacific albacore (Thunnus alalunga) by major gear types, 1993-2015. The Other gear category includes catches with purse seine, recreational gear, handlines and harpoons (ISC 2017).

Bigeye tuna

Factor 1.1 - Abundance

Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific | Trolling lines | United States | Hawaii

Moderate Concern
In 2020, a benchmark assessment for EPO bigeye was updated to better account for model uncertainty. This new form of assessment cycle for the IATTC includes a standard assessment approach and a separate risk analyses that considers different model runs (and weights them based on biological feasibility) to create management advice based on risk or management strategy evaluations (IATTC 2020). For all models combined in the risk assessment, bigeye SB_{2020} is 9% above SB_{MSY}, and there is a 47% chance that SB_{MSY} is exceeded. However, there is only a 6% chance that SB_{LIMIT} is exceeded by the estimated SB_{2020} (IATTC 2020b).

It's important to note that there are considerable discrepancies in results depending on selected model attributes. According to the 44 converged reference model runs for 2020 bigeye assessment, the spawning biomass of bigeye at the beginning of 2020 ranged from 51% - 532% of the spawning biomass at the LRP level (IATTC 2020). All short-term models and two environment models estimate that at the beginning of 2020 the bigeye stock is overfished (IATTC 2020). However, the models in the aggregate risk analyses suggest this population is likely not overfished (IATTC 2020b). While the EPO bigeye stock is currently not considered overfished, the significant variations between model estimates and high uncertainty yield a "moderate concern" score for stock status.
Justification:
According to the last full assessment of bigeye tuna in the Eastern Pacific Ocean (2016), 2005-2009 saw a recovering trend for bigeye in the EPO (likely due in part to to IATTC tuna conservation resolutions initiated in 2004). Although the resolutions have continued since 2009, the rebuilding trend was not sustained during 2010-2013, and the spawning biomass ratio (SBR) gradually declined to a historically low level of 0.16 at the start of 2013. The spawning biomass ratio subsequently increased to 0.21 at the start of 2017 but was predicted to decline again in 2018 (IATTC 2017)(IATTC 2018). Indicators (CPUE, weight, fleet capacity) were used to assess bigeye tuna in 2019 while the revised stock assessment was conducted, and all bigeye indicators suggested reduced bigeye abundance in the EPO at that time (IATTC 2019b).

Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Low Concern
Bigeye tuna in the WCPO were most recently assessed in 2018, using a new age and growth curve. According to the updated growth model, the median ratio of the current average (2012-2015) spawning biomass to that needed to produce the MSY ($SB_{2012\text{-}2015}/SB_{MSY}$) was 1.311 and the ratio of the latest (2015) spawning biomass (mature fish) to that needed to produce the MSY (SB_{2015}/SB_{MSY}) was 1.624. 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. In 2018, the assessment was updated with additional new age and growth information and the status re-evaluated (Vincent et al. 2018). WCPO bigeye tuna receive a low concern score because bigeye tuna are not considered overfished and the spawning stock biomass is above MSY. We have not awarded a very low concern score because of the high amount of uncertainty in the models.

Factor 1.2 - Fishing Mortality

Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific | Trolling lines | United States | Hawaii

Moderate Concern
In 2018, approximately 16 million lbs of bigeye tuna were harvested as part of the deep-set longline fishery in Hawaii and roughly 108,000 lbs of bigeye were harvested as part of the shallow-set longline fishery (WPRFMC 2018). As with stock status estimates, there is a significant degree of uncertainty surrounding the most recent bigeye assessment fishing mortality estimates (2020). The 2020 risk analysis for management suggests that bigeye F_{2019} is 7% greater than F_{MSY} (50% probability) but does not exceed the F_{LRP} (fishing mortality threshold that should be avoided because fishing harder could endanger the sustainability of the stock). The risk assessment (based on multiple model runs) concludes there is a 5% chance that $F_{2019} > F_{LRP}$ (IATTC 2020). Bigeye tuna receive a "moderate concern" for fishing mortality because F is likely fluctuating around F_{MSY}, but there is a very low probability that overfishing is occurring despite uncertainty within the current assessment and risk analyses approach.
Justification:
The 2020 benchmark standard assessment indicates that fishing mortality of bigeye in 2017-2019 ranged from 51% - 223% of the F_{MSY} (roughly half of the model runs suggest that the fishing mortality of bigeye in 2017-2019 is higher than the MSY level). Estimates of F_{2019} of bigeye in 2017-2019 ranged from 32% - 114% of the F_{LRP}, and overfishing is unlikely to be occurring (only 3 of 44 models predicted overfishing) (IATTC 2020).

Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Low Concern
In 2018, an updated assessment was conducted in the WCPO that included additional new age and growth information, and stock status and fishing mortality were re-evaluated (Vincent et al. 2018). The median ratio of recent (2012-2015) fishing mortality rates to those that produce the maximum sustainable yield ($F_{2012-2015}/F_{MSY}$) was 0.768, indicating overfishing is not occurring (Vincent et al. 2018). We have awarded a low concern score based on the assessment results that overfishing is not occurring.

Justification:
In the Hawaii longline fisheries, bigeye are primarily taken in the deep-set longline fishery (approximately 16 million lbs in 2018) versus the shallow-set fishery (108,000 lbs in 2018)(WPRFMC 2018). US harvests of bigeye represent a small portion of overall Pacific bigeye harvests (Figure A). Updated models of bigeye in the Western Pacific suggest that previous models may have underestimated bigeye stock status and there is a 94% probability $F<F_{MSY.}$(WCPFC 2018). However, there is a high degree of uncertainty around these estimates and fishing mortality appears to be increasing (especially for juveniles).

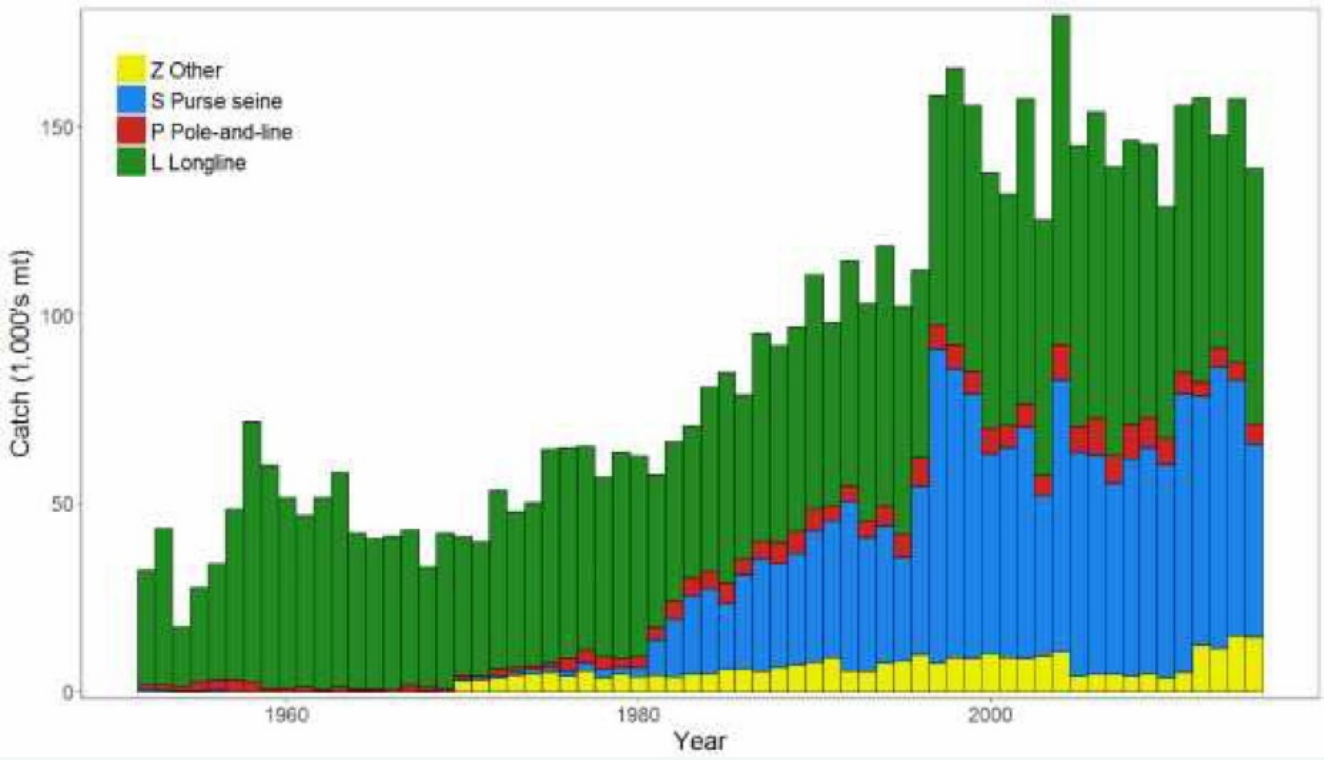

Figure 11: Time series of total annual bigeye tuna catch (1000's mt) by fishing gear over the full assessment period (WCPFC 2018).

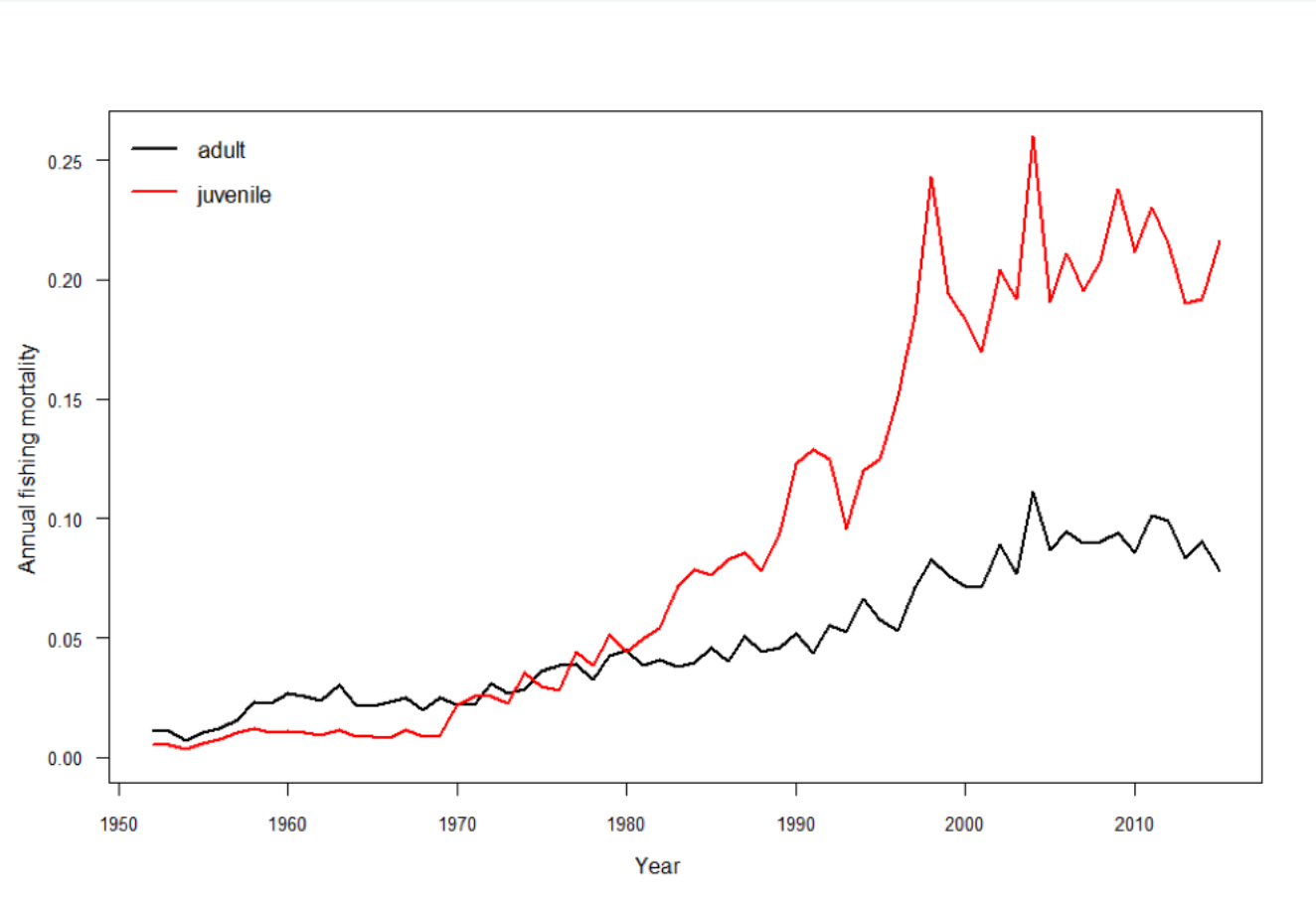

Figure 12: Estimated annual average juvenile and adult fishing mortality for the diagnostic case model (WCPFC 2018).

Black marlin

Factor 1.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern

No assessment for black marlin has been conducted in the 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. 2011d). 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. 2015)	2
Fecundity	11,000,000 (Sun et al. 2015b)	1
Average maximum size (fish only)	400 cm (Sun et al. 2015)	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 2019)	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

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern

No stock assessment has been conducted for black marlin in the Pacific Ocean, 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. 2011d). 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 (Arata et al. 2009), (WCPFC 2018b). In 2017, only 209 t black marlin were caught in longlines in the Eastern Pacific Ocean (EPO), which is only 0.6% of all billfish catches, and 3% of all marlin catches (IATTC 2019b), 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

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

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. 2011e). 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

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

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 Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

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). Deep set CPUE has increased since 2013, while shallow-set CPUE has been variable since 2008 with no clear trend. Blue sharks exhibited the second highest CPUE (after bigeye tuna and swordfish) in both the deep-set and shallow-set fishery, respectively (WPRFMC 2018). Multiple data points indicate that blue shark stock is not overfished, and we have therefore awarded a low concern score for blue shark stock status.

Factor 1.2 - Fishing Mortality

North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Low Concern
In 2019, the shallow-set and deep-set fisheries combined caught approximately 114, 300 blue sharks (PIFSC 2020). Blue sharks are widely distributed throughout the North Pacific and dominate shark catches in that region. However, the Hawaii longline fishery only retained only two blue sharks. Post-release mortality estimates of blue sharks (0.17, 95%CI = 0.09-0.30) and meta-analyses indicated that total fishing mortality of blue sharks may be underestimated, and were consistent across spatial and temporal scales (Musyl and Gilman 2019) (Musyl and Gilman 2018).

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 low concern score for blue shark fishing mortality in deep-set and shallow-set fisheries in Hawaii.

Dolphinfish

Factor 1.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii

Moderate Concern
Data are limited for dolphinfish (also known as mahimahi and dorado) in the EPO and WCPO. No stock assessment has been conducted for dolphinfish in the western Pacific. An exploratory stock assessment was conducted on dolphinfish in the southern EPO in 2016. The SSB has remained fairly stable since 2007, with a slight decrease during 2010. Some common reference points used for species such as tuna were assessed for dolphinfish. The spawning biomass ratio to that of the unfished stock averaged 0.20 for the time series (IATTC 2016). The IUCN assessed dolphinfish as a species of Least Concern (Collette et al. 2011). There is a high degree uncertainty surrounding reference points for dolphinfish (especially in the western Pacific), however the IUCN rates this species as Least Concern; therefore, dolphinfish receive a moderate concern score for abundance due to data limitations.

