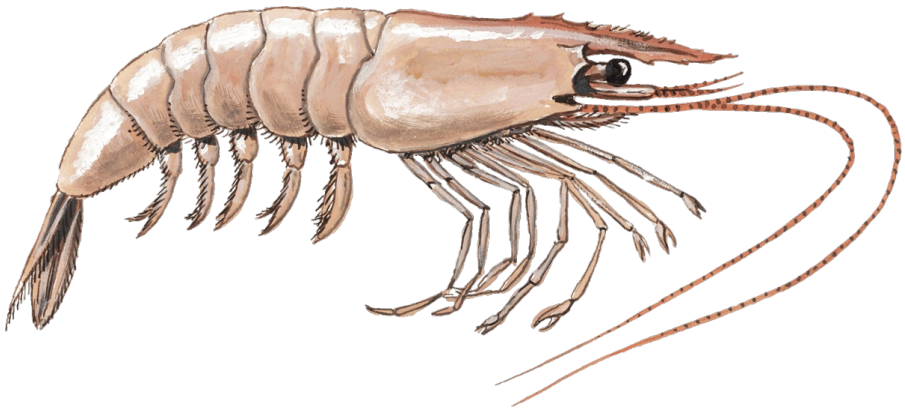
Monterey Bay Aquarium Seafood Watch®

Shrimp

Blue shrimp (*Litopenaeus stylirostris*)
Brown shrimp (*Farfantepenaeus aztecus*)
Pink shrimp (*Farfantepenaeus duorarum*)
Seabob shrimp (*Xiphopenaeus kroyeri*)
White shrimp (*Litopenaeus setiferus*)
Whiteleg shrimp (*Litopenaeus vannamei*)
Yellowleg shrimp (*Farfantepenaeus californiensis*)



Mexico: Pacific, Gulf of Mexico, Gulf of California

Bottom trawls, Gillnets and entangling nets (unspecified), Suripera, Magdalena - Artisanal bottom trawl, Cast nets

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Seafood Watch Consulting Researcher

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

Table of Contents

About Seafood Watch

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

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

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

Guiding Principles

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

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

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

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

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

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

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

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

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

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

Summary

A number of shrimp species inhabit Mexican waters. The fisheries assessed in this report include all the major fisheries in Mexican waters: those for blue shrimp (*Litopenaeus stylirostris*), yellowleg shrimp (*Farfantepenaeus californiensis*), and whiteleg shrimp (*L. vannamei*) in the Pacific/Gulf of California; and brown shrimp (*F. aztecus*), white shrimp (*L. setiferus*), pink shrimp (*F. duorarum*), and seabob shrimp (*Xiphopenaeus kroyeri*) in the Gulf of Mexico. Ratings are broken down by gear and by industrial versus artisanal fleets. In the Mexican Pacific, industrial trawlers *(arrastre*), suripera nets, cast nets (*atarraya*), small trawls (Magdalena I), and gillnets (*chinchorro de línea*) are used, while in the Gulf of Mexico, trawlers, cast nets (*atarraya*), small trawls, and charanga nets were assessed.

Criterion 1: Impacts of the Fisheries on Shrimp Populations

Overall, managers consider shrimp stocks to be exploited at their maximum capacity. There are no comprehensive stock assessments for shrimp in Mexico, but there is evidence that concern is justified for some stocks. The most robust analyses conducted to date are on blue shrimp off Sinaloa-Nayarit and yellowleg shrimp off Sonora. Both were found to be of concern and are likely still being overexploited. There is some evidence that blue shrimp in the Upper Gulf of California and Sonora and pink and white shrimp in the Gulf of Mexico are also depleted. For all others, there does not appear to be any specific reason for concern, but as reference points have not been determined, current biomass and fishing mortality relative to a sustainable level is unknown.

Criterion 2: Impacts of the Fisheries on Other Species

Most fleets targeting shrimp in Mexico use non-selective gears, leading to bycatch of numerous other species. The exceptions are cast nets and charangas, which do not appear to have significant catch of species other than shrimp. The suripera fishery in Sinaloa-Nayarit is also relatively selective, though there are still some other species caught. Data on bycatch in the other fisheries comes from observer program data (Pacific only), off-season surveys, logbooks, and other published literature.

The main species of concern in the trawl fisheries are totoaba (Upper Gulf of California only), sea turtles, seahorse species and some species of sharks and rays. The abundance of some of these is a high concern because they are considered endangered or threatened (totoaba, sea turtles) or otherwise vulnerable due to possible overexploitation or life history characteristics. The implementation of mitigation measures in some fleets (most notably turtle excluder devices (TEDs) and fish excluder devices in the trawl fisheries and closed areas in the gillnet fisheries) is likely to have reduced fishing mortality on at least some of these species. Yet, no comprehensive analysis has been undertaken to determine the impact of on these populations of fishing mortality in the Mexican shrimp fisheries. Concern over sea turtle bycatch in the Pacific trawl fisheries (including the Gulf of California) is somewhat mitigated by evidence of increasing abundance of some of those populations, combined with data from the limited observer program in place, which suggests TEDs are proving effective at reducing or even eliminating sea turtle mortality. A lack of observer program for the Gulf of Mexico fisheries precludes this reassurance, especially as similar fisheries in the Gulf are known to be a major source of mortality for turtles.

In recent years, perhaps the most serious bycatch concern in the shrimp gillnet fisheries has been of vaquita in the Upper Gulf of California. Gillnetting for everything other than corvina is now prohibited in the area, so no analysis of the (former) shrimp fishery is presented in this assessment. The primary remaining bycatch concerns in gillnet fisheries are of sharks and rays, for the same reasons as in the trawl fisheries described above.

Criterion 3: Management Effectiveness

In the past few years, numerous improvements have been made in the Mexican shrimp fisheries, such as:

- The gillnet ban to protect vaquita.
- New research, modeling, expert workshops, and additional management efforts on shrimp.
- Expanded enforcement programs.
- Reinstatement of the onboard observer program and data analysis in the Pacific.
- Implementation of fish excluder devices in trawlers in addition to the mandatory TEDs in use for a long time.
- Public transparency, including the provision of compliance and enforcement data and observer data.
- Better outlook for most turtle populations.
- Fishery Improvement Projects/Fair Trade certification for two fisheries.

C3.1: Management Strategy and Implementation - Moderately effective

In Mexico, three government bodies (SAGARPA, CONAPESCA, and INAPESCA) implement a diversity of tools to manage the impacts of fishing on shrimp stocks and bycatch populations. The focus of many of the measures used in the fishery-including these temporary closures, but also permanent closures, gear restrictions, and a buyback program- have been designed to reduce effort on shrimp, which was determined to be too high more than a decade ago. While these measures have reduced the number of vessels in the industrial fishery, it is unclear what impact they've had overall on the combined effort in the industrial and artisanal fisheries. The impacts of the fishery on many of the shrimp populations is also unclear, as robust estimates of current fishing mortality relative to a sustainable level are generally not available. While the limited data and analyses available suggest some populations may be being fished at a sustainable level, others are apparently not.

C3.2: Bycatch Strategy – Moderately effective

There are no concerns over bycatch in the cast net and charanga fisheries, and no serious concerns over bycatch in the suripera and Magdalena I fisheries. Bycatch mitigation measures are in place in the trawl fisheries, including turtle excluder devices for all vessels in the artisanal and industrial trawl fleets, and finfish excluder devices in all vessels in the industrial trawl fleets. Also, a ban to fish within the 0 to 5 fathoms strip has been in place for several years for the industrial fleet. Mitigation measures are also in place in the gillnet fisheries, such as closed areas to protect shark and ray nursery grounds and sea turtle aggregation areas (and the Upper Gulf of California shrimp gillnet fishery is now banned out of concerns for vaquita). Although these are likely to be effective strategies in reducing bycatch mortality, there has been no thorough assessment of their effectiveness.

C3.3: Scientific Research and Monitoring – Highly effective (charanga, cast net); Moderately effective (suripera, Magdalena I and industrial trawlers in the Pacific); Ineffective (small trawls in the Pacific, all trawls in the Gulf of Mexico)

Shrimp stocks are regularly monitored through both commercial catch data and survey data, which are used to set the open season each year. Historically, limited analysis has been conducted on these data relative to identifying a sustainable level of catch, but analyses to determine these levels are now being conducted for some stocks (most recently in 2016). More work is needed to assess the impacts of the fishery on shrimp populations through more robust and comprehensive stock assessments, but enough research and monitoring is occurring on shrimp to be moderately effective for understanding the effects of fishing on these target populations.

Bycatch monitoring is far less developed in most fleets, a major weakness in the fleets that incidentally catch species of concern (e.g., rare, endangered, threatened, depleted, or overfished species). This includes all fleets

except the charanga (which catch only shrimp, though some of those populations are of concern) and cast net fleets in the Gulf of Mexico and the Pacific. Where there are data on bycatch, it is generally collected through logbooks and off-season surveys, but observer programs are necessary to properly assess impacts.

From 2004 to 2011, an onboard observer program was in place for the industrial fleet in the Pacific (including the Gulf of California) (CONAPESCA 2015). Yet, from 2011 to 2015 there was no observer monitoring program in any shrimp fishery except the cooperatives working with Del Pacifico FIP in Sinaloa, using the suripera and cooperatives working with the Thai Foon FIP, which used the Magdalena I gear in Bahia Magdalena. The observer program in the industrial fleet in the Pacific was recently reinstated for the 2015 to 2016 and 2016 to 2017 seasons, with an estimated 1.5% coverage (INAPESCA, 2017). Managers plan to expand it to at least 5% in future years. There is no observer program in the Gulf of Mexico, a serious concern given the potential impact of trawl fleets on species of concern such as turtles.

C3.4: Enforcement of Management Regulations – Moderately effective (industrial, suripera, and Magdalena I); Ineffective (other artisanal fleets)

Illegal fishing was identified in the past as a serious and complex problem within fisheries in Mexico, including shrimp. Since these accounts were published, the enforcement program in the shrimp fisheries has been strengthened, and the number of enforcement actions has increased. Government reports suggest that compliance with at least some of the regulations has improved, such as the VMS and TED regulations in the industrial fleet.

Enforcement efforts in place in the suripera fishery FairTrade Certification and the Magdalena I trawl fishery improvement project also suggest improved compliance in those fisheries. Until reports are available that suggest compliance is much improved in the rest of the artisanal fleet, however, serious concerns remain for that sector.

C3.5: Stakeholder inclusion – Highly effective

The process to review, evaluate, and revise management regulations, is often based on demand by producers and fishermen. In particular, for the shrimp fishery, stakeholders (including NGOs, universities, and researchers) are allowed to participate in the development process of Mexican Official Standards (NOMs). Federal laws govern the public's access to information, including fisheries information. The government generates reports and analyses, which are available to the public. Since the management process is transparent and includes some stakeholder consultation, stakeholder inclusion of the Mexican Pacific and GOM industrial and artisanal shrimp fisheries is deemed highly effective.

C4: Habitat and Ecosystem Impacts

Bottom trawling has adverse effects on a wide variety of ecosystems. The Mexican fleet operates mainly in soft sediments at moderate depth, and although these habitats can recover more rapidly, it is likely that the frequency and intensity of bottom trawling generates substantial impacts on them. Gillnets cause less habitat disturbance, but they still may disturb the seabed where they contact it. Cast, charanga, and suripera nets have a low impact on seafloor habitats and marine ecosystems because they contact only the seafloor where they are set or the contact is minimal.

Managers have tried to mitigate these impacts through reducing fishing effort, as well as reducing the area of operation for the trawlers close to the coast, and creating marine protected areas (MPAs); however, MPAs cover a very small portion of the fishing area in Mexican waters and the fishers' buyout program has been focused on the industrial fleet only. The Mexican Pacific and GOM industrial and artisanal fisheries generate a high level of bycatch. Yet, the extent of the impact of removing these bycatch species from the overall

ecosystem is unclear.

Information on Certification and Improvement Projects

A portion of the fisheries covered in this report is engaged in a Fishery Improvement Project (FIP): The industrial shrimp fishery in the Pacific led by PROMARMEX, the small-scale shrimp fishery in Magdalena Bay lead by Thai Foong, and the small scale Suripera fishery in Sinaloa lead by Del Pacifico that recently was awarded with FairTrade certification in Sinaloa. Engagement in a FIP does not affect the Seafood Watch score, because we base our assessments on the current situation. Monterey Bay Aquarium is a member organization of the Conservation Alliance for Seafood Solutions. The Alliance has outlined guidelines for credible Fishery Improvement Projects. As such, Seafood Watch will support procurement from fisheries engaged in a FIP provided it can be verified by a third party that the FIP meets the Alliance guidelines. It is not the responsibility of Monterey Bay Aquarium to verify the credibility or progress of a FIP, or promote the fisheries engaged in improvement projects.

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
Brown shrimp Mexico Gulf of Mexico, Bottom trawls, Mexico	Yellow (2.644)	Red (0.750)	Red (2.000)	Yellow (2.449)	**Avoid (1.765)**
Pink shrimp Mexico Gulf of Mexico, Bottom trawls, Mexico	Red (1.732)	Red (0.750)	Red (2.000)	Yellow (2.449)	**Avoid (1.588)**
Blue shrimp Mexico Gulf of California, Bottom trawls, Mexico, Nayarit	Red (1.000)	Red (1.299)	Yellow (3.000)	Yellow (2.449)	**Avoid (1.757)**
Blue shrimp Mexico Gulf of California, Bottom trawls, Mexico, Sinaloa-North-Central	Red (1.000)	Red (1.299)	Yellow (3.000)	Yellow (2.449)	**Avoid (1.757)**
Blue shrimp Mexico Gulf of California, Gillnets and entangling nets (unspecified), Mexico, Sinaloa-North-Central	Red (1.000)	Yellow (2.236)	Red (2.000)	Yellow (3.000)	**Avoid (1.913)**
Blue shrimp Mexico Gulf of California, Bottom trawls, Mexico, Sinaloa South	Red (1.000)	Red (1.299)	Yellow (3.000)	Yellow (2.449)	**Avoid (1.757)**
Blue shrimp Mexico Gulf of California, Bottom trawls, Mexico, Sonora	Red (1.732)	Red (0.750)	Yellow (3.000)	Yellow (2.449)	**Avoid (1.757)**
Blue shrimp Mexico Gulf of California, Gillnets and entangling nets (unspecified), Mexico, Sonora	Red (1.732)	Yellow (2.236)	Red (2.000)	Yellow (3.000)	**Avoid (2.195)**
Blue shrimp Mexico Gulf of California, Bottom trawls, Mexico, Upper Gulf of California	Red (1.732)	Red (1.299)	Yellow (3.000)	Yellow (2.449)	**Avoid (2.016)**

Yellowleg shrimp Mexico Gulf of California, Bottom trawls, Mexico, Nayarit	Yellow (2.644)	Red (0.750)	Yellow (3.000)	Yellow (2.449)	**Avoid (1.953)**
Yellowleg shrimp Mexico Gulf of California, Bottom trawls, Mexico, Sinaloa-North-Central	Yellow (2.644)	Red (0.750)	Yellow (3.000)	Yellow (2.449)	**Avoid (1.953)**
Yellowleg shrimp Mexico Pacific, Bottom trawls, Mexico, West Coast of Baja	Yellow (2.644)	Red (1.299)	Yellow (3.000)	Yellow (2.449)	**Good Alternative (2.241)**
Yellowleg shrimp Mexico Gulf of California, Bottom trawls, Mexico, Sinaloa South	Yellow (2.644)	Red (0.750)	Yellow (3.000)	Yellow (2.449)	**Avoid (1.953)**
Yellowleg shrimp Mexico Gulf of California, Bottom trawls, Mexico, Sonora	Red (1.000)	Red (1.299)	Yellow (3.000)	Yellow (2.449)	**Avoid (1.757)**
Yellowleg shrimp Mexico Gulf of California, Bottom trawls, Mexico, Upper Gulf of California	Yellow (2.644)	Red (1.299)	Yellow (3.000)	Yellow (2.449)	**Good Alternative (2.241)**
Whiteleg shrimp Mexico Pacific, Bottom trawls, Mexico, Gulf of Tehuantepec	Yellow (2.644)	Red (1.299)	Yellow (3.000)	Yellow (2.449)	**Good Alternative (2.241)**
Whiteleg shrimp Mexico Gulf of California, Bottom trawls, Mexico, Nayarit	Yellow (2.644)	Red (0.750)	Yellow (3.000)	Yellow (2.449)	**Avoid (1.953)**
Whiteleg shrimp Mexico Gulf of California, Bottom trawls, Mexico, Sinaloa-North-Central	Yellow (2.644)	Red (0.750)	Yellow (3.000)	Yellow (2.449)	**Avoid (1.953)**
Whiteleg shrimp Mexico Gulf of California, Bottom trawls, Mexico, Sinaloa South	Yellow (2.644)	Red (0.750)	Yellow (3.000)	Yellow (2.449)	**Avoid (1.953)**

Whiteleg shrimp Mexico Gulf of California, Cast nets, Mexico, Nayarit	Yellow (2.644)	Green (5.000)	Red (2.000)	Yellow (3.000)	**Good Alternative (2.984)**
Whiteleg shrimp Mexico Gulf of California, Cast nets, Mexico, Sinaloa South	Yellow (2.644)	Green (5.000)	Red (2.000)	Yellow (3.000)	**Good Alternative (2.984)**
Brown shrimp Mexico Gulf of Mexico, Cast nets, Mexico	Yellow (2.644)	Green (5.000)	Red (2.000)	Yellow (3.000)	**Good Alternative (2.984)**
White shrimp Mexico Gulf of Mexico, Bottom trawls, Mexico	Red (1.732)	Red (0.750)	Red (2.000)	Yellow (2.449)	**Avoid (1.588)**
Blue shrimp Mexico Pacific, Bottom trawls, Mexico, West Coast of Baja	Yellow (2.644)	Red (1.299)	Yellow (3.000)	Yellow (2.449)	**Good Alternative (2.241)**
Blue shrimp Mexico Pacific, Magdalena - Artisanal bottom trawl, Mexico, West Coast of Baja	Yellow (2.644)	Red (1.732)	Yellow (3.000)	Yellow (2.449)	**Good Alternative (2.408)**
Yellowleg shrimp Mexico Pacific, Magdalena - Artisanal bottom trawl, Mexico, West Coast of Baja	Yellow (2.644)	Red (1.732)	Yellow (3.000)	Yellow (2.449)	**Good Alternative (2.408)**
Yellowleg shrimp Mexico Pacific, Bottom trawls, Mexico, Gulf of Tehuantepec	Yellow (2.644)	Red (1.299)	Yellow (3.000)	Yellow (2.449)	**Good Alternative (2.241)**
Blue shrimp Mexico Gulf of California, Suripera, Mexico, Sinaloa-North-Central	Red (1.000)	Green (3.413)	Yellow (3.000)	Yellow (3.000)	**Good Alternative (2.354)**
Brown shrimp Mexico Gulf of Mexico, Traps (unspecified), Mexico	Yellow (2.644)	Red (1.732)	Red (2.000)	Yellow (3.000)	**Avoid (2.289)**

Pink shrimp Mexico Gulf of Mexico, Traps (unspecified), Mexico	Red (1.732)	Yellow (2.644)	Red (2.000)	Yellow (3.000)	**Avoid (2.289)**
Atlantic seabob Mexico Gulf of Mexico, Bottom trawls, Mexico, Seabob fishery	Yellow (2.644)	Red (1.299)	Red (2.000)	Yellow (2.449)	**Avoid (2.025)**
White shrimp Mexico Gulf of Mexico, Bottom trawls, Mexico, Seabob fishery	Red (1.732)	Red (1.299)	Red (2.000)	Yellow (2.449)	**Avoid (1.821)**

Scoring Guide

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

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

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

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

Introduction

Scope of the analysis and ensuing recommendation

In terms of landed weight and economic value, the most important species of shrimp that are caught in Mexican waters are: the blue shrimp (*Litopenaeus stylirostris*), brown shrimp (*Farfantepenaeus californiensis*), and white shrimp (*Litopenaeus vannamei*) in the Mexican Pacific, including Baja California, the Gulf of California, and the Mexican west coast of the Baja peninsula. This report examines these species and also discusses the brown shrimp (*Farfantepenaeus aztecus*), white shrimp (*Litopenaeus setiferus*), pink shrimp (*Farfantepenaeus duorarum*), and seabob shrimp (*Xiphopenaeus kroyeri*) caught in the Gulf of Mexico, since these represent the most important species in the region.

These resources and regions have been broken up into two main groups: industrial and artisanal fleet, each broken down by gear type.

Pacific/Gulf of California	
Gear	**Region**
Trawl	Upper Gulf of California, Sonora, Sinaloa, Nayarit, west coast of Baja, and Gulf of Tehuantepec
Gillnet	Sonora and Sinaloa
Cast net	Sinaloa, Nayarit
Magdalena I	West coast of Baja
Suripera	Sinaloa (some in the west coast of Baja)

Gulf of Mexico	
Gear	**Region**
Trawl	All Gulf of Mexico shrimp region
Charanga	Northern Gulf of Mexico
Cast net	Coastal zones
Gillnet	Coastal zones

Species Overview

Shrimp is one of the most valuable fishing resources in Mexico; it represents the third-highest productive resource in terms of volume, just behind sardine and tuna (SAGARPA 2015). The fishery accounts for 0.31% of employment in the country (Hernandez et al. 2000).

The Gulf of California supports more than 80% of the total catch derived from the Mexican Pacific shrimp fishery, whereas 15% is caught in the Gulf of Tehuantepec and less than 5% on the western coast of Baja California and the central Pacific coast of Mexico (INAPESCA 2000). Over 80% of industrial trawlers in the Mexican Pacific are established in three ports: Mazatlán, Sinaloa; Guaymas, Sonora; and Puerto Peñasco, Sonora (INAPESCA 2000).

In Guaymas, approximately 60% of the shrimp caught is from the industrial fishery and the reported shrimp catch has been variable from the late 1980s to the mid-1990s.

Five shrimp species are captured in the Mexican Pacific: brown shrimp (*F. californiensis*); blue shrimp (*L. stylirostris*); white shrimp (*L. vannamei*); crystal shrimp (*Farfantepenaeus brevirostris* and southern white shrimp (*Litopenaeus occidentalis*). Brown, blue, and white shrimp are caught in the highest quantities in the region, and the other species are caught and sold as a lower quality product, mostly for local consumption (FAO 2008) (CONAPESCA 2008).

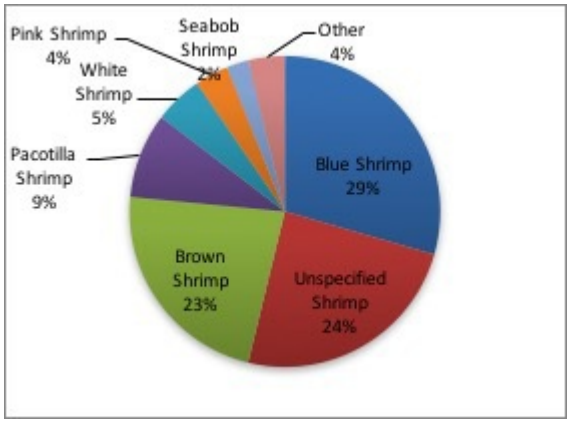

Figure 1 Shrimp proportion species caught in the Mexican Pacific (INAPESCA-CONAPESCA 2004).

Although trawls are the primary gear type used by industrial fleets in the Mexican Pacific, artisanal (ribereñas or pangas) fleets use a variety of gears including cast nets (*atarrayas*), entanglement or gillnets (*chinchorro de línea*; one net per pangas with a maximum permitted length of 200 m), suripera nets, and small trawl nets (changos) (CONAPESCA 2008). To better manage these species, fisheries managers have parsed these species out into regional groups and separate stocks: Upper Gulf of California (Zone 10), Sonora (Zone 20), Sinaloa North-Central (Zone 30), Sinaloa South (Zone 40), Nayarit (Zone 60), west coast of Baja California (Zone 50), and Gulf of Tehuantepec (zone 90) (INAPESCA-CONAPESCA 2004) (INAPESCA 2015).

Figure 2 Shrimp fishing zones base on INAPESCA-CONAPESCA tagging system.

In the GOM, the states of Tamaulipas, Veracruz, and Campeche present the highest landings (CONAPESCA b 2016). As in the Pacific, this fishery represents a big source for employment and income for many families (FAO

2003). In this region, four species compose the catch: Brown shrimp (*F. aztecus*); Pink shrimp (F. *duorarum*); White shrimp (*L. setiferus*) in the GOM, and in the Caribbean, Red Shrimp *(Farfantepenaeus brasiliensis)* and Pink Shrimp *(Sicyonia brevirostris)* are the target species.

The Campeche Bank was the most important area for the shrimp fishery in the GOM; however, declines in catches have been a constant for several years. Because of this, Tamaulipas and Veracruz have taken over regional importance; in 2014, 58% of the production was landed in these states (CONAPESCA database).

In the northern GOM (Tamaulipas y Veracruz), management regulations for Brown Shrimp are in place for each fleet, in order to reduce overfishing. As a result, Shrimp landings have remained stable. A no-fishing season in the northern GOM is in place and generally starts from May to July for the small-scale fleet, and from May to August for the industrial trawlers. In the Campeche Bank, the no-fishing season starts in May and ends in October every year. Shrimp production has remained consistent in both the Mexican Pacific and GOM over the last two decades (INAPESCA 2014 b), although some signals of decline have been documented for certain stocks (See Criterion 1) (SAGARPA-INAPESCA 2012) (CONAPESCA 2008) (SAGARPA-INAPESCA 2016).

