

Monterey Bay Aquarium Seafood Watch®

Dolphinfish

Coryphaena hippurus



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Panama/East Pacific

Drifting longlines

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Disclaimer

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

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About Seafood Watch

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

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

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

Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished¹ or farmed that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

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

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

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

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

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

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

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

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

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

Summary

This report focuses on mahi mahi (*Coryphaena hippurus*) caught by longlines in Panama. Mahi mahi is a fast growing species of fish that reaches sexual maturity at a young age and produces a large number of young.

An exploratory stock assessment was conducted on mahi mahi from the south eastern Pacific Ocean in 2016, which is considered the "core" region of the dorado stock in the EPO (IATTC 2016). Several other bony fish species are caught as bycatch in this fishery. However, the status of most of these bycatch species is sometimes unknown. There are concerns over the status of some sea turtle populations and sharks (pelagic thresher, scalloped hammerhead and small tail) that are incidentally captured in this fishery.

The Aquatic Resources Authority of Panama (ARAP) manages fisheries in Panama. There is some management, both domestically and regionally, for target and bycatch species included in this report. Measures have been adopted to limit longlining effort, but there are no reference points or harvest control rules in place. Some bycatch reduction measures (including the mandatory use of circle hooks) are in place for sea turtles and sharks, such as the development of a National Plan for the Preservation and Management of Shark Fisheries. However, it is unknown if bycatch reduction measures are sufficient to protect these vulnerable species. There has been a substantial improvement in the adoption of measures in the mahi mahi fishery since the approval of Executive Decree No.126 to regulate longline fishing in the Panamanian EEZ, including a seasonal closure implemented in 2018.

Pelagic longline fishing gear generally does not come into contact with bottom habitats. However, this fishery does capture exceptional species and there is no ecosystem based management in place. Information on discard rates in this fishery is not available.

Final Seafood Recommendations

SPECIES FISHERY	CRITERION 1: Impacts on the Species	CRITERION 2: Impacts on Other Species	CRITERION 3: Management Effectiveness	CRITERION 4: Habitat and Ecosystem	OVERALL RECOMMENDATION
Dolphinfish Panama/East Pacific Drifting longlines	Yellow (2.644)	Red (1.000)	Yellow (3.000)	Green (3.873)	Good Alternative (2.354)

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 focuses on mahi mahi (*Coryphaena hippurus*) caught by drifting longlines in Panama.

Species Overview

Coryphaena hippurus is one of two species in the family Coryphaenidae, along with the pompano dolphinfish (*C. equiselis*). Both species have a global distribution, and though pompano dolphinfish are typically smaller than mahi mahi, they share a similar morphology and coloration (Froese and Pauly 2017). Accordingly, pompano dolphinfish are often mistaken for juvenile mahi mahi (Froese and Pauly 2017) and are sometimes sold as mahi mahi (Whoriskey et al. 2011).

Mahi mahi are mid-trophic level predators, feeding primarily on other fishes and, occasionally, crustaceans and squid (Polovino et al. 2009) (Froese and Pauly 2017). They are found worldwide in tropical and subtropical waters warmer than 20°C (FAO 2004). 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. 2013)). For example, in the western Central Atlantic, female mahi mahi mature at approximately 41.9 cm (50%, 16.5 in; (McBride et al. 2012)) and males mature at approximately 47.6 cm (50%, 18.7 in; (Schwenke and Buckel 2008)), whereas in the Eastern Caribbean, 50% of males and females mature at 91 cm and 83 cm, respectively (Fonteneau et al. 2013). Females are highly fecund, producing as many as 1.5 million eggs per spawning event, and short-lived, with a typical lifespan of less than 5 years (Collette et al. 2013), (Froese and Pauly 2017). Mahi mahi are sexually dimorphic, with males significantly larger than females; in the tropical Pacific, maximum sizes of 149 cm fork length (FL) for males and 137 cm FL for females have been recorded (Uchiyama and Boggs 2006). Mahi mahi school in feeding aggregations, and these schools are commonly associated with floating objects; hence, they are often captured near fish aggregation devices (FADs; (Olson and Galván-Magaña 1996)). In the eastern Pacific Ocean the Inter-American Tropical Tuna Commission (IATTC) is charged with the management of tuna and bycatch species in the Pacific Ocean, including mahi mahi. Panama is bound by the recommendations and management guidelines set forth by this organization.