Factor 1.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii

Low Concern
Fishing mortality rates for dolphinfish in the EPO and the WCPO compared to reference points are unknown. According to an exploratory stock assessment in the EPO in 2016, dolphinfish fishing mortality rates have decreased slightly since 2007, and the analysis suggests that the fishing mortality is roughly 50% of MSY (IATTC 2016) in that area. Preliminary analysis shows variable (no trend) catch per unit effort (IATTC 2016). We have awarded a score of low concern because commercial fishing does not appear to be a major threat, the CPUE has been somewhat stable over time, and the preliminary stock assessment states that the current fishing mortality rates is approximately 50% of MSY for dolphinfish.
Justification:
Dolphinfish are caught as bycatch and targeted in longline fisheries in the North Pacific.The Hawaii deep-set longline fishery caught approximately 44,000 dolphinfish/mahimahi in 2018, and dolphinfish also support significant recreational fisheries across the Pacific Islands region as well, in addition to being important components of the catch in island territories (WPRFMC 2018). The IUCN does not consider there to be any major threats to dolphinfish from commercial fishing {Collete et al. 2011}.

Opah

Factor 1.1 - Abundance

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern
The status of opah in the Pacific Ocean including around Hawaii is unknown; however the IUCN lists this species as Least Concern (Smith-Vaniz et al. 2015). Catch rate series indicate a fairly stable trend over time (1992-2019) (PIFSC 2020). It is taken in some pelagic fisheries, however, this is not considered a threat to its global population. It is therefore listed as Least Concern. We have awarded a moderate concern score because of the IUCN Least Concern listing.

Factor 1.2 - Fishing Mortality

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern
There is no information on fishing mortality rates for opah in the Western and and Eastern Central Pacific Ocean. In 2018, just over 3 million lbs of opah were caught in the Hawaii longline fisheries (primarily deep-set), up 30% from 2017 (WPRFMC 2018) (WPRFMC 2019). As the footprint and effort of the deep-set longline fishery has expanded, catches of opah have declined relative to total landings in recent years. However, catches of opah continue to be a significant portion of overall landings for the deep-set fishery (>5%), and opah receive a moderate concern score for fishing mortality due to their unknown fishing mortality status and because there is no management in place.

Shortbill spearfish

Factor 1.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Moderate Concern
There is no stock assessment for shortbill spearfish and the IUCN Red List of Threatened Species lists it as "Data Deficient" (Collette et al. 2011b). Consequently, we conducted a productivity-susceptibility analysis, which resulting in a medium vulnerability. We have rated species abundance as moderate concern due to its unknown status and medium vulnerability.
Justification:

Shortbill spearfish, Hawaii						
Productivity Attributes	Value	Score (1 = low risk; 2 = medium risk; 5 = high risk)	Reference	Susceptibility Attribute	Information	Score (1 = low risk; 2 = medium risk; 5 = high risk)
Average age at maturity (years)	3	1	(Froese and Pauly 2019)	Areal overlap		3
Average maximum age (years)	6	1	(Salcedo-Bojorquez and Arreguin-Sanchez 2011)	Vertical overlap		3
Fecundity (eggs/yr)	N/A			Selectivity of fishery		2
Average maximum size (cm) (not to be used when scoring invertebrate species)	222	2	(Salcedo-Bojorquez and Arreguin-Sanchez 2011)	Post-capture mortality		3
Average size at maturity (cm) (not to be used when scoring invertebrate species)	132	2	(Salcedo-Bojorquez and Arreguin-Sanchez 2011)	Susceptibility Subscore		2.325
Reproductive strategy	Broadcast spawner	1	(Froese and Pauly 2019)			
Trophic level	4.5	3	(Froese and Pauly 2019)	Productivity-Susceptibility Score	2.89	
Density dependence (invertebrates only)	NA			Vulnerability Rating (high, medium or low)	Medium	
Quality of Habitat	Moderately altered	2				
Productivity Subscore		1.71				

Factor 1.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Moderate Concern
Shortbill spearfish are caught in both the Hawaii shallow- and deep-set longline fisheries (WPRFMC 2019). There are no stock assessments for shortbill spearfish nor reference points. Therefore, fishing mortality is unknown, which scores moderate concern.

Shortfin mako shark

Factor 1.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Low Concern
The most recent stock assessment (2018) indicated that the most recent spawning abundance (SA_{2016}) was 860,200 sharks (CV=46%) and was 36% (CV=30%) higher than the estimated SA at MSY (SA_{MSY}). Estimated SA has slightly increased since 1999 but generally exhibits a declining long term trend since 1975 (ISC 2018). The maximum likelihood estimate suggests SA has been above MSY throughout the entire assessment period, and shortfin mako are not considered overfished (ISC 2018a) {NOAA 2019}. Shortfin mako therefore receive a low concern in consideration of the endangered IUCN listing and a recent stock assessment that suggests the stock is within target reference points and is not overfished.
Justification:
A single stock of shortfin mako sharks is assumed in the north Pacific Ocean based on evidence from genetics, tagging studies, and lower catch rates of SFMs near the equator relative to temperate areas. Larger subadults and adults are observed in greater proportions in the central north Pacific Ocean.Shortfin mako sharks are distributed throughout the pelagic, tropical to temperate north Pacific Ocean. Pupping and/or nursery areas areas are thought to be distributed along the continental margins of the north Pacific Ocean, off the coast of U.S. and Mexico in the EPO and off the coast of Japan. There is ongoing uncertainty regarding smaller regional groupings (ISC 2018a).

The trend analysis of the modeled spawning abundance for 1975–2016 revealed annual rates of decline of 0.6%, consistent with a median decline of 36.5% over three generation lengths (72 years), with the highest probability of 30–49% reduction over three generation lengths (Rigby et al. 2018)(ISC 2018a). Because of this decline in the North Pacific (and more significant declines in the Atlantic), IUCN listed shortfin mako as endangered with a decreasing trend (Rigby et al. 2018).

Factor 1.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Low Concern
Shortfin mako sharks are one of the most frequently caught shark species in tropical longline fisheries. In 2019, approximately just under 5,100 mako sharks were caught in the deep-set and shallow-set fisheries combined (approximately 11% of that was retained)(WPRFMC 2019). The overall annual fishing intensity ($1\text{-}SPR_{2013\text{-}2015}$) was estimated to be 0.16 (CV=38%) and was 62% (CV=38%) of fishing intensity at MSY ($1\text{-}SPR_{MSY}$; 0.26), and these results suggest the stock is not likely (>50%) to be experiencing overfishing (ISC 2018a). Post-release mortality studies of other shark species indicate that fishing morality may be underestimated (Musyl and Gilman 2018), (Musyl and Gilman 2019).

While there is concern regarding fishing mortality species-wide, the Hawaii longline fisheries does not contribute substantially to the cumulative fishing mortality (which is estimated to be within target reference points for fishing mortality). Shortfin mako sharks receive a low concern score for fishing mortality in the Hawaiian deep-set and shallow-set fisheries because they are not substantial contributors to overall fishing mortality, which is within target reference points.
Justification:
Currently, the primary source of known shortfin mako shark fishing intensity is oceanic longline fisheries targeting swordfish and tuna, including mostly shallow-set longline fisheries in temperate waters, and deep-set longline fisheries in more tropical areas. Asian shark markets, which have been developing for over a decade, provide economic value to shortfin mako shark bycatch in these fisheries (ISC 2018a). Catch data pre-1993 are highly uncertain. The total estimated catch of North Pacific shortfin mako sharks reached a peak of 7,068 mt in 1981 and then declined in the early 1990s, with catches fluctuating between 1,948 mt and 2,395 mt since the early 1990s.

Sickle pomfret

Factor 1.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern

The sickle pomfret belongs to the family Bramidae and includes about 20 species across the Atlantic and Pacific Oceans. Data are limited for this species. A Productivity Susceptibility Analysis scored medium vulnerability (2.82). Because information about its abundance is unknown, and it scores medium vulnerability, we have rated it as moderate concern for abundance.

Justification:

Sickle pomfret, Hawaii pelagic fleet						
Productivity Attributes	Value	Score (1 = low risk; 2 = medium risk; 5 = high risk)	Reference	Susceptibility Attribute	Information	Score (1 = low risk; 2 = medium risk; 5 = high risk
Average age at maturity (years)	-			Areal overlap		3
Average maximum age (years)	8	1	(Froese and Pauly 2019)	Vertical overlap		3
Fecundity (eggs/yr)	-			Selectivity of fishery		2
Average maximum size (cm) (not to be used when scoring invertebrate species)	65	1	{Froese and Pauly 2019	Post-capture mortality		3
Average size at maturity (cm) (not to be used when scoring invertebrate species)	NA			Susceptibility Subscore		2.325
Reproductive strategy	Broadcast spawner	1	{Froese and Pauly 2019			
Trophic level	4.2	3	{Froese and Pauly 2019	Productivity-Susceptibility Score	2.82	
Density dependence (invertebrates only)	NA			Vulnerability Rating (high, medium or low)	Medium	
Quality of Habitat	Moderately altered	2				
Productivity Subscore		1.60				

Factor 1.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern

Sickle pomfrets (monchong) are a common bycatch in the deep-set longline fishery, and these smaller fishes are increasing in their relative proportion of the catch in recent years. Catches of pomfrets peaked in 2013-2016 at over 1 million lbs annually (see Figure) (WPRFMC 2019). There are no fishing mortality reference points or annual limits, so sickle pomfrets receive a moderate concern score for fishing mortality.

Justification:

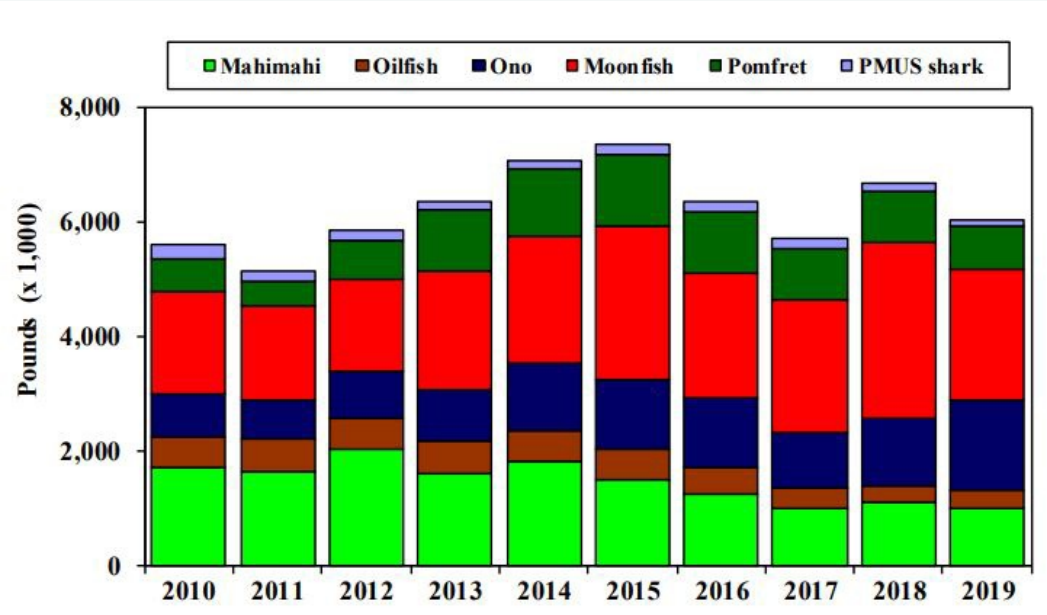

Figure 13: Other Hawaii Pacific Pelagic Management Unit catch by species, 2010-2019 (WPRFMC 2019).

Skipjack tuna

Factor 1.1 - Abundance

Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Low Concern

Due to the complexity associated with skipjack tuna stock assessments in the EPO (neither biomass or fishing mortality reference points are available), the latest skipjack tuna assessment is based on indicators to assess relative trends in biomass. According to the indicators tracked and associated simplistic stock assessment, both skipjack biomass and recruitment have been increasing over the past 20 years, and were above their respective upper reference levels in 2015 and 2016. However, the average skipjack weight was at or below its lower reference level 2015-2017. A high degree of uncertainty exists with regards to stock status, however, most indicators and model-estimates suggest the skipjack population is moderately stable (there does not appear to be any indication the population is overfished) (IATTC 2019a), and skipjack tuna receives a low concern score for abundance.

Justification:

Skipjack tuna are a challenging species to assess due to high and variable productivity (annual recruitment is a large proportion of total biomass) and challenges around estimating the impacts of fishing mortality (IATTC 2019a). In response, the IATTC evaluates eight indicators to track skipjack tuna biomass and recruitment relative to historic levels. Indicators include: skipjack catch, standardized effort (sum of days of fished for FAD and NOA fisheries), catch per unit effort (CPUE). A simple stock assessment is also used to estimate proxies of biomass, recruitment and exploitation rates (IATTC 2019a).

Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Very Low Concern

Skipjack tuna in the WCPO were last assessed in 2016. According to the assessment, the total biomass has been higher than the reference point (B_{MSY}, the biomass needed to produce the maximum sustainable yield) over the entire period (1972–2014). The current total biomass is around 62% of virgin levels (B_0) and the ratio of the current spawning biomass to that needed to produce the MSY is well above 1 (SB_{latest}/SB_{MSY} = 2.56) (McKechnie et al. 2016). Therefore, skipjack tuna is not overfished and is above target levels and receives a very low concern score.

Factor 1.2 - Fishing Mortality

Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern

Similar to biomass for skipjack tuna, fishing mortality is tracked via a suite of indicators (including catch, days fished) to assess exploitation rates. The standardized effort indicator of exploitation rate increased starting in the early 1990s and has been above the average level since about 2000. The most recent skipjack stock indicator assessment (2019) suggests the long-term pattern in reduced average skipjack weight may be "due to increasing fishing mortality resulting from the increasing number of sets. However, it is unknown if the current fishing mortality levels are appropriate because there are no reference points for skipjack tuna in the EPO {IATCC 2019a}". The report goes on to add that any continued decline in average length is a concern with regards to fishing mortality. Recruitment and biomass indicators used to determine the status of skipjack tuna in the EPO have not generally indicated significant negative effects to the population from increased fishing (IATTC 2019a), however, due to the high degree of uncertainty and increasing exploitation rates, skipjack tuna in the EPO receive a moderate concern score for fishing mortality.

Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Low Concern

The current level of exploitation of skipjack tuna in the WCPO is below MSY, and harvests are increasing in the Pacific (Figure A). Although fishing mortality rates have been increasing over time, the current fishing mortality rate is well within management reference points (F/F_{MSY} = 0.45) (McKechnie et al. 2016). Therefore, overfishing of skipjack tuna is not occurring, and skipjack tuna receives a low concern score for fishing mortality in the WCPO.