Management scheme

Shrimp fishery in Mexico is managed by a network of federal agencies (FAO 2008). The Secretary of Agriculture, Livestock, Rural Development, Fisheries, and Food (SAGARPA in Spanish) is the agency responsible for establishing public policies to ensure optimum development of resources. The National Commission of Aquaculture and Fisheries (CONAPESCA) is the branch of SAGARPA committed to fisheries management, monitoring, and enforcement. CONAPESCA is responsible for administering the sustainable development of fisheries and aquaculture resources, promoting the development of chains of production, distribution, and consumption (CONAPESCA 2016).

At the Upper Gulf of California, the National Commission for Natural Protected Areas (CONANP) has operated public policies for reducing fishing effort and replacing traditional gears for alternative and selective fishing gears. CONANP operates in coordination with the Secretary of the Environment and Natural Resources (SEMARNAT), the agency responsible for enforcing the use of appropriate fishing gear and establishing fishing regulations inside protected areas and species. The National Fisheries Institute (INAPESCA) is responsible for gathering data and providing the scientific and technical basis for decision-making (FAO 2008) (CONAPESCA 2016). INAPESCA assesses the status of wild stocks and evaluates the impacts of fishing gears. It has a decentralized network of 13 Regional Centers of Fisheries Research or CRIPs. The CRIPs and INAPESCA-Regional Research Directors coordinate with shrimp producers by means of national shrimp fishery-focused workshops (CONAPESCA 2016). The overall mission of these agencies is to promote the long-term sustainability, conservation, and protection of natural resources (FAO 2008).

The shrimp fishery is managed under several laws (INAPESCA-CONAPESCA 2004)

- General Law of Sustainable Fisheries and Aquaculture defines access rights and obligations for users.
- The General Law for Cooperative Societies regulates fishers' organizations.
- Ley General del Equilibrio Ecológico y Protección al Ambiente (Environmental Law) focused on environmental protection.
- A draft of a Management Plan for Shrimp in the Mexican Pacific Ocean focuses on leading the fishery towards maintaining maximum economic profit as well as sustainability yields, biomass, recruitment, and yield. The plan also includes measures for reducing interactions with the environment or other fisheries, promoting economic benefits for the society, and improving the quality of the marine products; however, this draft is not public and is not in place yet.
- The National Committee for Fisheries and Aquaculture negotiates management and ordinance policies with fishers and fleet owners.

· Ley de Metrología y Normalización regulates the generation of Mexican Official Standards (NOMs). NOMs regulate mesh sizes, types of fishing gear used, spatial-temporal restrictions and other features.
· Gear and zone restrictions are regulated by the Mexican Official Standards (*Normas Oficiales Mexicana*s or NOMs); NOM 002-PESC-1993.

In addition to these agencies, the Gulf of California is considered a high conservation priority for various institutions and national and international NGOs. International foundations and agencies (e.g., The David and Lucile Packard Foundation, World Wildlife Fund, Conservation International, The Walton Family Foundation, and The Nature Conservancy, among others) have made strong, coordinated efforts to promote a comprehensive protection for Gulf of California marine ecosystems.

Production Statistics

Approximately 3.4 million t of shrimp are caught worldwide each year with 60% of shrimp production attributed to wild-caught fisheries and 40% attributed to aquaculture (FAO 2008). Mexico is the 7th largest producer of shrimp worldwide when wild-caught and aquaculture production are combined (NOAA-NMFS 2016).

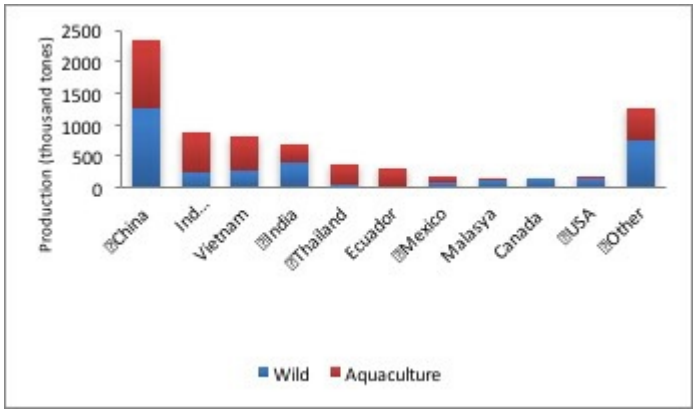

Figure 3 Average annual shrimp catches by country (FAO 2012)

In Mexico, shrimp production averages the 64,000 t according to the landing data from 2004 to 2014. In 2014, landings reached 71,000 t, of which 75% was landed in the Mexican Pacific, and 25% from the GOM (CONAPESCA landing data 2014). The industrial fleet (offshore) has been the major producer in the past, however, since 2010 both fleets have been showing closer levels of production. No data were available on the volume of shrimp caught by gear type for this assessment.

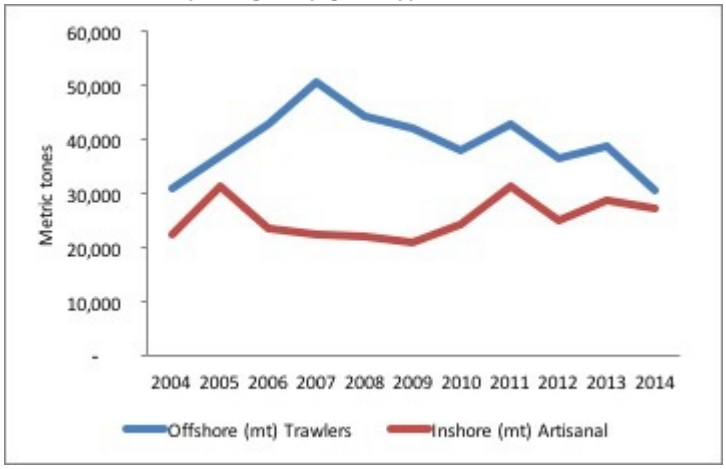

Figure 4 Volume of catch per fleet in the Mexican Pacific, from 2004 to 2015 (CONAPESCA Annual reports)

In terms of species proportions, the artisanal fleet catches mostly blue shrimp within the Gulf of California. The industrial fleet targets mostly brown shrimp (51%).

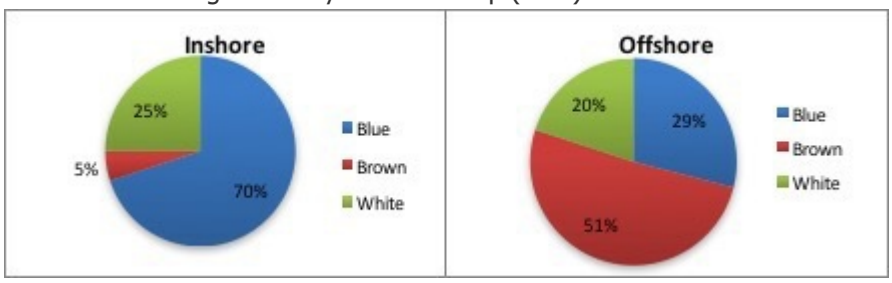

Figure 5 Composition of shrimp catches by species by fleet (inshore= Artisanal; offshore= Industrial) (FAO 2012)

List of shrimp species caught in the Mexican Pacific and the Gulf of Mexico with common names in English and Spanish as well as Scientific name

COMMON NAME		SCIENTIFIC NAME
Pacific/Gulf of California		
Yellowleg (Brown) shrimp	Camaron cafe	*Farfantepenaeus californiensis*
Blue shrimp	Camaron azul	*Litopenaeus stylirostris*
Whiteleg (White) shrimp	Camaron blanco	*Litopenaeus vannamei*
Gulf of Mexico		
Brown shrimp	Camaron cafe	*Farfantepenaeus aztecus*
Pink shrimp	Camaron rosado	*Farfantepenaeus duorarum*
White shrimp	Camaron blanco	*Litopenaeus setiferus*
Atlantic seabob	Camaron siete barbas	*Xiphopenaeus kroyeri*

Importance to the US/North American market.

In 2015, Mexico was the seventh largest shrimp exporter to the US (NMFS 2016). According to the statistics from the United States National Marine Fisheries Service, approximately 24,443 MT of shrimp (wild-caught and farmed), were sent to the U.S. in 2015 (NMFS 2016). In the U.S. market, Mexico accounts for approximately 5.6% of total seafood supply, and 8.3% of shrimp imports (Ardjosoediro and Bourns 2009). Imports to the US via Nogales, Arizona are dominated by shrimp from Mexico, at 62% of total seafood imports (NMFS 2016). It is unclear which species or the quantities of each species, nor what proportion of the imports come from industrial versus artisanal fleets, that are imported to the US, as Mexico does not record species but rather by size.

Common and market names.

In general, the market name for all Mexican species is quite simply "shrimp." The common name varies by species.

Primary product forms

Most of the Mexican shrimp is exported complete (headed), frozen, and packed in five-pound boxes called "marquetas" with similar sizes (pers. comm., Sergio Castro Del Pacifico 2016). Within the national market, mostly small and medium size shrimp is sold fresh, or frozen. In general, the larger sizes are exported and the smaller shrimp remain for the domestic market.

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

ATLANTIC SEABOB			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
Mexico/Gulf of Mexico | Bottom trawls | Mexico | Seabob fishery	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)

BLUE SHRIMP			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
Mexico/Gulf of California | Bottom trawls | Mexico | Nayarit	1.00: High Concern	1.00: High Concern	Red (1.000)
Mexico/Gulf of California | Bottom trawls | Mexico | Sinaloa-North-Central	1.00: High Concern	1.00: High Concern	Red (1.000)
Mexico/Gulf of California | Gillnets and entangling nets (unspecified) | Mexico | Sinaloa-North-Central	1.00: High Concern	1.00: High Concern	Red (1.000)

Mexico/Gulf of California | Bottom trawls | Mexico | Sinaloa South	1.00: High Concern	1.00: High Concern	Red (1.000)
Mexico/Gulf of California | Bottom trawls | Mexico | Sonora	1.00: High Concern	3.00: Moderate Concern	Red (1.732)
Mexico/Gulf of California | Gillnets and entangling nets (unspecified) | Mexico | Sonora	1.00: High Concern	3.00: Moderate Concern	Red (1.732)
Mexico/Gulf of California | Bottom trawls | Mexico | Upper Gulf of California	1.00: High Concern	3.00: Moderate Concern	Red (1.732)
Mexico/Pacific | Bottom trawls | Mexico | West Coast of Baja	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Pacific | Magdalena - Artisanal bottom trawl | Mexico | West Coast of Baja	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Gulf of California | Suripera | Mexico | Sinaloa-North-Central	1.00: High Concern	1.00: High Concern	Red (1.000)

BROWN SHRIMP			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
Mexico/Gulf of Mexico | Bottom trawls | Mexico	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Gulf of Mexico | Cast nets | Mexico	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Gulf of Mexico | Traps (unspecified) | Mexico	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)

PINK SHRIMP			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
Mexico/Gulf of Mexico | Bottom trawls | Mexico	1.00: High Concern	3.00: Moderate Concern	Red (1.732)

Mexico/Gulf of Mexico | Traps (unspecified) | Mexico	1.00: High Concern	3.00: Moderate Concern	Red (1.732)

WHITE SHRIMP			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
Mexico/Gulf of Mexico | Bottom trawls | Mexico	1.00: High Concern	3.00: Moderate Concern	Red (1.732)
Mexico/Gulf of Mexico | Bottom trawls | Mexico | Seabob fishery	1.00: High Concern	3.00: Moderate Concern	Red (1.732)

WHITELEG SHRIMP			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
Mexico/Pacific | Bottom trawls | Mexico | Gulf of Tehuantepec	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Gulf of California | Bottom trawls | Mexico | Nayarit	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Gulf of California | Bottom trawls | Mexico | Sinaloa-North-Central	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Gulf of California | Bottom trawls | Mexico | Sinaloa South	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Gulf of California | Cast nets | Mexico | Nayarit	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Gulf of California | Cast nets | Mexico | Sinaloa South	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)

YELLOWLEG SHRIMP			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
Mexico/Gulf of California | Bottom trawls | Mexico | Nayarit	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)

Mexico/Gulf of California | Bottom trawls | Mexico | Sinaloa-North-Central	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Pacific | Bottom trawls | Mexico | West Coast of Baja	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Gulf of California | Bottom trawls | Mexico | Sinaloa South	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Gulf of California | Bottom trawls | Mexico | Sonora	1.00: High Concern	1.00: High Concern	Red (1.000)
Mexico/Gulf of California | Bottom trawls | Mexico | Upper Gulf of California	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Pacific | Magdalena - Artisanal bottom trawl | Mexico | West Coast of Baja	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
Mexico/Pacific | Bottom trawls | Mexico | Gulf of Tehuantepec	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)

PACIFIC (including the Gulf of California)

Summary

No comprehensive stock assessments have been carried out for any Mexican shrimp populations, though a biomass dynamic model has been used to assess two stocks very recently. Researchers suggest that the stock–recruitment relationship is driven by environmental conditions rather than by the fishery, based on the fact that these shrimp populations only live for a year or two. For this reason, no reference points have been calculated for the stocks. Instead, managers rely on CPUE indices from off-season sampling as an indicator of relative stock biomass.

Various data–poor approaches have been employed to assess the status of shrimp stocks, in some cases using these survey CPUE data, in others using commercial catch data.

Taken together, these approaches suggest a "high" concern is appropriate for abundance of blue shrimp in Sinaloa–Nayarit and the Upper Gulf of California, and yellowleg shrimp in Sonora. Abundance of other stocks is considered a "moderate" concern, primarily because of the uncertainty of current biomass versus a sustainable level.

In the past, several researchers have found that fluctuations in wild shrimp abundance are correlated with inter‐annual variations in ocean conditions {Lopez-Martinez 2000}. El Niño Southern Oscillation (ENSO) years have been described as having negative impacts on a number of fish populations, but shrimp species appear to respond positively to ENSO events {Leal-Gaxiola et al. 2001} {Aragón-Noriega and Calderón-Aguilera 2000}; {Galindo-Bect et al. 2000} {Lopez-Martinez 2000}. Some calculations on the BMSY had been developed {INAPESCA 2000}, but no reference points have been defined either in the National Fisheries Chart nor the Official Norm from shrimp {NOM‐002‐PESC‐1993}. Instead, managers rely on CPUE indices from off-season surveys as an indicator of relative stock biomass {SAGARPA-INAPESCA 2016}.

In 2000, INAPESCA evaluated the different shrimp species along the Pacific regions {INAPESCA 2000}. This information was presented in the National Fisheries Chart {DOF 2006} and included in a draft of the Shrimp Fisheries Management plan {INAPESCA-CONAPESCA 2004} (not published). INAPESCA used two stock assessment models: a) The Schaefer Dynamic Biomass model proposed by Hilborn and Walters (1992), which uses catch and effort data; and b) the age structure model with delay recruitment (EERR) by Deriso (1980), which is more complex and includes biological characteristics of the species, like species growth, survival rates, and recruitment. For the assessment, managers assumed that both fleets (artisanal and industrial) have access to all the components of the stock.

Based on the results of the evaluation in 2000, CONAPESCA and INAPESCA indicated that all three penaeid species in the Mexican Pacific—as a whole—were at the maximum sustainable exploitation and included this information on the National Fisheries Chart in 2012 (CNP) {DOF 2012}.

As part of the constant monitoring of the species, INAPESCA samples inshore (coastal lagoons) and offshore (marine) waters during off‐season along the Pacific coast.

Information collected for each species includes relative abundance (CPUE expressed as kg/hour or area), size, and sex and maturity composition. Though the main assessment tool had been dynamic production modeling, these models have not been applied to all the shrimp stocks or to all the species or regions where fisheries occur along the Pacific Coast of Mexico. The main tool used presently by managers to assess the status of the stocks and to make management decisions is the interannual variation in relative abundance.

Trends in CPUE over a five‐year period, spawning biomass, and changes in size‐structure are used to determine the beginning and closure of the fishing season and to predict when shrimp production will be optimized.

INAPESCA has conducted a number of analyses using the sample data. CPUE trend data from 1998 to 2016 are available on the INAPESCA reports in their website. Also, INAPESCA graciously developed two other analyses available to Seafood Watch for this assessment {INAPESCA b 2016}.

For these analyses, INAPESCA estimated the status of two stocks (Sinaloa North‐Central blue shrimp and Sonora yellowleg shrimp) using the off‐season abundance index (considered by managers as a good indicator of the catch during fishing season) and catch data during the fishing season. Researchers adjusted the data (through maximum likelihood method) to the biomass dynamic model proposed by Hilborn and Mangel (1997) and a catch at size model {Deriso 1980}.

INAPESCA has also developed benchmarks of fishery performance based on catch data from the commercial fishery using an approach based on Branch et al. (2011) {INAPESCA b 2016}. The approach consists of comparing the average catch of the last three seasons against the historical average. The method was modified from that used by Branch et al. (2011), using average historical catch, rather than maximum historical catch because of the belief that stocks were at MSY at the beginning of the time series and the fact that shrimp show high variability in annual recruitment {INAPESCA b 2016}. It is unclear how these modifications affect the robustness of the approach. The fishery was classified according to the following thresholds: fully exploited (>

0.8), overexploited (0.3 to 0.8), or collapsed (<0.3).

GULF OF MEXICO

Summary

Like the Mexican Pacific shrimp species, stock assessments for Gulf of Mexico penaeids are performed by INAPESCA using the same models that provide results with a high degree of uncertainty (EERR) {Deriso 1980} {SAGARPA-INAPESCA 2012}. Managers have indicated that all species in the GOM region have shown drastic declines in catches over the last 25 years with the exception of brown shrimp, which have maintained stable landings over the last quarter decade {SAGARPA 2012b}. Biomass values for the GOM penaeid species are not publicly available; however, in 2008, based on the 2014 offseason report, managers listed pink shrimp as depleted {INAPESCA 2014}, and white shrimp as depleted but recovering {INAPESCA 2014}. White shrimp stocks have shown some signs of recovery in the past {INAPESCA 2014 b}, but in the last report from INAPESCA {INAPESCA 2014 b}, managers still considered the stock as depleted. For these reasons, the white shrimp and pink stock are deemed a "high" concern.

Although the uncertainty surrounding the stock trends is high, brown shrimp and seabob are generally considered to be healthy {INAPESCA 2014 b}. Since reference points have not been determined, however, current biomass relative to a sustainable level is unknown. As this species (and all shrimp assessed in this report) are not considered highly vulnerable to overfishing based on a Productivity|Susceptibility Analysis (see above), a rating of "moderate" concern is applied.

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.*

ATLANTIC SEABOB

Factor 1.1 - Abundance

MEXICO/GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY

Moderate Concern

This is a species exploited by the artisanal fleet in Campeche; it produces around 1,200 MT per year (CONAPESCA b 2012), although from 2004 to 2014 the average production has been around the 850 t/year (INAPESCA 2014). Managers believed that the stock was close to the B_{MSY} (INAPESCA 2000) (INAPESCA 2014), but have indicated that without quantitative biomass estimates; uncertainty is high (DOF 2012). Therefore, seabob shrimp stocks in the GOM are deemed a "moderate" concern as they are not highly vulnerable to overfishing (see PSA above).

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY

Moderate Concern

Managers have indicated that all species in the GOM region have shown drastic declines in catches over the last 25 years with the exception of brown shrimp, which has maintained stable landings over the last quarter decade (DOF 2012). Regulations such as closures have been established in an attempt to protect reproduction process, and increase catches of the species (INAPESCA c 2012). Mixed results for the species have been achieved.

There are no quantitative estimates of fishing mortality in relation to F_{MSY} to determine biological reference points for GOM shrimp species. A 2005 study estimated F_{MSY} for seabob shrimp and indicated that two years of landings illustrated that the fishery had exceeded its fishing threshold (Wakida-Kusunoki 2005). In 2011, however, seabob landings remained below this threshold (INAPESCA c 2012). Without more comprehensive data on effort and average landings, fishing mortality for the GOM shrimp species is unknown. Therefore, fishing mortality for the GOM shrimp species is rated as "moderate" concern for brown, pink, seabob, and white shrimp.

Justification:

In 2005 F_{MSY} for seabob shrimp was estimated in 1,700 MT (Wakida‐Kusunoki 2005). Fishery‐dependent data from the 1998 to 2000 fishing seasons showed catch rates exceeding this number (INAPESCA c 2012); however, catch data from 2011 show landings to be at 1,211 MT, below the calculated F_{MSY} (CONAPESCA 2012b). So far, it is unclear whether effort and season restrictions are preventing overfishing from occurring in the GOM seabob fishery (Núñez-Márquez and Wakida 2003). No recent quantitative estimates of fishing mortality are against F_{MSY}. Because of this uncertainty, seabob shrimp mortality is deemed a "moderate" concern.

BLUE SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT

High Concern

The biomass dynamic model indicates the stock is overfished in the North‐Central region ($B_{CURRENT}/B_{MSY}$=0.43 (2600/6000)).

CPUE data for the stock indicates a relatively stable trend around the historical average, with most abundance estimates below the average, but punctuated with very high abundance estimates at different times since the mid‐2000s depending on area. Point estimates for 2015 are below the historical average in all regions.

The catch at size analysis suggests an increase in biomass from 2012 to 2013 and then a decline.

The benchmark analysis led INAPESCA to classify blue shrimp from Sinaloa and Nayarit as fully exploited (average catch over the last three seasons over average historical catch = 0.99).

In summary, the multiple analyses suggest a need for concern about the abundance in this stock. It is thus rated here as a high concern.

Justification:

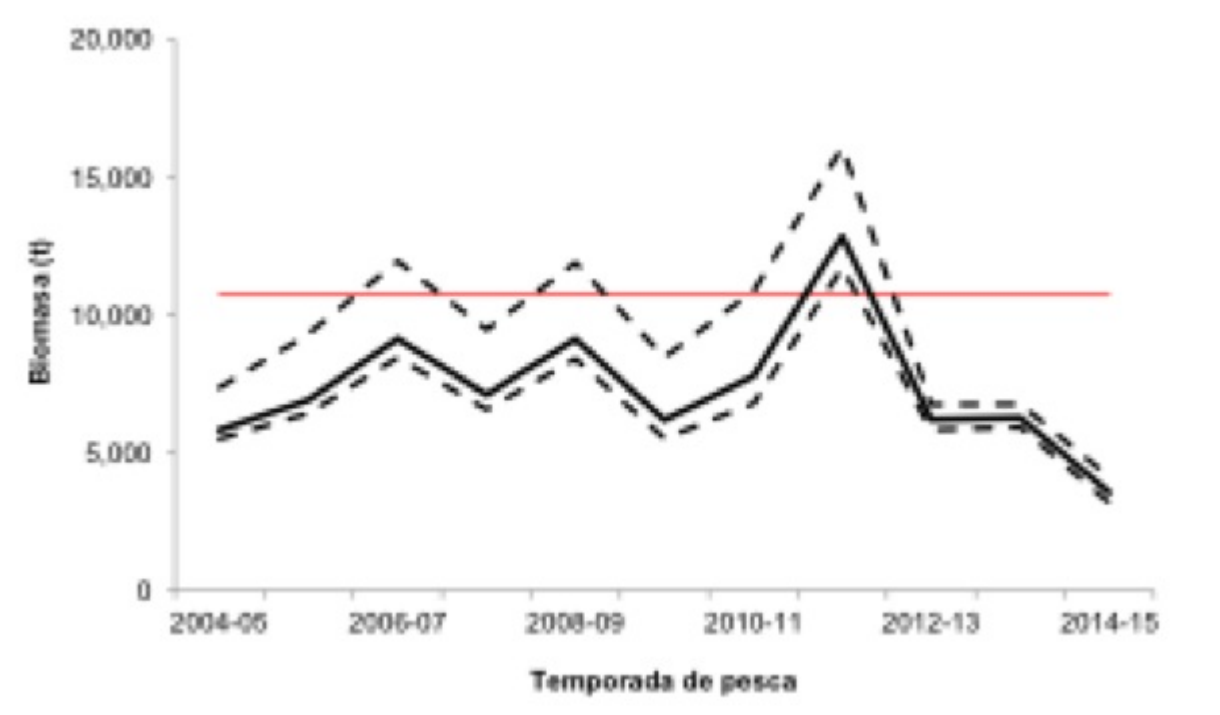

Figure 6 Estimated biomass of blue shrimp in Sinaloa North against the BMSY. The bold black line is the average biomass by season with its confidence intervals. The red line represents the biomass needed to reach the MSY (INAPESCA 2016)

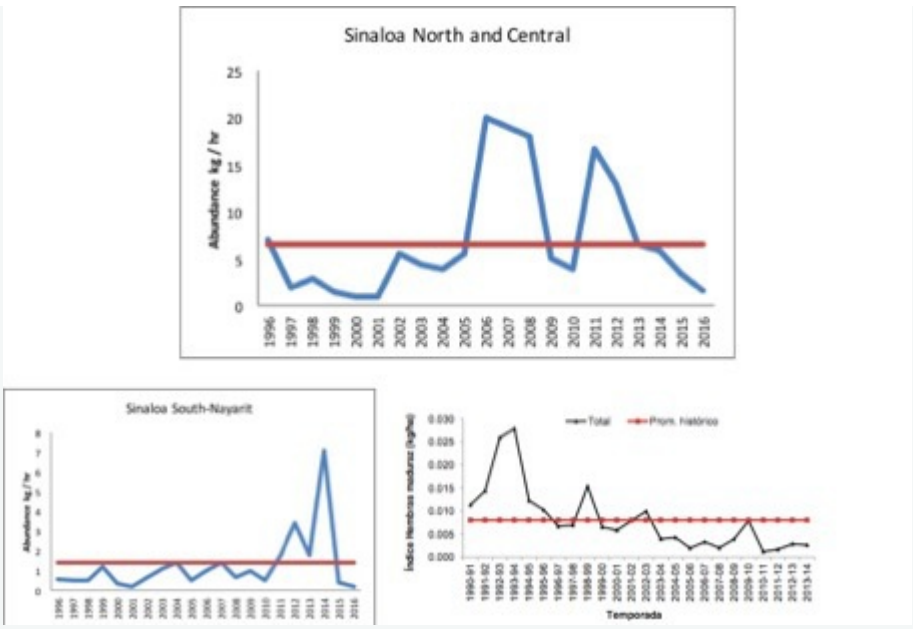

Figure 7 a) CPUE values and historical average (red line) for Blue shrimp stocks in Sinaloa North and Sinaloa South- Nayarit from 1996 to 2016 (Data from INAPESCA annual off season monitoring reports) b) Number of mature females in the Sinaloa coastal lagoons from the 1990-91 to 2013-2014 season (Source: Chavez-Herrera, et al., 2014)

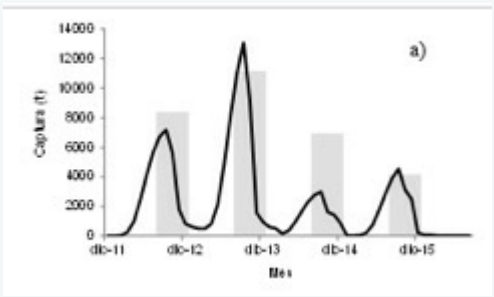

Figure 8 Blue shrimp catch at age changes from December 2011 to December 2015. (INAPESCA end of the season reports)

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT

High Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a high concern. This rating is applied to blue shrimp from the whole of Sinaloa and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing and yet have (nonlsignificant) increasing (Sinaloa North Central blue shrimp) or (nonlsignificant) stable CPUE trends

(Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

BLUE SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO/GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL
MEXICO/GULF OF CALIFORNIA, SURIPERA, MEXICO, SINALOA-NORTH-CENTRAL

High Concern

The biomass dynamic model indicates the stock is overfished in the North|Central region ($B_{CURRENT}/B_{MSY}$=0.43 (2600/6000)).