The Aquatic Resources Authority of Panama (ARAP) is in charge of fisheries management.

Production Statistics

Production statistics are lacking, but a fisheries improvement project reported mahi mahi catch of about 1,000 mt per year of mahi mahi (CeDePesca 2013). Guzman et al. (2015) reported catches ranging from around 700 t to 1,370 between 2006 and 2009.

Importance to the US/North American market.

During 2014, the United States imported 26,467 t of mahi mahi. The majority of this (26%) came from Ecuador, followed by Chinese Taipei (21%) and Peru (21%). Approximately 1,595 or 6% was imported from Panama (NMFS 2017), which is more than reported catches in the FIP (CeDePesca 2013).

Common and market names.

Mahi mahi is also known as dorado and dolphinfish.

Primary product forms

Mahi mahi are commonly sold in fresh and frozen fillet forms.

Assessment

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

Criterion 1: Impacts on the Species Under Assessment

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

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

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

Guiding Principles

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

Criterion 1 Summary

DOLPHINFISH			
Region Method	Abundance	Fishing Mortality	Score
Panama/East Pacific Drifting longlines	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)

Criterion 1 Assessment

SCORING GUIDELINES

Factor 1.1 - Abundance

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

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

Factor 1.2 - Fishing Mortality

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

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

DOLPHINFISH

Factor 1.1 - Abundance

PANAMA / EAST PACIFIC

Drifting Longlines

Moderate Concern

An exploratory stock assessment was conducted on mahi mahi from the south eastern Pacific Ocean in 2016, which is considered the "core" region of dorado stock in the EPO (IATTC 2016). The spawning stock biomass (time series 2007 to 2015) has remained fairly stable since 2007, with a slight decrease during 2010 (IATTC 2016). There are no reference points defined for mahi mahi in the eastern Pacific Ocean. Some common reference points used for species such as tuna were assessed for mahi mahi. According to these reference points, the spawning stock biomass ratio to that of the unfished stock has averaged 0.20 for the time series (IATTC 2016). The IUCN has assessed mahi mahi as a species of "Least Concern" (Collete et al. 2011). Because there are no reference points or other indications of abundance for the mahi mahi stock and therefore the biomass is unknown, a Productivity and Susceptibility Analysis (PSA) was conducted. The PSA score = 2.81 (see justification section for PSA details), which suggests a medium susceptibility to fishing. Because B is unknown relative to reference points and mahi mahi has a medium vulnerability to fishing, we have awarded a score of "moderate" concern for abundance.

Justification:

Productivity Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Average age at maturity	0.5 years (Beardsley 1967)	1
Average maximum age	4 years (Uchiyama et al. 1986)	1
Fecundity	85,000 eggs (Froese and Pauly 2017)	1
Average maximum size (fish only)	210 cm (Collette 1999)	2
Average size at maturity (fish only)	55 cm (Beardsley 1967)	2
Reproductive strategy	Broadcast spawner (Froese and Pauly 2017)	1

Trophic level	4.4 (Froese and Pauly 2017)	3
Density dependence (invertebrates only)		
Susceptibility Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Areal overlap (Considers all fisheries)	There is areal overlap between the fishery and pollack.	3
Vertical overlap (Considers all fisheries)	There is vertical overlap between the fishery and pollack.	3
Selectivity of fishery (Specific to fishery under assessment)	The selectivity is not available	2
Post-capture mortality (Specific to fishery under assessment)	Post capture mortality information is unknown.	3

Factor 1.2 - Fishing Mortality

PANAMA / EAST PACIFIC

Drifting Longlines

Moderate Concern

Fishing mortality rates for mahi mahi in the Eastern Pacific Ocean compared to reference points are unknown. However, the Inter-American Tropical Tuna Commission (IATTC) conducted an exploratory stock assessment which suggests that fishing mortality rates have decreased slightly since 2007 and the fishing mortality needed to produce the maximum sustainable yield is two times more than current levels (Aires da Silva et al. 2017). However, according to Aires da Silva et al. 2017, the geographic range of the exploratory stock assessment includes the "core" region of the EPO stock, but there is uncertainty in areas north of the Equator (Aires da Silva et al. 2017)

Mahi mahi are caught as bycatch and targeted in longline fisheries in the Eastern Pacific Ocean . The IUCN does not consider there to be any major threats to mahi mahi from commercial fishing (Collette et al. 2011b). Preliminary analysis shows variable, but somewhat steady, catch per unit effort trends in abundance . We have awarded a score of moderate concern because commercial fishing does not appear to be a major threat, and the catch per unit effort has been somewhat stable over time and the preliminary stock

assessment states that current fishing mortality rates of 50% of the maximum sustainable yield and due to the uncertainty levels in areas north of the Equator.