Justification:

Striped marlin

Factor 1.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern
The most recent striped marlin stock assessment in the EPO was conducted in 2009 and published in 2010 {Hinton et al. 2010}. At that time, model results showed striped marlin were at or above levels to expected to provide landings at MSY (Hinton et al. 2010). Hinton et al. 2010 estimated biomass at about 3,600 t in 2009, and the ratio of spawning biomass S_{2009}/S_{MSY} = 1.2 (Hinton et al. 2010). The data and stock assessment are greater than 10 years old, which greatly increases the uncertainty around the results. Due to the age of the data and stock assessment, we have scored abundance of striped marlin in the EPO as moderate concern.

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

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.

Factor 1.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern
The EPO stock assessment for striped marlin calculated commercial fishing mortality (F) was 40% of F_{MSY} (F_{2009}/F_{MSY} = 0.4) and recreational fishing mortality in 2009 was 30% of F_{MSY} (F_{2009}/F_{MSY} = 0.3), assuming that 75% of fish caught and released recreationally survive {Hinton et al. 2010}. The average recreational fishing mortality between 2007-2009 =0.45. {Hinton et al. 2010}. Due to the age of the stock assessment (>10 years) and the subsequent uncertainty caused by the age of the information, we have scored fishing mortality of striped marlin in the EPO as moderate concern.

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

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.

Swordfish

Factor 1.1 - Abundance

Northwestern and Central Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwestern and Central Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Low Concern
An assessment for swordfish in the WCPO was conducted in 2018. The north Pacific population is reviewed here only as genetic studies indicate there is not uniform gene flow among swordfish populations, and the northwest and southwest populations are the most discrete (Takeuchi et al. 2017). 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 MSY level (ISC 2018). The spawning potential ratio of the stock is currently estimated at 45% (ISC 2018). The population has been fairly stable with a slight decline until the mid-1990's, followed by a slight increase since 2000 (ISC 2018).

The spawning stock biomass has remained above MSY levels throughout the time series of the assessment (ISC 2018). 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.

Factor 1.2 - Fishing Mortality

Northwestern and Central Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwestern and Central Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Low Concern
An assessment for swordfish in the northwest Pacific Ocean was conducted in 2018. The current fishing mortality rate ($F_{2013-2015}$) is 0.08, which is around 45% lower than the level necessary to produce the maximum sustainable yield (F_{MSY}=25%). It is very likely (>99%) that fishing mortality rates are sustainable, and therefore overfishing is not occurring (ISC 2018). We have therefore awarded a low concern score for swordfish fishing mortality in the Hawaiian shallow-set longline fishery.
Justification:
Swordfish are primarily taken in the shallow-set longline fishery in the Hawaiian Islands fishery (Figure A), and are taken more extensively in the WCPO in international longline fishery. Approximately 2.33 million lbs of swordfish were harvested in the Hawaiian Islands fisheries in 2018 (WPRFMC 2018). Exploitation rates in this region peaked in 1960's and have declined since.

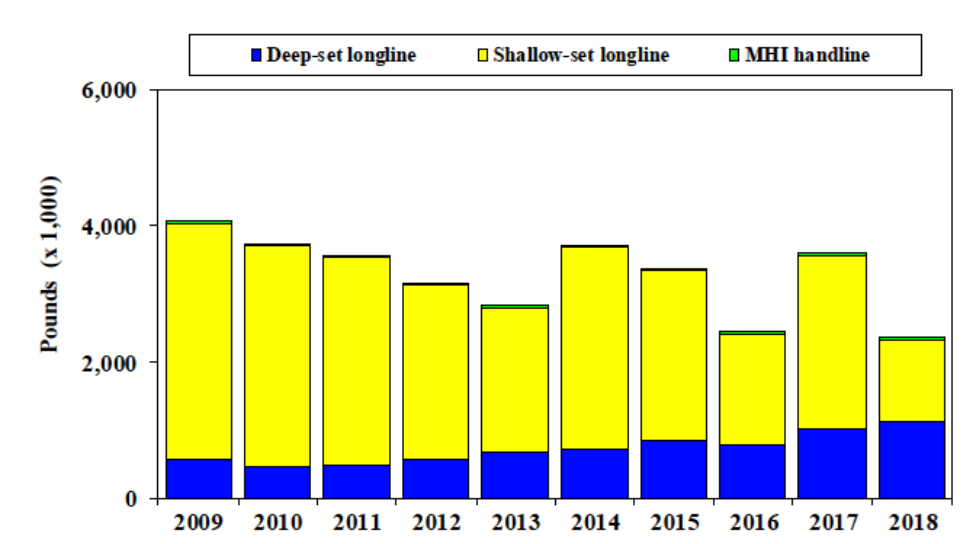

Figure 14: Hawaii swordfish catch by gear type, 2009-2018 (WPRFMC 2018).

Wahoo

Factor 1.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii
Eastern Central Pacific | Trolling lines | United States | Hawaii

Moderate Concern
Wahoo are listed as a species of Least Concern by the IUCN (Collette et al. 2011c). No population assessments have been conducted for this species in the Pacific Ocean. Data limitations coupled with an IUCN Least Concern rating yield a moderate concern score for wahoo in the WCPO and EPO.

Factor 1.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii
Eastern Central Pacific | Trolling lines | United States | Hawaii

Moderate Concern
Wahoo are caught as bycatch and targeted in longline fisheries in the North Pacific. The Hawaii deep-set longline fishery caught approximately 32,871 wahoo in 2018. Wahoo support significant recreational fisheries across the Pacific Islands regions as well, in addition to being important components of the commercial catch in island territories (WPRFMC 2018). Catches of wahoo the EPO have been increasing over the past 20 years, with a particularly sharp uptick around 2006. Higher catches of wahoo are likely related to changes in longline data reporting and an increasing number of floating object purse seine sets (IATTC 2018). Roughly 368 t and 243 t of wahoo were caught in 2017 in purse seine and longline fisheries, respectively (IATTC 2018). Fishing mortality rates for wahoo in the EPO and the WCPO compared to reference points are unknown, and wahoo therefore receive a moderate concern score for fishing mortality.

Yellowfin tuna

Factor 1.1 - Abundance

Eastern Pacific (EPO) Stock | Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Low Concern
Annual recruitment of yellowfin has been near or below average since 2003 (IATTC 2019)(IATTC 2019a){IATTC 2018c}. The 2020 full assessment for yellowfin tuna estimated that SB_{2020} ranged from 49% - 219% of the target reference point SB_{MSY}. The probability that the spawning biomass at the beginning of SB_{2020} is lower than SB_{MSY} is 50% or less for 13/48 models. The risk analyses for yellowfin with model estimates aggregated indicate there is a 12% chance overall that SB_{2020} is lower than SB_{MSY} (IATTC 2020b), and the probability that the SB_{2020} is below the SB_{LRP} ranges from 0% - 2% (IATTC 2020c).

Similar, to bigeye tuna, there are considerable discrepancies in results depending on selected model attributes and the steepness of the stock-recruit curve. Additional uncertainty relates to spatial structure and differing trends by fishery (longline, purse seine type, etc.) There are still models that estimate the yellowfin stock may be overfished {IATTC 2019c), however most model runs in aggregate indicate this is highly unlikely {IATTC 2020b; IATTC 2020c}. In summary, there is some conflicting information about stock status; however the majority of models indicate this stock is not overfished, and yellowfin tuna receive a "low concern" score for abundance in the EPO.
Justification:
Yellowfin tuna in the eastern Pacific Ocean were last fully assessed during the 2017 cycle (IATTC 2018). At that time, there was a high degree uncertainty concerning recent and future recruitment and biomass levels, with the potential for three different regimes since 1975 (IATTC 2018). In 2019, the IATTC was unable to reconcile the trend data for the full assessment model, so the assessment and management for 2019/20 yellowfin tuna abundance is based on a set of proxy indicators for the most recent year. Indicators from 2019 of relative abundance (CPUE across gear types, length) have been at low levels since 2010, however the average length of fish has increased (IATTC 2019a).

Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

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 (2012-2015) spawning (mature fish) biomass to that needed to produce the maximum sustainable yield) was 1.41 (WPRFMC 2018). The median ratio of the latest (2015) spawning biomass to the level needed to produce the maximum sustainable yield (SBl_{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 $SB_{MSY,}$ and yellowfin receive a very low concern score for abundance.

Factor 1.2 - Fishing Mortality

Eastern Pacific (EPO) Stock | Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Low Concern
The average fishing mortality rate has been increasing for all age classes of yellowfin tuna in the EPO since 2009 (IATTC 2019a), in large part due to increasing effort from object associated purse seine fisheries. The point estimate of the fishing mortality in 2017-2019 ranged from 40% - 168% of the F_{MSY} (IATTC 2020c). The probability that the fishing mortality of yellowfin in 2017-2019 is higher than the F_{MSY} level is 50% or more for only 14/48 models. The risk analyses with aggregated model runs indicates that there is only 9% chance that $F>F_{MSY}$(IATTC 2020b). Additionally, the point estimate of the $F_{2017\text{-}2019}$ ranged from 22% - 65% of the LRP (IATTC 2020c). The probability that the fishing $F_{2017\text{-}2019} > F_{LRP}$ was estimated to be zero for all models (IATTC 2020b). In summary, the majority of models indicate that F is within target and limit reference points, and yellowfin tuna receive a "low concern" score for fishing mortality.

Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Low Concern
The current fishing mortality rate is below levels needed to produce the maximum sustainable yield (F_{recent}/F_{MSY} = 0.74) for the most realistic models (WPRFMC 2018); therefore overfishing is not occurring (Tremblay-Boyer et al. 2017), and we have awarded a low concern score for fishing mortality for yellowfin tuna in the WCPO.

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

Criterion 2 score(s) overview

This table(s) provides an overview of the Criterion 2 subscore, discards+bait modifier, and final Criterion 2 score for each fishery. A separate table is provided for each species/stock that we want an overall rating for.

ALBACORE			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)

BIGEYE TUNA			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)

BLACK MARLIN			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)

BLUE MARLIN			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)

BLUE SHARK			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	1.732	1.000: < 100%	Red (1.732)
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	1.732	1.000: < 100%	Red (1.732)
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)

DOLPHINFISH			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	1.732	1.000: < 100%	Red (1.732)
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	1.732	1.000: < 100%	Red (1.732)
Eastern Central Pacific | Trolling lines | United States | Hawaii	2.644	1.000: < 100%	Yellow (2.644)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii	2.644	1.000: < 100%	Yellow (2.644)

OPAH			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)

SHORTBILL SPEARFISH			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	1.732	1.000: < 100%	Red (1.732)

SHORTBILL SPEARFISH			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	1.732	1.000: < 100%	Red (1.732)

SHORTFIN MAKO SHARK			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	1.732	1.000: < 100%	Red (1.732)
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	1.732	1.000: < 100%	Red (1.732)

SICKLE POMFRET			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)

SKIPJACK TUNA			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)

STRIPED MARLIN			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)

SWORDFISH			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Northwestern and Central Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	1.732	1.000: < 100%	Red (1.732)
Northwestern and Central Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	1.732	1.000: < 100%	Red (1.732)

WAHOO			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii	2.644	1.000: < 100%	Yellow (2.644)
Eastern Central Pacific | Trolling lines | United States | Hawaii	2.644	1.000: < 100%	Yellow (2.644)

YELLOWFIN TUNA			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)
Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	1.000	1.000: < 100%	Red (1.000)

Criterion 2 main assessed species/stocks table(s)

This table(s) provides a list of all species/stocks included in this assessment for each 'fishery' (as defined by a region/method combination). The text following this table(s) provides an explanation of the reasons the listed species were selected for inclusion in the assessment.

EASTERN CENTRAL PACIFIC | HANDLINES AND HAND-OPERATED POLE-AND-LINES | UNITED STATES | HAWAII			
SUB SCORE: 2.644	DISCARD RATE: 1.000	**SCORE: 2.644**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Bigeye tuna	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Wahoo	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Dolphinfish	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Yellowfin tuna	3.670: Low Concern	5.000: Low Concern	Green (4.284)

EASTERN CENTRAL PACIFIC | TROLLING LINES | UNITED STATES | HAWAII			
SUB SCORE: 2.644	DISCARD RATE: 1.000	**SCORE: 2.644**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Bigeye tuna	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Wahoo	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Dolphinfish	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Yellowfin tuna	3.670: Low Concern	5.000: Low Concern	Green (4.284)

EASTERN CENTRAL PACIFIC, NORTHEAST PACIFIC | LONGLINE (DEEP-SET) | UNITED STATES | HAWAII

SUB SCORE: 1.000 | DISCARD RATE: 1.000 | **SCORE: 1.000**

SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Pygmy sperm whale	1.000: High Concern	1.000: High Concern	Red (1.000)
Dwarf sperm whale	1.000: High Concern	1.000: High Concern	Red (1.000)
False killer whale	1.000: High Concern	1.000: High Concern	Red (1.000)
Olive Ridley turtle	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Black-footed albatross	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Thresher shark (Unspecified)	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Leatherback turtle	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Green sea turtle	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Loggerhead turtle	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Humpback whale	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Laysan albatross	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Striped marlin	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Wahoo	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Long snouted lancetfish	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Black marlin	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Opah	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Bigeye tuna	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Shortbill spearfish	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Sickle pomfret	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Skipjack tuna	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Bottlenose dolphin	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Short-finned pilot whale	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Risso's dolphin	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Rough-toothed dolphin	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Dolphinfish	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Albacore	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Blue shark	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Blue marlin	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Shortfin mako shark	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Yellowfin tuna	3.670: Low Concern	5.000: Low Concern	Green (4.284)

EASTERN CENTRAL PACIFIC, NORTHEAST PACIFIC | LONGLINE (SHALLOW-SET) | UNITED STATES | HAWAII			
SUB SCORE: 1.732	DISCARD RATE: 1.000	**SCORE: 1.732**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Leatherback turtle	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Loggerhead turtle	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Black-footed albatross	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
False killer whale	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Green sea turtle	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Laysan albatross	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Olive Ridley turtle	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Bigeye tuna	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Shortbill spearfish	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Bottlenose dolphin	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Dolphinfish	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Risso's dolphin	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Striped dolphin	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Blue shark	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Shortfin mako shark	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Swordfish	3.670: Low Concern	5.000: Low Concern	Green (4.284)

NORTHWEST PACIFIC, WESTERN CENTRAL PACIFIC | LONGLINE (DEEP-SET) | UNITED STATES | HAWAII			
SUB SCORE: 1.000	DISCARD RATE: 1.000	**SCORE: 1.000**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Pygmy sperm whale	1.000: High Concern	1.000: High Concern	Red (1.000)
Striped marlin	1.000: High Concern	1.000: High Concern	Red (1.000)
Dwarf sperm whale	1.000: High Concern	1.000: High Concern	Red (1.000)
False killer whale	1.000: High Concern	1.000: High Concern	Red (1.000)
Thresher shark (Unspecified)	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Black-footed albatross	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Olive Ridley turtle	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Leatherback turtle	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Green sea turtle	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Loggerhead turtle	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Laysan albatross	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Humpback whale	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Wahoo	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Long snouted lancetfish	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)