CPUE data for the stock indicates a relatively stable trend around the historical average, with most abundance estimates below the average, but punctuated with very high abundance estimates at different times since the mid|2000s depending on area. Point estimates for 2015 are below the historical average in all regions.

The catch at size analysis suggests an increase in biomass from 2012 to 2013 and then a decline.

The benchmark analysis led INAPESCA to classify blue shrimp from Sinaloa and Nayarit as fully exploited (average catch over the last three seasons over average historical catch = 0.99).

In summary, the multiple analyses suggest a need for concern about the abundance in this stock. It is thus rated here as a high concern.

Justification:

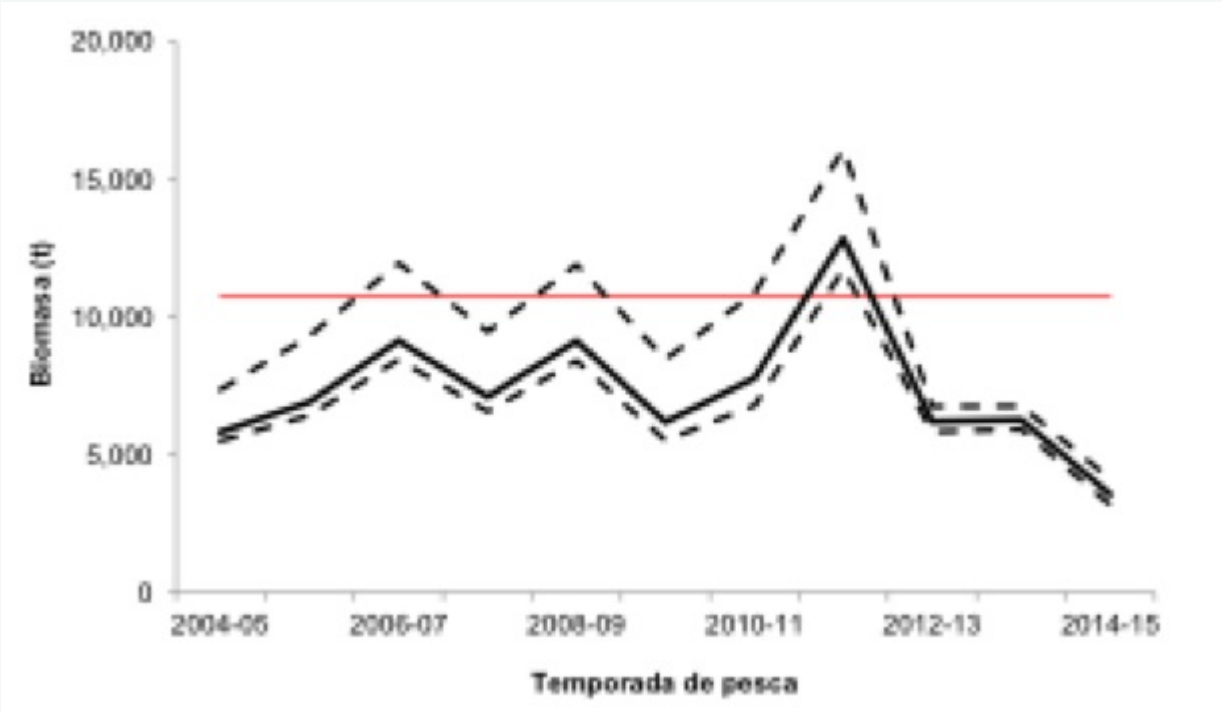

Figure 9 Estimated biomass of blue shrimp in Sinaloa North against the BMSY. The bold black line is the average biomass by season with its confidence intervals. The red line represents the biomass needed to reach the MSY (INAPESCA 2016)

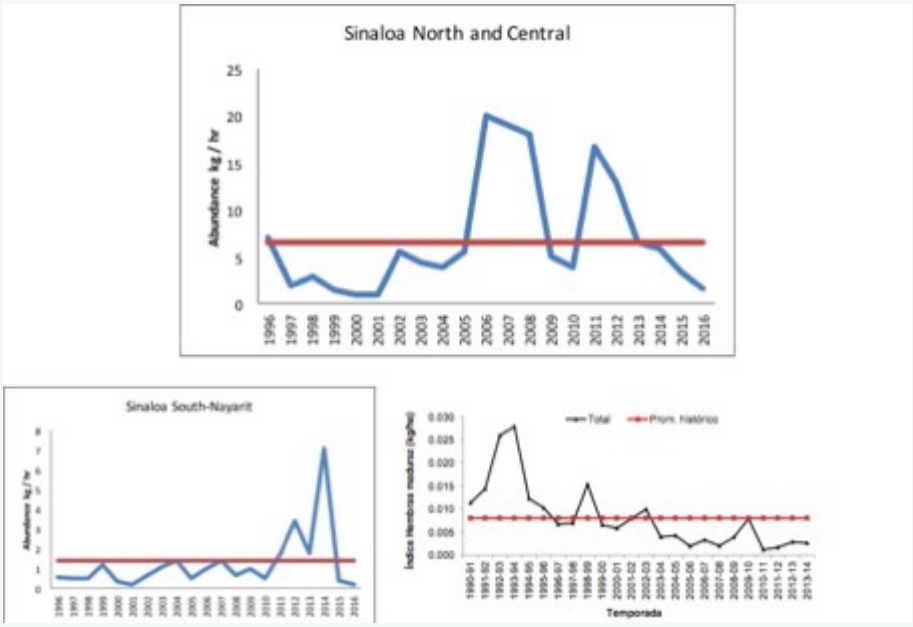

Figure 10 a) CPUE values and historical average (red line) for Blue shrimp stocks in Sinaloa North and Sinaloa South- Nayarit from 1996 to 2016 (Data from INAPESCA annual off season monitoring reports) b) Number of mature females in the Sinaloa coastal lagoons from the 1990-91 to 2013-2014 season (Source: Chavez-Herrera, et al., 2014)

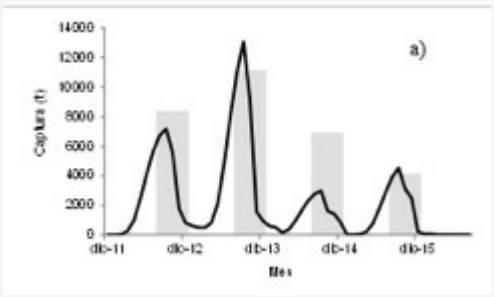

Figure 11 Blue shrimp catch at age changes from December 2011 to December 2015. (INAPESCA end of the season reports)

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO/GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL
MEXICO/GULF OF CALIFORNIA, SURIPERA, MEXICO, SINALOA-NORTH-CENTRAL

High Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6,

respectively) (INAPESCA b 2016) and are thus a high concern. This rating is applied to blue shrimp from the whole of Sinaloa and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing and yet have (non‐significant) increasing (Sinaloa North Central blue shrimp) or (non‐significant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

BLUE SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH

High Concern

The biomass dynamic model indicates the stock is overfished in the North‐Central region ($B_{CURRENT}/B_{MSY}$=0.43 (2600/6000)).

CPUE data for the stock indicates a relatively stable trend around the historical average, with most abundance estimates below the average, but punctuated with very high abundance estimates at different times since the mid‐2000s depending on area. Point estimates for 2015 are below the historical average in all regions.

The catch at size analysis suggests an increase in biomass from 2012 to 2013 and then a decline.

The benchmark analysis led INAPESCA to classify blue shrimp from Sinaloa and Nayarit as fully exploited (average catch over the last three seasons over average historical catch = 0.99).

In summary, the multiple analyses suggest a need for concern about the abundance in this stock. It is thus rated here as a high concern.

Justification:

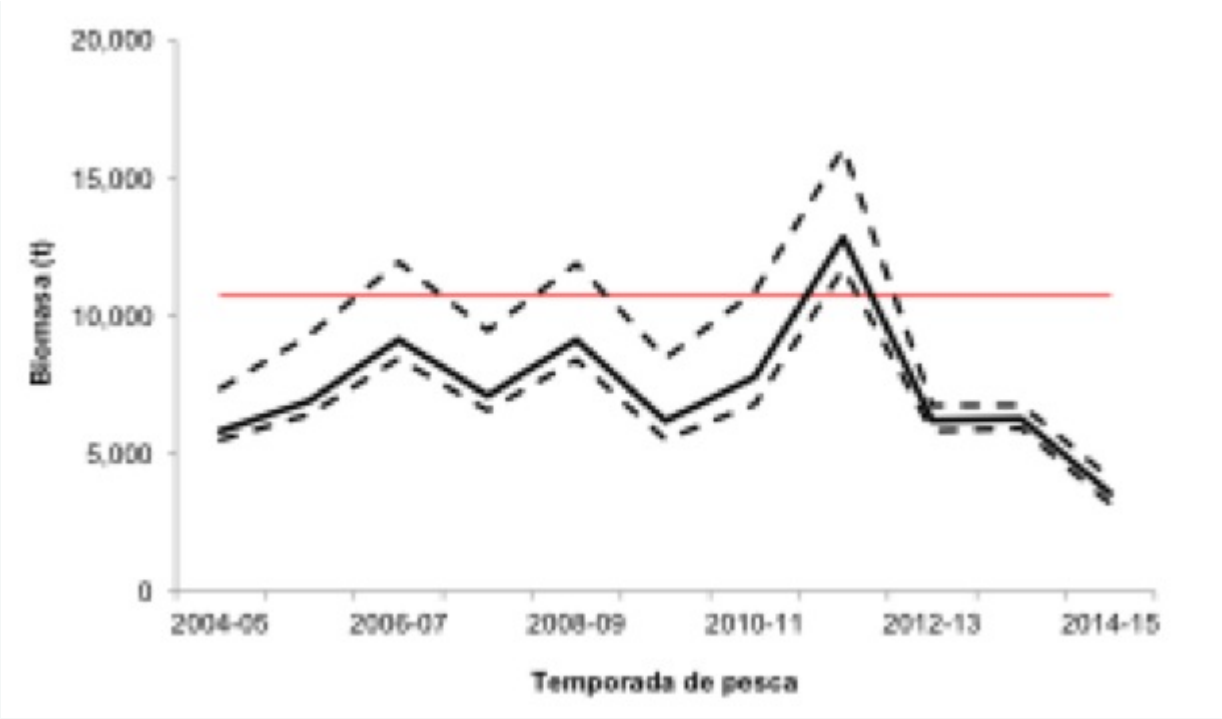

Figure 12 Estimated biomass of blue shrimp in Sinaloa North against the BMSY. The bold black line is the average biomass by season with its confidence intervals. The red line represents the biomass needed to reach the MSY (INAPESCA 2016)

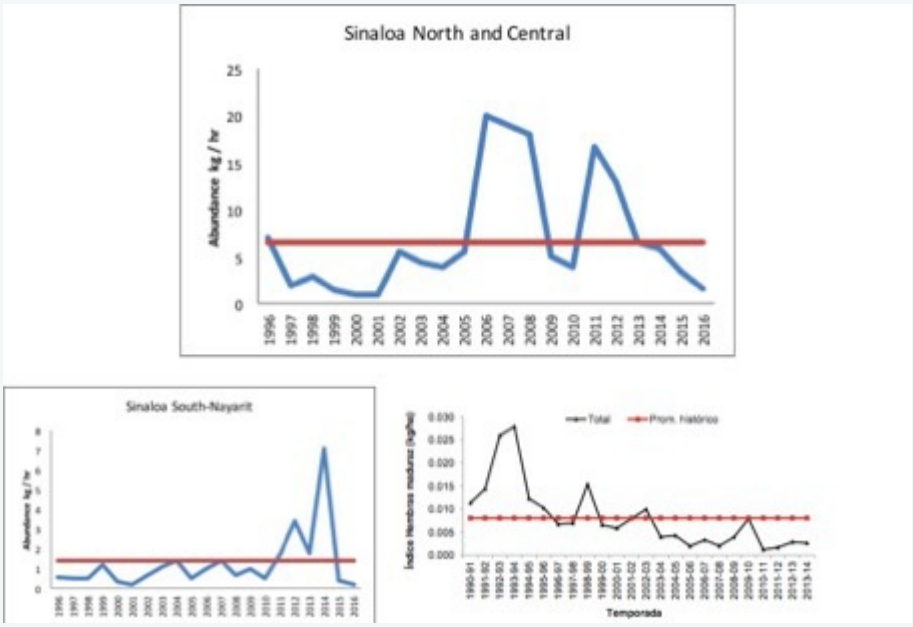

Figure 13 a) CPUE values and historical average (red line) for Blue shrimp stocks in Sinaloa North and Sinaloa South- Nayarit from 1996 to 2016 (Data from INAPESCA annual off season monitoring reports) b) Number of mature females in the Sinaloa coastal lagoons from the 1990-91 to 2013-2014 season (Source: Chavez-Herrera, et al., 2014)

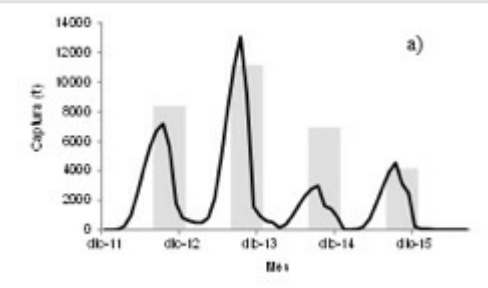

Figure 14 Blue shrimp catch at age changes from December 2011 to December 2015. (INAPESCA end of the season reports)

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH

High Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a high concern. This rating is applied to blue shrimp from the whole of Sinaloa and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing and yet have (nonlsignificant) increasing (Sinaloa North Central blue shrimp) or (nonlsignificant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

BLUE SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO/GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA

High Concern

CPUE data showed a relatively stable trend below the historical average, a marked increase in 2014, followed by a decline to back below the average in 2015 and 2016.

The benchmark analysis led INAPESCA to classify the stock as overexploited (average catch over the last three seasons over average historical catch = 0.34). In summary, the benchmark analysis suggests a need for concern about the abundance in this stock. It is thus rated here as a "high" concern.

Justification:

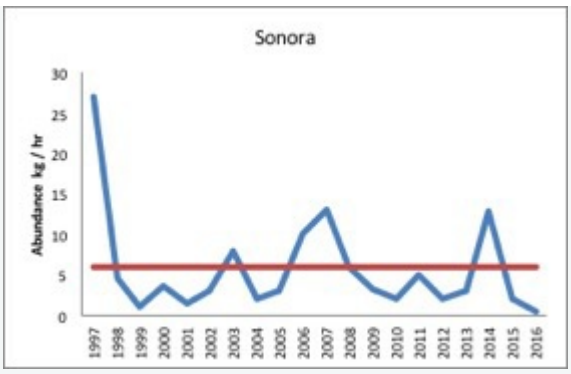

Figure 15 CPUE values and historical average (red line) for Blue shrimp stock in Sonora, from 1996 to 2016 (INAPESCA annual off season reports)

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO/GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA

Moderate Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both of these cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a "high" concern. This rating is applied to blue shrimp from the whole of Sinaloa South and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing, and yet have (nonlsignificant) increasing (Sinaloa North Central blue shrimp) or (nonlsignificant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

BLUE SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA

High Concern

No other blue shrimp stocks have been assessed using the biomass dynamic model or catch at size analysis. Because reference points have not been determined, current biomass relative to a sustainable level is unknown; however, the CPUE trend for blue shrimp from the Upper Gulf of California has been declining since 2009, so a rating of "high" concern is applied.

Justification:

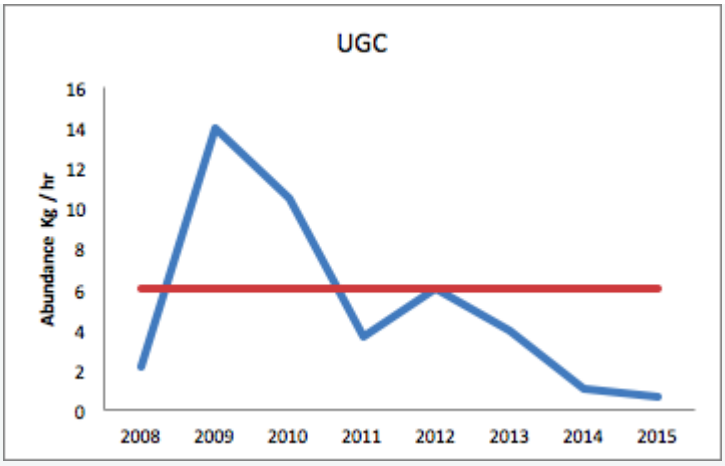

Figure 16 CPUE values and historical average (red line) for Blue shrimp stocks in UGC from 2008 to 2016 (Data from INAPESCA annual offseason monitoring reports)

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA

Moderate Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both of these cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a "high" concern. This rating is applied to blue shrimp from the whole of Sinaloa South and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing, and yet have (nonlsignificant) increasing (Sinaloa North Central blue shrimp) or (nonlsignificant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

BLUE SHRIMP

Factor 1.1 - Abundance

MEXICO/PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO/PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

Moderate Concern

No other blue shrimp stocks have been assessed using the biomass dynamic model or catch at size analysis. The CPUE and benchmarks for blue shrimp from the West Coast of Baja California do not indicate any particular reason for concern; however, since reference points have not been determined, current biomass relative to a sustainable level is unknown. Because this species (and all shrimp assessed in this report) are not considered highly vulnerable to overfishing based on a Productivity-Susceptibility Analysis (see below), a rating of "moderate" concern is applied.

Justification:

Blue shrimp, West Coast of Baja

Benchmarks: BCS (1.98, fully exploited)

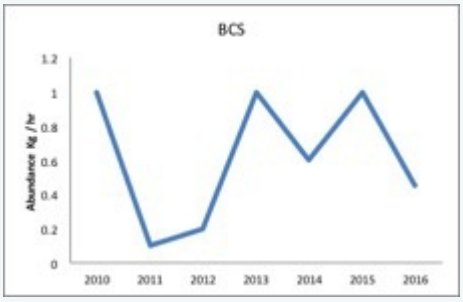

Figure 17 CPUE values for Blue shrimp stock in the West coast of Baja, from 2008 to 2016 (INAPESCA annual off season reports)

Productivity|Susceptibility Analysis:

Scoring Guidelines

1.) Productivity score (P) = average of the productivity attribute scores (p1, p2, p3, p4 (finfish only), p5 (finfish only), p6, p7, and p8 (invertebrates only))

2.) Susceptibility score (S) = product of the susceptibility attribute scores (s1, s2, s3, s4), rescaled as follows: S = ((s1 ∗ s2 ∗ s3 ∗ s4) − 1/ 40) + 1 .

3.) Vulnerability score (V) = the Euclidean distance of P and S using the following formula:

$V = \sqrt{(P2 + S)2}$

Inherent Vulnerability

Inherent vulnerability is a function of the biological productivity of the stock and its susceptibility to the fishery (based on the scoring guidelines above and the tables below). It is used to help guide scoring in cases where there is no stock assessment (see abundance scoring tables on pages 7 and 8 of the Seafood Watch Standard for Fisheries for more information). The default scores for susceptibility were used (score=2.325).

Shrimp are highly productive species (productivity score of 1), and are considered of low vulnerability overall (score of 2.60).

Productivity Attribute	Relevant Information	Source	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Average age at maturity	Within 1st 12 months	(FAO, 2000, SAGARPA/INAPESCA, 2000)	1
Average maximum age	**1.5-2 years**	**(Lopez, et al. 2005)**	**1**
Fecundity	>20,000 eggs a year	Perez Velazquez and Garcia 2000	2
Reproductive strategy	**Broadcast Spawner**	**(Palomares & Pauly, 2012)**	**1**
Trophic level	2		
Density dependence (invertebrates only)	**Compensatory dynamics demonstrated**	**(Perez-Castañeda & Defeo, 2005)**	**1**

Figure 18 Productivity Attributes

Susceptibility Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Areal overlap (Considers all fisheries)	*Default value used*	3
Vertical overlap (Considers all fisheries)	***Default value used***	**3**
Selectivity of fishery (Specific to fishery under assessment)	*Default value used*	2
Post-capture mortality (Specific to fishery under assessment)	***Default value used***	**3**

Figure 19 Susceptibility Attributes

Factor 1.2 - Fishing Mortality

MEXICO/PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO/PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

Moderate Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both of these cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a "high" concern. This rating is applied to blue shrimp from the whole of Sinaloa South and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing, and yet have (nonlsignificant) increasing (Sinaloa North Central blue shrimp) or (nonlsignificant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

BROWN SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO/GULF OF MEXICO, CAST NETS, MEXICO
MEXICO/GULF OF MEXICO, TRAPS (UNSPECIFIED), MEXICO

Moderate Concern

Brown shrimp are the most commercially important species in the northwest Gulf of Mexico accounting for more than 95% of combined shrimp landings (INAPESCA 2000). Some dated studies have mentioned that brown shrimp stock in the northwest Gulf of Mexico was close to the maximum sustainable yield (Arreguin-Sanchez et al. 1997) (SAGARPA 2014). According to INAPESCA, fishing yield, landings and size proportion of the catch (*"camaron de linea"*)/smaller size (*"pacotilla"*) trends are direct indicators of the status of the stock (INAPESCA b 2012).

Nonetheless, without biomass estimates in relation to B_{MSY} and use of the dynamic Schaefer model, abundance relative to a sustainable level is unknown. As brown shrimp are not considered to be highly vulnerable to overfishing (see above), a rating of "moderate" concern is applied.