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 Critical

Guiding Principles

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

Criterion 2 Summary

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

DOLPHINFISH					
Panama/East Pacific Drifting Longlines					
Subscore:	1.000	Discard Rate:	1.00	C2 Rate:	1.000
Species Stock	Abundance	Fishing Mortality	Subscore		
Scalloped hammerhead	1.00:High Concern	1.00:High Concern	Red (1.000)		
Pelagic thresher shark	1.00:High Concern	1.00:High Concern	Red (1.000)		
Small tail shark	1.00:High Concern	1.00:High Concern	Red (1.000)		
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Olive ridley turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Silky shark	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Yellowfin tuna	3.67:Low Concern	1.00:High Concern	Red (1.916)		
Vicuda	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		
Striped bonito	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		
Pacific agujon needlefish	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		

Information on bycatch in Panama's mahi mahi fishery is limited. However, data suggest that the main retained species, in addition to mahi mahi, are striped bonito, yellowfin tuna, and vicuda (CeDePesca 2013). The Pacific agujon needlefish also has been listed as a bycatch species. In addition, sharks are incidentally captured. The most commonly identified species include the pelagic thresher shark, scalloped hammerhead, silky and small tail shark. Other species likely are caught, but species-specific information is not available. Sea turtles are incidentally captured, with green and olive ridley identified to species (CeDePesca 2013) (CeDePesca 2014).

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)

SCALLOPED HAMMERHEAD

Factor 2.1 - Abundance

PANAMA / EAST PACIFIC

Drifting Longlines

High Concern

No full stock assessment of scalloped hammerhead sharks in the eastern Pacific Ocean has been conducted (NMFS 2015c). The IUCN has listed scalloped hammerheads in the eastern central and southeast Pacific as "Endangered" (Baum et al. 2007). The assessment noted instances of decreases in abundance of this species in several areas in Central America and the Galapagos Islands (Baum et al. 2007). A Status Review conducted by the US National Marine Fisheries Service found the eastern Pacific Distinct Population Segment was at a high risk of extinction (Miller et al. 2013) and this DPS (along with three others) are listed as "Endangered" in the US Endangered Species Act (ESA) (NMFS 2014). We have awarded a score of "high" concern due to the IUCN and ESA listing's.

Factor 2.2 - Fishing Mortality

PANAMA / EAST PACIFIC

Drifting Longlines

High Concern

No full stock assessment has been conducted on scalloped hammerhead in this region so fishing mortality rates are unknown (NMFS 2015c) but a region analysis indicated a fishing mortality rate of 0.4 (Pacheco 2013). The International Union for Conservation of Nature has indicated that scalloped hammerheads are exploited through both directed and bycatch fisheries throughout the eastern Pacific region (Baum et al. 2007). The US Status Review of scalloped hammerhead sharks determined that over-utilization in the eastern Pacific was a severe threat to this species (Miller et al. 2013). Information specific to Panama is limited, although some research has suggested that one shark (species unknown) is caught per 1,230 hooks used in this fishery (Vega et al. 2010). We have awarded a score of "high" concern because fishing mortality rates are unknown and the population may be depleted.

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

PANAMA / EAST PACIFIC

Drifting Longlines

< 100%

Information on discards from this fishery is not available. Longline fisheries worldwide have discard rates that range from 0 to 40% (Kelleher 2005). We have therefore awarded a <100% score.

PELAGIC THRESHER SHARK

Factor 2.1 - Abundance

PANAMA / EAST PACIFIC

Drifting Longlines

High Concern

No full stock assessment of pelagic thresher sharks has been conducted in the eastern Pacific Ocean (NMFS 2015b). However, a demographic analysis of this species in the northwestern Pacific Ocean has been conducted. The results suggest pelagic thresher sharks are overexploited (Tsai et al. 2010). The IUCN has listed this and all thresher shark species as "Vulnerable" with declining population trends (Reardon et al. 2009). We have awarded a score of "high" concern due to the IUCN rating.

