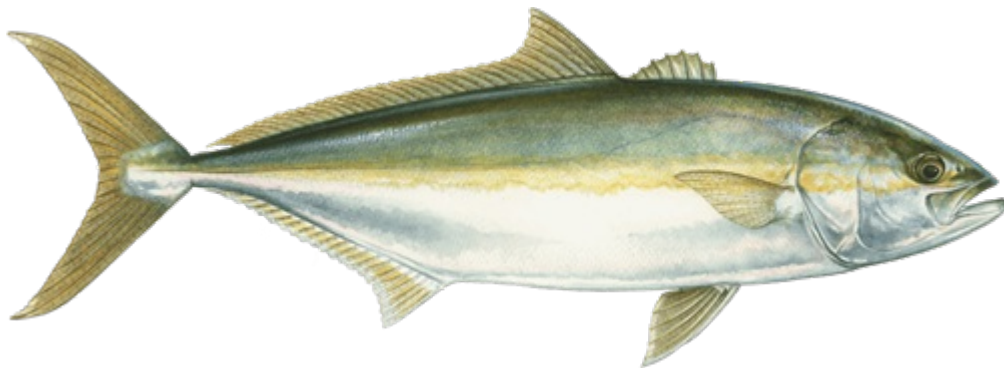


Monterey Bay Aquarium Seafood Watch®

Yellowtail

Seriola lalandi



©Diane Rome Peebles

Mexico: Pacific and Gulf of California

Trolling lines, Set gillnets, Hooks and lines, Encircling gillnets

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Seafood Watch Consulting Researcher

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

California yellowtail or jurel de Castilla (for its name in Spanish) (*Seriola lalandi*) is a species restricted to subtropical waters. In Mexico, it is found along the Baja California peninsula, and in the Gulf of California.

In Mexico, the species is targeted seasonally during the species "runs" along the west coast of the Baja peninsula and inside the Gulf of California. It is targeted mostly by the artisanal fleet and sport fishing vessels. This report addresses the artisanal fleet that targets the species using set and drift gillnets, hook and line, and trolling lines on the West coast of Baja; and the fisheries that use encircling nets, hook and line, and set gillnets, inside the Gulf of California.

Landings reports aggregate yellowtail within the jack and medregal fishery (jureles and medregales), which makes it difficult to measure abundance or the impact of fishing effort in the species. Although no stock assessments have been developed for any of the species within this category in Mexico, the National fisheries commission—the governmental branch in charge of fisheries management—stated that jack fisheries in Mexico were exploited at their maximum sustainable levels, and recommended the need to evaluate the status of these species' stocks, and create management regulations to control fishing mortality (e.g., established minimum size limit). However, no evidence that these evaluations and regulations have been developed or implemented.

To monitor the status of the fishery, managers compare the aggregated landings by each state against a set reference amount based on historical production. If annual production for each state is below the minimum set value for that state, managers should implement regulations, although it is unclear what kind of measures would be implemented. Abundance and fishing mortality were scored as "moderate" concern for the species, considering that there are no appropriate reference points, and the stock status is unknown; however, the species has a moderate vulnerability according to the PSA.

Some information related to catch composition was available for gillnets. We used this information to identify main bycatch species, but also consulted the National Fisheries Chart that lists species of rays and sharks as associated with the fishery. Other species likely to interact with California yellowtail gears are sea turtles, marine mammals, seabirds, and finfish. Where no abundance or fishing mortality information was available, the Seafood Watch Unknown Bycatch Matrices (UBMs) was used to score these species. Giant sea bass, sea turtles, seabirds, and marine mammals were scored as "high" concern for fishing mortality and limited the Criterion 2 score for drift and set gillnets, although trolling lines, hand lines and encircling nets have minimal impact on other species.

Currently, minimal management measures are in place for the fishery; access is granted by a finfish permit, but no other measures are in place. Management was scored as "ineffective" for all the fisheries, considering that the fishery lacks specific reference points and *Seriola lalandi* landings are currently mixed with other species, which may not give an accurate picture of the current status of these stocks. In addition, no quotas or strategies to ensure that stocks are maintained at a sustainable level are in place and there are no regulations on minimum size limit or mesh size limit that prevents capture of immature organisms.

Bycatch strategy for trolling lines and hand lines was scored as "highly effective" due to the low level of impact that these gears have on other species. For encircling nets, the strategy is considered moderate, in part because although the impact on other species is uncertain, it was stated that species of concern are not impacted by the gear. Similarly, for gillnets (drift and set), the factor was scored as "moderate," considering that measures that focus on reducing the impact on bycatch species are currently in place, but its effectiveness is also uncertain.

Finally, the gillnet fisheries were identified as having a moderate impact on the ecosystem.

For these reasons, the Yellowtail fishery in Mexico developed by hand lines, trolling lines, and encircling nets are scored as a "good alternative," while gillnets are rated as "avoid."

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
Yellowtail Mexico Pacific, Trolling lines, Mexico	Yellow (2.644)	Green (5.000)	Red (1.000)	Green (3.873)	Good Alternative (2.674)
Yellowtail Mexico Gulf of California, Set gillnets, Mexico	Yellow (2.644)	Red (1.000)	Red (1.000)	Yellow (2.449)	Avoid (1.595)
Yellowtail Mexico Pacific, Set gillnets, Mexico	Yellow (2.644)	Red (1.000)	Red (1.000)	Yellow (2.449)	Avoid (1.595)
Yellowtail Mexico Gulf of California, Encircling gillnets, Mexico	Yellow (2.644)	Green (5.000)	Red (1.000)	Green (3.873)	Good Alternative (2.674)
Yellowtail Mexico Gulf of California, Handlines and hand-operated pole-and-lines, Mexico	Yellow (2.644)	Green (5.000)	Red (1.000)	Green (3.873)	Good Alternative (2.674)
Yellowtail Mexico Pacific, Drift gillnets, Mexico	Yellow (2.644)	Red (1.000)	Red (1.000)	Green (3.873)	Avoid (1.788)

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

In Mexico, several finfish species are contained in a fishery group called "escama" with more than 200 species. In the Pacific, species of jacks and amberjacks (*jureles* and *medregales* for their name in Spanish) are considered a sub-group with nine targeted species and at least 12 associated species (associated species are those that are regularly caught when targeting the main species) (DOF 2010) (DOF 2012). California yellowtail is one of the nine targeted species in the Mexican Pacific, where it is reported to be caught by the small-scale vessel fleet inside the Gulf of California and the west coast of Baja California. According to the information currently available, fishers that target California yellowtail have used trolling lines, hook and line, encircling nets (mostly inside the Gulf of California and in shallow areas closer to the coast), and gillnets (both driftnets and stationary nets at different levels in the water column) (Gomez-Gomez et al. 2016)

This report focuses on California yellowtail (*Seriola lalandi*) targeted by fishers in NW Mexico using encircling gillnets, set gillnets, and hand lines in the Gulf of California, and set and drift gillnets and trolling lines in the west coast of Baja.