Justification:

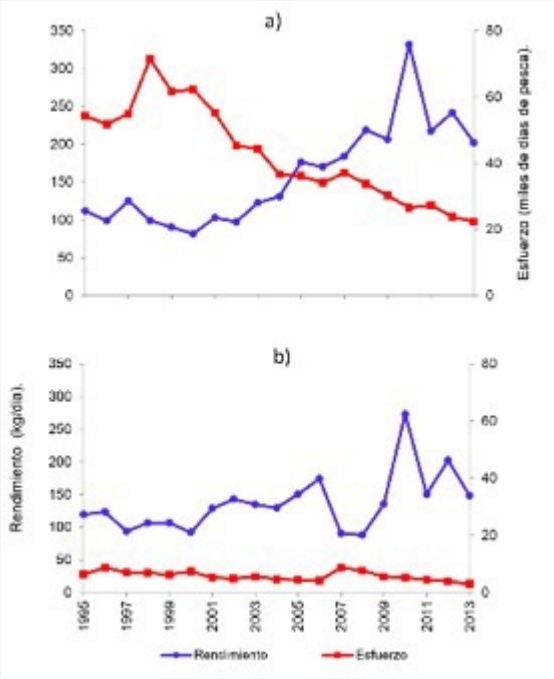

Figure 20 Brown shrimp fishing yield in kg/day (blue line) and fishing effort expressed in thousand fishing days (red line) for Tamaulipas a) and Veracruz (b) in the Gulf of Mexico. (Figure from INAPESCA, 2014)

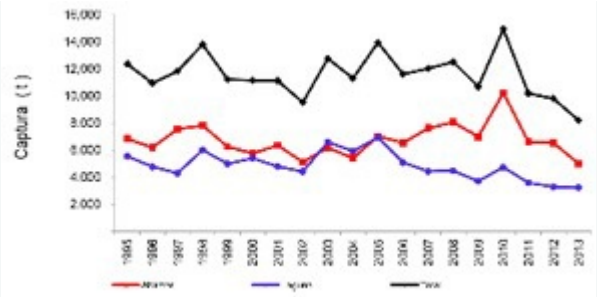

Figure 21 Brown shrimp landings in tonnes (t) in the Gulf of Mexico. The black line is the total landings, while red line just industrial fleet and blue line, artisanal fleet. (Figure from INAPESCA, 2014)

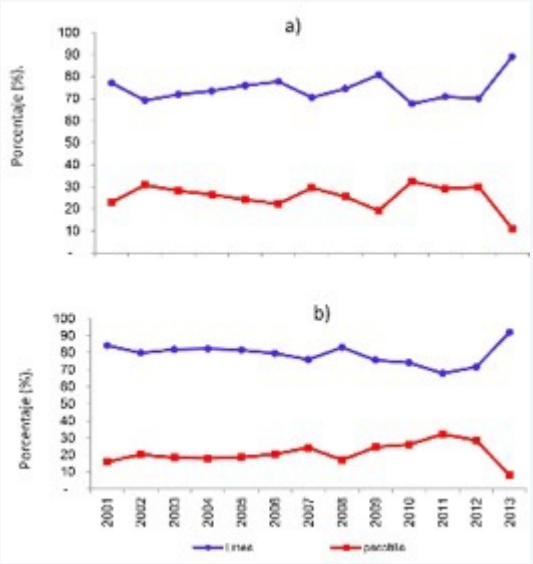

Figure 22 Percentage of "linea" Brown shrimp (commercial sizes) and "pacotilla" (small sizes) in the Gulf of Mexico. (Figure from INAPESCA, 2014)

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO/GULF OF MEXICO, CAST NETS, MEXICO
MEXICO/GULF OF MEXICO, TRAPS (UNSPECIFIED), MEXICO

Moderate Concern

Managers have indicated that all species in the GOM region have shown drastic declines in catches over the last 25 years, with the exception of brown shrimp, which has maintained stable landings over the last quarter decade (DOF 2012). Regulations such as closures have been established in an attempt to protect reproduction process, and increase catches of the species (INAPESCA c 2012). Mixed results for the species have been achieved.

There are no quantitative estimates of fishing mortality in relation to F_{MSY} to determine biological reference points for GOM shrimp species. A 2005 study estimated F_{MSY} for seabob shrimp and indicated that two years of landings illustrated that the fishery had exceeded its fishing threshold (Wakida-Kusunoki 2005); however, in 2011, seabob landings remained below this threshold (INAPESCA c 2012). Without more comprehensive data on effort and average landings, fishing mortality for the GOM shrimp species is unknown. Therefore, fishing mortality for the GOM shrimp species is rated as "moderate" concern for brown, pink, seabob, and white shrimp.

Justification:

Temporal restrictions for the brown shrimp fishery are in place to reduce the juvenile fishing mortality inside the lagoons and allow recruitment and migration to offshore. The length of the no-fishing season is about 45 days in the lagoons and 100 days offshore. Under this management regime, landings in Tamaulipas and Veracruz have remained stable, averaging more than 6,000 t for offshore waters and more than 4,700 in the coastal lagoons (INAPESCA 2014). Fishing mortality of brown shrimp stocks is deemed a "moderate" concern.

PINK SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO/GULF OF MEXICO, TRAPS (UNSPECIFIED), MEXICO

High Concern

This fishery was characterized by strong fishing effort in the 1960s and 1970s; some studies mentioned that during this season the fishery was already operating close to the MSY (RamirezIRodriguez 2002). This overfishing combined with the reduction on the primary production levels on the region and other environmental conditions, could explain changes on the carrying capacity of the system (Arreguin-Sanchez et al. 1997) (Wakida-Kusunoki 2005) lower productivity and the decline on the yields by vessels (INAPESCA 2014).

Although there is no evidence that the shrimp population has recovered from overexploitation, annual landings have stabilized at around 585 MT per year during the last eight seasons (INAPESCA 2014). Continued protection of developing female shrimp is crucial to maintain stock viability. Since pink shrimp stocks in the Gulf of Mexico are considered to be overexploited by managers (SAGARPA-INAPESCA 2012) and landings have remained stable, the stock is deemed a "high" concern.

Justification:

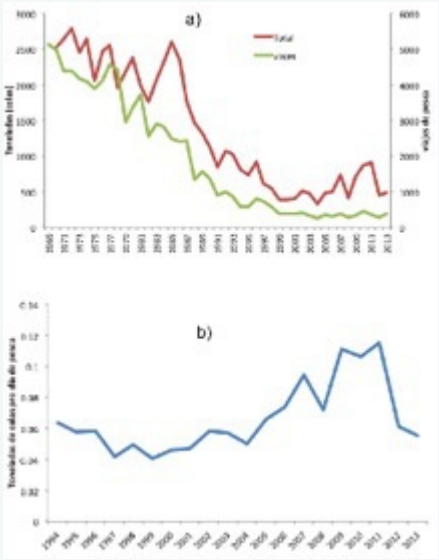

Figure 23 Pink shrimp catch and effort (a) and average production per fishing day (b) in the Campeche region (Figure from INAPESCA, 2014)

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO/GULF OF MEXICO, TRAPS (UNSPECIFIED), MEXICO

Moderate Concern

Managers have indicated that all species in the GOM region have shown drastic declines in catches over the last 25 years with the exception of brown shrimp, which has maintained stable landings over the last quarter decade (DOF 2012). Regulations such as closures have been established in an attempt to protect reproduction process, and increase catches of the species (INAPESCA c 2012). Mixed results for the species have been achieved.

There are no quantitative estimates of fishing mortality in relation to F_{MSY} to determine biological reference points for GOM shrimp species. A 2005 study estimated F_{MSY} for seabob shrimp and indicated that two years of landings illustrated that the fishery had exceeded its fishing threshold (Wakida-Kusunoki 2005); however, in 2011, seabob landings remained below this threshold (INAPESCA c 2012). Without more comprehensive data on effort and average landings, fishing mortality for the GOM shrimp species is unknown. Therefore, fishing mortality for the GOM shrimp species is rated as "moderate" concern for brown, pink, seabob, and white shrimp.

Justification:

The Mexican government has placed temporal and spatial restrictions on the GOM pink shrimp fishery to promote stock recovery. An annual fishing ban on pink shrimp has been established from May to October/November to allow female shrimp to mature to spawning age, and a ban on fishing in the coastal region from 0 to 15 miles to protect juvenile habitat (INAPESCA 2000). Even with these efforts, however, no evidence that shrimp population has recovered from overexploitation has been found (SAGARPA-INAPESCA 2012). Also, there are no publicly available quantitative estimates of biomass or of fishing mortality in relation to MSY, making it difficult to discern whether the depressed stock is due to fishing pressure or environmental factors. For these reasons, fishing mortality of pink shrimp stocks in the GOM is deemed a "moderate" concern.

WHITE SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

High Concern

The GOM white shrimp is targeted by industrial trawlers offshore, but is also taken incidentally in the seabob fishery, and has seen variable landings in the last two decades (INAPESCA 2014). At present, the fishery is sustaining a low level of landings (INAPESCA 2014). A study on recruitment and fisheries mortality showed that overall stock recruitment has been depressed because of spawning female mortality in the small vessel coastal fishery between May and October of each year (INAPESCA 2014 b). Because of this, the stock is rated as a "high" concern.

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

Moderate Concern

Managers have indicated that all species in the GOM region have shown drastic declines in catches over the last 25 years with the exception of brown shrimp, which has maintained stable landings over the last quarter decade (DOF 2012). Regulations such as closures have been established in an attempt to protect reproduction process, and increase catches of the species (INAPESCA c 2012). Mixed results for the species have been achieved.

There are no quantitative estimates of fishing mortality in relation to F_{MSY} to determine biological reference points for GOM shrimp species. A 2005 study estimated F_{MSY} for seabob shrimp and indicated that two years of landings illustrated that the fishery had exceeded its fishing threshold (Wakida-Kusunoki 2005). In 2011, however, seabob landings remained below this threshold (INAPESCA c 2012). Without more comprehensive data on effort and average landings, fishing mortality for the GOM shrimp species is unknown. Therefore, fishing mortality for the GOM shrimp species is rated as "moderate" concern for brown, pink, seabob, and white shrimp.

Justification:

Annual landings of white shrimp by the Industrial fleet averaged 57 MT per year since 2000, though there had been a notable increase since 2001 (INAPESCA c 2012) that continued until 2012, including an increase in the CPUE (SAGARPA-INAPESCA 2014). The observed decline in landings in Campeche during the late1990s was originally thought to be attributable to decreased fishing effort by the large vessel fleet; however, a study on recruitment showed that overall stock recruitment was depressed because of spawning female mortality reported as bycatch by the artisanal fishery between May and October of each year (INAPESCA 2000). Landings have decreased and and have remained at low levels, and the cause of the decreased landings is unclear. Without a clear understanding of the fishing mortality or the cause of the suppressed landings, white shrimp fishing mortality is considered a "moderate" concern.

WHITE SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY

High Concern

The GOM white shrimp is targeted by industrial trawlers offshore, but is also taken incidentally in the seabob fishery, and has seen variable landings in the last two decades (INAPESCA 2014). At present, the fishery is sustaining a low level of landings (INAPESCA 2014). A study on recruitment and fisheries mortality showed that overall stock recruitment has been depressed because of spawning female mortality in the small vessel coastal fishery between May and October of each year (INAPESCA 2014 b). Because of this, the stock is rated as a "high" concern.

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY

Moderate Concern

Managers have indicated that all species in the GOM region have shown drastic declines in catches over the last 25 years with the exception of brown shrimp, which has maintained stable landings over the last quarter decade (DOF 2012). Regulations such as closures have been established in an attempt to protect reproduction process, and increase catches of the species (INAPESCA c 2012). Mixed results for the species have been achieved.

There are no quantitative estimates of fishing mortality in relation to F_{MSY} to determine biological reference points for GOM shrimp species. A 2005 study estimated F_{MSY} for seabob shrimp and indicated that two years of landings illustrated that the fishery had exceeded its fishing threshold (Wakida-Kusunoki 2005). In 2011, however, seabob landings remained below this threshold (INAPESCA c 2012). Without more comprehensive data on effort and average landings, fishing mortality for the GOM shrimp species is unknown. Therefore, fishing mortality for the GOM shrimp species is rated as "moderate" concern for brown, pink, seabob, and white shrimp.

Justification:

Annual landings of white shrimp by the Industrial fleet averaged 57 MT per year since 2000, though there had been a notable increase since 2001 (INAPESCA c 2012) that continued until 2012, including an increase in the CPUE (SAGARPA-INAPESCA 2014). The observed decline in landings in Campeche during the late1990s was originally thought to be attributable to decreased fishing effort by the large vessel fleet; however, a study on recruitment showed that overall stock recruitment was depressed because of spawning female mortality reported as bycatch by the artisanal fishery between May and October of each year (INAPESCA 2000). Landings have decreased and and have remained at low levels, and the cause of the decreased landings is unclear. Without a clear understanding of the fishing mortality or the cause of the suppressed landings, white shrimp fishing mortality is considered a "moderate" concern.

WHITELEG SHRIMP

Factor 1.1 - Abundance

MEXICO/PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC

Moderate Concern

No whiteleg stocks have been assessed using the biomass dynamic model or catch at size analysis. The CPUE and benchmarks do not indicate any particular reason for concern; however, as reference points have not been determined, current biomass relative to a sustainable level is unknown. Since this species (and all shrimp assessed in this report) are not considered highly vulnerable to overfishing based on a Productivity Susceptibility Analysis (see above), a rating of "moderate" concern is applied.

Justification:

Whiteleg shrimp Sinaloa North, South, Nayarit and Gulf of Tehuantepec

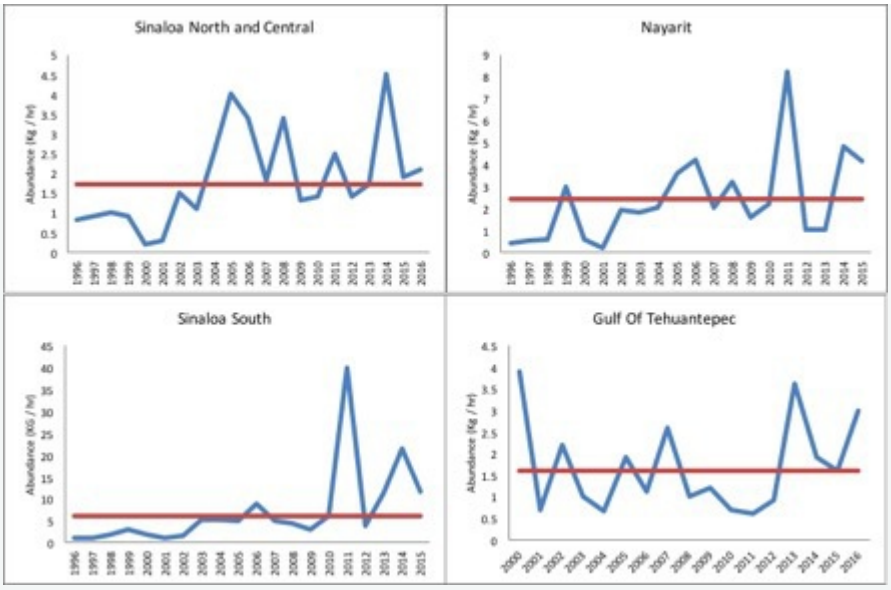

Figure 24 CPUE values and historical average (red line) for Whiteleg shrimp stock in Sinaloa North, Sinaloa South, Nayarit and Gulf of Tehuantepec (INAPESCA annual off season reports)

Benchmarks: SinaloaINayarit (0.82, Fully Exploited), Gulf of Tehuantepec (0.98, Fully Exploited).

The most recent abundance values for white shrimp stocks showed values within the historical average, with signs of improvement in the case of the Gulf of Tehuantepec stock. In 2011, research on the Sinaloa and Nayarit stocks (Madrid-Vera et al. 2012) assumed that the status of *Litopenaeus vannamei* was deteriorated, considering that the landings from 1993 to 1994, against the 2008 to 2009 season, showed a 65% decrease; it was concluded that this decline provided a risk on the stock and a review of the management rules was recommended. It is important to consider that in the Gulf of Tehuantepec researchers have found that environmental factors may be also be contributing to the stock's behavior (Cervantes-Hernandez et al. 2000).

Factor 1.2 - Fishing Mortality

MEXICO/PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC

Moderate Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both of these cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a "high" concern. This rating is applied to blue shrimp from the whole of Sinaloa South and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing, and yet have (nonIsignificant) increasing (Sinaloa North Central blue shrimp) or (nonIsignificant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

WHITELEG SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO/GULF OF CALIFORNIA, CAST NETS, MEXICO, NAYARIT

Moderate Concern

No whiteleg stocks have been assessed using the biomass dynamic model or catch at size analysis. The CPUE and benchmarks do not indicate any particular reason for concern; however, as reference points have not been determined, current biomass relative to a sustainable level is unknown. Since this species (and all shrimp assessed in this report) are not considered highly vulnerable to overfishing based on a Productivity Susceptibility Analysis (see above), a rating of "moderate" concern is applied.

Justification:

Whiteleg shrimp Sinaloa North, South, Nayarit and Gulf of Tehuantepec

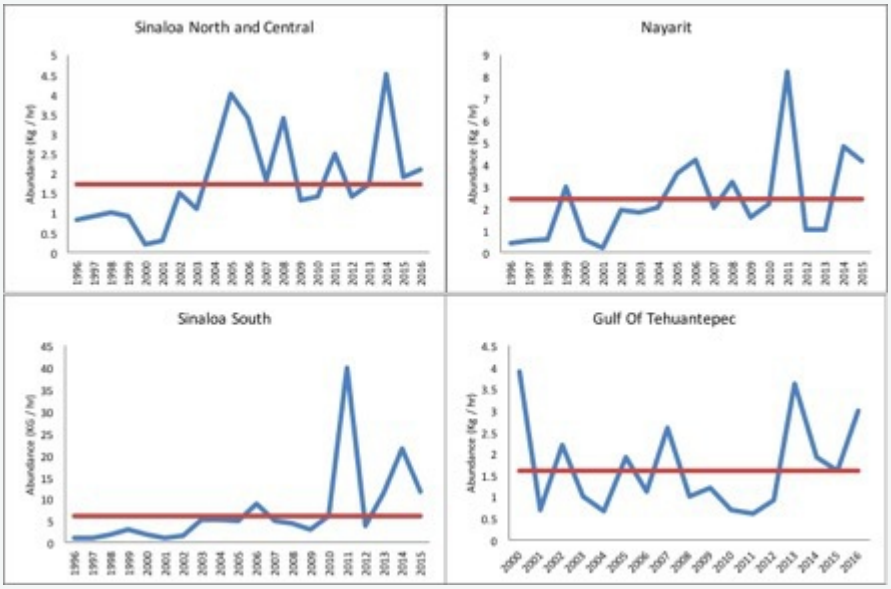

Figure 25 CPUE values and historical average (red line) for Whiteleg shrimp stock in Sinaloa North, Sinaloa South, Nayarit and Gulf of Tehuantepec (INAPESCA annual off season reports)

Benchmarks: SinaloaNayarit (0.82, Fully Exploited), Gulf of Tehuantepec (0.98, Fully Exploited).

The most recent abundance values for white shrimp stocks showed values within the historical average, with signs of improvement in the case of the Gulf of Tehuantepec stock. In 2011, research on the Sinaloa and Nayarit stocks (Madrid-Vera et al. 2012) assumed that the status of *Litopenaeus vannamei* was deteriorated, considering that the landings from 1993 to 1994, against the 2008 to 2009 season, showed a 65% decrease; it was concluded that this decline provided a risk on the stock and a review of the management rules was recommended. It is important to consider that in the Gulf of Tehuantepec researchers have found that environmental factors may be also be contributing to the stock's behavior (Cervantes-Hernandez et al. 2000).

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO/GULF OF CALIFORNIA, CAST NETS, MEXICO, NAYARIT

Moderate Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both of these cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a "high" concern. This rating is applied to blue shrimp from the whole of Sinaloa South and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing, and yet have (non‐significant) increasing (Sinaloa North Central blue shrimp) or (non‐significant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

WHITELEG SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL

Moderate Concern

No whiteleg stocks have been assessed using the biomass dynamic model or catch at size analysis. The CPUE and benchmarks do not indicate any particular reason for concern; however, as reference points have not been determined, current biomass relative to a sustainable level is unknown. Since this species (and all shrimp assessed in this report) are not considered highly vulnerable to overfishing based on a Productivity‐Susceptibility Analysis (see above), a rating of "moderate" concern is applied.

Justification:

Whiteleg shrimp Sinaloa North, South, Nayarit and Gulf of Tehuantepec

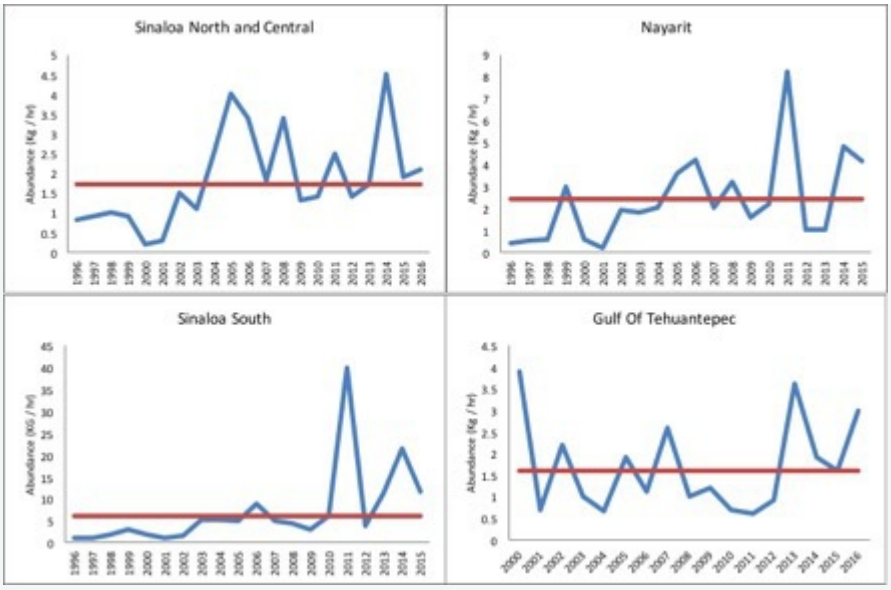

Figure 26 CPUE values and historical average (red line) for Whiteleg shrimp stock in Sinaloa North, Sinaloa South, Nayarit and Gulf of Tehuantepec (INAPESCA annual off season reports)

Benchmarks: SinaloaINayarit (0.82, Fully Exploited), Gulf of Tehuantepec (0.98, Fully Exploited).

The most recent abundance values for white shrimp stocks showed values within the historical average, with signs of improvement in the case of the Gulf of Tehuantepec stock. In 2011, research on the Sinaloa and Nayarit stocks (Madrid-Vera et al. 2012) assumed that the status of *Litopenaeus vannamei* was deteriorated, considering that the landings from 1993 to 1994, against the 2008 to 2009 season, showed a 65% decrease; it was concluded that this decline provided a risk on the stock and a review of the management rules was recommended. It is important to consider that in the Gulf of Tehuantepec researchers have found that environmental factors may be also be contributing to the stock's behavior (Cervantes-Hernandez et al. 2000).

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL

Moderate Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both of these cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a "high" concern. This rating is applied to blue shrimp from the whole of Sinaloa South and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing, and yet have (nonIsignificant) increasing (Sinaloa North Central blue shrimp) or (nonIsignificant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

WHITELEG SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO/GULF OF CALIFORNIA, CAST NETS, MEXICO, SINALOA SOUTH

Moderate Concern

No whiteleg stocks have been assessed using the biomass dynamic model or catch at size analysis. The CPUE and benchmarks do not indicate any particular reason for concern; however, as reference points have not been determined, current biomass relative to a sustainable level is unknown. Since this species (and all shrimp assessed in this report) are not considered highly vulnerable to overfishing based on a Productivity Susceptibility Analysis (see above), a rating of "moderate" concern is applied.

Justification:

Whiteleg shrimp Sinaloa North, South, Nayarit and Gulf of Tehuantepec

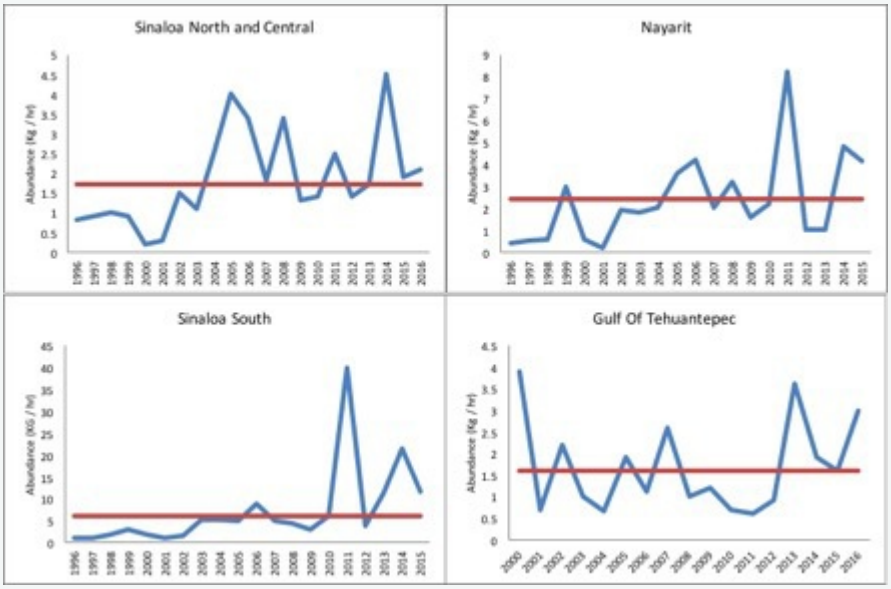

Figure 27 CPUE values and historical average (red line) for Whiteleg shrimp stock in Sinaloa North, Sinaloa South, Nayarit and Gulf of Tehuantepec (INAPESCA annual off season reports)

Benchmarks: SinaloaNayarit (0.82, Fully Exploited), Gulf of Tehuantepec (0.98, Fully Exploited).

The most recent abundance values for white shrimp stocks showed values within the historical average, with signs of improvement in the case of the Gulf of Tehuantepec stock. In 2011, research on the Sinaloa and Nayarit stocks (Madrid-Vera et al. 2012) assumed that the status of *Litopenaeus vannamei* was deteriorated, considering that the landings from 1993 to 1994, against the 2008 to 2009 season, showed a 65% decrease; it was concluded that this decline provided a risk on the stock and a review of the management rules was recommended. It is important to consider that in the Gulf of Tehuantepec researchers have found that environmental factors may be also be contributing to the stock's behavior (Cervantes-Hernandez et al. 2000).