Factor 2.2 - Fishing Mortality

PANAMA / EAST PACIFIC

Drifting Longlines

High Concern

Pelagic thresher sharks are taken as bycatch in a number of fisheries operating in the eastern Pacific Ocean (Reardon et al. 2009). They are considered to be highly vulnerable to overexploitation (Tsai et al. 2010). No full stock assessment has been conducted so fishing mortality rates in this region are unknown. However, demographic modeling in the northwestern Pacific indicates that the current fishing pressure will lead to a population decline of 43.3% over the next 20 years (Tsai et al. 2010). Pelagic thresher sharks have been identified as one of the three main bycatch shark species in Panama's mahi mahi fishery, with research suggesting that one shark is caught per 1,230 hooks used in this fishery (Vega et al. 2010). We have awarded a score of "high" concern because fishing mortality rates are unknown, the species is listed as "Vulnerable" by the IUCN, and fishing mortality is expected to lead to future population declines.

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

PANAMA / EAST PACIFIC

Drifting Longlines

< 100%

Information on discards from this fishery is not available. Longline fisheries worldwide have discard rates that range from 0 to 40% (Kelleher 2005). We have therefore awarded a <100% score.

SMALL TAIL SHARK

Factor 2.1 - Abundance

PANAMA / EAST PACIFIC

Drifting Longlines

High Concern

No full stock assessment of small tail sharks in the eastern Pacific Ocean has been conducted. The International Union for the Conservation of Nature (IUCN) lists this species a "Data Deficient" (Lessa et al. 2006). We have awarded a score of "high" concern due to a lack of information on their status combined with their high vulnerability to fishing.

Factor 2.2 - Fishing Mortality

PANAMA / EAST PACIFIC

Drifting Longlines

High Concern

No stock assessment has been conducted for this species in the eastern Pacific Ocean, so regional fishing mortality rates are unknown. Although catch and effort information is lacking, this species is known to occur as bycatch in fisheries operating in the eastern Pacific (Lessa et al. 2006). Information specific to Panama is lacking, but research has suggested that one shark (species unknown) is caught per 1,230 hooks used in this fishery (Vega et al. 2010). We have awarded a score of "high" concern because fishing mortality rates are unknown and sharks are considered highly susceptible to interactions with longlines, according to the Seafood Watch Unknown Bycatch Matrix.

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

PANAMA / EAST PACIFIC

Drifting Longlines

< 100%

Information on discards from this fishery is not available. Longline fisheries worldwide have discard rates that range from 0 to 40% (Kelleher 2005). We have therefore awarded a <100% score.

Criterion 3: Management Effectiveness

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

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

The Criterion 3 rating is determined as follows:

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

Rating is Critical if Management Strategy and Implementation is Critical.

GUIDING PRINCIPLE

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

Criterion 3 Summary

Fishery	Management Strategy	Bycatch Strategy	Research and Monitoring	Enforcement	Stakeholder Inclusion	Score
Fishery 1: Panama/East Pacific Drifting longlines	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Yellow (3.000)

Criterion 3 Assessment

Factor 3.1 - Management Strategy and Implementation

Considerations: What type of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? Do managers 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.

PANAMA / EAST PACIFIC

Drifting Longlines

Moderately Effective

The Aquatic Resources Authority of Panama (ARAP) is in charge of fisheries management in Panama. There has been a substantial improvement in the adoption of measures in the mahi mahi fishery since the approval of Executive Decree No.126, which regulates longline fishing in the Panamanian EEZ, including a seasonal closure implemented in 2018. This new Decree mandates the following: 1) vessel monitoring system; 2) prohibition of wire leaders; 3) only 1 mechanical winch 4) a maximum of 450 circle hooks with offset, size C13/0 minimum; 5) logbooks; 6) bycatch reporting; 7) equipment for releasing sea turtles; 8) creation of an observer program; 9) seasonal closure from 15 August to 15 October; and 10) circle hooks with a size 16/0 (La Estrella de Panama 2017).