Species Overview

California yellowtail, *Seriola lalandi*, which was formally known as *Seriola dorsalis* (Froese and Pauly 2018), is a large member of the jack family, Carangidae, common in the eastern Pacific coastal waters from Southern Washington to Baja California.

This is a large, fast-swimming, coastal pelagic species (Froese and Pauly 2018) with northerly movement into California from Mexico in the spring and summer with warm ocean temperatures (CDFG 2001). The maximum recorded size is 1.5 m and 36.3 kg (80 lb) (Love 1996) (CDFG 2001). All females older than three years are 71.12 cm (28") and are capable of spawning, which occurs in summer months (CDFG 2001). Older females are capable of spawning multiple times per season and a 9.1 kg (20 lb) fish is capable of producing 940,000 eggs during one season (CDFG 2001).

The fishery in Mexico is developed by small-scale vessels in the west coast of the Baja Peninsula and inside the Gulf of California (DOF 2012). The fishery is managed by the federal body, the National Fisheries Commission (CONAPESCA), although the species is grouped with several other "jack" species and there currently is no stock assessment or fishery management plan in place for California yellowtail in Mexico.

In the region, at least three fishing gear/techniques are used to commercially fish California yellowtail: trolling (Figure 1), encircling nets (Figure 2), gillnets (Figure 3) and hook and line (Figure 4)



Figure 1 Trolling lines

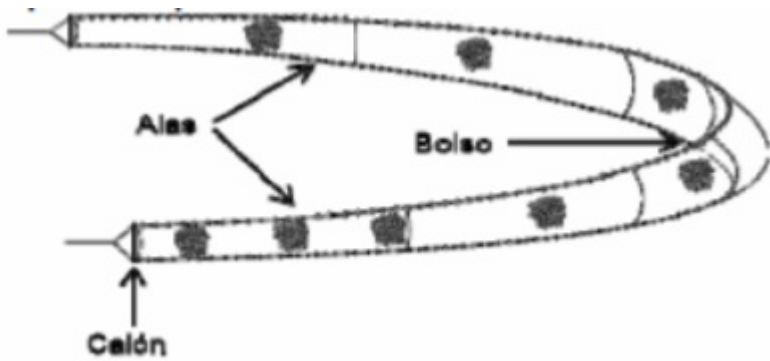


Figure 2 Encircling nets

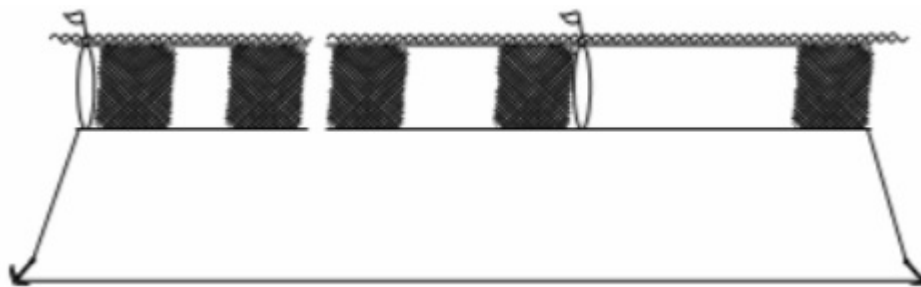


Figure 3 Gillnets



Figure 4 Hook and line

Trolling lines and hook and line gears are pulled while the vessel is moving, and stationary, respectively. However, gillnets are used either on the surface, bottom, stationary, or adrift (Gomez-Gomez et al. 2016). In the case of encircling nets, these are used only in Sonora and were described by local experts as a highly specialized technique. The net used is 6 inches (in) mesh size. The crew (composed by 3 fishermen) seeks a yellowtail school; when identified, the boat drives around the school while other members deploy the net until they enclose the school, which remains swimming in circles inside the enclosure. This process is highly dynamic and occurs in less than 10 minutes. According to the experts, the loud noise generated with a bat against the

boat is used to scare the school, provoking the gillnetting effect. It is reported that, given the dynamic of the fishing process and the use of the engine at high revolutions, the process captures exclusively the targeted school. When asked about other species, including sensitive ones, they report that the engine noise and vibrations make them escape from the area (pers. comm., J.M., Garcia-Caudillo 2018).

Production Statistics

The fishery is active year-round with highest landings between May and the end of July (DOF 2010). Total landings for individual species (California yellowtail) were taken from government landings; however, it is important to state that jack species are commonly reported together by producers (jacks). The state of Baja California, Sur is by far the most important in terms of production (DOF 2010). In 2017, BCS produced more than 2,900 tons (t); the rest of the states in the northwest (Baja California, Sonora, and Sinaloa) contributed 534 t, 279 t, and 31 t, respectively (Figure 5).