NORTHWEST PACIFIC, WESTERN CENTRAL PACIFIC | LONGLINE (DEEP-SET) | UNITED STATES | HAWAII			
SUB SCORE: 1.000	DISCARD RATE: 1.000	**SCORE: 1.000**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Sickle pomfret	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Opah	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Black marlin	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Shortbill spearfish	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Dolphinfish	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Bottlenose dolphin	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Risso's dolphin	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Rough-toothed dolphin	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Short-finned pilot whale	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Albacore	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Blue shark	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Blue marlin	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Bigeye tuna	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Shortfin mako shark	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Skipjack tuna	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)
Yellowfin tuna	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

NORTHWEST PACIFIC, WESTERN CENTRAL PACIFIC | LONGLINE (SHALLOW-SET) | UNITED STATES | HAWAII			
SUB SCORE: 1.732	DISCARD RATE: 1.000	**SCORE: 1.732**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Leatherback turtle	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Loggerhead turtle	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Black-footed albatross	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
False killer whale	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Green sea turtle	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Laysan albatross	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Olive Ridley turtle	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Shortbill spearfish	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Bottlenose dolphin	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Dolphinfish	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)

NORTHWEST PACIFIC, WESTERN CENTRAL PACIFIC | LONGLINE (SHALLOW-SET) | UNITED STATES | HAWAII			
SUB SCORE: 1.732	DISCARD RATE: 1.000	**SCORE: 1.732**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Risso's dolphin	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Striped dolphin	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Bigeye tuna	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Blue shark	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Shortfin mako shark	3.670: Low Concern	5.000: Low Concern	Green (4.284)
Swordfish	3.670: Low Concern	5.000: Low Concern	Green (4.284)

Data from the Western Pacific Regional Fishery Management Council's 2018 annual report were utilized to identify main species to include in this review (WPRFMC 2018). This information was supplemented by data from National Marine Fisheries Service Marine Mammal Stock Assessment Reports. For tunas, billfish and bony fish, species constituting approximately >5% of landings overall and/or in specific Island territories (Guam, Samoa, etc.) were included. Two species of seabirds, black-footed and Laysan albatross, were commonly reported in both fisheries and were therefore included in the review. Turtle species were included based on any takes occurring from 2014-2018. For marine mammals, species were included for the deep-set fishery if at least one incidental take of the species was recorded from 2014-2018 (20% observer coverage). And for the shallow-set fishery, species were included if greater than one take occurred for a given marine mammal species from 2014-2018 (100% observer coverage) .

Loggerhead turtles and black-footed albatross limited the C2 scores for the shallow-set fishery due to their high vulnerability and susceptibility to the interactions with longline fisheries (some of then with minimal monitoring across the Pacific). False killer whales limited the C2 score for the deep-set longline fishery due to their vulnerable stock status, ESA and IUCN listings, and encounter rates with this fishery (Category I listing in the NOAA List of Fisheries). False-killer whale interactions with the deep-set fishery have prompted the formation of a Take Reduction Team for this region. Additionally, pygmy and dwarf sperm whales also drove a low C2 score for the deep-set fishery due to their inherent vulnerability, unknown stock status, and potential to interact with the deep-set longline fishery.

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)

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

Bigeye tuna

Factor 2.1 - Abundance

Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific | Trolling lines | United States | Hawaii

Moderate Concern
In 2020, a benchmark assessment for EPO bigeye was updated to better account for model uncertainty. This new form of assessment cycle for the IATTC includes a standard assessment approach and a separate risk analyses that considers different model runs (and weights them based on biological feasibility) to create management advice based on risk or management strategy evaluations (IATTC 2020). For all models combined in the risk assessment, bigeye SB_{2020} is 9% above SB_{MSY}, and there is a 47% chance that SB_{MSY} is exceeded. However, there is only a 6% chance that SB_{LIMIT} is exceeded by the estimated SB_{2020} (IATTC 2020b).

It's important to note that there are considerable discrepancies in results depending on selected model attributes. According to the 44 converged reference model runs for 2020 bigeye assessment, the spawning biomass of bigeye at the beginning of 2020 ranged from 51% - 532% of the spawning biomass at the LRP level (IATTC 2020). All short-term models and two environment models estimate that at the beginning of 2020 the bigeye stock is overfished (IATTC 2020). However, the models in the aggregate risk analyses suggest this population is likely not overfished (IATTC 2020b). While the EPO bigeye stock is currently not considered overfished, the significant variations between model estimates and high uncertainty yield a "moderate concern" score for stock status.
Justification:
According to the last full assessment of bigeye tuna in the Eastern Pacific Ocean (2016), 2005-2009 saw a recovering trend for bigeye in the EPO (likely due in part to to IATTC tuna conservation resolutions initiated in 2004). Although the resolutions have continued since 2009, the rebuilding trend was not sustained during 2010-2013, and the spawning biomass ratio (SBR) gradually declined to a historically low level of 0.16 at the start of 2013. The spawning biomass ratio subsequently increased to 0.21 at the start of 2017 but was predicted to decline again in 2018 (IATTC 2017)(IATTC 2018). Indicators (CPUE, weight, fleet capacity) were used to assess bigeye tuna in 2019 while the revised stock assessment was conducted, and all bigeye indicators suggested reduced bigeye abundance in the EPO at that time (IATTC 2019b).

Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Low Concern
Bigeye tuna in the WCPO were most recently assessed in 2018, using a new age and growth curve. According to the updated growth model, the median ratio of the current average (2012-2015) spawning biomass to that needed to produce the MSY ($SB_{2012\text{-}2015}/SB_{MSY}$) was 1.311 and the ratio of the latest (2015) spawning biomass (mature fish) to that needed to produce the MSY (SB_{2015}/SB_{MSY}) was 1.624. 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. In 2018, the assessment was updated with additional new age and growth information and the status re-evaluated (Vincent et al. 2018). WCPO bigeye tuna receive a low concern score because bigeye tuna are not considered overfished and the spawning stock biomass is above MSY. We have not awarded a very low concern score because of the high amount of uncertainty in the models.

Factor 2.2 - Fishing Mortality

Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific | Trolling lines | United States | Hawaii

Moderate Concern
In 2018, approximately 16 million lbs of bigeye tuna were harvested as part of the deep-set longline fishery in Hawaii and roughly 108,000 lbs of bigeye were harvested as part of the shallow-set longline fishery (WPRFMC 2018). As with stock status estimates, there is a significant degree of uncertainty surrounding the most recent bigeye assessment fishing mortality estimates (2020). The 2020 risk analysis for management suggests that bigeye F_{2019} is 7% greater than F_{MSY} (50% probability) but does not exceed the F_{LRP} (fishing mortality threshold that should be avoided because fishing harder could endanger the sustainability of the stock). The risk assessment (based on multiple model runs) concludes there is a 5% chance that $F_{2019} > F_{LRP}$ (IATTC 2020). Bigeye tuna receive a "moderate concern" for fishing mortality because F is likely fluctuating around F_{MSY}, but there is a very low probability that overfishing is occurring despite uncertainty within the current assessment and risk analyses approach.
Justification:
The 2020 benchmark standard assessment indicates that fishing mortality of bigeye in 2017-2019 ranged from 51% - 223% of the F_{MSY} (roughly half of the model runs suggest that the fishing mortality of bigeye in 2017-2019 is higher than the MSY level). Estimates of F_{2019} of bigeye in 2017-2019 ranged from 32% - 114% of the F_{LRP}, and overfishing is unlikely to be occurring (only 3 of 44 models predicted overfishing) (IATTC 2020).

Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Low Concern
In 2018, an updated assessment was conducted in the WCPO that included additional new age and growth information, and stock status and fishing mortality were re-evaluated (Vincent et al. 2018). The median ratio of recent (2012-2015) fishing mortality rates to those that produce the maximum sustainable yield ($F_{2012-2015}/F_{MSY}$) was 0.768, indicating overfishing is not occurring (Vincent et al. 2018). We have awarded a low concern score based on the assessment results that overfishing is not occurring.

Justification:
In the Hawaii longline fisheries, bigeye are primarily taken in the deep-set longline fishery (approximately 16 million lbs in 2018) versus the shallow-set fishery (108,000 lbs in 2018)(WPRFMC 2018). US harvests of bigeye represent a small portion of overall Pacific bigeye harvests (Figure A). Updated models of bigeye in the Western Pacific suggest that previous models may have underestimated bigeye stock status and there is a 94% probability $F<F_{MSY.}$(WCPFC 2018). However, there is a high degree of uncertainty around these estimates and fishing mortality appears to be increasing (especially for juveniles).

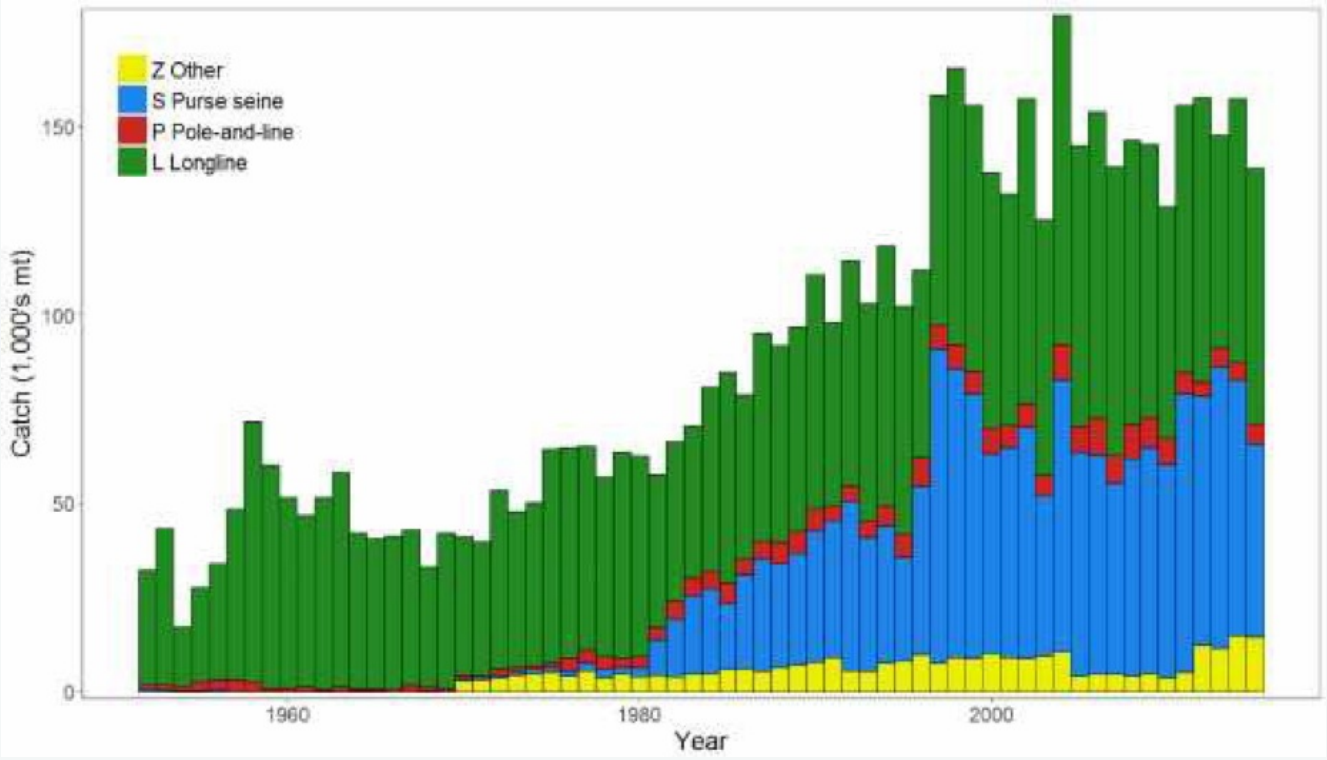

Figure 11: Time series of total annual bigeye tuna catch (1000's mt) by fishing gear over the full assessment period (WCPFC 2018).

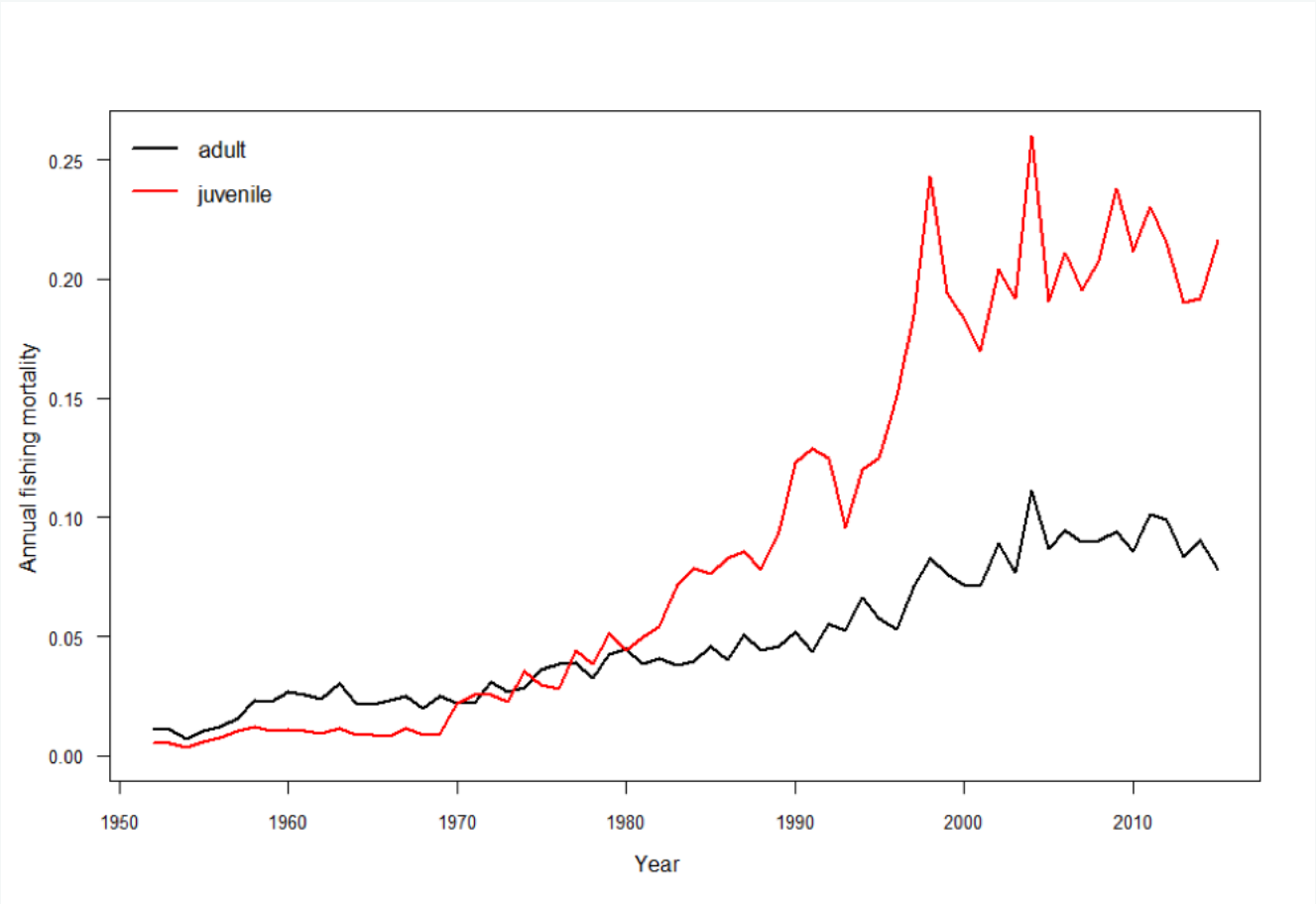

Figure 12: Estimated annual average juvenile and adult fishing mortality for the diagnostic case model (WCPFC 2018).