There are no management measures in place for any other species included in this report. Panama is also a member of the Regional Fisheries Management Organization in the region, the Inter-American Tropical Tuna Commission (IATTC). However, IATTC has no measures in place for Mahi mahi. We have awarded a score of "moderately effective" because there are some management measures in place to protect mahi mahi.

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.

PANAMA / EAST PACIFIC

Drifting Longlines

Moderately Effective

Panama must comply with Inter-American Tropical Tuna Commission (IATTC) sea turtle measures including prohibiting their retention. Circle hooks, which help reduce the incidental capture of sea turtles, had been traditionally used in this fishery (CeDePesca 2013) (Pacheco 2013) (Andraka et al 2013) and have been mandatory since 2017 (executive decree number 126). There also are some wildlife refuge areas that protect nesting turtles (CeDePesca 2013). No management measures are in place, however, for other fish species caught in this fishery (i.e., Pacific agujon needlefish, striped bonito, and vicuda). Panama initiated an observer program in 2018 (ARAP 2018), and works with the IATTC on a program to estimate shark species and size composition from the industrial fleet (IATTC 2018).

Shark finning is prohibited in Panama. Panama adopted an Administrative Resolution (No. 13) in 2009 to adopt their National Plan for the Preservation and Management of Shark Fisheries but it is unclear if the recommendations have been implemented (CeDePesca 2013). There are no specific management measures for shark species caught in this fishery. There has been a substantial improvement in the adoption of measures in the mahi mahi fishery since the approval of Executive Decree No.126, which regulates longline fishing in the Panamanian EEZ, including a seasonal closure implemented in 2018. This new Decree mandates the following: 1) only 1 mechanical winch; 2) bycatch reporting; 3) equipment for releasing sea turtles; and 4) circle hooks with a size 16/0 (La Estrella de Panama 2017).

We have awarded a score of "moderately effective" because Panama has taken some action to protect bycatch species.

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.

PANAMA / EAST PACIFIC

Drifting Longlines

Moderately Effective

The Inter-American Tropical Tuna Commission conducts research and monitoring on mahi mahi and has a preliminary stock assessment (IATTC 2013). Information on other species including tuna and sharks is available (IATTC 2016) (IATTC 2018b), but research and monitoring is lacking for several species including needlefish. We have therefore awarded only a score of "moderately effective."

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.

PANAMA / EAST PACIFIC

Drifting Longlines

Moderately Effective

Enforcement in Panama is conducted by the Panama Maritime Authority. Panama is a member of the International Maritime Organization (IMO). The General Directorate of Merchant Marine is in charge of compliance and enforcement of fisheries law (PMA 2018). We have awarded a score of "moderately effective" because Panama has some enforcement in place.

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.

PANAMA / EAST PACIFIC

Drifting Longlines

Moderately Effective

It is unclear how involved stakeholders are in the fishery management process in Panama (CeDePesca 2013). We have therefore awarded a score of "moderately effective."

Criterion 4: Impacts on the Habitat and Ecosystem

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

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

GUIDING PRINCIPLES

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

Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

Region Method	Gear Type and Substrate	Mitigation of Gear Impacts	EBFM	Score
Panama/East Pacific Drifting longlines	5	0	Moderate Concern	Green (3.873)

Criterion 4 Assessment

SCORING GUIDELINES

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

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

- *5 - Fishing gear does not contact the bottom*
- *4 - Vertical line gear*
- *3 - Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Or bottom seine on resilient mud/sand habitats. Or midwater trawl that is known to contact bottom occasionally. Or purse seine known to commonly contact the bottom.*
- *2 - Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Or gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Or bottom seine except on mud/sand. Or there is known trampling of coral reef habitat.*

- 1 - Hydraulic clam dredge. Or dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)
- 0 - Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl)
Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

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

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

Factor 4.3 - Ecosystem-Based Fisheries Management

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

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

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

PANAMA / EAST PACIFIC

Drifting Longlines

5

Pelagic fishing gear does not come in contact with the bottom habitat.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

PANAMA / EAST PACIFIC

Drifting Longlines

0

N/A

Factor 4.3 - Ecosystem-Based Fisheries Management

PANAMA / EAST PACIFIC

Drifting Longlines

Moderate Concern

IATTC has recently addressed the broader ecosystem implications of some EPO fishing practices and has supported several measures to reduce the impacts of longline fishers on shark populations (IATTC 2013). Among these are a prohibition on the retention and sale of oceanic white tip sharks (Resolution C-11-10, 2011), catch restrictions for longline-caught silky shark (Resolution C-16-06), and the soliciting of funding to support the development of technologies to allow for the release, and post-release monitoring of sharks and rays (Resolution C-04-05, 2006; REF). As a member of IATTC, Panama is bound by these guidelines. This fishery captures exceptional species, including sharks, and there are no ecosystem-based measures in place (CeDePesca 2013). We have awarded a score of "moderately effective" because detrimental food web impacts are possible, and there is some ecosystem-based management in place; however, stronger policies may be needed to fully protect the ecological role of harvested and non-retained species.