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO/GULF OF CALIFORNIA, CAST NETS, MEXICO, SINALOA SOUTH

Moderate Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both of these cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a "high" concern. This rating is applied to blue shrimp from the whole of Sinaloa South and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing, and yet have (non‖significant) increasing (Sinaloa North Central blue shrimp) or (non‖significant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

YELLOWLEG SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT

Moderate Concern

CPUE data for the stocks indicate stable trends at around the average (Sinaloa North‖ Central and South) and below the average (Nayarit).

The catch at size analysis suggests a stable trend in biomass.

The benchmark analysis led INAPESCA to classify the stock as fully exploited (average catch over the last three seasons over average historical catch = 1.06).

In summary, available data do not suggest any particular reason for serious concern with the stock. But, since reference points have not been determined, current biomass relative to a sustainable level is unknown. Because this species (and all shrimp assessed in this report) are not considered highly vulnerable to overfishing based on a Productivity‖Susceptibility Analysis (see below), a rating of "moderate" concern is applied.

Justification:

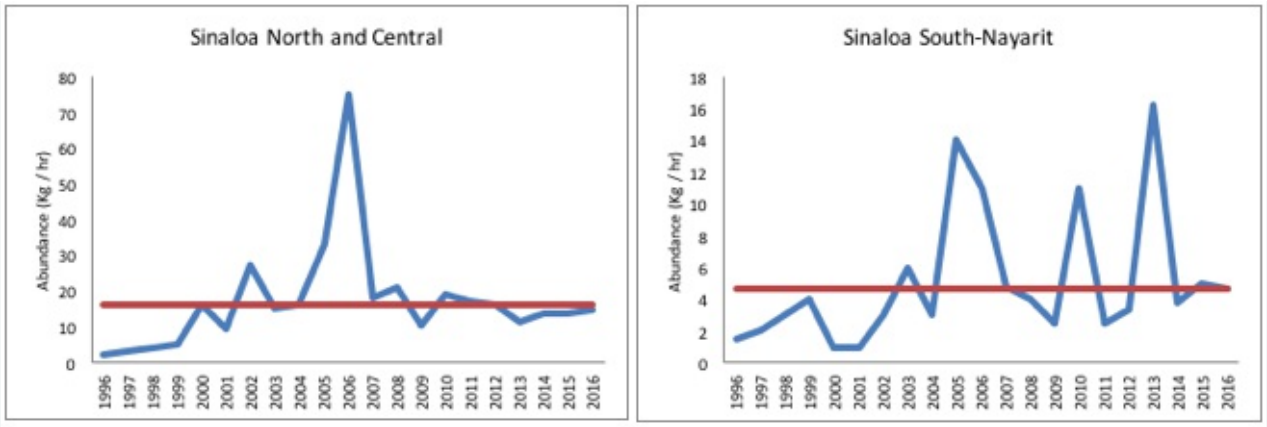

Figure 28 CPUE values and historical average (red line) for yellowleg shrimp stocks in Sinaloa North and Sinaloa South- Nayarit from 1996 to 2016 (INAPESCA annual off season reports)

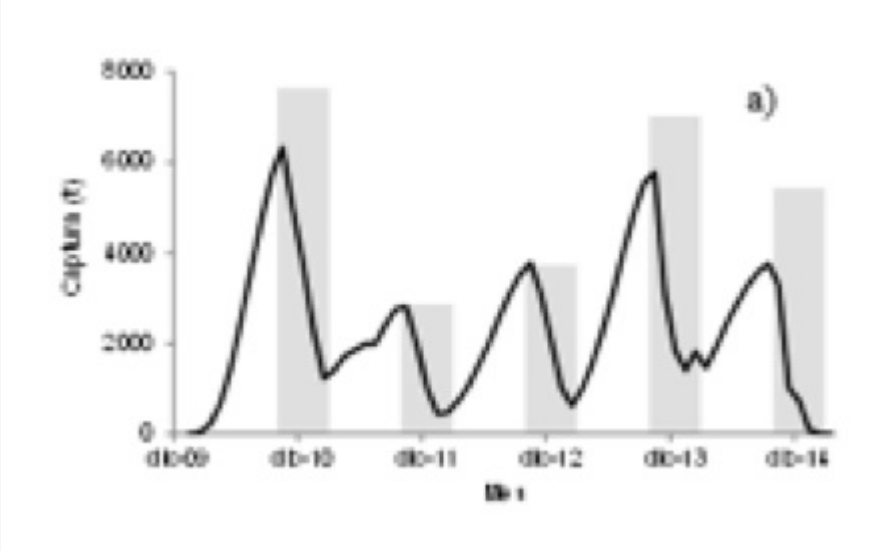

Figure 29 Yellowleg shrimp catch at age changes from December 2009 to December 2014. (INAPESCA end of the season reports)

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT

Moderate Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both of these cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a "high" concern. This rating is applied to blue shrimp from the whole of Sinaloa South and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing, and yet have (nonlsignificant) increasing (Sinaloa North Central blue shrimp) or (nonlsignificant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a

rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

YELLOWLEG SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL

Moderate Concern

CPUE data for the stocks indicate stable trends at around the average (Sinaloa North‖ Central and South) and below the average (Nayarit).

The catch at size analysis suggests a stable trend in biomass.

The benchmark analysis led INAPESCA to classify the stock as fully exploited (average catch over the last three seasons over average historical catch = 1.06).

In summary, available data do not suggest any particular reason for serious concern with the stock. But, since reference points have not been determined, current biomass relative to a sustainable level is unknown. Because this species (and all shrimp assessed in this report) are not considered highly vulnerable to overfishing based on a Productivity‖Susceptibility Analysis (see below), a rating of "moderate" concern is applied.

Justification:

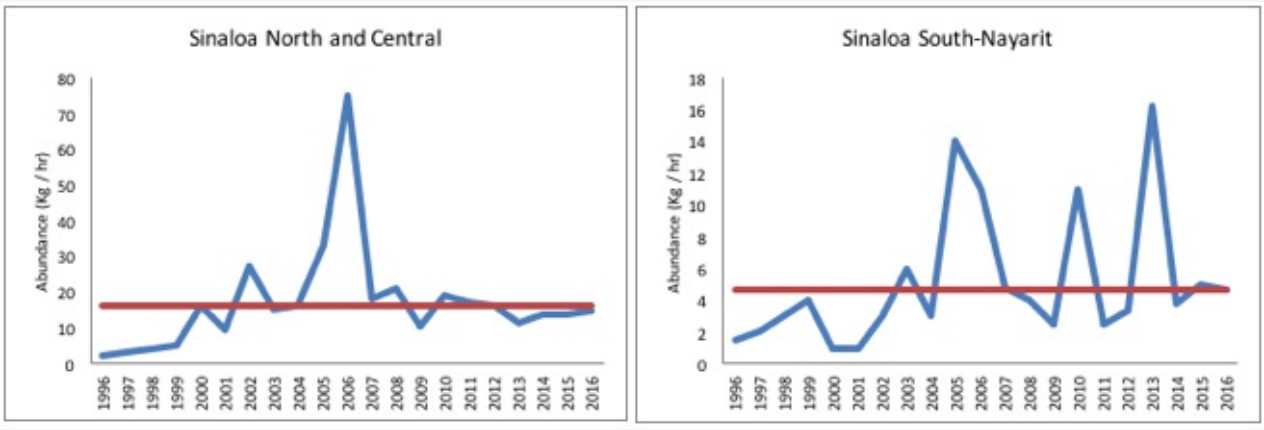

Figure 30 CPUE values and historical average (red line) for yellowleg shrimp stocks in Sinaloa North and Sinaloa South- Nayarit from 1996 to 2016 (INAPESCA annual off season reports)

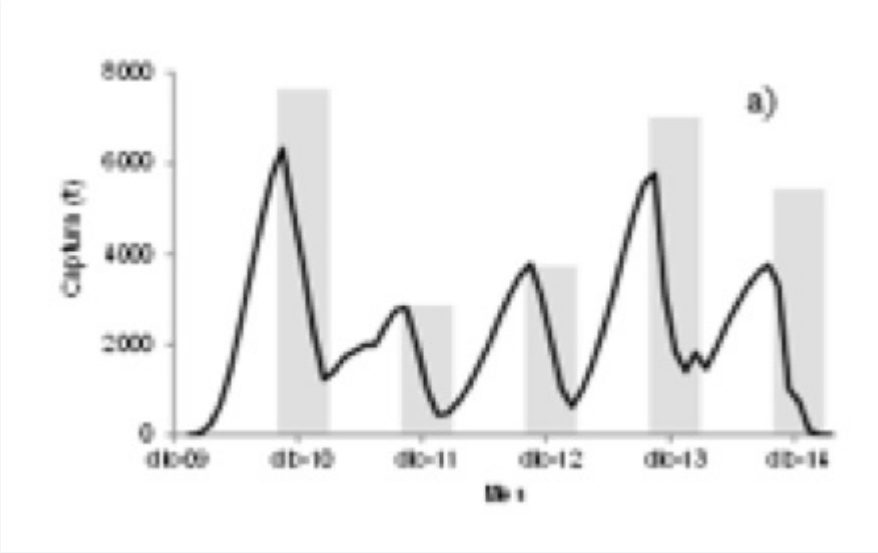

Figure 31 Yellowleg shrimp catch at age changes from December 2009 to December 2014. (INAPESCA end of the season reports)

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL

Moderate Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both of these cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a "high" concern. This rating is applied to blue shrimp from the whole of Sinaloa South and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing, and yet have (non‐significant) increasing (Sinaloa North Central blue shrimp) or (non‐significant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

YELLOWLEG SHRIMP

Factor 1.1 - Abundance

MEXICO/PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO/PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

Moderate Concern

No other yellowleg stocks have been assessed using the biomass dynamic model or catch at size analysis. The CPUE and benchmarks do not indicate any particular reason for concern; however, as reference points have not been determined, current biomass relative to a sustainable level is unknown. Because this species (and all shrimp assessed in this report) are not considered highly vulnerable to overfishing based on a Productivity‐Susceptibility Analysis (see above), a rating of "moderate" concern is applied.

Justification:

Yellowleg shrimp west coast of Baja, Gulf of Tehuantepec and Upper Gulf of California

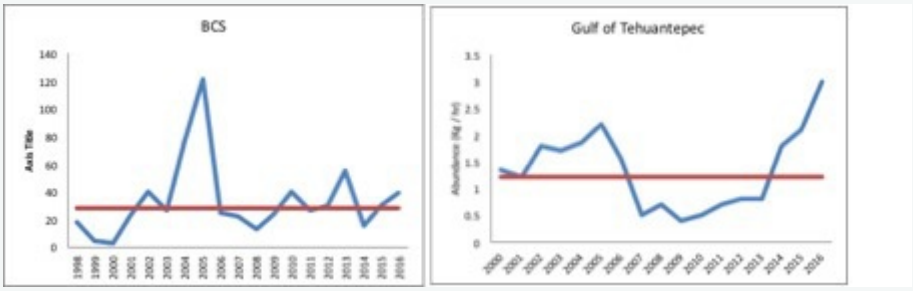

Figure 32 CPUE values and historical average (red line) for yellowleg shrimp stocks in the West coast of Baja and the Gulf of Tehuantepec (INAPESCA annual off season reports)

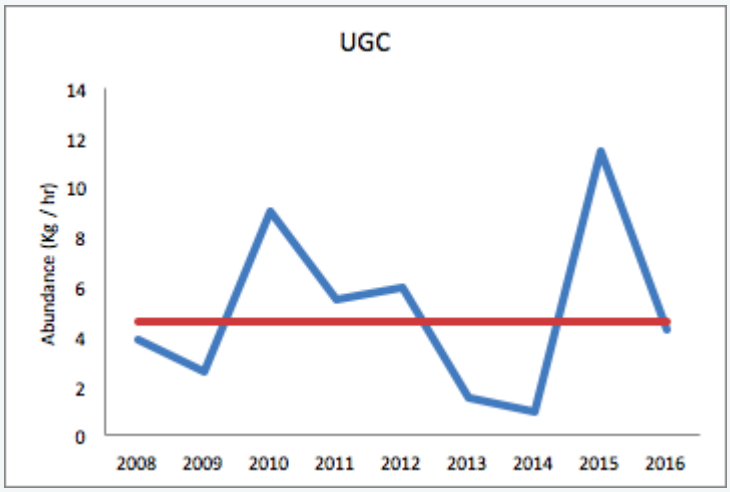

Figure 33 CPUE values and historical average (red line) for yellowleg shrimp stocks in UGC from 2008 to 2016 (Data from INAPESCA annual offseason monitoring reports)

Factor 1.2 - Fishing Mortality

MEXICO/PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO/PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

Moderate Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both of these cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a "high" concern. This rating is applied to blue shrimp from the whole of Sinaloa South and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing, and yet have (nonlsignificant) increasing (Sinaloa North Central blue shrimp) or (nonlsignificant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

YELLOWLEG SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH

Moderate Concern

CPUE data for the stocks indicate stable trends at around the average (Sinaloa North| Central and South) and below the average (Nayarit).

The catch at size analysis suggests a stable trend in biomass.

The benchmark analysis led INAPESCA to classify the stock as fully exploited (average catch over the last three seasons over average historical catch = 1.06).

In summary, available data do not suggest any particular reason for serious concern with the stock. But, since reference points have not been determined, current biomass relative to a sustainable level is unknown. Because this species (and all shrimp assessed in this report) are not considered highly vulnerable to overfishing based on a Productivity|Susceptibility Analysis (see below), a rating of "moderate" concern is applied.

Justification:

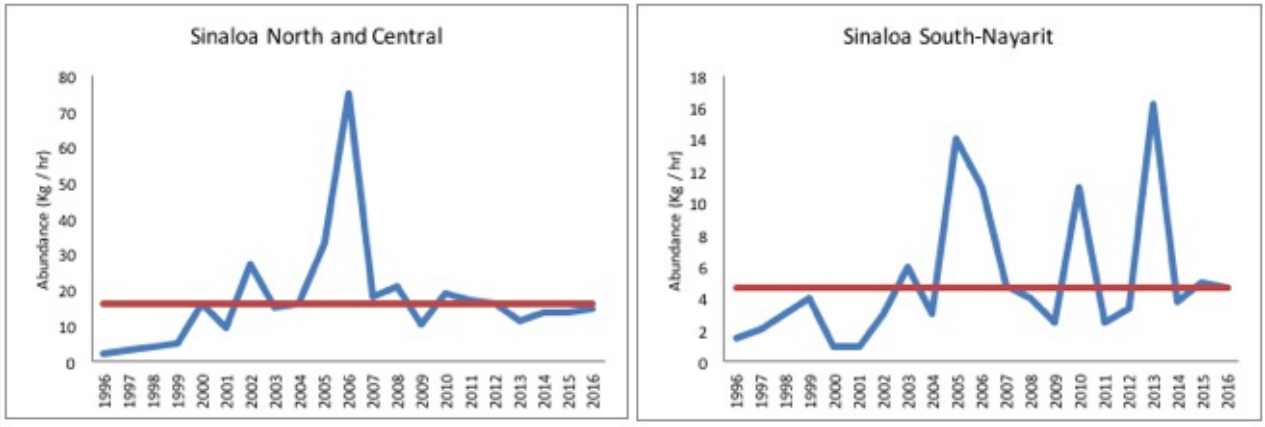

Figure 34 CPUE values and historical average (red line) for yellowleg shrimp stocks in Sinaloa North and Sinaloa South- Nayarit from 1996 to 2016 (INAPESCA annual off season reports)

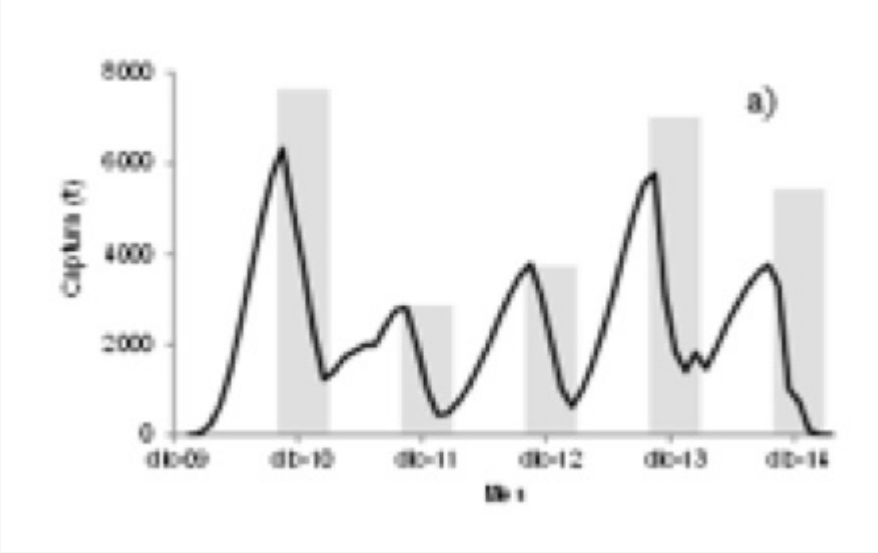

Figure 35 Yellowleg shrimp catch at age changes from December 2009 to December 2014. (INAPESCA end of the season reports)

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH

Moderate Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both of these cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a "high" concern. This rating is applied to blue shrimp from the whole of Sinaloa South and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing, and yet have (nonlsignificant) increasing (Sinaloa North Central blue shrimp) or (nonlsignificant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

YELLOWLEG SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA

High Concern

The biomass dynamic model indicates the stock is overfished ($B_{CURRENT}/B_{MSY}$=0.33 (3,500/10,500).

CPUE data for the stock indicates a stable trend after a steep increase in 2009 and a decline in 2015 to a point below the average.

The benchmark analysis led INAPESCA to classify the stock as overexploited (average catch over the last three

seasons over average historical catch= 0.76). In summary, the biomass dynamic model and benchmark suggest a need for concern about the abundance in this stock. It is thus rated here as a "high" concern.

Justification:

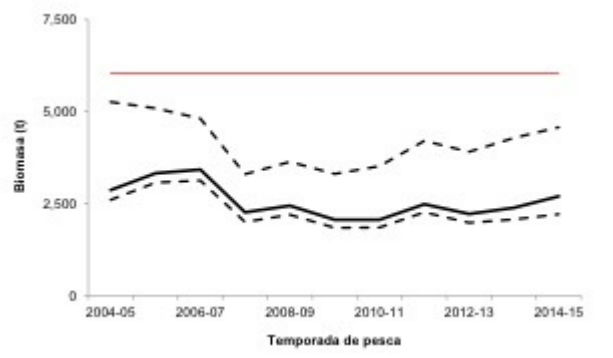

Figure 36 Estimated biomass of yellowleg shrimp in Sonora against the BMSY. The bold black line is the average biomass by season with its confidence intervals. The red line represents the biomass needed to reach the MSY (INAPESCA, 2016)

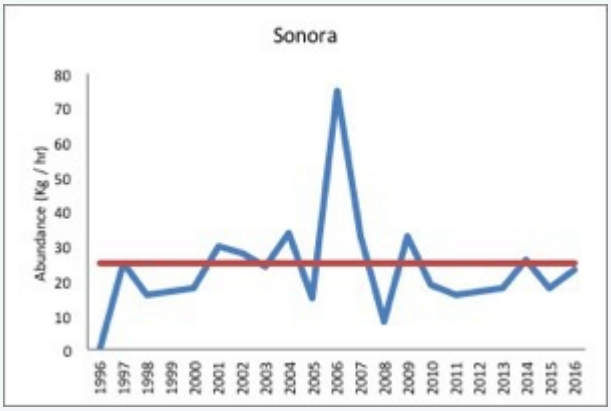

Figure 37 CPUE values, historical average (red line) and trend line (black line) for yellowleg shrimp stock in Sonora, from 1996 to 2016 (INAPESCA annual offseason reports).

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA

High Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a high concern. This rating is applied to blue shrimp from the whole of Sinaloa and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing and yet have (nonlsignificant) increasing (Sinaloa North Central blue shrimp) or (nonlsignificant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem

that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

YELLOWLEG SHRIMP

Factor 1.1 - Abundance

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA

Moderate Concern

No other yellowleg stocks have been assessed using the biomass dynamic model or catch at size analysis. The CPUE and benchmarks do not indicate any particular reason for concern; however, as reference points have not been determined, current biomass relative to a sustainable level is unknown. Because this species (and all shrimp assessed in this report) are not considered highly vulnerable to overfishing based on a Productivity Susceptibility Analysis (see above), a rating of "moderate" concern is applied.

Justification:

Yellowleg shrimp west coast of Baja, Gulf of Tehuantepec and Upper Gulf of California

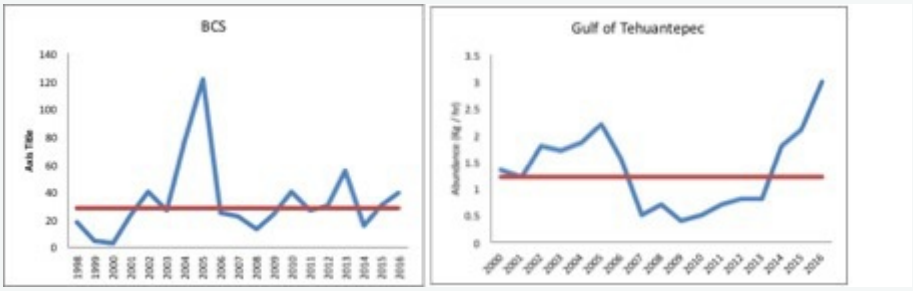

Figure 38 CPUE values and historical average (red line) for yellowleg shrimp stocks in the West coast of Baja and the Gulf of Tehuantepec (INAPESCA annual off season reports)

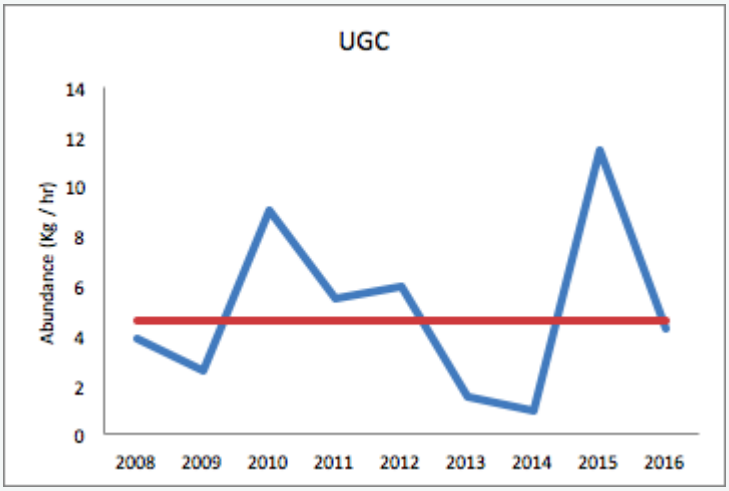

Figure 39 CPUE values and historical average (red line) for yellowleg shrimp stocks in UGC from 2008 to 2016 (Data from INAPESCA annual offseason monitoring reports)

Factor 1.2 - Fishing Mortality

MEXICO/GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA

Moderate Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both of these cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a "high" concern. This rating is applied to blue shrimp from the whole of Sinaloa South and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing, and yet have (non‐significant) increasing (Sinaloa North Central blue shrimp) or (non‐significant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

YELLOWLEG SHRIMP

Factor 1.1 - Abundance

MEXICO/PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC

Moderate Concern

No other yellowleg stocks have been assessed using the biomass dynamic model or catch at size analysis. The CPUE and benchmarks do not indicate any particular reason for concern; however, as reference points have not been determined, current biomass relative to a sustainable level is unknown. Because this species (and all shrimp assessed in this report) are not considered highly vulnerable to overfishing based on a Productivity‐Susceptibility Analysis (see above), a rating of "moderate" concern is applied.