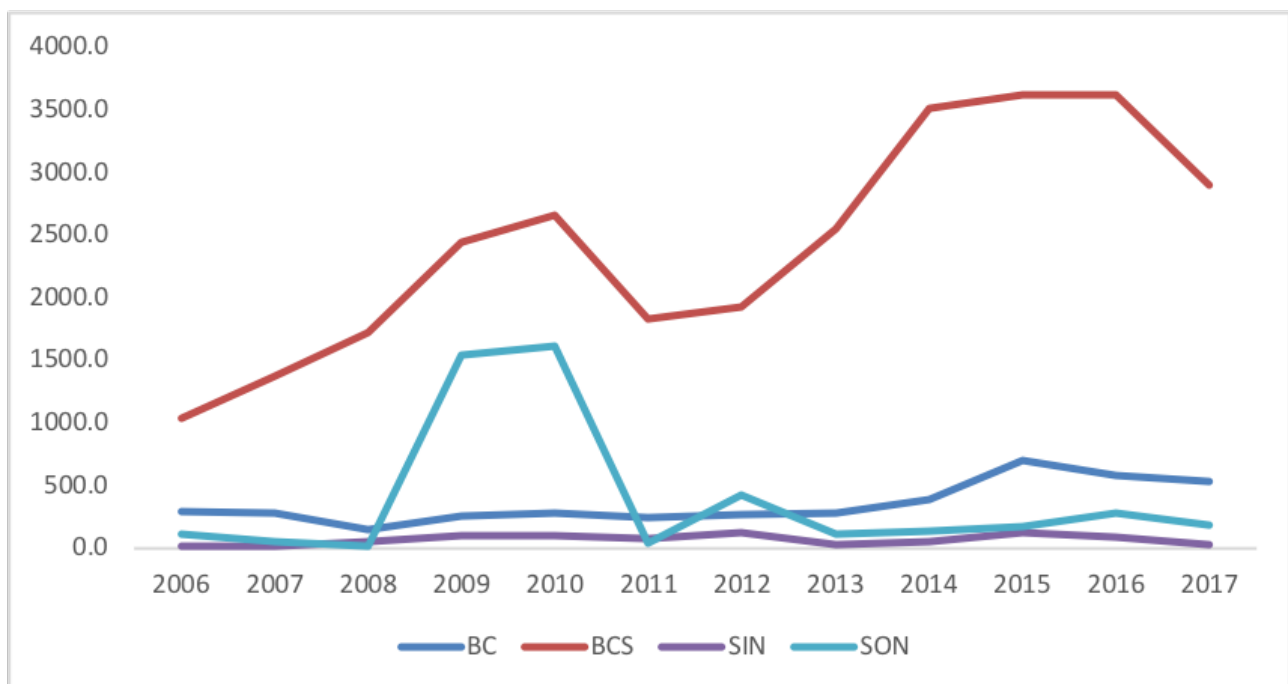


Figure 5 Landings per state

Jack landings in 2014 reached about 4,000 t between the NW states in the Pacific (Sonora, Sinaloa, and the two Baja states), but more than 86% (3,508 t) was landed in BCS (CONAPESCA-SIAP 2016). However, landing reports do not specify the fishing gear used (e.g., trolling, gillnet, or hook and line) and it's unclear how much volume is caught by recreational fishers.

Importance to the US/North American market.

California yellowtail exports are believed to be small compared to other products. Import data from the NMFS foreign trade database groups California yellowtail with "marine fish nspf" (not specified further). Therefore, precise import and export data for yellowtail are unavailable.

Common and market names.

In the US: California yellowtail, yellowtail, or amberjack (FDA 2017)

In Mexico: medregal, cola amarilla, and jurel (DOF 2010)

Primary product forms

California yellowtail is primarily consumed in the Mexican market, although according to local experts the level of product exported to the US has been increasing (Gomez-Gomez et al. 2016). The product exported to the US is exported mostly as fresh fillets and whole.

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

YELLOWTAIL			
Region Method	Abundance	Fishing Mortality	Score
Mexico/Pacific Trolling lines Mexico	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Gulf of California Set gillnets Mexico	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Pacific Set gillnets Mexico	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Gulf of California Encircling gillnets Mexico	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Gulf of California Handlines and hand-operated pole-and-lines Mexico	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Pacific Drift gillnets Mexico	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.*

YELLOWTAIL

Factor 1.1 - Abundance

MEXICO/PACIFIC, TROLLING LINES, MEXICO
MEXICO/GULF OF CALIFORNIA, SET GILLNETS, MEXICO
MEXICO/PACIFIC, SET GILLNETS, MEXICO
MEXICO/GULF OF CALIFORNIA, ENCIRCLING GILLNETS, MEXICO
MEXICO/GULF OF CALIFORNIA, HANDLINES AND HAND-OPERATED POLE-AND-LINES, MEXICO
MEXICO/PACIFIC, DRIFT GILLNETS, MEXICO

Moderate Concern

The status of California yellowtail in NW Mexico is unknown. Currently, no stock assessments for the species are available in the country.

Since no assessment is available, we conducted a Productivity-Susceptibility Analysis (PSA) to help score this factor. The PSA result was 2.88, indicating a medium inherent vulnerability to fishing. Detailed scoring of each attribute is shown below.

Considering that California yellowtail scored as medium inherent vulnerability and the species is listed as "Least Concern" by the IUCN, abundance is deemed a "moderate" concern.

Justification:

Productivity Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Average age at maturity	4 years (Froese and Pauly 2018)	1
Average maximum age	12 years (Froese and Pauly 2018)	2
Fecundity	>20,000 eggs per year (Froese and Pauly 2018)	1
Average maximum size (fish only)	250 cm (Froese and Pauly 2018)	2
Average size at maturity (fish only)	~45 cm males and 83 cm for females (Froese and Pauly 2018)	2
Reproductive strategy	Broadcast spawner	1
Trophic level	4.2 (Froese and Pauly 2018)	3
Density dependence (invertebrates only)	-	-
Habitat Quality	N / A	N / A
Total Productivity (average)		1.71

Susceptibility Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Areal overlap (Considers all fisheries)	Considering the large distribution of the species, which is constantly moving along its distribution around the globe), but also targeted by different nations and fleets, it is highly possible that >30 of the species concentrations are fished, considering all fisheries.	3
Vertical overlap (Considers all fisheries)	The species is a targeted species for commercial and sports fishers, who use gears that overlap with the shallowest species distribution, though it has been reported that the species can be found in depths of 300 m (Hureau 1991).	3
Selectivity of fishery (Specific to fishery under assessment)	According to the literature, encircling nets are used to target yellowtail spawning aggregations (Sala et al. 2003), though it is unclear if this is also the case for the other gears. Hook and line used in the fishery have proved effective in capturing yellowtail adult sizes (Gomez-Gomez et al. 2016)	2
Post-capture mortality (Specific to fishery under assessment)	The level of post-capture mortality is unknown, although it is believed that all the organisms are retained.	3
Total Susceptibility (multiplicative)		2.32

PSA score for yellowtail is calculated as follows:

$$\text{Vulnerability (V)} = \sqrt{(P^2 + S^2)}$$

$$V = \sqrt{([1.71])^2 + ([2]^2 + (2.32^2))}$$

$$V = 2.88$$

Factor 1.2 - Fishing Mortality

MEXICO/PACIFIC, TROLLING LINES, MEXICO

MEXICO/GULF OF CALIFORNIA, SET GILLNETS, MEXICO

MEXICO/PACIFIC, SET GILLNETS, MEXICO

MEXICO/GULF OF CALIFORNIA, ENCIRCLING GILLNETS, MEXICO

MEXICO/GULF OF CALIFORNIA, HANDLINES AND HAND-OPERATED POLE-AND-LINES, MEXICO

MEXICO/PACIFIC, DRIFT GILLNETS, MEXICO

Moderate Concern

Fishing mortality information is not available for California yellowtail in Mexico. Managers rely on the production by each state as an indicator of the status of the fishery (e.g., if landings in Baja California, Sur get below 500 t/year, the National Fisheries Chart states that managers will develop research to find the causes of the decline and take the appropriate measures (though appropriate measures are not specified) (DOF 2010). In 2010, according to the National Fisheries Chart—the government's official management instrument—the resource was fished at its maximum sustainable yield (DOF 2010). Despite two updates of the Chart (2012 and 2018), no updates on the fishery's file have been made (DOF 2012). In addition, It is unclear how the maximum sustainable yield statement was reached, especially considering that the species is grouped with other species, and reported landings included all the species within the resource category, and not just California yellowtail.