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

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Appendix A: Extra By Catch Species

GREEN SEA TURTLE

Factor 2.1 - Abundance

PANAMA / EAST PACIFIC

Drifting Longlines

High Concern

The International Union for Conservation of Nature (IUCN) has classified green sea turtles as "Endangered" with a decreasing population trend (Seminoff 2004). Green sea turtles have been listed in the Convention on International Trade in Endangered Species (CITES) since 1975 and are currently listed in Appendix 1, meaning they are threatened with extinction and international trade is prohibited (Seminoff 2004). However, this assessment is ten years old and more recent information suggests that populations in Mexico have been increasing (Delgado-Trejo and Alvarado-Diaz 2012). A recent analysis of the Eastern Pacific Distinct Population Segment by the US Endangered Species Act found the DPS should be considered "threatened" and not "endangered" (FR 2015). We have awarded a score of "high" concern due to its threatened status.

Factor 2.2 - Fishing Mortality

PANAMA / EAST PACIFIC

Drifting Longlines

Moderate Concern

The incidental capture in fisheries is considered a major threat to green sea turtles worldwide (Seminoff 2004), but there are regional differences. Green sea turtles are reported as incidentally captured in longline fisheries in the eastern Pacific Ocean (IAC 2012). The bycatch impacts in this region are considered low, but a high risk to the population size (Wallace et al. 2013). Panama reported that during 29 longline sets 16 sea turtles (green and olive ridley) were incidentally captured (Vega et al. 2010). Other research has suggested that one sea turtle is caught for every 846 hooks used (Vega et al. 2010). According to Andraka et al. (2013), 99% of sea turtle individuals caught on surface longlines in the EPO are found alive. However, the severity of hooking injury and the probability of post-capture survival depends on the type of hook, the handling of the individual, and release techniques (Parga 2012) (Parga et al. 2015). Entanglements in lines may be the reason for a higher mortality rate in some cases (Parga 2012). However, available information on post-release mortality in sea turtles is sparse (Swimmer and Gilman 2012). In Panama, the information recorded between 2005 and 2010 in this surface longline fishery shows that 98.5% of turtles are recovered alive (Pacheco, 2013). Circle hooks are traditionally used in this fishery (Pacheco 2013) (Andraka et al 2013) and mandatory since 2017 (executive decree number 126). We have awarded a score of "moderate" concern because circle hooks are used and known to effectively reduce sea turtle bycatch.

Factor 2.3 - Discard Rate

PANAMA / EAST PACIFIC

Drifting Longlines

< 100%

Information on discards from this fishery is not available. Longline fisheries worldwide have discard rates that range from 0 to 40% (Kelleher 2005). We have therefore awarded a <100% score.

OLIVE RIDLEY TURTLE

Factor 2.1 - Abundance

PANAMA / EAST PACIFIC

Drifting Longlines

High Concern

The IUCN considers the population of olive ridley sea turtles to be "Vulnerable" (Abreugrobois and Plotkin 2008). In the eastern Pacific Ocean, estimates of the total number of nests range from 608 protected nests in Mexico to 33,530 to 68,753 nests in Nicaragua (Abreu-Grobois and Plotkin 2008). Female population size ranges from 8,768 in Panama to 1,013,034 in Mexico (Abreu-Grobois and Plotkin 2008). The annual nesting female sub-population size has decreased by 99% in some regions in Mexico, increased substantially in others, and not changed at all in areas such as Nicaragua (Abreu-grobois and Plotkin 2008). Overall, the annual nesting female sub-population size in the eastern Pacific Ocean has declined to around 35% over time (Abreu-grobois and Plotkin 2008), but the risk to populations from longline fishing in this region is considered low (Wallace et al. 2013). A score of "high" concern is awarded based on the IUCN classification.