Black-footed albatross

Factor 2.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

High Concern
According to the International Union for Conservation of Nature (IUCN), black-footed albatross are classified as Near Threatened with a a stable to increasing population trend (BirdLife International 2017). The breeding season population is estimated to be 69,404 pairs (ACAP 2012). The population of black-footed albatross has remained stable since 1957, and the population is currently increasing (Arata et al. 2009). Despite the stable/increasing population, the Near Threatened IUCN status and high vulnerability to fishing interactions results in a high concern score.
Justification:
The Northwestern Hawaiian Islands are a breeding ground for this species (BirdLife International 2017). Based on counts conducted during the 2006-2007 breeding season, 64,500 pairs were estimated in colonies that support 90% of the global breeding population. Other estimates from 2000 concluded there were 275,000 birds {Birdlife International 2017}. The United States Department of Fish and Wildlife Services has determined this species does not warrant listing under the US Endangered Species Act (ESA) (76 FR 62504, October 7, 2011).

Factor 2.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern
In the Hawaiian deep-set longline fishery, observed interactions with black-footed albatross have ranged from a low of 5 in 2004 to a high of 194 in 2018. In 2018, 168 out of the 194 black-footed albatross observed caught were discarded dead, and the expansion factor estimated takes at approximately 951 black-footed albatross (PIROP 2018)(WPRFMC 2018). The potential biological removal (PBR) for US fisheries that incidentally capture this species is 11,980 birds (Arata and Naughton 2009); the deep-set longline fishery accounts for approximately 7-8% of the PBR. The deep-set fishery only has 20% observer coverage, thus fishing mortality estimates are uncertain. Basin-wide cumulative fishing mortality estimates are also highly uncertain due the nature of multi-national fisheries with 3%-5% observer coverage (rough estimates range 5,200 - 10,000 individuals per year), and research suggests cumulative fishing mortality could negatively impact this population {Lewison & Crowder 2003} (Gilman et al. 2008). Black-footed albatross receive a moderate concern score because Hawaii deep-set longline fishery takes are estimated to be approaching 10% of the PBR, the US Hawaiian deep-set longline fishery black-footed albatross mortality estimates are uncertain, and the fishery may be a substantial contributor to uncertain cumulative fishing mortality levels.

Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Low Concern
In the shallow-set fishery, mortalities of black-footed albatross peaked at 20 in 2017 and averaged 11.6 mortalities from 2014-2018. Two black-footed albatross were released dead in 2018 (PIROP 2018a). The potential biological removal (PBR) for US fisheries that incidentally capture this species is 11,980 birds (Arata and Naughton 2009); the shallow-set fishery, with 100% observer coverage, accounts for approximately 1% of the PBR. Basin-wide cumulative fishing mortality estimates are highly uncertain due the nature of multi-national fisheries with 3%-5% observer coverage (rough estimates range 5,200 - 10,000 individuals per year), and research suggests cumulative fishing mortality could negatively impact this population {Lewison & Crowder 2003}(Gilman et al. 2008). Black-footed albatross receive a low concern score because Hawaii shallow-set fishery takes are estimated to be well below 10% of the PBR, and US Hawaiian shallow-set longline fishery is not likely a substantial contributor to cumulative fishing mortality levels.

Bottlenose dolphin

Factor 2.1 - Abundance

Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern
Striped and common bottlenose dolphins are found in tropical to warm-temperate waters throughout the world. The minimum population estimates (2010) for striped and pelagic bottlenose dolphins are 44,922 and 13,957 individuals, respectively (NMFS 2019b). Population trend data are not available. There is a high degree of uncertainty regarding striped dolphin stock structure. Sightings and genetic data indicate at least four demographically distinct resident bottlenose dolphin populations associated with the Hawaiian Islands. Insular common bottlenose dolphin stocks are significantly smaller (unknown - 184 individuals) than the pelagic common bottlenose dolphin stock (NMFS 2019b). Globally, striped and common bottlenose dolphins are listed as IUCN Least Concern (Braulik 2019)(Wells et al. 2019) and receive a moderate concern score for abundance due to their IUCN listing, limited trend data and uncertainty regarding stock structure and/or substock population demographics.

Factor 2.2 - Fishing Mortality

Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Low Concern
Striped and common bottlenose dolphins are taken primarily in the shallow-set Hawaiian longline fishery. Incidental mortality and serious injury account for less than 10% of the PBR for both species (NMFS 2019b). Insular island common bottlenose dolphin stock structure (comprised of smaller substocks) increases the potential for localized depletions associated with fishing mortality, however, all of the interactions are presumed to occur with the pelagic stock (NMFS 2019b). In summary, Hawaiian shallow-set and deep-set longline fisheries receive a low concern score for pelagic stock common bottlenose dolphin fishing mortality, and the Hawaiian shallow-set receives a low concern score for striped dolphin fishing mortality.

Justification:
Between 2011 and 2015, 11 bottlenose dolphins were observed hooked or entangled in the shallow-set longline fishery (100% observer coverage). Average 5-yr estimates of annual mortality and serious injury for the common bottlenose pelagic stock during 2011-2015 are 4.2 (CV = 0.9) More recently one bottlenose dolphin was taken each year in 2016 and 2018 in the shallow-set fishery, and one bottlenose dolphin was taken each year 2016-2018 in the deep-set fishery (WPRFMC 2018). The pelagic common bottlenose stock PBR is 140 individuals, and estimated takes are well below the PBR value.

Between 2011 and 2015, one striped dolphin was seriously injured, one not seriously injured, and one could not be determined based on the information provided by the observer in he shallow-set fishery fishery. More recently, one striped dolphin was taken again each year in 2016 and 2017 (WPRFMC 2018) in the shallow-set fishery. The PBR for the striped dolphin stock is 449 dolphins per year, and the formal average 5-year estimate of annual mortality and serious injury for 2011-2015 for this species is 1.7 (CV = 1.0) dolphins, which is well below the PBR (NMFS 2019b).

Dwarf sperm whale

Factor 2.1 - Abundance

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

High Concern
Abundance data are outdated for pygmy sperm and dwarf sperm whales (last surveyed in 2002), and the National Marine Fisheries Service does not recognize these historical estimates for estimating formal PBRs (NMFS 2019b). Pygmy sperm whales and dwarf sperm whales are IUCN Data Deficient (Taylor et al. 2012b)(Taylor et al. 2012a), and there are no current abundance estimates or population trends available for these species. Pygmy and dwarf sperm whales receive a high concern score due to their inherent vulnerability and stock status data deficiencies (NMFS 2019b).

Factor 2.2 - Fishing Mortality

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

High Concern
Dwarf and pygmy sperm whale sightings are rare, but they do infrequently interact with Hawaiian longline fisheries. Mortalities associated with longline fisheries are assigned to both species due to identification challenges. And in 2014, the deep-set longline fishery took one dwarf or pygmy sperm whale (expanded to 10)(WPRFMC 2018). Published stock assessments for these species have not been updated since 2013 for these species and do not reflect the 2014 take (NMFS 2019b). There are no PBR estimates for either stock (because there have been no directed surveys since 2002 (NMFS 2019b)), however, these fisheries may be some of the main contributors to total fisheries-related mortalities, and dwarf and pygmy sperm whales therefore receive a high concern score for fishing mortality.

False killer whale

Factor 2.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

High Concern
The IUCN lists false killer whales as Near Threatened with an unknown population trend (Baird 2018). There are three populations of false killer whales in Hawaiian waters, a pelagic population, a Main Hawaiian Islands population and a Northwestern Hawaiian Islands population, with a combined estimated population size of roughly 2,300 individuals (NMFS 2019). The Main Hawaiian Islands Insular false killer whale stock is listed as Endangered under the ESA and MMPA Depleted (NMFS 2019). False killer whales receive a high concern score for abundance because they are IUCN Near Threatened, ESA Endangered (portion of stock), their population trend is unknown, and they have a high inherent level of vulnerability to longline fishing activities.
Justification:
The abundance estimate for the Main Hawaiian Islands Insular stock based on mark-recapture analyses of photo-identified animals was 167 individuals (NMFS 2019). Extant data suggest that the Main Hawaiian Islands Insular stock abundance in the 1980s was much higher, likely in the 400-700 range, which indicates a substantial long-term decline. More recent trend data are unknown due to the variability associated with recent abundance estimates (NMFS 2019). Abundance of the stock in the Northwestern Hawaiian Islands, in an area of 0.4 million km², was estimated to be 617 individuals based in 2017. The abundance of the pelagic stock within the entire US EEZ around the Hawaiian Archipelago (an area of 2.3 million km²) was estimated as 1,540 individuals (CV 0.66) based on a 2010 line-transect survey (Baird 2018).

Factor 2.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

High Concern
The Hawaii-deep set fishery is a Category I fishery, indicating frequent incidental mortality or serious injuries with marine mammals occurs, and false killer whale interactions drive the Category 1 designation for this fishery. From 2011-2015, the estimated minimum total annual takes was 7.5 animals for the pelagic stock of false killer whales within the US EEZ and 15.2 outside of the US EEZ. The current PBR is 9.3 individuals (NMFS SAR 2018). A Take Reduction Team was formed in 2010 (because the PBR was exceeded 2009-2013) to establish gear requirements, time-area closures and improved responses to entangled whales. The efficacy of this the False Killer Whale Take Reduction Plan is unknown; however, 12 false killer whales Mortality and Serious Injury (M&SI) events occurred in 2018 alone. And in July of 2018, the Southern Exclusion Zone (SEZ) was closed pursuant to the False Killer Whale Take Reduction Plan following two false killer whale interactions within the US EEZ resulting in a M&SI event (WPRFMC 2018). False killer whales receive a high concern score for fishing mortality in the deep-set longline fishery because of the Category 1 listing, takes over PBRs in recent years and because a significant proportion of the overall PBR is taken in this fishery.

Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Low Concern
The Hawaii shallow-set fishery is a Category II, and the potential for interactions with false killer whales drives this designation. From 2011-2015, the estimated minimum total annual takes was 0.1 animals for the pelagic stock of false killer whales within and outside the US EEZ. The current false killer whale PBR is 9.3 individuals (NMFS SAR 2018), and the estimated takes within and outside the US EEZ were below the PBR from 2011-2015. The most recent reported M&SI event for this 100% observed fishery occurred in 2014 (WPRFMC 2018). Despite the fact that the cumulative PBR has likely been exceeded in recent years regionally, false killer whales receive a low concern score for fishing mortality in the shallow-set longline fishery per Seafood Watch Criteria because the shallow-set fishery is responsible for <10% of the PBR.

Green sea turtle

Factor 2.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

High Concern
The IUCN has classified green sea turtles as Endangered with a decreasing population trend. Green sea turtles have been listed on the Convention on International Trade in Endangered Species (CITES) since 1975 and are currently listed on Appendix 1 because they are threatened with extinction and international trade is prohibited. The mean annual number of nesting turtles worldwide has decreased between 48% to 67% over the past 100-150 years (Seminoff 2004). The United States has listed the central north Pacific Distinct Population Segment (DPS) as Endangered under the Endangered Species Act (ESA) and the central Pacific DPS is listed as Threatened under the ESA. Green sea turtles receive a high concern score for abundance due their IUCN and ESA classifications.
Justification:
Wallace et al. (2011, 2013) 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).

Factor 2.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern
Observed incidental takes of green sea turtles in the Hawaiian deep-set longline fishery are variable, ranging between 0-3 greens per year (0-16 expanded estimates). Using the expansion factor estimates, the average annual numbers of incidental takes from 2004- 2018 were five green turtles in the deep-set longline fishery (WPRFMC 2018). These values are well below the total Pacific cumulative estimate (high degree of uncertainty) of green sea turtle interactions (6,500 from 1989-2015)(NMFS 2019a).

The deep-set fishery also has regulatory ITSs for turtles, however these ITSs are not considered hard caps and only trigger reinitiation of a consultation. The 2018 takes of green turtles exceeded the ITS for the East Pacific DPS. At that point, NMFS reinitiated consultation for the deep-set fishery and determined that the conduct of the deep-set fishery during the period of consultation will not violate the ESA (WPRFMC 2018). The Hawaiian deep-set longline fishery receives a moderate concern score for green sea turtle fishing mortality because, while they are likely not a major contributor to overall mortality, they are exceeding ITS regulatory reference points.
Justification:
Incidental capture in fisheries is considered a major threat to green sea turtles worldwide, and green sea turtles are bycatch in pelagic longline and purse seine fisheries in the Pacific (Seminoff 2004). A number of conservation-based regulations have been established to mitigate the impacts of turtle bycatch including using mackerel-type bait, gear requirements and specific circle hook standards and safe handling and release regulations (WPRFMC 2018).

Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Low Concern
The total green sea turtle incidental takes in Hawaiian shallow-set longline fishery from 2014-2018 was 4 individuals, and green sea turtles had the third highest interaction rates in the Hawaiian shallow-set longline fishery (Wallace et al. 2013a)(WPRFMC 2018). Green turtle mortalities in this fishery have been below the regulatory 2-year Incidental Take Statements (ITS) since 2012 and are well below the total cumulative estimate (high degree of uncertainty) of green sea turtle interactions (6,500 from 1989-2015)(NMFS 2019a). Green sea turtles receive a low concern score for fishing mortality in the Hawaiian shallow-set longline because they are not a major contributor to overall green sea turtle mortality and are below regional reference points.
Justification:
The incidental capture in fisheries is considered a major threat to green sea turtles worldwide, and green sea turtles are bycatch in pelagic longline and purse seine fisheries in the Pacific Ocean (Seminoff 2004). A number of conservation-based regulations have been established to mitigate the impacts of turtle bycatch including using mackerel-type bait, gear requirements and specific circle hook standards and safe handling and release regulations (WPRFMC 2018).

Humpback whale

Factor 2.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

High Concern
Humpback whales were listed as endangered under the US ESA until 2016 when 14 Distinct Population Segments (DPSs) with unique stock status designations were established in legislation. Humpback whales from the Central North Pacific stock overwinter in the Hawaiian archipelago (FR 2016). In summer, the majority of whales from the Central North Pacific stock are found in the Aleutian Islands, Bering Sea, Gulf of Alaska, and Southeast Alaska/northern British Columbia. This DPS/Stock is considered Not At Risk under the ESA at this time; however it is listed as Depleted under the Marine Mammal Protection Act (MMPA). The minimum population estimate for this stock is 7,891, with a likely increasing trend (Muto et al. 2018). These abundance estimates are over 10 years old.