Since fishing mortality is unknown, and the species scores as medium inherent vulnerability, this factor is rated as a "moderate" concern.

Justification:

It is unclear how many boats are authorized and actively fishing on both the west coast of Baja and inside the Gulf of California. According to a 2013 report, more than 100,000 small vessels known as "*pangas*" were operating in Mexico, with a high percentage of those in the northwestern states (IMCO et al 2013). It is uncertain, however, how many are actively fishing in the region, and of these, the number of those that are actively targeting yellowtail. In addition, this species is also targeted by recreational fishers and there is no information regarding the volume that is extracted by these vessels.

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.

YELLOWTAIL - MEXICO/GULF OF CALIFORNIA - ENCIRCLING GILLNETS - MEXICO					
Subscore:	5.000	Discard Rate:	1.00	C2 Rate:	5.000
Species	Abundance	Fishing Mortality	Subscore		
No other main species caught					

YELLOWTAIL - MEXICO/GULF OF CALIFORNIA - HANDLINES AND HAND-OPERATED POLE-AND-LINES - MEXICO					
Subscore:	5.000	Discard Rate:	1.00	C2 Rate:	5.000
Species	Abundance	Fishing Mortality	Subscore		
No other main species caught					

YELLOWTAIL - MEXICO/GULF OF CALIFORNIA - SET GILLNETS - MEXICO					
Subscore:	1.000	Discard Rate:	1.00	C2 Rate:	1.000
Species	Abundance	Fishing Mortality	Subscore		
Sea turtle (unspecified)	1.00:High Concern	1.00:High Concern	Red (1.000)		
Mammals	1.00:High Concern	1.00:High Concern	Red (1.000)		

Finfish	2.33: Moderate Concern	1.00: High Concern	Red (1.526)
Sharks	1.00: High Concern	3.00: Moderate Concern	Red (1.732)
Rays (unspecified)	1.00: High Concern	3.00: Moderate Concern	Red (1.732)

YELLOWTAIL - MEXICO/PACIFIC - DRIFT GILLNETS - MEXICO					
Subscore:	1.000	Discard Rate:	1.00	C2 Rate:	1.000
Species	Abundance	Fishing Mortality	Subscore		
Giant seabass	1.00: High Concern	1.00: High Concern	Red (1.000)		
Mammals	1.00: High Concern	1.00: High Concern	Red (1.000)		
Sea turtle (unspecified)	1.00: High Concern	1.00: High Concern	Red (1.000)		
Sharks	1.00: High Concern	3.00: Moderate Concern	Red (1.732)		
Shortfin corvina	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)		

YELLOWTAIL - MEXICO/PACIFIC - SET GILLNETS - MEXICO					
Subscore:	1.000	Discard Rate:	1.00	C2 Rate:	1.000
Species	Abundance	Fishing Mortality	Subscore		
Giant seabass	1.00: High Concern	1.00: High Concern	Red (1.000)		
Sea turtle (unspecified)	1.00: High Concern	1.00: High Concern	Red (1.000)		
Mammals	1.00: High Concern	1.00: High Concern	Red (1.000)		
Sharks	1.00: High Concern	3.00: Moderate Concern	Red (1.732)		
Rays (unspecified)	1.00: High Concern	3.00: Moderate Concern	Red (1.732)		
Gorgonians (unspecified)	1.00: High Concern	3.00: Moderate Concern	Red (1.732)		
Shortfin corvina	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)		

YELLOWTAIL - MEXICO/PACIFIC - TROLLING LINES - MEXICO					
Subscore:	5.000	Discard Rate:	1.00	C2 Rate:	5.000
Species	Abundance	Fishing Mortality	Subscore		
No other main species caught					

Bycatch rates for the hook and line and trolling line fisheries are generally believed to be low (Chuenpagdee et al. 2003). A recent bycatch analysis found that rates for the fisheries that target yellowtail using hook and line and trolling lines are close to zero (Gomez-Gomez et al. 2016); therefore, no C2 species were considered for these gears. Encircling nets, according to local experts, target and catch only yellowtail; this gear (as deployed in this fishery) does not impact species of concern (pers. comm. Fernandez Riveramelo 2018) (pers. comm., J. M. Garcia-Caudillo 2018).

Gillnets (drift and set nets), however, have reported being less selective, and some data related to catch composition was available and included as a reference. According to a 2016 report, the shortfin corvina (*Cynoscion parvipinnis*) represented 21% of the catches with set and drift gillnets, followed by giant sea bass (*Stereolepis gigas*) 7%, and 11% of several species of elasmobranchs (rays and sharks) (Gomez-Gomez et al. 2016). In addition, other taxa most likely to interact with gill nets, according to the SFW Unknown Bycatch Matrix (UBM), include sea turtles and marine mammals. These taxa were included in the assessment using both the SFW Unknown Bycatch Matrix (UBMs), as well as results reported by (Shester and Micheli 2016), who analyzed landings by different gears in the west coast of BCS. For these reasons: shortfin corvina, giant sea bass, rays, sharks, sea turtles, marine mammals, and gorgonians were included as C2 species for gillnets in the Pacific.

Since abundance and fishing mortality for some of the taxa were not available, we scored abundance and fishing mortality using the SFW UBMs.

After the analysis, giant sea bass, marine mammals, and sea turtles presented the lowest scores overall for gillnets, since these taxa are known to be subject to entanglement in the gillnet fisheries. Giant sea bass, as well as sea turtles and some marine mammal species, are listed as "Endangered" by the IUCN and the Endangered Species Act (ESA) in the US, as well as the NOM-059-SEMARNAT (a federal regulation that contains species that need special protection) in Mexico.

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)

GIANT SEABASS

Factor 2.1 - Abundance

MEXICO / PACIFIC, SET GILLNETS, MEXICO
MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

High Concern

Giant Sea Bass has been classified as a "Critically Endangered" species by IUCN since 1996 (IUCN 2018), mostly due to the heavy levels of exploitation in both California and Mexican waters (IUCN 2018).

It is unclear if the stock in the Pacific and the Gulf of California are the same population. In 2007, Gaffney et al. tried to determine whether populations of the species from the Pacific and the Gulf of California were genetically homogeneous, and concluded that DNA composition was consistent with high levels of gene flow, although with very limited exchange (Gaffney et al. 2007). The authors concluded that additional studies will help to differentiate the populations and recommended the use of regional derived broodstock for restoration programs (Gaffney et al. 2007). In 2004, it was suggested that the population size of giant sea bass in California may be increasing as it is under protection (IUCN 2004); however, there are no hard data to support it.

Due to the IUCN rating and considering that no current stock assessment is in place, and that the species is particularly vulnerable due to its ecology, abundance is scored as "high" concern.