Factor 2.2 - Fishing Mortality

PANAMA / EAST PACIFIC

Drifting Longlines

Moderate Concern

The incidental capture of olive ridley sea turtles occurs worldwide. There is some thought that impacts from other fisheries such as trawls and gillnets appear to have a larger negative impact compared to longlines in many areas except for the eastern Pacific Ocean (EPO) (Abreu-Grobois and Plotkin 2008) (Wallace et al. 2013). Within this region, the impact from incidental captures in longline fisheries is considered high (Wallace et al. 2013). Panama reported that during 29 longline sets 16 sea turtles (green and olive ridley) were incidentally captured (Vega et al. 2010). Other research has suggested that one sea turtle is caught for every 846 hooks used (Vega et al. 2010). Circle hooks are traditionally used in this fishery (Pacheco 2013) (Andraka et al 2013) and mandatory since 2017 (executive decree number 126). We have awarded a score of "moderate" concern because circle hooks are used and known to effectively reduce sea turtle bycatch.

Factor 2.3 - Discard Rate

PANAMA / EAST PACIFIC

Drifting Longlines

< 100%

Information on discards from this fishery is not available. Longline fisheries worldwide have discard rates that range from 0 to 40% (Kelleher 2005). We have therefore awarded a <100% score.

VICUDA

Factor 2.1 - Abundance

PANAMA / EAST PACIFIC

Drifting Longlines

Moderate Concern

No full stock assessment of vicuda in the eastern Pacific Ocean has been conducted. The International Union for Conservation of Nature has assessed this species as "Least Concern," although their population trend is unknown (Robertson 2010). The IUCN notes that they are widespread in this region with no known threats (Robertson et al. 2010). We have awarded a score of "moderate" concern due to the unknown status of this population and the IUCN "Least Concern" rating, indicating the species is not highly vulnerable.

Factor 2.2 - Fishing Mortality

PANAMA / EAST PACIFIC

Drifting Longlines

Moderate Concern

Vicuda is a common species in Panama's artisanal fisheries. No stock assessment has been conducted so fishing mortality rates are unknown. The IUCN does not consider fishing to be a threat to this species (Robertson et al. 2010). We have awarded a score of "moderate" concern because fishing mortality rates are unknown.

Factor 2.3 - Discard Rate

PANAMA / EAST PACIFIC

Drifting Longlines

< 100%

Information on discards from this fishery is not available. Longline fisheries worldwide have discard rates that range from 0 to 40% (Kelleher 2005). We have therefore awarded a <100% score.

STRIPED BONITO

Factor 2.1 - Abundance

PANAMA / EAST PACIFIC

Drifting Longlines

Moderate Concern

A full stock assessment has not been conducted on striped bonito in the eastern Pacific Ocean. The International Commission for Conservation of Nature has listed this species as "Least Concern" (Collette et al. 2011). The population trend for this species is unknown (Collette et al. 2011). We have awarded a score of "moderate" concern due to striped bonito's unknown status and the IUCN "Least Concern" rating, indicating the species is not highly vulnerable.

Factor 2.2 - Fishing Mortality

PANAMA / EAST PACIFIC

Drifting Longlines

Moderate Concern

No full stock assessment has been conducted on striped bonito in the eastern Pacific Ocean, so fishing mortality rates are unknown. The IUCN indicates that catches in the eastern Pacific have declined over time but the reason for this is unknown (Collette et al. 2011). The majority of striped bonito are caught in purse seine and longline fisheries. It is generally believed that catches of this species are under-reported (Collette et al. 2011). We have awarded a score of "moderate" concern because fishing mortality rates are unknown.

Factor 2.3 - Discard Rate

PANAMA / EAST PACIFIC

Drifting Longlines

< 100%

Information on discards from this fishery is not available. Longline fisheries worldwide have discard rates that range from 0 to 40% (Kelleher 2005). We have therefore awarded a <100% score.

PACIFIC AGUJON NEEDLEFISH

Factor 2.1 - Abundance

PANAMA / EAST PACIFIC

Drifting Longlines

Moderate Concern

No stock assessment of Pacific agujon needefish has been conducted. The International Union for Conservation of Nature (IUCN) has listed this species as "Least Concern" and considers this species to be abundant throughout its range in the eastern Pacific Ocean. The IUCN also notes that there is no indication of population declines (Collette et al. 2010). We have awarded a score of "moderate" concern because the stock status is unknown.