Stock delineation under the MMPA has yet to be finalized to align with the US DPS ESA delineations. Thus, management measures are still in development for the Central North Pacific humpback whale stock under the MMPA. Central North Pacific humpback whales utilizing the Hawaiian archipelago are not listed as endangered and exhibit an increasing trend (per older data); however they are still MMPA-depleted and therefore receive a high concern score for abundance.

Factor 2.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Low Concern
Humpback whales are vulnerable to interactions with pot fishing and trawl gear; however, interactions with longline gear do occur occasionally. In 2014, observers recorded one take of a humpback whale in the Hawaiian deep-set fishery, and this interaction was assigned to the Central North Pacific stock (WPRFMC 2018). The mean-estimated annual mortality for this stock associated with the Hawaiian deep-set fishery is 0.9 animals per year 2013-2017, and the cumulative fisheries estimated annual mortality is 6.4 individuals The Potential Biological Removal (PBR) for this stock is currently 83 individuals (Muto et al. 2018). Therefore, Central North Pacific humpback whales receive a low concern score for fishing mortality because the cumulative fisheries mortality is well below the PBR, and the Hawaiian deep-set longline fishery contributes <10% of the estimated takes.

Laysan albatross

Factor 2.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

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

Factor 2.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Low Concern
It has been estimated that 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 2017a). Seabird interaction rates have been linked to the annual mean multivariate El Nino Southern Oscillation Index (ENSO; decreased ocean productivity) and specific gear setting methods. The Hawaiian deep-set fishery observed takes ranged from 1- 44 from 2002-2018; however the expanded annual estimate ranged between 7 and 236 for laysan albatrosses during that time (high degree of variability). Laysan albatross mortality rates in the shallow-set fishery are substantially lower, and ranged from 1-18 observed mortalities (a high proportion of entangled or hooked animals are released alive). Overall, the Hawaiian longline fisheries do not contribute substantially to cumulative laysan fisheries mortality and receive a low concern score.

Leatherback turtle

Factor 2.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

High Concern
Leatherback sea turtles have been listed as Endangered under the ESA since 1970 {FR 1970}. The IUCN classified leatherback turtles as Vulnerable with a decreasing population trend in 2000 (East and West Pacific RMUs are Critically Endangered) (Wallace et al. 2013). Wallace et al. (2011, 2013) identified the West Pacific leatherback RMU to be at a high risk of population declines (Wallace et al. 2013)(Wallace et al. 2011). Leatherback turtles have been listed on the 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 high concern score based on the ESA, IUCN and CITES listings and RMU status.

Factor 2.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern
The continuation of the Hawaiian longline fisheries "will have a negligible impact to leatherback populations in the north Pacific," according to the recent Biological Opinions (BIOP). The most recent BIOP (2019) concluded that the continued operation of the shallow-set fishery would not jeopardize the existence of leatherback turtles (NMFS 2019). However, it did reduce the shallow-set fleet-wide interaction limit to 16 leatherbacks and included new trip limits. From 2015-2018, an average of 4 leatherback turtles were taken per year by the shallow-set fishery, which is well under the 2-year ITS limit (52 leatherbacks). From 2016-2018, the estimated total interactions and mortalities for leatherbacks in the deep-set fishery was 8.6 individuals, which is well below the 3-year ITS of 27 (WPRFMC 2018). While some studies have sought to estimate PBR levels for leatherback turtle RMUs or subpopulations, there are no established west Pacific PBR (or equivalent) levels determined for leatherback turtles (Curtis et al. 2015). Mortality associated with the Hawaiian longline fisheries likely accounts for less than 10% of the overall west Pacific mortality; however cumulative leatherback mortality in longline fisheries in the Pacific Ocean is thought to be negatively impacting the population. Therefore, the Hawaiian deep-set and shallow-set longline fisheries therefore receive a moderate concern score for leatherback fishing mortality due to the high degree of uncertainty surrounding cumulative fishing mortality and limit reference points.

Justification:
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). Interactions between leatherbacks and the Hawaiian longline fisheries are much lower than those seen in other tuna and swordfish longline fisheries (IATTC 2018), and management measures introduced into the shallow-set fishery in 2004 have reduced leatherback interactions by 83% (Gilman et al. 2007). Example bycatch mitigation methods include using mackerel-type bait, gear deployment and type requirements such as specific circle hook standards and safe handling and release regulations (WPRFMC 2018).

From 1989-2015, 331 leatherback interactions were reported by 16 countries that operate in the WCPO, therefore the total estimated leatherback interactions was approximately 6620 for those 16 countries that participated in the areas beyond national jurisdiction. Due to lack of reporting across the Pacific Ocean, the actual number of leatherback turtles taken in longline fisheries is unknown, however most studies suggest bycatch mortality is likely a factor in the continued decline of the leatherback population (NMFS 2019).

Loggerhead turtle

Factor 2.1 - Abundance

Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

High Concern
The IUCN classifies loggerhead turtles as Vulnerable with a decreasing population trend {Casale & Tucker 2017}, and loggerheads in the North Pacific RMU were identified as among the 11 most endangered sea turtle RMUs (Wallace et al. 2011). Loggerheads are listed on 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 high concern score for abundance.

Factor 2.2 - Fishing Mortality

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Low Concern
Across the Pacific, there were 549 loggerhead sea turtles reported with a total estimate of 10,980 loggerheads caught from 1989-2016 for 16 countries that participated in the areas beyond national jurisdiction, and annual average takes in longline fisheries in the Pacific range from 400-6,000 loggerheads (NMFS 2019a). Incidental takes of loggerheads are significantly lower in the deep-set fishery than the shallow-set fishery in Hawaii. Using the expansion factor estimates, the average annual numbers of incidental takes from 2002 to 2018 were 4 loggerheads in the deep-set fishery, which is well under ITS limits (NMFS 2019a) (WPRFMC 2018). While cumulative loggerhead mortality in longline fisheries in the Pacific Ocean may be negatively impacting the population, the mortality associated with the Hawaiian deep-set longline fishery accounts for less than 10% of the overall mortality, and therefore the fishery receives a low concern score for loggerhead fishing mortality.

Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii

Moderate Concern
The Hawaii shallow-set fishery captured an estimated 417 loggerhead sea turtles annually, with about 40% mortality before it was closed by court order in 2001(NMFS 2018)(NMFS 2019a)(Gilman et al. 2007). Since the fishery reopened in 2004 loggerhead sea turtle interactions have been reduced by 95% due to mitigation measures (NMFS 2019a). Between 2004 and 2018, the Hawaii shallow-set fishery fishery captured 176 loggerhead sea turtles (average 19.2 loggerheads per year 2014-2018). And from 2004-2017, the shallow-set fishery exceeded the annual hard cap limit (34 turtles); however in May of 2018 fishery had 33 loggerhead interactions and was closed prior to reaching the hard cap limit. Cumulative fishery mortality for loggerhead estimates (see justification) have a high degree of uncertainty, and there are no established fishing mortality take limits or reference points for the north Pacific loggerheads. In summary, the Hawaii shallow-set fishery may contribute to more than 10% of the cumulative loggerhead turtle fishery mortality, and total fisheries mortality for loggerheads in the Pacific is highly uncertain. The 2019 NMFS BIOP did not find jeopardy for loggerheads associated with the continued operation of the fishery. Therefore, the Hawaii shallow-set fishery receives a moderate concern score for loggerhead sea turtle mortality.

Justification:
Across the Pacific, there were 549 loggerhead sea turtles reported with a total estimate of 10,980 loggerheads caught from 1989-2016 for 16 countries that participated in the areas beyond national jurisdiction, and annual average takes in longline fisheries in the Pacific range from 400-6,000 loggerheads (NMFS 2019a). Other studies have estimated higher interaction rates, and Peatman et al. (2018) estimated 6,619 to 41,180 loggerhead interactions occurred from 2003-2017 (annual average 473-2941)(Peatman et al. 2018). Artisinal and commercial fisheries operating off the coast of Baja are presumed to be responsible for a significant proportion of these mortalities (NMFS 2019b).

Long snouted lancetfish

Factor 2.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern
The status of deep dwelling lancetfish in the Pacific Ocean is unknown; however the IUCN lists this species as Least Concern (Paxton 2010). Increased CPUE of lancetfish in the Hawaii deep-set longline fishery may indicate the stock is stable (WPRFMC 2018). We have awarded a moderate concern score because of stock status data deficiencies and the IUCN Least Concern listing.

Factor 2.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern
Due to the spatiotemporal expansion of the Hawaiian deep-set longline fishery, there has been an increase in the amount of lancetfish caught since the early 2000s. Lancetfish have no commercial value and all catches are discarded. Lancetfish catch rates are highest north of 26°N and in the third quarter. Thus, the fishery is deploying more effort both in the region where lancetfish are most commonly caught and at the time when catch rates are highest. This has resulted in lancetfish catches exceeding bigeye CPUE since 2005 (WPRFMC 2018). Data are limited on discard mortality, however, one study found lancetfish may have relatively high vulnerability to discard mortality (Carruthers et al. 2009). The IUCN suggests that catches from commercial fisheries is likely not a threat to the lancetfish population (Paxton 2010). Fishing mortality is unknown for this species, and lancetfish therefore receive a moderate concern score for fishing mortality.

Olive Ridley turtle

Factor 2.1 - Abundance

Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

High Concern
The 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 under ESA since 1978. In the Western and Central Pacific Ocean there has been an overall decrease in annual nesting females of 92%, from 1,412 to 108 (Abreu-Grobis and Plotkin 2008). More recent information by Wallace et al. (2011), however, indicates that the West Pacific olive ridley sea turtle RMU is at low risk of population decline but retain a number of threats (Wallace et al. 2011). Eastern Pacific olive ridley populations exhibit different trends regionally, however most populations experienced significant declines 1970s to the 1990s and are generally considered depleted (Abreu-Grobis and Plotkin 2008). We have awarded a high concern score because of olive ridley sea turtle ESA and IUCN listings.

Factor 2.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern
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. 2013){Abreu-Grobois and Plotkin 2008}. Olive Ridley turtles are caught primarily in the deep-set longline fishery in Hawaii. Since 2005, the Hawaii deep-set longline fishery has caught approximately 686 olive ridley sea turtles, and there have been an estimated 650 mortalities (NMFS 2019a). Bycatch interactions in the eastern and western Pacific are under the established ITS levels, and the 2019 BiOP found non-jeopardy. We have awarded a moderate concern score because while Hawaii deep-set interactions are below established take limits, and the Hawaii deep-set longline fishery contribution to cumulative olive ridley turtle mortality is likely less than 10%, there is a high degree of uncertainty regarding and evidence of impacts to the population (Wallace et al. 2013a) for olive ridleys in the east and west Pacific.
Justification:
Wallace et al. (2013) found that most olive ridley populations were at low population risk but experienced variable bycatch impacts associated with longline fisheries. Other gear types (trawls, nets) ranked higher for bycatch impact risk, suggesting that cumulative fisheries mortality for olive ridleys is a concern (Wallace et al. 2013a). Fisheries occurring in the western zones tend to incur fewer turtle mortalities (annual average 19 mortalities west of 140 degrees W; annual average 64 mortalities east of 140 degrees W)(NMFS 2019a). Mitigation measures (circle hooks and mackerel bait) are in use in this fishery.

Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii

Low Concern
Olive ridley turtles are caught primarily in the deep-set longline fishery in Hawaii; however, incidental capture of olive ridley turtles occurs worldwide (trawl and purse seine impacts may be more significant)(Wallace et al. 2013){Abreu-Grobois and Plotkin 2008}. From 2014-2018, one olive ridley turtle was captured in the Hawaii shallow-set longline fishery and was deemed alive upon release. In light of negligible bycatch rates in this fishery, the Hawaii shallow-set longline fishery receives a low concern score for olive ridley fishing mortality.

Pygmy sperm whale

Factor 2.1 - Abundance

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

High Concern
Abundance data are outdated for pygmy sperm and dwarf sperm whales (last surveyed in 2002), and the National Marine Fisheries Service does not recognize these historical estimates for estimating formal PBRs (NMFS 2019b). Pygmy sperm whales and dwarf sperm whales are IUCN Data Deficient (Taylor et al. 2012b)(Taylor et al. 2012a), and there are no current abundance estimates or population trends available for these species. Pygmy and dwarf sperm whales receive a high concern score due to their inherent vulnerability and stock status data deficiencies (NMFS 2019b).

Factor 2.2 - Fishing Mortality

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

High Concern
Dwarf and pygmy sperm whale sightings are rare, but they do infrequently interact with Hawaiian longline fisheries. Mortalities associated with longline fisheries are assigned to both species due to identification challenges. And in 2014, the deep-set longline fishery took one dwarf or pygmy sperm whale (expanded to 10)(WPRFMC 2018). Published stock assessments for these species have not been updated since 2013 for these species and do not reflect the 2014 take (NMFS 2019b). There are no PBR estimates for either stock (because there have been no directed surveys since 2002 (NMFS 2019b)), however, these fisheries may be some of the main contributors to total fisheries-related mortalities, and dwarf and pygmy sperm whales therefore receive a high concern score for fishing mortality.

Risso's dolphin

Factor 2.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Moderate Concern
The most recent (2010) minimum population estimate for Risso's dolphins within the Hawaiian Islands EEZ was 8,210 individuals; however, it is not possible to determine a population trend for this stock (NMFS 2019b). Risso's dolphins are IUCN Least Concern {Kiszka & Braulik 2018} and are not listed as "threatened" or "endangered" under the ESA, nor designated as "depleted" under the MMPA. In summary, while data are limited for this stock (especially outside of the US EEZ), they are IUCN Least Concern, and Risso's dolphins receive a moderate concern score for abundance.
Justification:
Risso's dolphins are found in the temperate and tropical zones of all the world's oceans. They tend to inhabit deeper offshore waters, especially near the continental shelf edge and slope and are deep divers (NMFS 2019b). They are also very active on the ocean surface. Under the MMPA, Risso's dolphins within the Pacific US EEZ are divided into two discrete areas: 1) Hawaiian waters (this report), and 2) waters off California, Oregon and Washington. The Hawaiian stock includes animals found both within the Hawaiian Islands EEZ and in adjacent high seas waters; however, because data on abundance, distribution, and human-caused impacts are largely lacking for high seas waters, the status of this stock is evaluated based on data from US EEZ waters of the Hawaiian Island.

Factor 2.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Low Concern
Risso's dolphins are occasionally seriously injured or taken in Hawaiian longline fisheries, primarily in the shallow-set longline fishery targeting swordfish. Between 2011 and 2015, 13 Risso's dolphins were observed killed or seriously injured in the shallow-set fishery (100% observer coverage), and 2 Risso's dolphins were observed killed or seriously injured in the deep-set longline fishery (20-21% observer coverage) (NMFS 2019b). More recently, one observed mortality occurred in 2017 for the deep-set fishery (expanded to 5 takes), and the shallow-set fishery has taken 2 Risso's dolphins each year 2016-2018 (WPRFMC 2018). The published annual takes per year for both fisheries is 3.2 individuals and accounts for only 4% of the PBR (82 individuals). The Hawaiian shallow-set and deep-set fisheries therefore receive a low concern score for fishing mortality.