Factor 2.2 - Fishing Mortality

MEXICO / PACIFIC, SET GILLNETS, MEXICO
MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

High Concern

The level of fishing mortality is unknown, considering that (Gomez-Gomez et al. 2016) reported that giant sea bass represented up to 7% of the total catch in gillnets, and the current critically endangered status of the species, this factor is scored as "high" concern.

Factor 2.3 - Modifying Factor: Discards and Bait Use

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

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

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

MEXICO / PACIFIC, SET GILLNETS, MEXICO
MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

< 100%

Specific information on the amount of discard from the set gillnet fishery is lacking. In the west coast of Baja, Shester and Micheli reported that around 30% of the gillnet catches are discarded (Shester and Micheli 2016). Similar information for the Gulf of California was not available; however, some regional experts state that most of the incidental, lower-value species caught in the Gulf of California fishery are retained for commercial or personal consumption (pers. comm., L. Villanueva 2018). Finally, considering the low level of bycatch on the hook and line and trolling line fisheries, a score of <100% is given to all the fisheries.

SEA TURTLE (UNSPECIFIED)

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
MEXICO / PACIFIC, SET GILLNETS, MEXICO
MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

High Concern

Based on the Seafood Watch fisheries standard, sea turtle abundance is scored as "high" concern due to their high inherent vulnerability. Sea turtles species have "Endangered" or "Threatened" status under the IUCN, Mexican legislation, and the US Endangered Species Act.

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
MEXICO / PACIFIC, SET GILLNETS, MEXICO
MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

High Concern

This score was calculated using the Seafood Watch Unknown Bycatch Matrix (UBM), which evaluated turtle bycatch susceptibility by regions and gear type. Based on the UBM, fishing mortality is scored as a "high" concern because sea turtles are highly susceptible to interactions with gillnets in most regions, and currently no data overrule the UBM scoring.

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

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
MEXICO / PACIFIC, SET GILLNETS, MEXICO
MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

< 100%

Specific information on the amount of discard from the set gillnet fishery is lacking. In the west coast of Baja, Shester and Micheli reported that around 30% of the gillnet catches are discarded (Shester and Micheli 2016). Similar information for the Gulf of California was not available; however, some regional experts state that most of the incidental, lower-value species caught in the Gulf of California fishery are retained for commercial or personal consumption (pers. comm., L. Villanueva 2018). Finally, considering the low level of bycatch on the hook and line and trolling line fisheries, a score of <100% is given to all the fisheries.

MAMMALS

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
MEXICO / PACIFIC, SET GILLNETS, MEXICO
MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

High Concern

We included this taxonomic group based on results from the Seafood Watch Unknown Bycatch Matrix (UBM).

Marine mammals scored as "high" concern for abundance because some of the species in this group are highly vulnerable to interactions with gill nets, and interactions have been found in similar fisheries, like the halibut fishery in California, where 18 humpback whales were observed entangled, alive, or dead in fishing gear from 2004 to 2008 (Carretta et al. 2013).

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
 MEXICO / PACIFIC, SET GILLNETS, MEXICO
 MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

High Concern

To score this factor, we used the Seafood Watch Unknown Bycatch Matrix (UBM).

The matrix scores bycatch susceptibility by region and gear type. According to the UBM, marine mammals are highly susceptible to interactions with gillnet fisheries in nearly all regions. Since no information is available to overrule the UBM, fishing mortality scores as "high" concern for marine mammals.

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

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
 MEXICO / PACIFIC, SET GILLNETS, MEXICO
 MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

< 100%

Specific information on the amount of discard from the set gillnet fishery is lacking. In the west coast of Baja, Shester and Micheli reported that around 30% of the gillnet catches are discarded (Shester and Micheli 2016). Similar information for the Gulf of California was not available; however, some regional experts state that most of the incidental, lower-value species caught in the Gulf of California fishery are retained for commercial or personal consumption (pers. comm., L. Villanueva 2018). Finally, considering the low level of bycatch on the hook and line and trolling line fisheries, a score of <100% is given to all the fisheries.

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: Mexico / Gulf of California Encircling gillnets Mexico	Ineffective	Moderately Effective	NA	NA	NA	Red (1.000)
Fishery 2: Mexico / Gulf of California Handlines and hand-operated pole-and-lines Mexico	Ineffective	Highly Effective	NA	NA	NA	Red (1.000)
Fishery 3: Mexico / Gulf of California Set gillnets Mexico	Ineffective	Moderately Effective	NA	NA	NA	Red (1.000)
Fishery 4: Mexico / Pacific Drift gillnets Mexico	Ineffective	Moderately Effective	NA	NA	NA	Red (1.000)
Fishery 5: Mexico / Pacific Set gillnets Mexico	Ineffective	Moderately Effective	NA	NA	NA	Red (1.000)

Fishery 6: Mexico / Pacific Trolling lines Mexico	Ineffective	Highly Effective	NA	NA	NA	Red (1.000)
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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.

MEXICO / GULF OF CALIFORNIA, ENCIRCLING GILLNETS, MEXICO
 MEXICO / GULF OF CALIFORNIA, HANDLINES AND HAND-OPERATED POLE-AND-LINES, MEXICO
 MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
 MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO
 MEXICO / PACIFIC, SET GILLNETS, MEXICO
 MEXICO / PACIFIC, TROLLING LINES, MEXICO

Ineffective

Management for the yellowtail fishery in Mexico is minimal; access is through a finfish permit that has minimal specifications, like a limit on fishing areas and general gear selection. Currently, there are no quota limits, minimum size limits, or closed seasons in place. In 2010, the National Fisheries Chart stated that the fishery was fished at its maximum sustainable limit and recommended developing a series of actions to improve its management (DOF 2010). It is unclear how the "maximum limit" statement was reached since no stock assessment has been conducted or reference point established. Managers also recommended not to increase fishing effort and suggested the following:

- Evaluate catch composition and proportion of target and associated species
- Establish a minimum size limit
- Establish a mesh size limit
- Estimate the impact that sport-fishing has on the stock (DOF 2010)

There is no evidence that these recommendations have been implemented. The current status of the yellowtail population is unknown and it is difficult to determine impacts on this species because landings are reported for all the jack species combined. It is unclear if yellowtail is being fished above sustainable levels (see Criterion 1) since landings are combined with other jack species; it is unclear how much is actually yellowtail. Although a recent report from one of the west coast of Baja California communities shows a CPUE that has remained relatively stable in the most recent years (Gomez-Gomez et al. 2016), overall, the status of the species is unknown. Since the effectiveness of the current management system is unknown, and it is likely that the fishery is impacting the retained species populations, this management strategy is scored as "ineffective."

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.

MEXICO / GULF OF CALIFORNIA, ENCIRCLING GILLNETS, MEXICO

Moderately Effective

In the Gulf of California, the use of gillnets has raised concerns due to the catch of vulnerable species like sharks, rays (Marquez-Farias 2011), and sea turtles (CIT 2006) as well as to interactions with marine mammals like sea lions and whales (Gayo-Reynoso 2006).