Factor 2.2 - Fishing Mortality

PANAMA / EAST PACIFIC

Drifting Longlines

Moderate Concern

Pacific agujon needlefish are reported as bycatch in Panama's mahi mahi fishery (CeDePesca 2013). No assessment has been conducted, so information on current fishing mortality rates is not available. The International Union for Conservation of Nature (IUCN) indicates that there is no indication that fishing has led to population declines (Collette et al. 2010). We have awarded a score of "moderate" concern because fishing mortality rates are unknown.

Factor 2.3 - Discard Rate

PANAMA / EAST PACIFIC

Drifting Longlines

< 100%

Information on discards from this fishery is not available. Longline fisheries worldwide have discard rates that range from 0 to 40% (Kelleher 2005). We have therefore awarded a <100% score.

YELLOWFIN TUNA

Factor 2.1 - Abundance

PANAMA / EAST PACIFIC

Drifting Longlines

Low Concern

Yellowfin tuna in the eastern Pacific Ocean were last assessed during 2017 (IATTC 2018b). There is some uncertainty concerning recent and future recruitment and biomass levels, with the potential for three different regimes since 1975 (IATTC 2018b). The spawning biomass ratio (SBR) was at or below maximum sustainable yield (MSY) levels between 2005 and 2017 (except during 2008 to 2010) (IATTC 2018b). The SBR at the start of 2018 was above MSY, with the ratio of the current biomass to that supporting MSY being 1.35 (IATTC 2018b). Yellowfin tuna in the eastern Pacific Ocean are not overfished and we have therefore awarded a score of "low" concern. We have not awarded a score of "very low" concern due to the uncertainty surrounding recruitment and biomass estimates (IATTC 2018b).

Factor 2.2 - Fishing Mortality

PANAMA / EAST PACIFIC

Drifting Longlines

High Concern

According to the 2017 assessment of yellowfin tuna in the eastern Pacific Ocean, current fishing mortality rates are slightly above maximum sustainable yield (MSY) levels (IATTC 2018b). The average fishing mortality rates has been increasing for all age classes since 2009, with a slight decline in 2017 (IATTC 2018b). The ratio of recent catches to those needed to produce the maximum sustainable yield is 0.85 (IATTC 2018b). The F multiplier ($F \text{ multiplier} = F_{\text{msy}} \text{ divided by } F_{\text{current}}$; $F \text{ multiplier} < 1, F_{\text{current}} > F_{\text{msy}}$) is estimated to be 0.99 because fishing mortality rates are above MSY levels (IATTC 2018b). We have awarded a score of "high" concern because overfishing is occurring.

Factor 2.3 - Discard Rate

PANAMA / EAST PACIFIC

Drifting Longlines

< 100%

Information on discards from this fishery is not available. Longline fisheries worldwide have discard rates that range from 0 to 40% (Kelleher 2005). We have therefore awarded a <100% score.

SILKY SHARK

Factor 2.1 - Abundance

PANAMA / EAST PACIFIC

Drifting Longlines

High Concern

Silky sharks are assessed as "Vulnerable" with a decreasing population trend by the International Union for Conservation of Nature (IUCN) (Rigby et al. 2016). We have awarded a score of "high" concern based on the IUCN status combined with their high vulnerability to fishing and unknown population status.

Factor 2.2 - Fishing Mortality

PANAMA / EAST PACIFIC

Drifting Longlines

Moderate Concern

Silky sharks are caught as bycatch in purse seine and longline fisheries operating in the eastern Pacific Ocean, but are also targeted, in small amounts, in some longline fisheries (IATTC 2013b) (IATTC 2016). The most recent attempt at an assessment for this species indicated that the current fishing mortality rates are unknown (IATTC 2016). We have awarded a score of "moderate" concern because there is a stock assessment available, but fishing mortality rates are unknown.

Factor 2.3 - Discard Rate

PANAMA / EAST PACIFIC

Drifting Longlines

< 100%

Information on discards from this fishery is not available. Longline fisheries worldwide have discard rates that range from 0 to 40% (Kelleher 2005). We have therefore awarded a <100% score.