Rough-toothed dolphin

Factor 2.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern
Rough-toothed dolphins are found in tropical to warm-temperate waters throughout the world. Rough-toothed dolphins were occasionally seen offshore throughout the US EEZ of the Hawaiian Islands during both 2002 and 2010 surveys. The minimum population estimates (2010) for rough-toothed dolphins are 52,883 individuals (NMFS 2019b). Population trend data are not available. Rough-toothed dolphins are listed as IUCN Least Concern (Kiszka et al. 2019) and receive a moderate concern score for abundance due to their IUCN listing and limited trend data.

Factor 2.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Low Concern
Rough-toothed dolphins are occasionally taken in the deep-set fishery. Between 2011 and 2015, one rough-toothed dolphin was observed hooked or entangled in the deep-set longline fishery (20-21% observer coverage, expanded to 5 take estimate). An additional rough-toothed dolphin was taken in 2016 in this fishery. The published average 5 year estimates of annual mortality and serious injury for rough-toothed dolphins from 2011-2015 is 2.1 (CV = 1.1) rough-toothed dolphins within the Hawaiian Islands EEZ and 0 dolphins outside of US EEZs, which accounts for less than 1% of the PBR (423 individuals). Rough-toothed dolphins therefore receive a low concern score for fishing mortality in the deep-set fishery.

Short-finned pilot whale

Factor 2.1 - Abundance

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern
Short-finned pilot whales are found in all oceans, primarily in tropical and warm-temperate waters. The Hawaii stock includes animals found both within the Hawaiian Islands EEZ and in adjacent high seas waters. The status of the Hawaii stock is evaluated based on abundance, distribution, and human-caused impacts within the Hawaiian Islands EEZ, as such datasets are largely lacking for high seas waters. The minimum population estimate (2010) for the Hawaiian Islands EEZ is 13,197 short-finned pilot whales, and there are no data on the population trend (NMFS 2019b). The IUCN lists short-finned pilot whales as Least Concern (Minton et al. 2018), and short-finned pilot whales receive a moderate concern score for abundance in light of their IUCN listing and data deficiencies.

Factor 2.2 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Low Concern
Short-finned pilot whales occasionally interact with longline fishing operations in Hawaiian waters. From 2013-2018 2015, two short-finned pilot whales were observed taken in the deep-set longline fishery in Hawaii. The published annual take estimate for this fishery is 2.3 animals per year (includes expansion factor), which accounts for approximately 2% of the PBR (106 animals) (NMFS 2019b). The deep-set longline fishery in Hawaii therefore receives a low concern score for short-finned pilot whale mortality.

Striped dolphin

Factor 2.1 - Abundance

Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii

Moderate Concern
Striped and common bottlenose dolphins are found in tropical to warm-temperate waters throughout the world. The minimum population estimates (2010) for striped and pelagic bottlenose dolphins are 44,922 and 13,957 individuals, respectively (NMFS 2019b). Population trend data are not available. There is a high degree of uncertainty regarding striped dolphin stock structure. Sightings and genetic data indicate at least four demographically distinct resident bottlenose dolphin populations associated with the Hawaiian Islands. Insular common bottlenose dolphin stocks are significantly smaller (unknown - 184 individuals) than the pelagic common bottlenose dolphin stock (NMFS 2019b). Globally, striped and common bottlenose dolphins are listed as IUCN Least Concern (Braulik 2019)(Wells et al. 2019) and receive a moderate concern score for abundance due to their IUCN listing, limited trend data and uncertainty regarding stock structure and/or substock population demographics.

Factor 2.2 - Fishing Mortality

Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii

Low Concern
Striped and common bottlenose dolphins are taken primarily in the shallow-set Hawaiian longline fishery. Incidental mortality and serious injury account for less than 10% of the PBR for both species (NMFS 2019b). Insular island common bottlenose dolphin stock structure (comprised of smaller substocks) increases the potential for localized depletions associated with fishing mortality, however, all of the interactions are presumed to occur with the pelagic stock (NMFS 2019b). In summary, Hawaiian shallow-set and deep-set longline fisheries receive a low concern score for pelagic stock common bottlenose dolphin fishing mortality, and the Hawaiian shallow-set receives a low concern score for striped dolphin fishing mortality.

Justification:
Between 2011 and 2015, 11 bottlenose dolphins were observed hooked or entangled in the shallow-set longline fishery (100% observer coverage). Average 5-yr estimates of annual mortality and serious injury for the common bottlenose pelagic stock during 2011-2015 are 4.2 (CV = 0.9) More recently one bottlenose dolphin was taken each year in 2016 and 2018 in the shallow-set fishery, and one bottlenose dolphin was taken each year 2016-2018 in the deep-set fishery (WPRFMC 2018). The pelagic common bottlenose stock PBR is 140 individuals, and estimated takes are well below the PBR value.

Between 2011 and 2015, one striped dolphin was seriously injured, one not seriously injured, and one could not be determined based on the information provided by the observer in he shallow-set fishery fishery. More recently, one striped dolphin was taken again each year in 2016 and 2017 (WPRFMC 2018) in the shallow-set fishery. The PBR for the striped dolphin stock is 449 dolphins per year, and the formal average 5-year estimate of annual mortality and serious injury for 2011-2015 for this species is 1.7 (CV = 1.0) dolphins, which is well below the PBR (NMFS 2019b).

Thresher shark (Unspecified)

Factor 2.1 - Abundance

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

High Concern
A number of thresher shark species are bycatch in the Hawaii deep-set longline fishery including bigeye, common and pelagic threshers. These pelagic sharks exhibit low productivity, are data deficient and and exhibited a general declining index of abundance based on decreased catch rates 2012-2014 (WCPFC 2017). A recent assessment of the common thresher shark in the northeastern Pacific estimated that SB/SB_{MSY} ratio is 1.3, indicating the stock is not overfished (Teo et al. 2018). A Pacific-wide sustainability risk assessment was also conducted for bigeye thresher sharks in 2016 and found that the annual risk of fishing activities exceeding the maximum impact sustainable threshold (MIST) was 20-40% (WCPFC 2017). In summary, abundance data are limited for most species in the thresher shark assemblages, and all three species are listed as IUCN vulnerable with a decreasing trend (Amorim et al. 2009)(Goldman et al. 2009)(Reardon et al. 2009). In light of the IUCN listings and data limitations by species, thresher sharks receive a high concern score for abundance.

Factor 2.2 - Fishing Mortality

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Moderate Concern
Thresher sharks (bigyeye, common and pelagic) are bycatch in the Hawaiian deep-set fishery. Landings data are often grouped at the family level. And in 2018, approximately 5,493 thresher sharks were caught in the deep-set fishery (WPRFMC 2018). Fishing mortality data for all species across the Pacific Ocean are limited; however a recent assessment of common thresher sharks estimated $F/F_{MSY} = 0.21$, indicating the stock is not experiencing overfishing (Teo et al. 2018). In general, species specific fishing mortality reference points for thresher sharks do not exist, and thresher sharks therefore receive a moderate concern score for fishing mortality in the Hawaii deep-set longline fishery.

Yellowfin tuna

Factor 2.1 - Abundance

Eastern Pacific (EPO) Stock | Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Low Concern
Annual recruitment of yellowfin has been near or below average since 2003 (IATTC 2019)(IATTC 2019a){IATTC 2018c}. The 2020 full assessment for yellowfin tuna estimated that SB_{2020} ranged from 49% - 219% of the target reference point SB_{MSY}. The probability that the spawning biomass at the beginning of SB_{2020} is lower than SB_{MSY} is 50% or less for 13/48 models. The risk analyses for yellowfin with model estimates aggregated indicate there is a 12% chance overall that SB_{2020} is lower than SB_{MSY} (IATTC 2020b), and the probability that the SB_{2020} is below the SB_{LRP} ranges from 0% - 2% (IATTC 2020c).

Similar, to bigeye tuna, there are considerable discrepancies in results depending on selected model attributes and the steepness of the stock-recruit curve. Additional uncertainty relates to spatial structure and differing trends by fishery (longline, purse seine type, etc.) There are still models that estimate the yellowfin stock may be overfished {IATTC 2019c), however most model runs in aggregate indicate this is highly unlikely {IATTC 2020b; IATTC 2020c}. In summary, there is some conflicting information about stock status; however the majority of models indicate this stock is not overfished, and yellowfin tuna receive a "low concern" score for abundance in the EPO.
Justification:
Yellowfin tuna in the eastern Pacific Ocean were last fully assessed during the 2017 cycle (IATTC 2018). At that time, there was a high degree uncertainty concerning recent and future recruitment and biomass levels, with the potential for three different regimes since 1975 (IATTC 2018). In 2019, the IATTC was unable to reconcile the trend data for the full assessment model, so the assessment and management for 2019/20 yellowfin tuna abundance is based on a set of proxy indicators for the most recent year. Indicators from 2019 of relative abundance (CPUE across gear types, length) have been at low levels since 2010, however the average length of fish has increased (IATTC 2019a).

Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

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 (2012-2015) spawning (mature fish) biomass to that needed to produce the maximum sustainable yield) was 1.41 (WPRFMC 2018). The median ratio of the latest (2015) spawning biomass to the level needed to produce the maximum sustainable yield (SBl_{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 $SB_{MSY,}$ and yellowfin receive a very low concern score for abundance.

Factor 2.2 - Fishing Mortality

Eastern Pacific (EPO) Stock | Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Low Concern
The average fishing mortality rate has been increasing for all age classes of yellowfin tuna in the EPO since 2009 (IATTC 2019a), in large part due to increasing effort from object associated purse seine fisheries. The point estimate of the fishing mortality in 2017-2019 ranged from 40% - 168% of the F_{MSY} (IATTC 2020c). The probability that the fishing mortality of yellowfin in 2017-2019 is higher than the F_{MSY} level is 50% or more for only 14/48 models. The risk analyses with aggregated model runs indicates that there is only 9% chance that $F>F_{MSY}$(IATTC 2020b). Additionally, the point estimate of the $F_{2017\text{-}2019}$ ranged from 22% - 65% of the LRP (IATTC 2020c). The probability that the fishing $F_{2017\text{-}2019} > F_{LRP}$ was estimated to be zero for all models (IATTC 2020b). In summary, the majority of models indicate that F is within target and limit reference points, and yellowfin tuna receive a "low concern" score for fishing mortality.

Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii

Low Concern
The current fishing mortality rate is below levels needed to produce the maximum sustainable yield (F_{recent}/F_{MSY} = 0.74) for the most realistic models (WPRFMC 2018); therefore overfishing is not occurring (Tremblay-Boyer et al. 2017), and we have awarded a low concern score for fishing mortality for yellowfin tuna in the WCPO.

Factor 2.3 - Discard Rate/Landings

Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii

< 100%
Troll and pole fisheries globally typically have low discard rates. For example, global estimates of 9.5% (6.4-14.4%) have been made for pole and line fisheries and handline (1.9-44.2%) (Perez Roda et al. 2019). An estimate from the Maldivian pole and line fishery suggests bycatch of non tuna was 0.65% of the total catch, with only 0.02% of that being discarded (Miller et al. 2017).

North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Eastern Pacific (EPO) Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Western and Central Pacific (WCPO) Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Northwestern and Central Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Northwestern and Central Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

< 100%
The published rate of discards in 2018 for the Hawaiian deep-set longline fishery was 18.5%, while the discard rate for the shallow-set fishery was moderately higher at 28.8%. The majority of discards are sharks in both fisheries, with approximately 98% discard rates for sharks (WPRFMC 2018). Bait use in these fisheries is generally unknown due to limited tracking, but is unlikely to account for a significant amount of weight relative to total catch. We have awarded a score of <100% based on these ratios.

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.

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:

Criterion 3 Summary

FISHERY	MANAGEMENT STRATEGY	BYCATCH STRATEGY	RESEARCH AND MONITORING	ENFORCEMENT	INCLUSION	SCORE
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii	Moderately Effective	Highly effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**
Eastern Central Pacific | Trolling lines | United States | Hawaii	Moderately Effective	Highly effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	Moderately Effective	Highly effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**
Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	Moderately Effective	Highly effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**

Criterion 3 Assessment

SCORING GUIDELINES

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.

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.

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.

Factor 3.1 - Management Strategy And Implementation

Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii

Moderately Effective
There are no total allowable catch (TAC) or allowable catch limit (ACL) restrictions for mahi mahi or wahoo in the Western Central Pacific including the U.S. EEZ. The State of Hawaii similarly has no size restrictions, bag limits, or seasonal closures of the commercial mahi mahi and wahoo fisheries. But both species are managed under the Pacific Pelagic Fisheries Ecosystem Plan (FEP), meaning that the management infrastructure and landings data are being collected and analyzed (e.g., CPUE). The FEP regulates harvest of pelagic species in U.S. waters through adaptive management (WPRFMC 2009b). Troll fishing regulations detailed in the FEP include requiring federal permits and logbooks.

Many of the fish managed under the Pelagic FEP are also managed under the international agreements governing the WCPFC and/or the IATTC, to which the US is a party. The Pelagic FEP includes overfishing thresholds for bigeye, yellowfin, and skipjack tunas and swordfish, but there are no target or rebuilding control rules or reference points for most species. We have awarded a moderately effective score to account for management measures that are currently in place, while recognizing that target reference points and harvest control rules are not in place for all stocks of tropical tunas. Some management is in place, but there is a need for precaution.
Justification:
For all pelagic management unit species (MUS), the Western Pacific Regional Fishery Management Council (WPRFMC) adopts a maximum sustainable yield (MSY) control rule. The WPRFMC also adopts a warning reference point, B_{FLAG}, set equal to B_{MSY} to provide a trigger for consideration of management action before a stock's biomass reaches the Maximum Sustainable Stock Threshold (MSST). A stock is approaching an overfished condition when there is more than a 50% chance that the biomass will decline below the MSST within two years. The WPRFMC will work with the WCPFC and IATTC to create rebuilding plans if a species is deemed depleted by the US Magnuson Stevens National Standard 1 {WPRFMC 2009b}. In addition, the US complies with international management measures adopted by the WCPFC and IATTC, and there is a limit on permit entries into the fishery.

In 2018, NMFS issued a final rule under the Tuna Conventions Act to implement fishing management measures for tropical tuna (i.e., bigeye tuna, yellowfin tuna, and skipjack tuna) in the EPO. This final rule established a bigeye catch limit in the EPO for all active fisheries. In 2018, NMFS published a final rule to implement recent decisions of the WCPO to implement catch limits for the US longline fleet operating in the WCPO (WPRFMC 2018). US longline fishery-specific harvest control rules and catch limits are not in place for species other than bigeye tuna at this time (WPRFMC 2018).

Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii

Moderately Effective

The U.S. Western Pacific Regional Fisheries Management Council (WPRFMC) manages the shallow-set fisheries under the Pelagic Fishery Ecosystem Plan (FEP). The Pelagic FEP includes overfishing thresholds for swordfish, but there are no target or rebuilding control rules or reference points for most species. All pelagic Management Unit Species (MUS) are excepted from annual catch limit (ACL) and accountability measure requirements of the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MSA), and related reference points. However, the WPRFMC can create ACLs if they deem it necessary. For all pelagic MUS, the WPRFMC adopts a maximum sustainable yield (MSY) control rule. The WPRFMC also adopts a warning reference point, B_{FLAG}, set equal to B_{MSY} to provide a trigger for consideration of management action before a stock's biomass reaches the Maximum Sustainable Stock Threshold (MSST). Most of the fish managed under the Pelagic FEP are also managed under the international agreements governing the WCPFC and/or the IATTC, to which the US is a party.

The IATTC is responsible for developing target and limit reference points for tuna and swordfish. Currently interim limit and/or target reference points have been defined for all targeted swordfish {IATTC 2018c}(IATTC 2019)(IATTC 2019a)(IATTC 2019b)

We have awarded a moderately effective score to account for management measures that are currently in place, while recognizing that target reference points and harvest control rules are not in place for all stocks of tropical tunas and large pelagics assessed in this report.

Justification:

A stock is approaching an overfished condition when there is more than a 50% chance that the biomass will decline below the MSST within two years. The WPRFMC will work with the WCPFC and IATTC to create rebuilding plans if a species is deemed depleted by the US Magnuson Stevens National Standard 1 {WPRFMC 2009b}. In addition, the US complies with international management measures adopted by the WCPFC and IATTC, and there is a limit on permit entries into the fishery.

Very few sharks are retained in the Hawaii longline fisheries. For example in 2019, the fishery caught over 114,000 blue sharks, all but two of which were released alive, and caught 5,082 mako sharks (255 lb), but only retained 560 sharks (WPRFMC 2019), (PIFSC 2020).

Add language on few retained sharks and anything you can find on mahi and wahoo

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii

Moderately Effective

The WPRFMC manages the US deep-set and shallow-set fisheries under the Pelagic Fishery Ecosystem Plan (FEP). Many of the fish managed under the Pelagic FEP are also managed under the international agreements governing the WCPFC and/or the IATTC, to which the US is a party. The Pelagic FEP includes overfishing thresholds for bigeye, yellowfin, and skipjack tunas and swordfish, but there are no target or rebuilding control rules or reference points for most species. We have awarded a moderately effective score to account for management measures that are currently in place, while recognizing that target reference points and harvest control rules are not in place for all stocks of tropical tunas and large pelagics assessed in this report.

Justification:

For all pelagic management unit species (MUS), the WPRFMC adopts a maximum sustainable yield (MSY) control rule. The WPRFMC also adopts a warning reference point, B_{FLAG}, set equal to B_{MSY} to provide a trigger for consideration of management action before a stock's biomass reaches the Maximum Sustainable Stock Threshold (MSST). A stock is approaching an overfished condition when there is more than a 50% chance that the biomass will decline below the MSST within two years. The WPRFMC will work with the WCPFC and IATTC to create rebuilding plans if a species is deemed depleted by the US Magnuson Stevens National Standard 1 {WPRFMC 2009b}. In addition, the US complies with international management measures adopted by the WCPFC and IATTC, and there is a limit on permit entries into the fishery.

In 2018, NMFS issued a final rule under the Tuna Conventions Act to implement fishing management measures for tropical tuna (i.e., bigeye tuna, yellowfin tuna, and skipjack tuna) in the EPO. This final rule established a bigeye catch limit in the EPO for all

active fisheries. In 2018, NMFS published a final rule to implement recent decisions of the WCPO to implement catch limits for the US longline fleet operating in the WCPO (WPRFMC 2018). US longline fishery-specific harvest control rules and catch limits are not in place for species other than bigeye tuna at this time (WPRFMC 2018).

Factor 3.2 - Bycatch Strategy

Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii

Highly effective
This fishery is highly selective. Therefore, bycatch in trolling line, hand-operated pole-and-line, and handline fisheries is extremely low. Non-target shark species are released alive. However, most non-target species in these fisheries are retained and their management is assessed in C3.1. Therefore, bycatch management is highly effective.

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii

Moderately Effective
The Hawaiian deep-set fishery is not highly selective (discards exceed 5% of landings) and catches species of concern including turtles, sharks and marine mammals. The Hawaiian deep-set fishery is a Category 1 fishery due to interactions with false killer whales, and a Take Reduction Team has been established since 2010. There are no lost gear reporting requirements to minimize ghost fishing. Nonetheless, a number of management measures in place to minimize the impacts of bycatch on non-target species and reduce takes of endangered/threatened turtles and marine mammals. Management measures and safe handling protocols have effectively reduced mortalities for a number of turtle and marine mammal species, and the Hawaiian deep-set fishery receives a moderately effective score for bycatch strategy.
Justification:
A Take Reduction Plan has been developed for false killer whales, including gear requirements, time-area closures and improvements to responses to entangled whales. However this Plan only went into effect in February of 2013, and the success is not yet known (NOAA 2019}. On July 18, 2018, NOAA Fisheries issued a temporary rule to close the Southern Exclusion Zone to deep-set longline fishing for the remainder of the calendar year, because the bycatch trigger was met per the regulations implementing the Plan.

There are several measures in place to reduce seabird interactions with Hawaii longline vessels, which have been proven to be effective at reducing interactions by 83% (PIFSC 2011). Vessels are required to employ gear modifications and use hook and bait types to minimize seabird interactions (PIFSC 2011)(WPRFMC 2018).

Shark finning is prohibited, and there are sea turtle handling guidelines (WPRFMC 2018). Vessels are required to use circle hooks and mackerel bait to reduce sea turtle interactions. Unlike the Hawaii shallow-set longline fishery, the deep-set fishery does not have hard caps, and the ITS triggers reinitiation of consultation when exceeded. The ITSs for green and olive ridley turtles were exceeded in 2018. And on October 4, 2018, NMFS reinitiated consultation for the deep-set fishery and determined that the conduct of the deep-set fishery during the period of consultation will not violate ESA Sections (WPRFMC 2018).

Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii

Highly effective
The shallow-set fishery is not highly selective and interacts with a number of species of concern including sea turtles, seabirds, marine mammals and sharks. There are hard caps on the number of turtle and short-tailed albatross takes allowed by this fishery (WPRFMC 2018). Bycatch reduction and mitigation measures have been shown to be effective at reducing interactions by 83% (Gilman et al. 2007). The Hawaiian shallow-set fishery employs a highly effective strategy to minimize adverse impacts on bycatch species, there is evidence these measures are reducing bycatch for a number of species, and the fishery is not a Category 1 fishery. Additionally, lost gear is tracked due to 100% observer coverage for the fleet. The Hawaiian shallow-set fishery therefore receives a highly effective score for bycatch strategy.
Justification:
The Hawaii shallow-set longline fishery operates under the ITSs in the 2012 Biological Opinion. The 1-year ITSs for leatherback

and loggerhead turtle interactions in this fishery are used as a "hard cap" of interactions in any given year, in that the fishery will be closed for the remainder of the year if these numbers are reached.

From 2012 to 2018, the fishery did not reach the annual hard cap for either leatherback or loggerhead turtles (26 and 34, respectively, based on the 2012 Biological Opinion ITSs). However, the Hawaii shallow-set longline fishery was closed because the fishery had 33 loggerhead interactions; thus the fishery was closed prior to reaching the annual hard cap limit of 34 turtles (WPRFMC 2018).

Factor 3.3 - Scientific Research And Monitoring

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii

Moderately Effective
The WPRFMC uses the results of stock assessments conducted by the WCPFC and the IATTC (and their associated scientific bodies) to inform their management strategy. Bigeye, yellowfin, and skipjack tuna stocks are regularly monitored and assessed, however tuna assessments tend to have a degree of uncertainty surrounding the results (IATTC 2018)(ISC 2017)(Mckechnie et al. 2017). Several other main species have been assessed including swordfish and blue sharks. However, due to the high diversity of species caught, many other bycatch species are data limited. The Hawaiian deep-set longline fishery has approximately 20% observer coverage while the shallow-set fishery has 100% observer coverage. Vessel monitoring systems and logbooks are used to collect catch and effort data (WPRFMC 2018). We have awarded a moderately effective score because of the uncertainty associated with the assessments and lack of assessments for a number of frequently caught species.

Factor 3.4 - Enforcement Of Management Regulations

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii

Highly effective
One of the primary objectives of the WPRFMC is to encourage compliance with fishery regulations (WPRFMC 2018). Management measures are implemented by the Pacific Islands Regional Office and the NOAA Office of Law Enforcement and the US Coast Guard enforce these regulations. Either full or partial observer coverage additionally fosters compliance with fishery regulations. All longline vessels must have VMS systems in place that are monitored by the NMFS and submit logbooks (WPRFMC 2018). We have awarded a highly effective score because effective enforcement measures in place.

Factor 3.5 - Stakeholder Inclusion

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii

Highly effective
The WPRFMC utilizes an Fishery Ecosystem Plan (FEP) advisory panel that advises the Council on fishery management issues, a pelagic FEP team that oversees the development and implementation of the plans of the Science and Statistical Committee, FEP Standing Committee, and a Regional Ecosystem Advisory Committee. Stakeholders and the public are allowed to make comments and suggestions to proposed amendments to the FEP as well as attend annual public meetings and provide public testimony (WPRFMC 2018). The WPRFMC receives a highly effective score because all major groups are involved, mechanisms are in place to address user conflicts and there is transparency in management decision making.

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

FISHERY	FISHING GEAR ON THE SUBSTRATE	MITIGATION OF GEAR IMPACTS	ECOSYSTEM-BASED FISHERIES MGMT	SCORE
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii	5	0	Moderate Concern	**Green (3.873)**
Eastern Central Pacific | Trolling lines | United States | Hawaii	5	0	Moderate Concern	**Green (3.873)**
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii	5	0	Moderate Concern	**Green (3.873)**
North Pacific Stock | Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii	5	0	Moderate Concern	**Green (3.873)**
North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii	5	0	Moderate Concern	**Green (3.873)**
North Pacific Stock | Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii	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 - Impact of Fishing Gear on the Habitat/Substrate

Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii

5
Trolling line and hand-operated pole and line gear does not come into contact with the ocean floor.

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii

5
Although pelagic longlines are surface and midwater fisheries, contact with the seabed can occasionally occur in shallow-set fisheries (Gilman et al. 2012)(Passfield and Gilman 2010). However, these effects are still considered to be a low risk to bottom habitats, and the pelagic Hawaiian longline fisheries receive a 5 for Gear Type and Substrate.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii

0
Not applicable.

Factor 4.3 - Ecosystem-based Fisheries Management

Eastern Central Pacific | Trolling lines | United States | Hawaii
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | Hawaii

Moderate Concern
Species caught in the Hawaii pelagic fisheries are managed under a Fishery Ecosystem Plan (Pelagic FEP). In 2015, the WPRFMC, in partnership with NMFS Pacific Islands Fisheries Science Center, local fishery resource management agencies, and the NMFS Pacific Islands Regional Office (PIRO), agreed to revise and expand the contents of future annual reports to include the range of ecosystem elements, including protected species interactions, oceanographic parameters, essential fish habitat review, and marine planning activities. Evidence also suggests that the Kona coast is a spawning area for several large pelagic species (Hyde et al. 2005) (Paine et al. 2008). Stock trends and ecosystem information in the FEP provide regional fishery management councils and NMFS with information for determining the annual catch limits for each stock in the fishery, documenting significant trends or changes in the resource, marine ecosystems, and fishery over time, implementing required Essential Fish Habitat (EFH) provisions, and assessing the relative success of existing relevant state and Federal fishery management programs (WPRFMC 2018). There are catch limits and/or hard caps in place in management to protect some target (bigeye) species. A number of closed areas are in place to preserve habitat and ecosystem function across the Hawaiian Archipelago.

In addition to tuna and large pelagics, troll and pole fisheries rely on live baitfish, which could include other "exceptional species" such as anchovy or sardines. The effect of the removal of these species on the ecosystem is unknown, and few baitfish fisheries are managed {Gillett 2012}, {FAO 2014}. The WPRFMC created the Hawaii Pelagic Fishery Ecosystem Plan that establishes a framework for Ecosystem-Based Fisheries Management (EBFM) in U.S. waters, and provides ten objectives to assist in its implementation. There are no efforts underway to assess the impacts of trolling line and hand-operated pole and line gears on the Hawaiian pelagic ecosystems.

Because this fishery catches apex predators and uses exceptional species for bait, detrimental food web impacts are possible. There is some ecosystem-based management in place; however stronger policies may be needed to fully protect the ecological role of harvested species. Therefore, we have rated EBFM for this fishery as moderate concern.

Northwest Pacific, Western Central Pacific | Longline (deep-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (deep-set) | United States | Hawaii
Northwest Pacific, Western Central Pacific | Longline (shallow-set) | United States | Hawaii
Eastern Central Pacific, Northeast Pacific | Longline (shallow-set) | United States | Hawaii

Moderate Concern
Species caught in the Hawaii longline fisheries are managed under a Fishery Ecosystem Plan (Pelagic FEP). In 2015, the WPRFMC, in partnership with NMFS Pacific Islands Fisheries Science Center, local fishery resource management agencies, and the NMFS Pacific Islands Regional Office (PIRO), agreed to revise and expand the contents of future annual reports to include the range of ecosystem elements, including protected species interactions, oceanographic parameters, essential fish habitat review, and marine planning activities. Stock trends and ecosystem information in the FEP provide regional fishery management councils and NMFS with information for determining the annual catch limits for each stock in the fishery, documenting significant trends or changes in the resource, marine ecosystems, and fishery over time, implementing required Essential Fish Habitat (EFH)

provisions, and assessing the relative success of existing relevant state and Federal fishery management programs (WPRFMC 2018). There are catch limits and/or hard caps in place in management to protect some target (bigeye) and non-target (turtles, false killer whales) species. A number of closed areas are in place to preserve habitat and ecosystem function across the Hawaiian Archipelago.

The Hawaiian longline fisheries receive a moderate concern score for ecosystem-based management because policies are in place to protect ecosystem function but the efficacy of these ecosystem-based measures are unknown for a number of vulnerable species and apex predators including sharks, turtles and some finfish species, and stronger measures may be needed.

Justification:

A number of area closures or Marine Managed Areas (MMAs) exist in the Hawaiian Islands. The USFWS prohibits fishing within the Howland Island, Jarvis Island, and Baker Island National Wildlife Refuge (NWR) boundaries. The USFWS manages Johnston Atoll as a National Wildlife Refuge, and Hawaiian breeding locations for some species of bird, including the black-footed albatross, are protected under the US National Wildlife Refuge system of State of Hawaii Seabird Sanctuaries and there is a 50 nautical mile Protected Species Zone surrounding the Northwestern Hawaiian Islands. In addition, the Hawaiian Islands Humpback Whale National Marine Sanctuary has been in place since 1992 (WPRFMC 2018).

Evidence also suggests that the Kona coast is a spawning area for several large pelagic species (Hyde et al. 2005) (Paine et al. 2008).

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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