However, the use of the encircling net to target yellowtail in Sonora operates in different circumstances (see overview section for operation of the gear), and fishery experts state that the net has minimal or close to zero impact on other species. Although no information is available, it is being collected through the implementation of a fishery improvement project in Sonora (pers. comm., Fernandez Riveramelo 2018). Considering these opinions, the bycatch strategy scores as "moderately effective."

MEXICO / GULF OF CALIFORNIA, HANDLINES AND HAND-OPERATED POLE-AND-LINES, MEXICO
MEXICO / PACIFIC, TROLLING LINES, MEXICO

Highly Effective

N / A

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO
MEXICO / PACIFIC, SET GILLNETS, MEXICO

Moderately Effective

In the Gulf of California, gillnet use has raised concerns due to the catch of vulnerable species like sharks, rays (Marquez-Farias 2011), and sea turtles (CIT 2006) as well as to interactions with marine mammals, like sea lions and whales (Gayo-Reynoso 2006), in addition to the reported catch of endangered species like the giant seabass (Gomez-Gomez et al. 2016).

Some regulations in place related to the use of gillnets include:

- The Mexican Official Norm, NOM-029-PESC-2006, for the protection of sharks and rays, contains specific rules to reduce or completely eliminate the use of gillnets in known reproductive areas (i.e., coastal lagoons of La Reforma and Altata in Sinaloa and Almejas Bay in BCS); creates sanctuaries (i.e., a five-km radius of Espiritu Santo Island in BCS), and establishes mesh size limits along the coast (DOF 2015).
- All whales and turtle species are listed in the official norm NOM-059-SEMARNAT that protects all endangered species and prohibits all species' use or extraction. In addition, several important areas were established as protected zones for whales in Northwestern Mexico (DOF 1972). Ojo de Liebre lagoon is the most important in Baja California Sur, where gillnets or other gears that have a negative impact on mammals are not allowed (DOF 2016).
- In relation to sea turtles, the Mexican government created a fishing refuge on the west coast of Baja California Sur, where several turtles, mostly loggerheads, were found stranded (Debate 2014) (DOF 2014). The purpose of the refuge was to reduce the possible interaction between turtles and fishing activities. A series of restrictions were established prohibiting the use of gillnets with six-inch mesh size or bigger inside the refuge and reducing the use of gillnets of less than six inches during the sea turtle nesting

season (May to August each year) (DOF 2014). As a result, a decrease in the number of stranded turtles in the area was reported (SDP 2017). Based on these new regulations, if the limit on the number of stranded loggerheads is reached (90 individuals/season), gillnet activities are suspended for the rest of the year (DOF 2015). In addition, managers also limited soak time of gillnets to six continuous hours in the restricted area to reduce impacts on turtles (DOF 2015). Finally, although researchers agreed that fishing mortality of sea turtles in the region has decreased, it is still considered a problem (Senko, et al 2017).

Current efforts to mitigate the impact on some of these species are in place, but the effectiveness of these regulations is unclear. Due to concerns of the impact that these gears have on endangered species like giant seabass, as well as threatened and vulnerable species (e.g., turtle and sharks) the bycatch strategy scores as "moderately effective."

Factor 3.3 - Scientific Research and Monitoring

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

Factor 3.4 - Enforcement of Management Regulations

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

Factor 3.5 - Stakeholder Inclusion

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

Criterion 4: Impacts on the Habitat and Ecosystem

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

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

GUIDING PRINCIPLES

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

Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

Region / Method	Gear Type and Substrate	Mitigation of Gear Impacts	EBFM	Score
Mexico / Gulf of California / Set gillnets / Mexico	2	0	Moderate Concern	Yellow (2.449)
Mexico / Gulf of California / Encircling gillnets / Mexico	5	0	Moderate Concern	Green (3.873)
Mexico / Gulf of California / Handlines and hand-operated pole-and-lines / Mexico	5	0	Moderate Concern	Green (3.873)
Mexico / Pacific / Drift gillnets / Mexico	5	0	Moderate Concern	Green (3.873)
Mexico / Pacific / Set gillnets / Mexico	2	0	Moderate Concern	Yellow (2.449)
Mexico / Pacific / Trolling lines / Mexico	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

MEXICO / GULF OF CALIFORNIA, ENCIRCLING GILLNETS, MEXICO

5

There are no impacts of encircling nets on the substrate according to local experts. According to these experts, fishers use this gear so that the net never touches the bottom (see the operation description on the overview section) (pers. comm., Fernandez Riveramelo 2018) (pers. comm., J. M. Garcia-Caudillo 2018). Based on these statements, this factor is scored 5 for encircling nets.

MEXICO / GULF OF CALIFORNIA, HANDLINES AND HAND-OPERATED POLE-AND-LINES, MEXICO
MEXICO / PACIFIC, TROLLING LINES, MEXICO

5

When targeting yellowtail with hook and line and trolling line, producers use the gears in the water column close to the surface, where contact with the bottom is avoided. This gear does not contact the seafloor, resulting in a score of 5.

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
MEXICO / PACIFIC, SET GILLNETS, MEXICO

2

The impacts of gillnets on the substrate vary depending on the way these are operated. In 2011, Shester and Micheli completed a study that quantified the potential impacts to benthic habitats of four artisanal fishing gears, including set gillnets, on the west coast of Baja California Sur (Shester and Micheli 2011). The authors reported that set gillnets tangled and removed *Eisenia* kelp plants and gorgonian corals, and were in contact with the seafloor 43% of the time when suspended within 2 m of the seafloor. The percentage declined to 4% when gillnets are suspended above 2 m from the bottom. The report included details on interactions between nets and habitat-forming species that resulted in organism removal or damage. The authors concluded that set gillnets damage or remove gorgonians and kelp significantly more than other gears (e.g., traps).

Considering the results of these reports, bottom gillnets and set gillnets can impact on the substrate, and this impact can be high when these gears are deployed over boulders or coral reefs.

Overall, set gillnets have a moderate impact on the habitat, resulting in a score of 2 for this subfactor.

MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

5

The impacts of driftnets on the substrate are minimal or non-existent, since they are used in areas that are deep enough for the nets to not have interaction with the bottom. In 2011 Shester and Micheli completed a study that quantified the potential impacts to benthic habitats of four artisanal fishing gears, including set gillnets, in the west coast of Baja California Sur (Shester and Micheli 2011). The authors reported that driftnets are unlikely to have an impact with the bottom since they are designed to drift in the water column (Shester and Micheli 2011)

Driftnets are scored as low impact on the habitat.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

MEXICO / GULF OF CALIFORNIA, ENCIRCLING GILLNETS, MEXICO

0

Considering that the encircling net technique does not contact the bottom and received the highest score for 4.1, no mitigation is necessary

MEXICO / GULF OF CALIFORNIA, HANDLINES AND HAND-OPERATED POLE-AND-LINES, MEXICO
MEXICO / PACIFIC, TROLLING LINES, MEXICO

0

Commercial hook and line and trolling fishing for yellowtail can be conducted by any fisher with a commercial fishing license or sports fishing permit. There are no specific area restrictions for these gears except those areas where no fishing is allowed (e.g., marine reserves). Considering the low impact on the habitat by these gears, there is no specific need for mitigation for hook and line and trolling lines.

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
MEXICO / PACIFIC, SET GILLNETS, MEXICO

0

Regulations on the use of gill nets in Mexico is driven by the impact that these gears have on specific groups of species (e.g., sharks or sea turtles) and less impact in the habitat. One example is the ban of the use of gill nets in the upper Gulf of California that are reported to kill vaquita (*Phocoena sinus*) (DOF 2017). Similarly in the Gulf of Ulloa, on the West Coast of Baja California Sur, a refuge area protecting loggerhead sea turtles (*Caretta caretta*) was created in 2016, which prohibited the use of gillnets of 6 inch mesh size and put restrictions on bigger mesh sizes (DOF 2015). Despite these regulations, no other measures related to the impact of the nets on the habitat have been enacted, and no extra points are granted for mitigation of impacts.

MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

0

Driftnets in this fishery do not contact the bottom and received the highest score for 4.1, so no mitigation is necessary.

Factor 4.3 - Ecosystem-Based Fisheries Management

MEXICO / GULF OF CALIFORNIA, ENCIRCLING GILLNETS, MEXICO

MEXICO / GULF OF CALIFORNIA, HANDLINES AND HAND-OPERATED POLE-AND-LINES, MEXICO

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO

MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

MEXICO / PACIFIC, SET GILLNETS, MEXICO

MEXICO / PACIFIC, TROLLING LINES, MEXICO

Moderate Concern

Some policies are in place to protect specific species that are a cause of concern (e.g., sea turtles, see 4.2). However, no spatial planning developed by managers is in place for the yellowtail fishery in Mexico.

In 2016, Rocchi et al. developed a food web network analysis as a tool to identify key species and measure the impacts of fisheries in Baja California Sur (Rocchi et al. 2016). The authors analyzed the resilience of the regional system due to changes in the food web structure and concluded that this coastal system was highly resilient to species loss. Yellowtail was not identified as one of the key species. Instead, species like octopuses and the kelp bass (*Paralabrax clathratus*) were reported to have a more significant role in the ecosystem (Rocchi et al 2016).

In the Gulf of California, some approaches to evaluate the trophic structure of the fish communities have been developed, (Jara-Marini et al. 2014). However, the specific role of yellowtail in the ecosystem has not been described. Management of the yellowtail fisheries in Mexico have spatial management regulations related to some gears (e.g., gill net bans of 6 inches in the Gulf of Ulloa), but it is unclear if these regulations have been effective, since no reports exist.

For these reasons, this factor is scored as "moderate" concern for all the fisheries in this report.

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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

SHORTFIN CORVINA

Factor 2.1 - Abundance

MEXICO / PACIFIC, SET GILLNETS, MEXICO
MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

Moderate Concern

Shortfin corvina is a widespread species in the eastern Pacific. Although considered intensively fished by the IUCN, the species is listed as data deficient (Chao et al. 2010). Information related to the current status of the species was not available (e.g., no stock assessment, or other data-limited information). For this reason, a PSA is used to score this factor. Due to the lack of data related to this species' history traits, parameters for a similar species, Gulf corvina (*C. othonoperus*), were used to complete the productivity section, differentiated with a * symbol in the table below)

The PSA score = 2.65, which indicates a medium inherent vulnerability. Detailed scoring of each attribute is shown below. Because shortfin corvina has a medium vulnerability and there is no quantitative stock assessment, abundance is deemed a "moderate" concern.

Productivity Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Average age at maturity	2.3 yr for females and 2 yr for males (Gherard et al. 2014) *	1
Average maximum age	N/A	
Fecundity	Between 240,000 to 1.2 million (Gherard et al. 2014)*	1
Average maximum size (fish only)	60 cm (Froese and Pauly 2018)	1
Average size at maturity (fish only)	29 cm for females and 26 cm for males (Gherard et al. 2014) *	1
Reproductive strategy	Broadcast spawner (Froese and Pauly 2017)	1
Trophic level	4.5 (Froese and Pauly 2017)	3
Density dependence (invertebrates only)	-	-
Habitat quality	N / A	N / A
Total Productivity (average)	1.28	

Susceptibility Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Areal overlap (Considers all fisheries)	The species is considered a target species within its range in Mexico and is part of the "escama" fishery (finfish fishery) (DOF 2012)	3
Vertical overlap (Considers all fisheries)	Similarly to the other species that are included in the fishery, it is highly likely that there is a high degree of overlap of the fishing depths and species vertical distribution.	3
Selectivity of fishery (Specific to fishery under assessment)	Unknown. Default score is used.	2
Post-capture mortality (Specific to fishery under assessment)	Unknown. Default score is used.	3
Total Susceptibility (multiplicative)		2.32

PSA score for shortfin corvina gillnet fishery is calculated as follows:

$$\text{Vulnerability (V)} = \sqrt{(P^2 + S^2)}$$

$$V = \sqrt{1.28^2 + (1.28^2 + (2.32^2))}$$

$$V = 2.65$$

Factor 2.2 - Fishing Mortality

MEXICO / PACIFIC, SET GILLNETS, MEXICO
MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

Moderate Concern

Shortfin corvina is targeted by different fleets in NW Mexico (DOF 2012). As a moderate inherent vulnerability species (see PSA in abundance) with unknown fishing mortality, Shortfin corvina scores "moderate" concern for this factor.

Factor 2.3 - Discard Rate

MEXICO / PACIFIC, SET GILLNETS, MEXICO
MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

< 100%

Specific information on the amount of discard from the set gillnet fishery is lacking. In the west coast of Baja, Shester and Micheli reported that around 30% of the gillnet catches are discarded (Shester and Micheli 2016). Similar information for the Gulf of California was not available; however, some regional experts state that most of the incidental, lower-value species caught in the Gulf of California fishery are retained for commercial or personal consumption (pers. comm., L. Villanueva 2018). Finally, considering the low level of bycatch on the hook and line and trolling line fisheries, a score of <100% is given to all the fisheries.