Justification:

Yellowleg shrimp west coast of Baja, Gulf of Tehuantepec and Upper Gulf of California

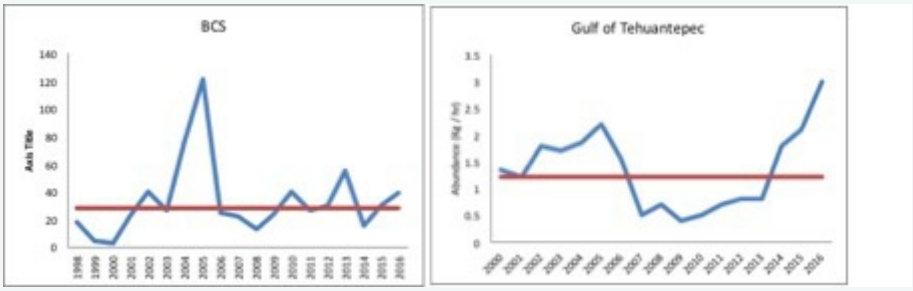

Figure 40 CPUE values and historical average (red line) for yellowleg shrimp stocks in the West coast of Baja and the Gulf of Tehuantepec (INAPESCA annual off season reports)

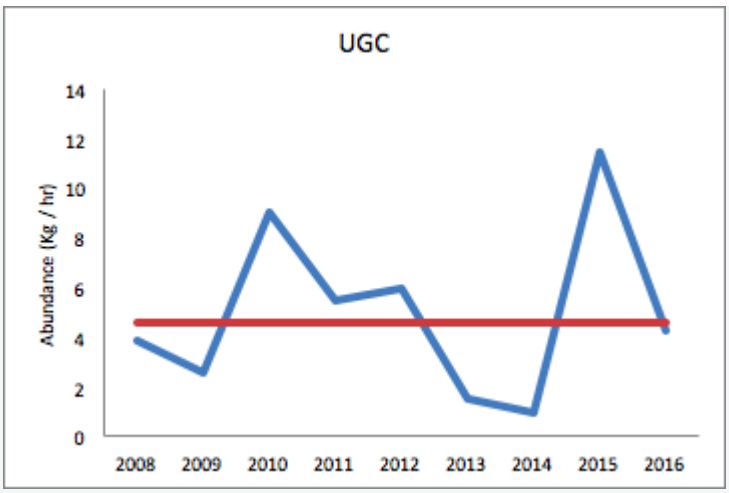

Figure 41 CPUE values and historical average (red line) for yellowleg shrimp stocks in UGC from 2008 to 2016 (Data from INAPESCA annual offseason monitoring reports)

Factor 1.2 - Fishing Mortality

MEXICO/PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC

Moderate Concern

There are no recent fishing mortality estimates in relation to MSY except for blue shrimp in Sinaloa North Central and brown shrimp in Sonora. In both of these cases, current fishing mortality exceeds fishing mortality at MSY, indicating the stocks are undergoing overfishing ($F_{CURRENT}/F_{MSY}$: 1.4/0.94=1.49 and 0.8/0.5=1.6, respectively) (INAPESCA b 2016) and are thus a "high" concern. This rating is applied to blue shrimp from the whole of Sinaloa South and Nayarit.

CPUE data, as a measure of relative abundance over time, may provide some indication of fishing mortality, such that if relative abundance is stable or increasing then fishing mortality may be sustainable; however, because the two areas assessed with the biomass dynamic model are experiencing overfishing, and yet have (nonlsignificant) increasing (Sinaloa North Central blue shrimp) or (nonlsignificant) stable CPUE trends (Sonora brown shrimp), precaution should be used when interpreting these trends. For this reason, we deem that there are not enough data to indicate fishing mortality on other stocks relative to a sustainable level, so a rating of "moderate" concern is given for all other shrimp stocks in the Pacific.

Criterion 2: Impacts on Other Species

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

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

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

Guiding Principles

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

Criterion 2 Summary

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

ATLANTIC SEABOB - MEXICO/GULF OF MEXICO - BOTTOM TRAWLS - MEXICO - SEABOB FISHERY					
Subscore:	**1.732**	**Discard Rate:**	**0.75**	**C2 Rate:**	**1.299**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
White shrimp	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		

BLUE SHRIMP - MEXICO/GULF OF CALIFORNIA - BOTTOM TRAWLS - MEXICO - NAYARIT					
Subscore:	**1.732**	**Discard Rate:**	**0.75**	**C2 Rate:**	**1.299**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Loggerhead 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)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Yellowleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Whiteleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)

BLUE SHRIMP - MEXICO/GULF OF CALIFORNIA - BOTTOM TRAWLS - MEXICO - SINALOA SOUTH

Subscore:	**1.732**	**Discard Rate:**	**0.75**	**C2 Rate:**	**1.299**

Species	**Abundance**	**Fishing Mortality**	**Subscore**
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Loggerhead 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)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Yellowleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Whiteleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)

BLUE SHRIMP - MEXICO/GULF OF CALIFORNIA - BOTTOM TRAWLS - MEXICO - SINALOA-NORTH-CENTRAL

Subscore:	**1.732**	**Discard Rate:**	**0.75**	**C2 Rate:**	**1.299**

Species	**Abundance**	**Fishing Mortality**	**Subscore**
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Loggerhead 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)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Yellowleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Whiteleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)

BLUE SHRIMP - MEXICO/GULF OF CALIFORNIA - BOTTOM TRAWLS - MEXICO - SONORA

Subscore:	1.000	Discard Rate:	0.75	C2 Rate:	0.750

Species	Abundance	Fishing Mortality	Subscore
Yellowleg shrimp	1.00:High Concern	1.00:High Concern	Red (1.000)
Totoaba	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific angel shark	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Loggerhead 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)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)

BLUE SHRIMP - MEXICO/GULF OF CALIFORNIA - BOTTOM TRAWLS - MEXICO - UPPER GULF OF CALIFORNIA

Subscore:	1.732	Discard Rate:	0.75	C2 Rate:	1.299

Species	Abundance	Fishing Mortality	Subscore
Totoaba	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific angel shark	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Loggerhead 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)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Yellowleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)

BLUE SHRIMP - MEXICO/GULF OF CALIFORNIA - GILLNETS AND ENTANGLING NETS (UNSPECIFIED) - MEXICO - SINALOA-NORTH-CENTRAL

Subscore:	2.236	Discard Rate:	1.00	C2 Rate:	2.236

Species	Abundance	Fishing Mortality	Subscore
Shovelnose guitarfish	1.00:High Concern	5.00:Low Concern	Yellow (2.236)
Bullseye puffer	2.33:Moderate Concern	5.00:Low Concern	Green (3.413)

BLUE SHRIMP - MEXICO/GULF OF CALIFORNIA - GILLNETS AND ENTANGLING NETS (UNSPECIFIED) - MEXICO - SONORA					
Subscore:	**2.236**	**Discard Rate:**	**1.00**	**C2 Rate:**	**2.236**

Species	Abundance	Fishing Mortality	Subscore
Shovelnose guitarfish	1.00:High Concern	5.00:Low Concern	Yellow (2.236)
Spotted sand bass	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)
Cortez swimming crab	3.67:Low Concern	3.00:Moderate Concern	Green (3.318)
Arched swimming crab	2.33:Moderate Concern	5.00:Low Concern	Green (3.413)

BLUE SHRIMP - MEXICO/GULF OF CALIFORNIA - SURIPERA - MEXICO - SINALOA-NORTH-CENTRAL					
Subscore:	**3.413**	**Discard Rate:**	**1.00**	**C2 Rate:**	**3.413**

Species	Abundance	Fishing Mortality	Subscore
Bullseye puffer	2.33:Moderate Concern	5.00:Low Concern	Green (3.413)

BLUE SHRIMP - MEXICO/PACIFIC - BOTTOM TRAWLS - MEXICO - WEST COAST OF BAJA					
Subscore:	**1.732**	**Discard Rate:**	**0.75**	**C2 Rate:**	**1.299**

Species	Abundance	Fishing Mortality	Subscore
Pacific angel shark	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Loggerhead turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific angel shark	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)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Yellowleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)

BLUE SHRIMP - MEXICO/PACIFIC - MAGDALENA - ARTISANAL BOTTOM TRAWL - MEXICO - WEST COAST OF BAJA					
Subscore:	**1.732**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.732**

Species	Abundance	Fishing Mortality	Subscore
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Yellowleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)

Bigscale anchovy	2.33:Moderate Concern	5.00:Low Concern	Green (3.413)

BROWN SHRIMP - MEXICO/GULF OF MEXICO - BOTTOM TRAWLS - MEXICO					
Subscore:	**1.000**	**Discard Rate:**	**0.75**	**C2 Rate:**	**0.750**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Hawksbill turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Kemp's ridley turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Green sea turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Pink shrimp	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
White shrimp	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Lined seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		

BROWN SHRIMP - MEXICO/GULF OF MEXICO - CAST NETS - MEXICO					
Subscore:	**5.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**5.000**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
No other main species caught					

BROWN SHRIMP - MEXICO/GULF OF MEXICO - TRAPS (UNSPECIFIED) - MEXICO					
Subscore:	**1.732**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.732**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Pink shrimp	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		

PINK SHRIMP - MEXICO/GULF OF MEXICO - BOTTOM TRAWLS - MEXICO					
Subscore:	**1.000**	**Discard Rate:**	**0.75**	**C2 Rate:**	**0.750**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Hawksbill turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Kemp's ridley turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Green sea turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		

White shrimp	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Lined seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Brown shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)

PINK SHRIMP - MEXICO/GULF OF MEXICO - TRAPS (UNSPECIFIED) - MEXICO					
Subscore:	**2.644**	**Discard Rate:**	**1.00**	**C2 Rate:**	**2.644**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Brown shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		

WHITE SHRIMP - MEXICO/GULF OF MEXICO - BOTTOM TRAWLS - MEXICO					
Subscore:	**1.000**	**Discard Rate:**	**0.75**	**C2 Rate:**	**0.750**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Leatherback turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Hawksbill turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Kemp's ridley turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Green sea turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Loggerhead turtle	1.00:High Concern	1.00:High Concern	Red (1.000)		
Pink shrimp	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Lined seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Brown shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		

WHITE SHRIMP - MEXICO/GULF OF MEXICO - BOTTOM TRAWLS - MEXICO - SEABOB FISHERY					
Subscore:	**1.732**	**Discard Rate:**	**0.75**	**C2 Rate:**	**1.299**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Atlantic seabob	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		

WHITELEG SHRIMP - MEXICO/GULF OF CALIFORNIA - BOTTOM TRAWLS - MEXICO - NAYARIT					
Subscore:	**1.000**	**Discard Rate:**	**0.75**	**C2 Rate:**	**0.750**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Blue shrimp	1.00:High Concern	1.00:High Concern	Red (1.000)		

Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Loggerhead 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)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Yellowleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)

WHITELEG SHRIMP - MEXICO/GULF OF CALIFORNIA - BOTTOM TRAWLS - MEXICO - SINALOA SOUTH					
Subscore:	**1.000**	**Discard Rate:**	**0.75**	**C2 Rate:**	**0.750**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Blue shrimp	1.00:High Concern	1.00:High Concern	Red (1.000)		
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Loggerhead 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)		
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Yellowleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		

WHITELEG SHRIMP - MEXICO/GULF OF CALIFORNIA - BOTTOM TRAWLS - MEXICO - SINALOA-NORTH-CENTRAL					
Subscore:	**1.000**	**Discard Rate:**	**0.75**	**C2 Rate:**	**0.750**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Blue shrimp	1.00:High Concern	1.00:High Concern	Red (1.000)		
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Loggerhead 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)		

Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Yellowleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)

WHITELEG SHRIMP - MEXICO/GULF OF CALIFORNIA - CAST NETS - MEXICO - NAYARIT					
Subscore:	**5.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**5.000**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
No other main species caught					

WHITELEG SHRIMP - MEXICO/GULF OF CALIFORNIA - CAST NETS - MEXICO - SINALOA SOUTH					
Subscore:	**5.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**5.000**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
No other main species caught					

WHITELEG SHRIMP - MEXICO/PACIFIC - BOTTOM TRAWLS - MEXICO - GULF OF TEHUANTEPEC					
Subscore:	**1.732**	**Discard Rate:**	**0.75**	**C2 Rate:**	**1.299**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Loggerhead 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)		
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Yellowleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		

YELLOWLEG SHRIMP - MEXICO/GULF OF CALIFORNIA - BOTTOM TRAWLS - MEXICO - NAYARIT					
Subscore:	**1.000**	**Discard Rate:**	**0.75**	**C2 Rate:**	**0.750**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Blue shrimp	1.00:High Concern	1.00:High Concern	Red (1.000)		
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		

Loggerhead 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)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Whiteleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)

YELLOWLEG SHRIMP - MEXICO/GULF OF CALIFORNIA - BOTTOM TRAWLS - MEXICO - SINALOA SOUTH					
Subscore:	**1.000**	**Discard Rate:**	**0.75**	**C2 Rate:**	**0.750**

Species	Abundance	Fishing Mortality	Subscore
Blue shrimp	1.00:High Concern	1.00:High Concern	Red (1.000)
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Loggerhead 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)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Whiteleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)

YELLOWLEG SHRIMP - MEXICO/GULF OF CALIFORNIA - BOTTOM TRAWLS - MEXICO - SINALOA-NORTH-CENTRAL					
Subscore:	**1.000**	**Discard Rate:**	**0.75**	**C2 Rate:**	**0.750**

Species	Abundance	Fishing Mortality	Subscore
Blue shrimp	1.00:High Concern	1.00:High Concern	Red (1.000)
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Loggerhead 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)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Whiteleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)

YELLOWLEG SHRIMP - MEXICO/GULF OF CALIFORNIA - BOTTOM TRAWLS - MEXICO - SONORA					
Subscore:	**1.732**	**Discard Rate:**	**0.75**	**C2 Rate:**	**1.299**

Species	Abundance	Fishing Mortality	Subscore
Blue shrimp	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Totoaba	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific angel shark	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Loggerhead 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)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)

YELLOWLEG SHRIMP - MEXICO/GULF OF CALIFORNIA - BOTTOM TRAWLS - MEXICO - UPPER GULF OF CALIFORNIA					
Subscore:	**1.732**	**Discard Rate:**	**0.75**	**C2 Rate:**	**1.299**

Species	Abundance	Fishing Mortality	Subscore
Blue shrimp	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Totoaba	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific angel shark	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Loggerhead 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)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)

YELLOWLEG SHRIMP - MEXICO/PACIFIC - BOTTOM TRAWLS - MEXICO - GULF OF TEHUANTEPEC					
Subscore:	**1.732**	**Discard Rate:**	**0.75**	**C2 Rate:**	**1.299**

Species	Abundance	Fishing Mortality	Subscore
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)

Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Loggerhead 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)
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)
Whiteleg shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)

YELLOWLEG SHRIMP - MEXICO/PACIFIC - BOTTOM TRAWLS - MEXICO - WEST COAST OF BAJA					
Subscore:	**1.732**	**Discard Rate:**	**0.75**	**C2 Rate:**	**1.299**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Pacific angel shark	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Scalloped hammerhead	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Hawksbill turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Loggerhead turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Pacific angel shark	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)		
Green sea turtle	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Blue shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		

YELLOWLEG SHRIMP - MEXICO/PACIFIC - MAGDALENA - ARTISANAL BOTTOM TRAWL - MEXICO - WEST COAST OF BAJA					
Subscore:	**1.732**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.732**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Pacific seahorse	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Shovelnose guitarfish	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Blue shrimp	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		
Bigscale anchovy	2.33:Moderate Concern	5.00:Low Concern	Green (3.413)		

The summary tables above represent the main conservation concerns with the wide variety of fish and invertebrate species that are caught in the Mexican shrimp fisheries. Official bycatch research studied and developed by INAPESCA, academic institutions, and nonlgovernment organizations were consulted to determine the most abundant species present as bycatch in the Mexican Pacific and Gulf of Mexico shrimp fisheries. In 2015, INAPESCA provided Seafood Watch with a complete list of species caught as bycatch, although the list

was not broken down by region or gear (Appendix A). This list was cross-referenced with regional studies in the Upper Gulf of California (Calderon-Aguilera 2011), Sonora (Meltzer et al. 2012), Sinaloa (Amezcua et al. 2006) (Nieto-Navarro et al. 2013) (Madrid-Vera et al. b 2012) (Madrid-Vera et al. 2010), BCS (Aguilar-Ramirez et al. 2010), the Gulf of Tehuantepec (Penagos-Garcia, F. et al 2011), as well as industrial trawlers (Rabago-Quiroz et al. 2012), and the Gulf of Mexico (WakidaIKusunoki et al 2005) for all the different gears used in the shrimp fisheries.

Some of the most important species in terms of relative abundance in the catch are: Anchovy, bigscale (*Anchovia macrolepidota*), Panama grunt (*Pomadasys panamensis*), electric ray (*Diplobatis ommata*), shovelnose guitarfish (*Pseudobatos productus,* formerly *Rhinobatos productus*), speckled guitarfish (*Pseudobatos productus*, formerly *Rhinobatos glaucostigma*), finescale triggerfish (*Balistes polylepis*) and a variety of other fish and invertebrates. Species of concern caught in the shrimp fisheries include turtles, various elasmobranchs, seahorses, and totoaba. Species that are not of conservation concern and would not drive the C2 score for any fishery are not assessed further in this report (e.g., anchovy, Panama grunt, pleuronectidae species, and finescale triggerfish).

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)

SHOVELNOSE GUITARFISH

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL

High Concern

All elasmobranchs reviewed in the assessment are considered a "high" concern for abundance, based on U.S. ESA listing (scalloped hammerheads in the Eastern Pacific), populations trend data and stock assessment (scalloped hammerheads in the Gulf of Mexico), or IUCN classification (Pacific angel sharks, shovelnose guitarfish).

Justification:

Shovelnose guitarfish are found from San Francisco Bay, California, to the southern Gulf of California, and Mexico. They are targeted in the Mexican elasmobranch fishery and are vulnerable to bottom gillnets in the

artisanal shrimp fishery (Farrugia et al. 2016). Due to effort increases in the 1990s, abundances of shovelnose guitarfish declined and do not appear to have rebounded (Farrugia et al. 2016). IUCN classifies shovelnose guitarfish as "Near Threatened" (Farrugia et al. 2016). Abundance of this population is therefore deemed a "high" concern.

Although shovelnose guitarfish is the focus of this assessment, due to information available about the fisheries, it may also reflect concern about other guitarfish (such as the speckled guitarfish) because they are a taxon that is highly vulnerable to over-exploitation, identification to the species level is often difficult, existing assessments of guitarfish generally are very old (60% of IUCN assessments are 10 or more years old), and the majority (70%) are either in threatened or data-deficient categories (Moore 2017).

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY

Moderate Concern

Shrimp trawls and gillnets have been shown to be a source of mortality for various elasmobranchs in Mexico. Managers reported minimal presence of these species in the bycatch, based on the most recent analysis of the onboard observer data, and conclude that shrimp fisheries do not represent a risk to these species (INAPESCA 2016). Nonetheless, mortality from shrimp fishing relative to a sustainable level is unknown; therefore, a "moderate" concern is appropriate.

Justification:

For a full account, see Pacific angel shark.

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL

Low Concern

There is evidence that shovelnose guitarfish is caught as bycatch in the gillnet fisheries in low quantities. (Balmori-Ramirez, A. et al 2012) reported only nine organisms in 420 sampling sets, during a study of the bycatch in Sonora and Sinaloa with smallscale shrimp fisheries. It is not clear if the low number of organisms caught was due high selectivity of the gillnets or low abundance of the species. According to the National Fisheries Chart (DOF 2010) the largest interactions of these elasmobranch species (shovelnose guitar, speckled guitar, electric guitar, etc) with artisanal gillnets are observed in the spring and summer months (DOF 2010) considering that the shrimp season is developed during the fall and winter months, there is a high chance that the shrimp fishery is not a substantial contributor to fishing mortality for shovelnose guitar fish, for this reason a low concern is deemed.

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, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

≥ 100%

Fishery	**Estimate (reference)**	**SFW category**
Mexican Pacific		
Industrial Fleet—Trawls	400% (INAPESCA 2017)	>100%
Artisanal Fleet—Gillnets	50% (Balmori-Ramirez et al. 2012)	<100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Magdalena I Trawl	55.6% of catch (INAPESCA b 2000)	<100%
Artisanal Fleet—Suripera nets	50% (Balmori-Ramirez et al. 2012)	<100%
Gulf of Mexico		
Industrial Fleet—Trawls	300% to 600% (INAPESCA 2014 b)	>100%
Artisanal Fleet—Small trawl ▌Seabob Fishery	600% (Wakida-Kusunoki 2005)	>100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Charanga nets	high selectivity, low discard mortality (SAGARPA 2004)	<100%

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA
MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL

< 100%

See table above.

SCALLOPED HAMMERHEAD

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY

High Concern

All elasmobranchs reviewed in the assessment are considered a "high concern" for abundance, based on U.S. ESA listing (scalloped hammerheads in the Eastern Pacific), populations trend data and stock assessment (scalloped hammerheads in the Gulf of Mexico), or IUCN classification (Pacific angel sharks, shovelnose guitarfish).

Justification:

Scalloped hammerheads in the Gulf of Mexico are from the Northwest Atlantic and Gulf of Mexico distinct population segment (DPS). This DPS is not listed under the U.S. Endangered Species Act, because the main threat of over-utilization will decrease in the foreseeable future (NMFS 2015). Nonetheless, according to the most recent stock assessment (NMFS 2015), the DPS has still suffered a significant decline since the early 1980s (approximately 83%). Earlier studies also indicate significant declines; e.g., (Baum et al. 2003) found an 89% decline in abundance based on longline Catch Per Unit Effort data. The DPS is thus considered a "high" concern for abundance.

Scalloped hammerheads off the coast of Mexico are from the Eastern Pacific DPS, which is considered "Endangered" under the U.S. ESA (NMFS 2015). Thus, this DPS is also considered a "high concern" for abundance.

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY

Moderate Concern

Shrimp trawls and gillnets have been shown to be a source of mortality for various elasmobranchs in Mexico. Managers reported minimal presence of these species in the bycatch, based on the most recent analysis of the onboard observer data, and conclude that shrimp fisheries do not represent a risk to these species (INAPESCA 2016). Nonetheless, mortality from shrimp fishing relative to a sustainable level is unknown; therefore, a "moderate" concern is appropriate.

Justification:

For a full account, see Pacific angel shark.

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, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY

≥ 100%

Fishery	Estimate (reference)	SFW category

Mexican Pacific		
Industrial Fleet—Trawls	400% (INAPESCA 2017)	>100%
Artisanal Fleet—Gillnets	50% (Balmori-Ramirez et al. 2012)	<100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Magdalena I Trawl	55.6% of catch (INAPESCA b 2000)	<100%
Artisanal Fleet—Suripera nets	50% (Balmori-Ramirez et al. 2012)	<100%
Gulf of Mexico		
Industrial Fleet—Trawls	300% to 600% (INAPESCA 2014 b)	>100%
Artisanal Fleet—Small trawl ▌Seabob Fishery	600% (Wakida-Kusunoki 2005)	>100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Charanga nets	high selectivity, low discard mortality (SAGARPA 2004)	<100%

PACIFIC SEAHORSE

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

High Concern

Pacific seahorse is listed as "Vulnerable" by the IUCN (Project Seahorse 2003) (Czembor et al. 2012). Therefore, Seafood Watch deems Pacific seahorse abundance a "high" concern.

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

Moderate Concern

Pacific seahorses have been recorded as bycatch in the Mexican Pacific shrimp fisheries (Baum and Vincent 2005) (Meltzer et al. 2012) (INAPESCA 2016) (see appendices). Listed on Mexico's NOM‐059‐SEMARNAT‐2001 as a species subject to special protection, intentional capture and trade of wild seahorses is prohibited. Also, the ban of trawling activities in shallow waters (five fathoms or less) may afford some protection as such areas have been recognized as main habitat for the species (INAPESCA 2016). Studies have shown that incidental catch of Pacific seahorse in the Mexican Pacific may impact species abundances in these regions (Czembor et al. 2012) (Project Seahorse 2003); however, the extent of these impacts is unknown. For these reasons, fishing mortality of Pacific seahorse for the Mexican Pacific (in all regions with all trawls and the west coast of Baja California using Magdalena I) is deemed a "moderate" 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 / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

≥ 100%

Fishery	Estimate (reference)	SFW category
Mexican Pacific		
Industrial Fleet—Trawls	400% (INAPESCA 2017)	>100%

Artisanal Fleet—Gillnets	50% (Balmori-Ramirez et al. 2012)	<100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Magdalena I Trawl	55.6% of catch (INAPESCA b 2000)	<100%
Artisanal Fleet—Suripera nets	50% (Balmori-Ramirez et al. 2012)	<100%
Gulf of Mexico		
Industrial Fleet—Trawls	300% to 600% (INAPESCA 2014 b)	>100%
Artisanal Fleet—Small trawl ▌Seabob Fishery	600% (Wakida-Kusunoki 2005)	>100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Charanga nets	high selectivity, low discard mortality (SAGARPA 2004)	<100%

MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

< 100%

See table above.

HAWKSBILL TURTLE

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

High Concern

All sea turtles are listed as Endangered or Threatened under the U.S. Endangered Species List, and so all are deemed a "high" concern for abundance. Some populations have shown improvements in recent years (see Detailed Rationale below); this is taken into account under fishing mortality.

Justification:

The 2013 "5▌Year Review" report for the hawksbill turtle by NOAA and the USFWS, examined hawksbill populations at 88 nesting sites among 10 regions around the world (NOAA-USFWS 2013). Overall, the report found a decrease in nesting abundance, although it does not have recent estimates for Mexico. When compared with the 2007 review, authors found that some populations in the eastern Pacific and Nicaragua in the Caribbean improved, but conclude that the overall trend has not changed (NOAA-USFWS 2013). In the Mexican Pacific, a small number (around 15) of females is estimated to nest each year (Seminoff et al. 2003) in remnant populations; the NOAA report concluded that, despite international cooperation to protect

hawksbills (e.g., East Pacific Hawksbill Initiative, Inter‐American Convention for the Protection and Conservation of Sea Turtles), threats from manmade and natural sources remain important factors on the recovery of this species (NOAA‐USFWS 2013). Some of these threats include tortoiseshell trade, poaching, incidental capture in commercial and artisanal fisheries, climate change, and coastal development (NOAA‐USFWS 2013). The report concludes that, based on a review of the best available information since the 2007 "5‐Year Review," hawksbill sea turtles remain in danger of extinction throughout all, or a significant portion, of its range and should retain their endangered status.

MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

High Concern

In the Gulf of Mexico, green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles, are all likely to be adversely affected by shrimp trawlers. These species migrate through areas subject to shrimp trawling (NOAAb 2017). Yet, some species are more likely to be affected by other factors (e.g., exploitation of eggs, harvesting of adults for meat) than for incidental bycatch by shrimp activities, like Kemp's ridley and green turtles (NOAAb 2017). All sea turtles are listed as Endangered or Threatened under the US Endangered Species List, and so all are deemed a "high" concern for abundance. Some populations have shown improvements in recent years (see Detailed Rationale below); this is taken into account under fishing mortality.

Justification:

The NOAA‐USFWS 2013 report for the hawksbill turtle showed an increase in the number of nesting females in the GOM/Caribbean (Yucatan Peninsula and Quintana Roo) (NOAA-USFWS 2013). The Yucatan Peninsula population was in decline until 1978, when protection regulations were implemented in Mexico. After these regulations were in place and during the 1985 to 1999 period, hawksbill nests increased dramatically (Garduno‐Andrade et al. 1999) in (NOAA‐USFWS 2013) followed by an abrupt decline during the 1999 to 2004 period (63% in 5 years) (Abreu-Grobois et al. 2005) in (NOAA‐USFWS 2013). Although the number of nests has been increasing (NOAA‐USFWS 2013), hawksbill turtles remain susceptible to several factors that limit their recovery, like interaction with fisheries, effects of climate change (e.g., loss of habitat to water levels) or other anthropogenic disturbances (e.g., pollution, coastal development) (NOAA-USFWS 2013).

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

Moderate Concern

The INAPESCA observer program has documented that the industrial fleet caught 87 olive ridleys, 32 greens, 2 loggerheads, and 1 unconfirmed hawksbill turtle over nine seasons (INAPESCA 2017). In addition, managers mentioned that, according to the observer's program data, since the 2007 to 2008 season no sea turtle mortalities have been reported; managers believe that the fishery does not jeopardize the recovery of these species populations (INAPESCA 2017).

Fishing mortality is considered a "high" concern under the Seafood Watch standard when cumulative mortality

is too high and the contribution of the fishery being assessed to mortality is unknown. Increasing abundance in the distinct population segments of green, olive ridley, and loggerhead turtles caught in the Mexican industrial shrimp fisheries suggests that cumulative fishing mortality may not be jeopardizing the ability of these DPSs to recover, although further data and analysis is needed to be more certain that this is the case. The annual certification of the fisheries on the correct use of turtle excluder devices, combined with observer data that suggests minimal mortality of turtles, is also reassuring. Additional years of nesting data, increased observer coverage, and analysis of these sources is needed to be more certain of the positive nesting trends and the fisheries' minimal impacts. A "moderate" concern is deemed appropriate for now.

Justification:

See detail under green sea turtles

MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

High Concern

The actual mortality rate of sea turtles in the Mexican shrimp fisheries in the GOM is unknown. There is no current observer program for the Gulf of Mexico shrimp trawl fishery. The SFW standard considers fishing mortality as a "high" when cumulative mortality is too high and the contribution of the fishery being assessed to mortality is unknown. Although some DPSs appear to be improving (green, Kemp's ridley, loggerhead, leatherback), the Kemp's ridley DPS does not; further analysis is necessary to be confident that cumulative fishing mortality is not too high. A lack of observer data compounds these concerns, especially given the number of turtles estimated to be caught in the U.S. Gulf of Mexico shrimp trawl fishery (>100,000 interactions, and >3000 mortalities) (Finkbeiner et al. 2011). Therefore, fishing mortality is deemed a "high" concern for all the sea turtles for the industrial fleet in the GOM.

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, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

≥ 100%

Fishery	Estimate (reference)	SFW category
Mexican Pacific		
Industrial Fleet—Trawls	400% (INAPESCA 2017)	>100%
Artisanal Fleet—Gillnets	50% (Balmori-Ramirez et al. 2012)	<100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Magdalena I Trawl	55.6% of catch (INAPESCA b 2000)	<100%
Artisanal Fleet—Suripera nets	50% (Balmori-Ramirez et al. 2012)	<100%
Gulf of Mexico		
Industrial Fleet—Trawls	300% to 600% (INAPESCA 2014 b)	>100%
Artisanal Fleet—Small trawl ▌Seabob Fishery	600% (Wakida-Kusunoki 2005)	>100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Charanga nets	high selectivity, low discard mortality (SAGARPA 2004)	<100%

LOGGERHEAD TURTLE

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

High Concern

All sea turtles are listed as Endangered or Threatened under the U.S. Endangered Species List, so all are deemed a "high" concern for abundance. Some populations have shown improvements in recent years (see Detailed Rationale below); this is taken into account under fishing mortality.

Justification:

The most recent update to the status of the Pacific DPS was by the IUCN in 2015. That report included a population viability analysis (PVA) This analysis estimated a 6% probability that the North Pacific loggerhead DPS will decline at 50% of the most recent abundance during the next 100 years (Van Houtan K.S. 2011). The IUCN assessment found that abundance has increased over the past three generations and that both geographic distribution and population size are relatively large, thus classifiying it as "Least Concern" (Casale and Matsuzama 2015). Note that this conclusion is very different than the earlier status report by NOAA in the Endangered and threatened species report of 2010 (NOAA 2010). That report was found to have significant

errors, which led to a new approach to assessing sea turtle status (Van Houtan and Halley 2011) (Van Houtan 2011) and (Ascani 2016).

MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

High Concern

In the Gulf of Mexico, green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles, are all likely to be adversely affected by shrimp trawlers. These species migrate through areas subject to shrimp trawling (NOAAb 2017); however, some species are more likely to be affected by other factors (e.g., exploitation of eggs, harvesting of adults for meat) than for incidental bycatch by shrimp activities, like Kemp's ridley and green turtles (NOAAb, 2017). All sea turtles are listed as Endangered or Threatened under the U.S. Endangered Species List, and so all are deemed a "high" concern for abundance. Some populations have shown improvements in recent years (see Detailed Rationale below); this is taken into account under fishing mortality.

Justification:

According to the most recent review of the status of the species by NOAA and the USFWS, the Northwest Atlantic loggerhead DPS appears to be stable or increasing (NOAA|USFWS 2013). The data used for the IUCN analysis indicated a positive overall trend for the North West Atlantic subpopulation (+2%) (Ceriani and Meylna 2015). The IUCN used the most recent available long|term series of nest counts, and reported an overall increase over the past three generations for the Northwest Atlantic loggerhead subpopulation (Ceriani and Meylna 2015) and for these reasons categorized the Northwest Atlantic loggerhead subpopulation as "Least Concern" under current IUCN criteria (Ceriani and Meylna 2015).

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

Moderate Concern

The INAPESCA observer program has documented that the industrial fleet caught 87 olive ridleys, 32 greens, 2 loggerheads, and 1 unconfirmed hawksbill turtle over nine seasons (INAPESCA 2017). In addition, managers mentioned that, according to the observer's program data, since the 2007 to 2008 season no sea turtle mortalities have been reported; managers believe that the fishery does not jeopardize the recovery of these species populations (INAPESCA 2017).

Fishing mortality is considered a "high" concern under the Seafood Watch standard when cumulative mortality is too high and the contribution of the fishery being assessed to mortality is unknown. Increasing abundance in the distinct population segments of green, olive ridley, and loggerhead turtles caught in the Mexican industrial shrimp fisheries suggests that cumulative fishing mortality may not be jeopardizing the ability of these DPSs to recover, although further data and analysis is needed to be more certain that this is the case. The annual certification of the fisheries on the correct use of turtle excluder devices, combined with observer data that suggests minimal mortality of turtles, is also reassuring. Additional years of nesting data, increased observer coverage, and analysis of these sources is needed to be more certain of the positive nesting trends and the

fisheries' minimal impacts. A "moderate" concern is deemed appropriate for now.

Justification:

See detail under green sea turtles

MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

High Concern

The actual mortality rate of sea turtles in the Mexican shrimp fisheries in the GOM is unknown. There is no current observer program for the Gulf of Mexico shrimp trawl fishery. The SFW standard considers fishing mortality as a "high" when cumulative mortality is too high and the contribution of the fishery being assessed to mortality is unknown. Although some DPSs appear to be improving (green, Kemp's ridley, loggerhead, leatherback), the Kemp's ridley DPS does not; further analysis is necessary to be confident that cumulative fishing mortality is not too high. A lack of observer data compounds these concerns, especially given the number of turtles estimated to be caught in the U.S. Gulf of Mexico shrimp trawl fishery (>100,000 interactions, and >3000 mortalities) (Finkbeiner et al. 2011). Therefore, fishing mortality is deemed a "high" concern for all the sea turtles for the industrial fleet in the GOM.

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, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

≥ 100%

Fishery	**Estimate (reference)**	**SFW category**
Mexican Pacific		
Industrial Fleet—Trawls	400% (INAPESCA 2017)	>100%
Artisanal Fleet—Gillnets	50% (Balmori-Ramirez et al. 2012)	<100%

Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Magdalena I Trawl	55.6% of catch (INAPESCA b 2000)	<100%
Artisanal Fleet—Suripera nets	50% (Balmori-Ramirez et al. 2012)	<100%
Gulf of Mexico		
Industrial Fleet—Trawls	300% to 600% (INAPESCA 2014 b)	>100%
Artisanal Fleet—Small trawl ǁ Seabob Fishery	600% (Wakida-Kusunoki 2005)	>100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Charanga nets	high selectivity, low discard mortality (SAGARPA 2004)	<100%

TOTOABA

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA

High Concern

Totoaba are considered "Critically Endangered" by the IUCN (Findley 2010) and, in 1979, was listed as "endangered" under the U.S. Endangered Species Act. Therefore, totoaba abundance is considered a "high" concern.

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA

Moderate Concern

Due to overfishing and a dramatic decline in the species abundance, a permanent ban for totoaba has been in place since 1975 in Mexico. In 2004, there was some evidence that the species was expanding its geographic range, suggesting positive steps towards population recovery (INAPESCA 2004). However, since then, no further status review has been undertaken. According to research by De AndaǁMontañez et al in 2013, the level of illegal poaching of totoaba is unknown. ValenzuelaǁQuiñonez et al. (2015) estimated the level of illegal catch based on the estimation of total mortality (Z) against natural mortality (M). Considering the difference of these two values as the result of illegal poaching. The authors found that illegal fishing has been increasing since 2013 (ValenzuelaǁQuiñonez, et al., 2015). Fishers are encouraged by the high price of the totoaba bladder, with a value of up to US$5000 kg−1 on the local black market (F. Valenzuelaǁ Quiñonez pers. obs. fishermen interview 2013).

There are reports that the species is still caught as bycatch in the Mexican Pacific trawls (Cisnerosǁ Montemayor and Vincent, 2016) (INAPESCA 2016). According to the IUCN, heavy fishing pressure continues on juveniles ("machorros," 20ǁ25 cm) due to the active shrimp trawl fishery in the upper Gulf of California

(Findley 2010). Observer data suggest its presence in shrimp trawls is rare with less than 0.01% presence in the catch (INAPESCA 2016). However, with no recent status review and the consequential 'unknown' status of fishing mortality relative to a sustainable level, and a lack of analysis determining that shrimp fishery bycatch is not substantial relative to total mortality, a score of moderate is warranted.

Justification:

In 1989, 92% of juvenile totoaba mortalities were attributed to the shrimp trawl fishery operating in a totoaba nursery area in the upper Gulf of California (Barrera‐Guevara 1990). In addition to fishing pressure, habitat degradation from the Colorado River has impacted the fishery (Findley 2010). To reduce fishing pressure and improve habitat quality, the Upper Gulf of California and Colorado River Delta Biosphere Reserve was established to protect the spawning and nursery habitat of many fish species, including totoaba. The management plan for the reserve established a core zone (closed to the Colorado river mouth) where any extraction activity –including fishing ‐ is prohibited (CONANP, 2007). Other subzones, that include the waters close to the coast as well as marine waters (with the exception of the vaquita refugee zone), allow fishing using low impact gears (hook and line, diving, traps, etc.). (CONANP 2007). The fishing pressure from shrimp trawls and gillnets have been greatly reduced in this region (Román‐Rodríguez and Hammann 1997).

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, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA

≥ 100%

Fishery	**Estimate (reference)**	**SFW category**
Mexican Pacific		
Industrial Fleet—Trawls	400% (INAPESCA 2017)	>100%
Artisanal Fleet—Gillnets	50% (Balmori-Ramirez et al. 2012)	<100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Magdalena I Trawl	55.6% of catch (INAPESCA b 2000)	<100%
Artisanal Fleet—Suripera nets	50% (Balmori-Ramirez et al. 2012)	<100%
Gulf of Mexico		

Industrial Fleet—Trawls	300% to 600% (INAPESCA 2014 b)	>100%
Artisanal Fleet—Small trawl ▌Seabob Fishery	600% (Wakida-Kusunoki 2005)	>100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Charanga nets	high selectivity, low discard mortality (SAGARPA 2004)	<100%

PACIFIC ANGEL SHARK

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

High Concern

All elasmobranchs reviewed in the assessment are considered a "high" concern for abundance, based on U.S. ESA listing (scalloped hammerheads in the Eastern Pacific), populations trend data and stock assessment (scalloped hammerheads in the Gulf of Mexico), or IUCN classification (Pacific angel sharks, shovelnose guitarfish).

Justification:

Pacific angel sharks occur off the coast of North America from Alaska to the tip of Baja California, Mexico (including the Gulf of California). In Mexico, the population trend is unknown, as is current abundance relative to a sustainable level. Landings have declined and could decline by more than 99% within the next three generations if current trends continue (Cailliet 2016). Landings are not necessarily indicative of population trends, but as fishing mortality in Mexican fisheries has likely remained stable over time (Cailliet 2016), declining landings are a cause for concern. The species is considered "Near Threatened" by the IUCN, and a "high concern" for abundance in the present assessment.

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

Moderate Concern

Shrimp trawls and gillnets have been shown to be a source of mortality for various elasmobranchs in Mexico. Managers reported minimal presence of these species in the bycatch, based on the most recent analysis of the onboard observer data, and conclude that shrimp fisheries do not represent a risk to these species (INAPESCA 2016); however, mortality from shrimp fishing relative to a sustainable level is unknown, and so a "moderate" concern is appropriate.

Justification:

Shrimp trawls have been shown to be a source of mortality for sharks and rays, and coastal shark bycatch in the Mexican Pacific shrimp fishery (Lopez-Martinez et al. 2010); however, the relative contribution of the

shrimp trawl fisheries to overall mortality of Pacific angel shark, shovelnose guitarfish, and scalloped hammerhead is unknown.

INAPESCA analyzed bycatch data from the Pacific shrimp trawls during the seasons 1982 to1983, 1985, 1989 to1990, 1992 to 1993, 1995 to 1996 and 2006. As a result, INAPESCA's researchers found that *S. californica* is captured only in the Upper Gulf of California (Palacios‐Salgado 2011) in (INAPESCA 2016). Managers confirmed that the species was considered to be abundant as bycatch four decades ago (Saldaña-Ruiza et al. 2017); however, in most recent years, its presence is minimal (Lopez-Martinez et al. 2010). A more recent analysis of observer data—also by INAPESCA—found that during 2004 to 2010, six hammerheads were reported to be caught by the industrial fleet in the Pacific during 222 fishing sets (INAPESCA 2015). In the case of angel shark, during the same period of time, 20 organisms were reported to be caught by the fleet in the Pacific; researchers estimated the catch per unit of area (CPUA) for the species in 1 organism/km 2. Finally, the ratio for shovelnose guitar in the industrial shrimp fisheries in the Pacific was estimated by managers in 22 organisms by km 2 during the 2004 to 2010 time frame. Managers add that, since the inclusion of the square mesh/extended funnel bycatch reduction device of the trawl nets, bycatch of some species, in particular, elasmobranchs, like the shovelnose guitarfish, has been reduced by approximately 40% (Garcia-Caudillo et al 2000).

Similarly, there is evidence that shovelnose guitarfish are caught as bycatch in the gillnet fisheries in low quantities. (Balmori-Ramirez et al. 2012) reported only nine organisms in 420 sampling sets, during a study of the bycatch in Sonora and Sinaloa with small‐scale shrimp fisheries. It is not clear if the low number of organisms caught was due to high selectivity of the gillnets or low abundance of the species. According to the National Fisheries Chart (DOF 2010) the largest interactions of these elasmobranch species (shovelnose guitar, speckled guitar, electric guitar, etc.) with artisanal gillnets are observed in the spring and summer months (DOF 2010). Considering that the shrimp season is developed during the fall and winter months, there is a high chance that the shrimp fishery is not a substantial contributor to fishing mortality for shovelnose guitarfish. For this reason, a "low" concern is deemed appropriate.

In Mexico, some fisheries target these species, using different gears (longlines, bottom longlines and gillnets) (DOF 2012). Baja California Sur, Baja California, Sonora and Sinaloa are the most important states in terms of landings for all three species (CONAPESCA 2008). Currently, managers considered the fisheries targeting this species to be at their maximum sustainable level and recommended not to increase effort (DOF 2012). It is unclear what this designation is based on, however, and no more recent status reports are available. Reported landings of these fisheries have remained stable, according to CONAPESCA data. Some increases can be seen in the hammerhead shark landings.

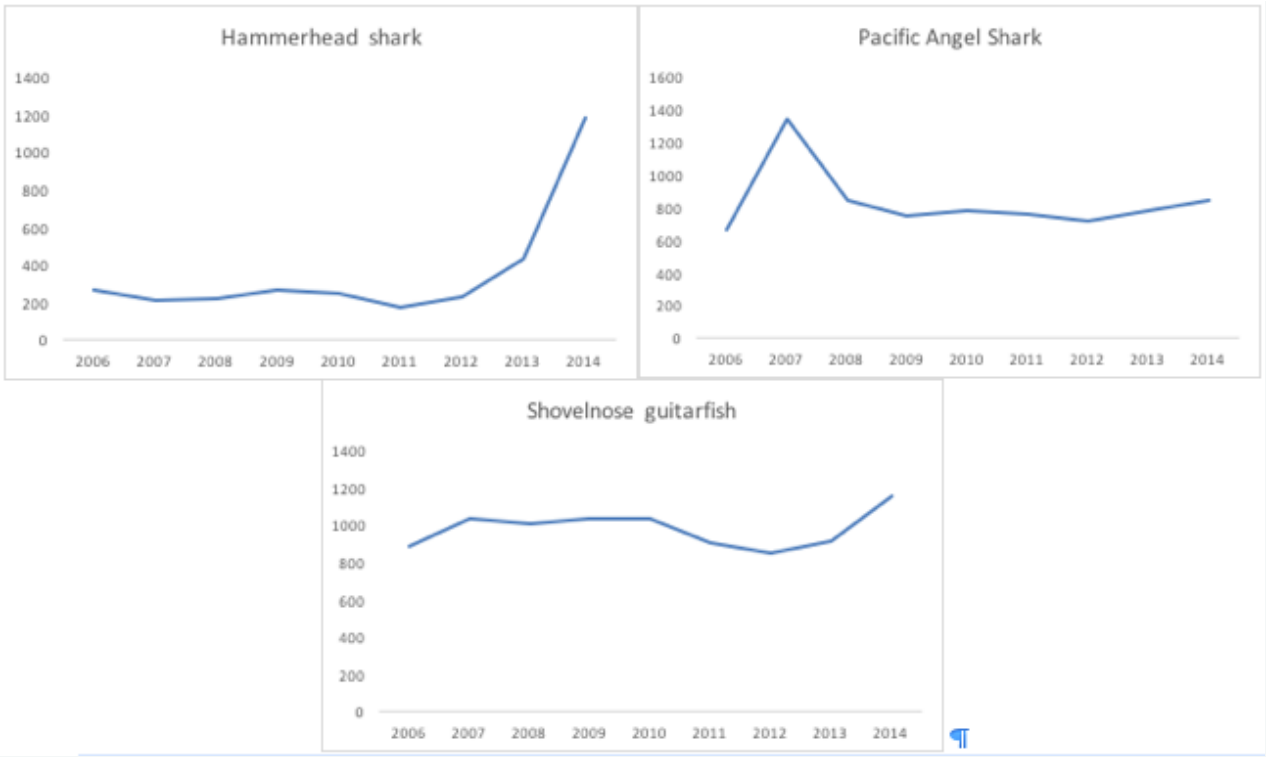

Figure 42 Reported landings of hammerhead shark, Pacific angel shark, and shovelnose guitarfish by Mexican fisheries that target these species (Data source CONAPESCA, 2014)

Nonetheless, the impacts of fishing mortality of the shrimp fisheries on these species has not been assessed. Managers analyzed data from the onboard observer's program from the 2011 to 2014 seasons. Based on the analyses, managers concluded that angel shark, scalloped hammerhead, and shovelnose guitarfish represented a small component of the bycatch of shrimp fishing in the Mexican Pacific, particularly if compared to other groups such as teleosts or invertebrates that exceed them in number and relative weight, and compared to other groups of elasmobranchs such as rounded rays, which are not of commercial importance (INAPESCA Shark Program report 2016) (see table below). The report also states that the impact on angel shark occurred principally in the Upper Gulf of California, but in the rest of the Mexican Pacific, this species is not impacted.

Table. Results of CPUE and CPUA on Hammerhead, Angel shark, Shovelnose guitarfish, and Mantas from onboard observer's program data (Source: INAPESCA's shark group report).

Fishing area	Group of species	Total landings	Positive landings	CPUE			CPUA (catch per area)		
				Media	Error	ANOVA	Media	Error típico	ANOVA
UGC	Hammerhead	147	2	0.1	0.1	p = 0.442	0.0	0.0	p = 0.388
	Angel		0	0.0	0.0	p = 0.429	0.0	0.0	p = 0.429
	Shovelnose		62	39.7	31.9	p = 0.246	16.6	12.6	p = 0.204
	Mantas		68	34.2	21.0	p = 0.095	12.7	7.5	p = 0.080
SONORA	Hammerhead	25	2	0.2	0.2	p = 0.442	0.1	0.1	p = 0.388
	Angel		0	0.0	0.0	p = 0.429	0.0	0.0	p = 0.429

	Shovelnose		4	0.8	0.5	p = 0.246	0.4	0.2	p = 0.204
	Mantas		14	5.1	4.5	p = 0.095	2.0	1.6	p = 0.080
SINALOA	Hammerhead	30	2	0.4	0.3	p = 0.442	0.2	0.1	p = 0.388
	Angel		0	0.0	0.0	p = 0.429	0.0	0.0	p = 0.429
	Shovelnose		1	0.9	0.9	p = 0.246	0.6	0.6	p = 0.204
	Mantas		1	0.1	0.1	p = 0.095	0.0	0.0	p = 0.080
BCS	Hammerhead	20	0	0.0	0.0	p = 0.442	0.0	0.0	p = 0.388
	Angel		20	5.2	5.2	p = 0.429	4.1	4.1	p = 0.429
	Shovelnose		0	0.0	0.0	p = 0.246	0.0	0.0	p = 0.204
	Mantas		0	0.0	0.0	p = 0.095	0.0	0.0	p = 0.080

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, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

≥ 100%

Fishery	**Estimate (reference)**	**SFW category**
Mexican Pacific		
Industrial Fleet—Trawls	400% (INAPESCA 2017)	>100%
Artisanal Fleet—Gillnets	50% (Balmori-Ramirez et al. 2012)	<100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Magdalena I Trawl	55.6% of catch (INAPESCA b 2000)	<100%
Artisanal Fleet—Suripera nets	50% (Balmori-Ramirez et al. 2012)	<100%

Gulf of Mexico		
Industrial Fleet—Trawls	300% to 600% (INAPESCA 2014 b)	>100%
Artisanal Fleet—Small trawl ▌Seabob Fishery	600% (Wakida-Kusunoki 2005)	>100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Charanga nets	high selectivity, low discard mortality (SAGARPA 2004)	<100%

LEATHERBACK TURTLE

Factor 2.1 - Abundance

MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

High Concern

In the Gulf of Mexico, green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles, are all likely to be adversely affected by shrimp trawlers. These species migrate through areas subject to shrimp trawling (NOAAb 2017); however, some species are more likely to be affected by other factors (e.g., exploitation of eggs, harvesting of adults for meat) than for incidental bycatch by shrimp activities, like Kemp's ridley and green turtles (NOAAb 2017). All sea turtles are listed as Endangered or Threatened under the U.S. Endangered Species List, and so all are deemed a "high" concern for abundance. Some populations have shown improvements in recent years (see Detailed Rationale below); this is taken into account under fishing mortality.

Justification:

In the Caribbean, Atlantic, and Gulf of Mexico, leatherback populations have been reported to be increasing (NOAA 2017). In the United States, the Atlantic coast of Florida is one of the main nesting areas in the country. Data from this area shows a general increase with some fluctuations (NOAA 2017). In 2014, the Florida index nesting data indicate that the number of nests ranged from 27 to 641 between 1989 and 2014 (NOAA 2017). In the status review of 2013 (NOAA▌USFWS 2013), the authors concluded that leatherback populations in the Atlantic appeared to be stable or increasing, suggesting that high reproductive output and consistent and high quality foraging areas in the Atlantic have contributed to the stable or recovering populations of the species (NOAA▌USFWS 2013).