SHARKS

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
MEXICO / PACIFIC, SET GILLNETS, MEXICO
MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

High Concern

We included this taxonomic group based on results of the Seafood Watch Unknown Bycatch Matrix. According to the Seafood Watch fisheries standard, sharks with unknown abundance are scored as "high" concern due to their high inherent vulnerability. Catch composition that describes the most important shark species is unavailable; however, (Micheli et al. 2014) tested gillnet interactions in the west coast of Baja and found that, at least, horn shark (*Heterodontus francisci*) and smoothhound shark (*Mustelus sp*) present a certain level of interactions with set and driftnets (Micheli et al. 2014).

Currently, no information related to the stock status of sharks that can overrun the matrix scoring is available.

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
MEXICO / PACIFIC, SET GILLNETS, MEXICO
MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

Moderate Concern

This score was calculated using the Seafood Watch Unknown Bycatch Matrix (UBM). For sharks, bycatch susceptibility was evaluated by region and gear type. In the case of the eastern Pacific, fishing mortality of

sharks was scored as a "high" concern because sharks are highly susceptible to interactions with gill nets.

Justification:

As with rays, Mexico has fisheries that target several species of sharks along the Pacific coast (DOF 2010). In addition, several species are reported to be bycatch in fisheries that use gillnets (Marquez-Farias 2011).

Factor 2.3 - Discard Rate

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
MEXICO / PACIFIC, SET GILLNETS, MEXICO
MEXICO / PACIFIC, DRIFT GILLNETS, MEXICO

< 100%

Specific information on the amount of discard from the set gillnet fishery is lacking. In the west coast of Baja, Shester and Micheli reported that around 30% of the gillnet catches are discarded (Shester and Micheli 2016). Similar information for the Gulf of California was not available; however, some regional experts state that most of the incidental, lower-value species caught in the Gulf of California fishery are retained for commercial or personal consumption (pers. comm., L. Villanueva 2018). Finally, considering the low level of bycatch on the hook and line and trolling line fisheries, a score of <100% is given to all the fisheries.

RAYS (UNSPECIFIED)

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
MEXICO / PACIFIC, SET GILLNETS, MEXICO

High Concern

In Mexico, several species of rays are commercially targeted (DOF 2010) or reported as bycatch in fisheries that use gillnets (Marquez-Farias 2011). However, no formal stock assessments have been developed for these species, and their current status is unknown.

Shester and Micheli analyzed the catch composition of different gears (set and drift gillnets as well as fish and lobster traps) in the west coast of Baja California Sur) and compared the discard of bycatch species in terms of biomass (kg) per every \$1000 income generated by targeted species. The authors reported at least nine species of rays caught as bycatch in gillnet fisheries in the region (Shester and Micheli 2011). One of these species was Shovelnose guitarfish (*Pseudobatos productus*), a species considered "Near Threatened" by the IUCN (Smith et al. 2006)(van Hees et al 2015)(Smith et al. 2016). Other ray species commonly caught in gillnets have been reported (Marquez-Farias 2011). Considering this, the abundance of rays is scored as "high" concern due to the unknown abundance of most of these species in Mexico, and the fact that the IUCN status for some species van Hees et al 2015 "Near Threatened."

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
MEXICO / PACIFIC, SET GILLNETS, MEXICO

Moderate Concern

The level of fishing mortality for rays in yellowtail gillnet fisheries is unknown. There is no information about the volumes of ray species caught by these fisheries when targeting yellowtail. In Mexico, fisheries that target rays and sharks show some stability in landings, and managers reported those fisheries were at their maximum level of exploitation (DOF 2010). Since the contribution for individual fisheries is unknown, this factor is deemed a "moderate" concern for all yellowtail gillnet fisheries in Mexico.

Factor 2.3 - Discard Rate

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO
MEXICO / PACIFIC, SET GILLNETS, MEXICO

< 100%

Specific information on the amount of discard from the set gillnet fishery is lacking. In the west coast of Baja, Shester and Micheli reported that around 30% of the gillnet catches are discarded (Shester and Micheli 2016). Similar information for the Gulf of California was not available; however, some regional experts state that most of the incidental, lower-value species caught in the Gulf of California fishery are retained for commercial or personal consumption (pers. comm., L. Villanueva 2018). Finally, considering the low level of bycatch on the hook and line and trolling line fisheries, a score of <100% is given to all the fisheries.

GORGONIANS (UNSPECIFIED)

Factor 2.1 - Abundance

MEXICO / PACIFIC, SET GILLNETS, MEXICO

High Concern

Due to the lack of information related to the abundance of this taxon in the region, we used the Unknown Bycatch Matrix (UBM) that ranks bycatch susceptibility of different taxonomic groups against various gear types. We included this taxonomic group based on results of the Seafood Watch UBM.

This taxonomic group was scored as "high" concern because it has been found by the UBM and local research that species in this group are highly vulnerable to interactions with set gillnets (Micheli et al. 2014).

Factor 2.2 - Fishing Mortality

MEXICO / PACIFIC, SET GILLNETS, MEXICO

Moderate Concern

Based on the Seafood Watch Unknown Bycatch Matrix (UBM), this factor scores as a "moderate" concern due to moderate susceptibility that corals and other biogenic habitats have to a variety of gear types including set gillnets.

Factor 2.3 - Discard Rate

MEXICO / PACIFIC, SET GILLNETS, MEXICO

< 100%

Specific information on the amount of discard from the set gillnet fishery is lacking. In the west coast of Baja, Shester and Micheli reported that around 30% of the gillnet catches are discarded (Shester and Micheli 2016). Similar information for the Gulf of California was not available; however, some regional experts state that most of the incidental, lower-value species caught in the Gulf of California fishery are retained for commercial or personal consumption (pers. comm., L. Villanueva 2018). Finally, considering the low level of bycatch on the hook and line and trolling line fisheries, a score of <100% is given to all the fisheries.

FINFISH

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO

Moderate Concern

We included this taxonomic group based on results of the Seafood Watch Unknown Bycatch Matrix. This taxonomic group was scored as "moderate" concern because most stocks of teleost fish are moderately vulnerable to interactions with set gillnets.

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO

High Concern

Similar to abundance, this score was calculated using the Seafood Watch Unknown Bycatch Matrix. Considering that finfish are highly susceptible to interactions with gillnets, this factor is scored as "high" concern for finfish species.

Factor 2.3 - Discard Rate

MEXICO / GULF OF CALIFORNIA, SET GILLNETS, MEXICO

< 100%

Specific information on the amount of discard from the set gillnet fishery is lacking. In the west coast of Baja, Shester and Micheli reported that around 30% of the gillnet catches are discarded (Shester and Micheli 2016). Similar information for the Gulf of California was not available; however, some regional experts state that most of the incidental, lower-value species caught in the Gulf of California fishery are retained for commercial or personal consumption (pers. comm., L. Villanueva 2018). Finally, considering the low level of bycatch on the hook and line and trolling line fisheries, a score of <100% is given to all the fisheries.