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

High Concern

The actual mortality rate of sea turtles in the Mexican shrimp fisheries in the GOM is unknown. There is no current observer program for the Gulf of Mexico shrimp trawl fishery. The SFW standard considers fishing mortality as a "high" when cumulative mortality is too high and the contribution of the fishery being assessed to mortality is unknown. Although some DPSs appear to be improving (green, Kemp's ridley, loggerhead, leatherback), the Kemp's ridley DPS does not; further analysis is necessary to be confident that cumulative fishing mortality is not too high. A lack of observer data compounds these concerns, especially given the

number of turtles estimated to be caught in the U.S. Gulf of Mexico shrimp trawl fishery (>100,000 interactions, and >3000 mortalities) (Finkbeiner et al. 2011). Therefore, fishing mortality is deemed a "high" concern for all the sea turtles for the industrial fleet in the GOM.

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 MEXICO, BOTTOM TRAWLS, MEXICO

≥ 100%

Fishery	**Estimate (reference)**	**SFW category**
Mexican Pacific		
Industrial Fleet—Trawls	400% (INAPESCA 2017)	>100%
Artisanal Fleet—Gillnets	50% (Balmori-Ramirez et al. 2012)	<100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Magdalena I Trawl	55.6% of catch (INAPESCA b 2000)	<100%
Artisanal Fleet—Suripera nets	50% (Balmori-Ramirez et al. 2012)	<100%
Gulf of Mexico		
Industrial Fleet—Trawls	300% to 600% (INAPESCA 2014 b)	>100%
Artisanal Fleet—Small trawl ▌Seabob Fishery	600% (Wakida-Kusunoki 2005)	>100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Charanga nets	high selectivity, low discard mortality (SAGARPA 2004)	<100%

BULLSEYE PUFFER

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, SURIPERA, MEXICO, SINALOA-NORTH-CENTRAL

Moderate Concern

A stock assessment relative to reference points is not available for this species. This species is listed as "Least Concern" by the IUCN (Nielsen et al. 2010). Given the age of the IUCN assessment, inherent vulnerability was also assessed using a Productivity-Susceptibility Analysis (PSA) (see justification). Bullseye puffer has a low vulnerability, and a "Least Concern" status from the IUCN, but there is no quantitative stock assessment or reference points. For these reasons, abundance is deemed a "moderate" concern.

Justification:

PSA score = 1.98. For this reason, the species is deemed "low" vulnerability (based on PSA scoring tool). Detailed scoring of each attribute is shown below.

Productivity Attribute	**Relevant Information**	**Score (1 = low risk, 2 = medium risk, 3 = high risk)**
Average age at maturity	*N / A*	
Average maximum age	N / A	
Average maximum size	44 cm (Bussing 1995)	1
Fecundity	<20,000 per year (Ibarra-Zatarian 2016)	1
Reproductive strategy	Broadcast spawner	1
Trophic level	3.1 (Froese and Pauly 2016)	1

Susceptibility Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Areal overlap (Considers all fisheries)	Common on rocky reefs and adjacent sand patches (Nielsen et al. 2010). Areas that are not worked by the gears.	2
Vertical overlap (Considers all fisheries)	Often seen in mid-water high off the bottom or at the surface. Juveniles inhabit the high and middle salinity portions of estuaries (Bussing 1995; Cooke 1992)	2
Selectivity of fishery (Specific to fishery under assessment)	Species is incidentally encountered and is not likely to escape the gear, but conditions under 'high risk' do not apply. Default value.	2
Post-capture mortality (Specific to fishery under assessment)	Unknown Default value.	3

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, SURIPERA, MEXICO, SINALOA-NORTH-CENTRAL

Low Concern

Bullseye puffer is a common species along the Pacific, and can be found from southern California to Pisco, Peru and the Galapagos islands (Nielsen et al. 2010). It is considered an associated species for the finfish fishers in the Pacific coast (DOF 2012). Despite its availability in Mexican waters, its exploitation for human consumption is recent, given that tetraodontids are widely known for being a poisonous food due to the tetrodoxin content (Ahasan et al. 2004). Sanchez-Cardenas et al. indicated that younger organisms are distributed in different habitats than older ones, where juveniles inhabit mixohaline systems and adults the neritic zone (Sanchez-Cardenas et al. 2007). Such behavior favors the conservation of this resource, given that it protects juveniles from fishing. Bullseye pufferfish have been reported as a rare species in the Suripera and Gillnet fisheries in Sinaloa (Del Pacifico 2016). This species is listed as "Least Concern" by the IUCN (Nielsen et al. 2010). Due to the species' low vulnerability and low presence in the catch, it is unlikely that the Magdalena I fishery is a substantial contributor of fishing mortality. For these reasons, fishing mortality is deemed "low" concern.

Factor 2.3 - Modifying Factor: Discards and Bait Use

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

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

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

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, SURIPERA, MEXICO, SINALOA-NORTH-CENTRAL

< 100%

See table above.

KEMP'S RIDLEY TURTLE

Factor 2.1 - Abundance

MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

High Concern

In the Gulf of Mexico, green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles, are all likely to be adversely affected by shrimp trawlers. These species migrate through areas subject to shrimp trawling (NOAAb 2017); however, some species are more likely to be affected by other factors (e.g., exploitation of eggs, harvesting of adults for meat) than for incidental bycatch by shrimp activities, like Kemp's ridley and green turtles (NOAAb 2017). All sea turtles are listed as Endangered or Threatened under the U.S. Endangered Species List, and so all are deemed a "high" concern for abundance. Some populations have shown improvements in recent years (see Detailed Rationale below); this is taken into account under fishing mortality.

Justification:

The most recent report on the status of Kemp's ridley turtles was developed by NOAA in 2015. This report measured the population growth rate (by numbers of nests) against the 2007 report. It found that population growth stopped abruptly after 2009 and estimated that, due to the low numbers of nests, the population is not projected to grow at former rates (NOAA|USFWS 2015). Authors believed that high mortality of females after the 2009 nesting season was the main reason for this decrease (NOAA|USFWS 2015). Based on the results, authors conclude that the population is not recovering. The report cites the oil spill of 2010 as a potential factor in fewer females, although this is still under evaluation (NOAA|USFWS 2015). The report still considers commercial and recreational fisheries a substantial threat to the Kemp's ridley populations despite measures to reduce bycatch, and added that Kemp's ridleys have the highest rate of interaction with fisheries operating in the Gulf of Mexico and Atlantic Ocean than any other species of turtle (NOAA|USFWS 2015).

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

High Concern

The actual mortality rate of sea turtles in the Mexican shrimp fisheries in the GOM is unknown. There is no current observer program for the Gulf of Mexico shrimp trawl fishery. The SFW standard considers fishing mortality as a "high" when cumulative mortality is too high and the contribution of the fishery being assessed to mortality is unknown. Although some DPSs appear to be improving (green, Kemp's ridley, loggerhead, leatherback), the Kemp's ridley DPS does not; further analysis is necessary to be confident that cumulative fishing mortality is not too high. A lack of observer data compounds these concerns, especially given the number of turtles estimated to be caught in the U.S. Gulf of Mexico shrimp trawl fishery (>100,000 interactions, and >3000 mortalities) (Finkbeiner et al. 2011). Therefore, fishing mortality is deemed a "high" concern for all the sea turtles for the industrial fleet in the GOM.

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 MEXICO, BOTTOM TRAWLS, MEXICO

≥ 100%

Fishery	Estimate (reference)	SFW category
Mexican Pacific		
Industrial Fleet—Trawls	400% (INAPESCA 2017)	>100%
Artisanal Fleet—Gillnets	50% (Balmori-Ramirez et al. 2012)	<100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Magdalena I Trawl	55.6% of catch (INAPESCA b 2000)	<100%
Artisanal Fleet—Suripera nets	50% (Balmori-Ramirez et al. 2012)	<100%
Gulf of Mexico		
Industrial Fleet—Trawls	300% to 600% (INAPESCA 2014 b)	>100%
Artisanal Fleet—Small trawl ▌Seabob Fishery	600% (Wakida-Kusunoki 2005)	>100%

Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Charanga nets	high selectivity, low discard mortality (SAGARPA 2004)	<100%

OLIVE RIDLEY TURTLE

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

High Concern

All sea turtles are listed as Endangered or Threatened under the U.S. Endangered Species List, and so all are deemed a "high" concern for abundance. Some populations have shown improvements in recent years (see Detailed Rationale below); this is taken into account under fishing mortality.

Justification:

The most recent fiveyear evaluation of the olive ridley turtle was published in 2014 by NOAA and the U.S. Fish and Wildlife Service (NOAA-USFWS 2014). Reported abundance of olive ridleys was compared against historical abundances at each of the large arribada beaches. The results indicated that populations experienced steep declines mostly due to overl exploitation (NOAA-USFWS 2014), with the exception of Ixtapilla in Mexico. Based on the nesting numbers in Mexico, authors found three populations to be stable (Mismaloya, Tlacoyunque, and Moro Ayuta), two increasing (Ixtapilla, La Escobilla), and one decreasing (Chacahua). Authors add that recent atlsea estimates of density and abundance of the olive ridley show a yearly estimate of 1.39 million (confidence interval: 1.15 to 1.62 million), consistent with the increases seen on the eastern Pacific nesting beaches as a result of protection programs (NOAA-USFWS 2014). The report concludes that protections (closure of the olive ridley turtle fishery and ban on egg harvest) have decreased the threat to the population, and found that the endangered populations appeared to have stabilized from the previous population collapse (NOAA-USFWS 2014). The report recommends that based on the most and best available information, the breeding colony populations on the Pacific coast of Mexico may warrant reclassification (NOAA-USFWS 2014), and so is currently under review by NOAA.

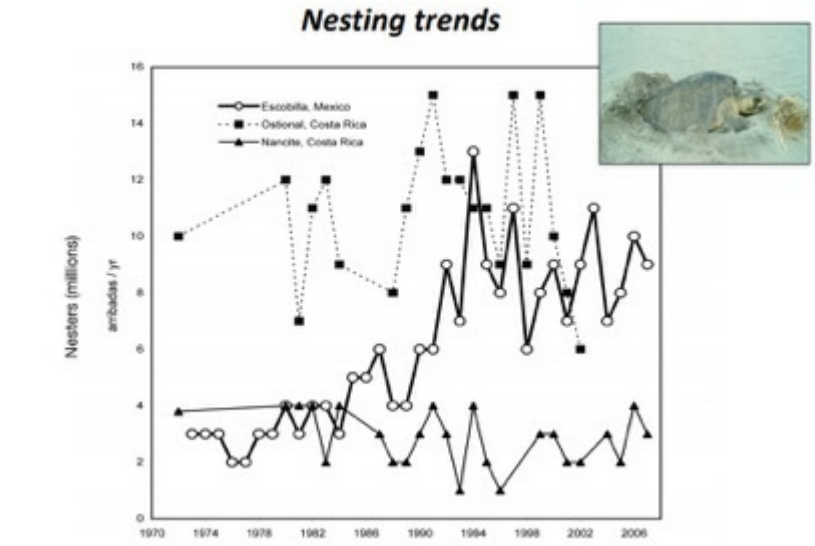

Figure 43 Change in nesting arribada abundance for olive ridley turtles at three major arribada sites in the eastern estimated nesting abundance of two major olive ridley nesting populations from the eastern Pacific (Plotkin et al. 2012). Chart and text from IATTC 2017

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

Moderate Concern

The INAPESCA observer program has documented that the industrial fleet caught 87 olive ridleys, 32 greens, 2 loggerheads, and 1 unconfirmed hawksbill turtle over nine seasons (INAPESCA 2017). In addition, managers mentioned that, according to the observer's program data, since the 2007 to 2008 season no sea turtle mortalities have been reported; managers believe that the fishery does not jeopardize the recovery of these species populations (INAPESCA 2017).

Fishing mortality is considered a "high" concern under the Seafood Watch standard when cumulative mortality is too high and the contribution of the fishery being assessed to mortality is unknown. Increasing abundance in the distinct population segments of green, olive ridley, and loggerhead turtles caught in the Mexican industrial shrimp fisheries suggests that cumulative fishing mortality may not be jeopardizing the ability of these DPSs to recover, although further data and analysis is needed to be more certain that this is the case. The annual certification of the fisheries on the correct use of turtle excluder devices, combined with observer data that suggests minimal mortality of turtles, is also reassuring. Additional years of nesting data, increased observer coverage, and analysis of these sources is needed to be more certain of the positive nesting trends and the fisheries' minimal impacts. A "moderate" concern is deemed appropriate for now.

Justification:

See detail under green sea turtles

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, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

≥ 100%

Fishery	**Estimate (reference)**	**SFW category**
Mexican Pacific		
Industrial Fleet—Trawls	400% (INAPESCA 2017)	>100%
Artisanal Fleet—Gillnets	50% (Balmori-Ramirez et al. 2012)	<100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Magdalena I Trawl	55.6% of catch (INAPESCA b 2000)	<100%
Artisanal Fleet—Suripera nets	50% (Balmori-Ramirez et al. 2012)	<100%
Gulf of Mexico		
Industrial Fleet—Trawls	300% to 600% (INAPESCA 2014 b)	>100%
Artisanal Fleet—Small trawl ▌Seabob Fishery	600% (Wakida-Kusunoki 2005)	>100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Charanga nets	high selectivity, low discard mortality (SAGARPA 2004)	<100%

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

High Concern

All sea turtles are listed as Endangered or Threatened under the U.S. Endangered Species List, and so all are deemed a "high" concern for abundance. Some populations have shown improvements in recent years (see Detailed Rationale below); this is taken into account under fishing mortality.

Justification:

In the report of the status for green turtle in 2015, NOAA officials analyzed nesting information for Mexico, particularly in Michoacán—the largest nesting aggregation in the East Pacific DPS (NOAA 2017). The report concluded that the green turtle population has improved, as compared with data from 1980. Authors suggest that protection regulations played a big role on this increase in abundance in Mexico (NOAA 2017). In addition, another important green turtle population—in Costa Rica—also reported a stable status on the nesting data, confirming that this section of the population is also increasing as well (NOAA 2017).

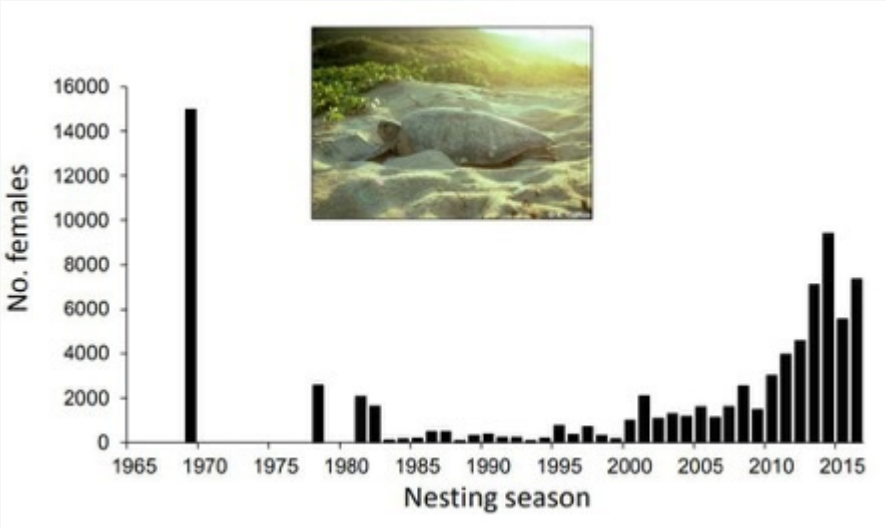

Figure 44 Change in nesting abundance of green turtles at Playa Colola, Michoacan, Mexico (chart from IATTC 2017).

MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

High Concern

In the Gulf of Mexico, green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles, are all likely to be adversely affected by shrimp trawlers. These species migrate through areas subject to shrimp trawling (NOAAb 2017). Some species, however, are more likely to be affected by other factors (e.g, exploitation of eggs, harvesting of adults for meat) than for incidental bycatch by shrimp activities, like Kemp's ridley and green turtles (NOAAb 2017). All sea turtles are listed as Endangered or Threatened under the U.S.

Endangered Species List, and so all are deemed a "high" concern for abundance. Some populations have shown improvements in recent years (see Detailed Rationale below); this is taken into account under fishing mortality.

Justification:

According to the most recent review of the status of green turtles, the North Atlantic distinct population segment (DPS) has nesting sites having relatively high levels of abundance (i.e., >1,000 nesters) (NOAA 2015). The report includes data for 16 countries, and all major nesting populations demonstrate long‐term increases in abundance (NOAA 2015). One of the conclusions reached by authors is that the dispersed location of nesting sites provides a level of habitat use diversity and population resilience that reduces overall extinction risk (NOAA 2015).

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

Moderate Concern

The INAPESCA observer program has documented that the industrial fleet caught 87 olive ridleys, 32 greens, 2 loggerheads and 1 unconfirmed hawksbill turtle over nine seasons (INAPESCA 2017). Also, managers mentioned that, according to the observer’s program data, since the 2007 to 2008 season, no sea turtle mortalities have been reported; and managers believe that the fishery does not jeopardize the recovery of these species' populations (INAPESCA, 2017).

Fishing mortality is considered a "high" concern under the Seafood Watch standard when cumulative mortality is too high and the contribution of the fishery being assessed to mortality is unknown. Increasing abundance in the distinct population segments of green, olive ridley and loggerhead turtles caught in the Mexican industrial shrimp fisheries suggests that cumulative fishing mortality may not jeopardizing the ability of these DPSs to recover, though further data and analysis is needed to be more certain that this is the case. The annual certification of the fisheries on the correct use of turtle excluder devices, combined with observer data that suggests minimal mortality of turtles, is also reassuring. Additional years of nesting data, increased observer coverage, and analysis of these sources is needed to be more certain of the positive nesting trends and the fisheries' minimal impacts. A "moderate" concern is deemed appropriate for now.

Justification:

Trawls, longlines, and gillnets have been discussed as the major sources of mortality for sea turtles around the world (Lewison et al. 2003). A technological solution can reduce the take of sea turtles in shrimp trawls: a trap‐door grate, called a turtle excluder device (TED), which allows turtles to push free of the net. The proper use of TEDs on shrimp trawl nets can reduce sea turtle bycatch by more than 90% (IAC 2006). INAPESCA reported that the Mexican shrimp fishery no longer poses an extinction threat to sea turtles, as the use of TEDs can reduce bycatch by 98%; however, realized reductions in mortality may be quite a bit less, depending on compliance with regulations and the suitability of TED designs to specific turtle species captured in the region (Lewison et al. 2003).

Coverage by the INAPESCA observer program coverage has not been homogeneous along the different

seasons (see table below). On average, the program has covered 3% of the fishing effort in the number of trips; the estimates of turtle interaction are made in turtles by the number of sets (1 in every 887 sets) (INAPESCA 2017). The analysis of the program's data showed that in 106,393 fishing sets (during nine fishing seasons), the probability of interaction with sea turtles was estimated in 0.1%, or one sea turtle per 887 fishing sets (INAPESCA, 2017).

Percentage of coverage for the onboard observer's program (Source: INAPESCA 2017). Note there was no observer program for the 2011/12 to 2014/15 seasons.

Season	No. of Total	fishing trips W/Observer	Coverage %
2004–05	5,547	52	0.9
2005–06	5,505	208	3.8
2006–07	5,583	239	4.3
2007–08	4,948	206	4.2
2008–09	5,233	185	3.5
2009–10	4,540	159	3.5
2010–11	4,201	167	4.0
2015–16	4,078	11	0.3
2016–17	4,680	98	2.1
Total	44,315	1,334	3.0

MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

High Concern

The actual mortality rate of sea turtles in the Mexican shrimp fisheries in the GOM is unknown. There is no current observer program for the Gulf of Mexico shrimp trawl fishery. The SFW standard considers fishing mortality as a "high" when cumulative mortality is too high and the contribution of the fishery being assessed to mortality is unknown. Although some DPSs appear to be improving (green, Kemp's ridley, loggerhead, leatherback), the Kemp's ridley DPS does not; further analysis is necessary to be confident that cumulative fishing mortality is not too high. A lack of observer data compounds these concerns, especially given the number of turtles estimated to be caught in the U.S. Gulf of Mexico shrimp trawl fishery (>100,000 interactions, and >3000 mortalities) (Finkbeiner et al. 2011). Therefore, fishing mortality is deemed a "high" concern for all the sea turtles for the industrial fleet in the GOM.

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, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA

≥ 100%

Fishery	**Estimate (reference)**	**SFW category**
Mexican Pacific		
Industrial Fleet—Trawls	400% (INAPESCA 2017)	>100%
Artisanal Fleet—Gillnets	50% (Balmori-Ramirez et al. 2012)	<100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Magdalena I Trawl	55.6% of catch (INAPESCA b 2000)	<100%
Artisanal Fleet—Suripera nets	50% (Balmori-Ramirez et al. 2012)	<100%
Gulf of Mexico		
Industrial Fleet—Trawls	300% to 600% (INAPESCA 2014 b)	>100%
Artisanal Fleet—Small trawl ▌Seabob Fishery	600% (Wakida-Kusunoki 2005)	>100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Charanga nets	high selectivity, low discard mortality (SAGARPA 2004)	<100%

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 | Bottom trawls | Mexico | Nayarit	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Yellow (3.000)
Fishery 2: Mexico / Gulf of California | Bottom trawls | Mexico | Sinaloa South	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Yellow (3.000)
Fishery 3: Mexico / Gulf of California | Bottom trawls | Mexico | Sinaloa-North-Central	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Yellow (3.000)
Fishery 4: Mexico / Gulf of California | Bottom trawls | Mexico | Sonora	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Yellow (3.000)

Fishery 5: Mexico / Gulf of California | Bottom trawls | Mexico | Upper Gulf of California	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Yellow (3.000)
Fishery 6: Mexico / Gulf of California | Cast nets | Mexico | Nayarit	Moderately Effective	Highly Effective	Highly Effective	Ineffective	Highly Effective	Red (2.000)
Fishery 7: Mexico / Gulf of California | Cast nets | Mexico | Sinaloa South	Moderately Effective	Highly Effective	Highly Effective	Ineffective	Highly Effective	Red (2.000)
Fishery 8: Mexico / Gulf of California | Gillnets and entangling nets (unspecified) | Mexico | Sinaloa-North-Central	Moderately Effective	Moderately Effective	Ineffective	Ineffective	Highly Effective	Red (2.000)
Fishery 9: Mexico / Gulf of California | Gillnets and entangling nets (unspecified) | Mexico | Sonora	Moderately Effective	Moderately Effective	Ineffective	Ineffective	Highly Effective	Red (2.000)
Fishery 10: Mexico / Gulf of California | Suripera | Mexico | Sinaloa-North-Central	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Yellow (3.000)
Fishery 11: Mexico / Gulf of Mexico | Bottom trawls | Mexico	Moderately Effective	Moderately Effective	Ineffective	Moderately Effective	Highly Effective	Red (2.000)
Fishery 12: Mexico / Gulf of Mexico | Bottom trawls | Mexico | Seabob fishery	Moderately Effective	Moderately Effective	Ineffective	Moderately Effective	Highly Effective	Red (2.000)
Fishery 13: Mexico / Gulf of Mexico | Cast nets | Mexico	Moderately Effective	Highly Effective	Highly Effective	Ineffective	Highly Effective	Red (2.000)
Fishery 14: Mexico / Gulf of Mexico | Traps (unspecified) | Mexico	Moderately Effective	Highly Effective	Highly Effective	Ineffective	Highly Effective	Red (2.000)
Fishery 15: Mexico / Pacific | Bottom trawls | Mexico | Gulf of Tehuantepec	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Yellow (3.000)
Fishery 16: Mexico / Pacific | Bottom trawls | Mexico | West Coast of Baja	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Yellow (3.000)

Fishery 17: Mexico / Pacific | Magdalena - Artisanal bottom trawl | Mexico | West Coast of Baja	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly 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 manages follow scientific advice? To achieve a highly effective rating, there must be appropriately defined management goals, precautionary policies that are based on scientific advice, and evidence that the measures in place have been successful at maintaining/rebuilding species.

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, SURIPERA, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY
MEXICO / GULF OF MEXICO, CAST NETS, MEXICO
MEXICO / GULF OF MEXICO, TRAPS (UNSPECIFIED), MEXICO
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

Moderately Effective

Shrimp fisheries in Mexico are managed based on the studies and recommendations of INAPESCA through temporary closures to protect juvenile shrimp and maintain a minimum level of broodstock. INAPESCA's recommendations are implemented through CONAPESCA with fishing permits and updates to the Mexican Official Standard NOM‐002‐SAG/PESC‐2013.

The focus of many of the measures used in the fishery— including these temporary closures, but also permanent closures, gear restrictions and a buyback program—have been designed to reduce fishing effort for shrimp, which was determined to be too high more than a decade ago (DOF 2000). Although these measures have reduced the number of vessels in the industrial fishery, it is unclear what impact they've had overall on the combined effort in the industrial and artisanal fisheries. The impacts of the fishery on many of the shrimp populations are also unclear, because robust estimates of current fishing mortality relative to a sustainable level are generally not available. Although the limited data and analyses available suggest some

populations are being fished at a sustainable level, others are apparently not (see Criterion 1). Therefore, management strategy and implementation for Mexican Pacific and GOM industrial and artisanal shrimp fisheries is considered only "moderately" effective.

Justification:

The Mexican Government has implemented several actions to promote sustainable fisheries, including the Sustainability Law for Fisheries enacted in 2007. This law regulates all the activities related to the extraction of marine products for commercial or recreational purposes (DOF 2007) and provides the power to SAGARPA and CONAPESCA to generate the guidelines for these activities. The NOM‐002‐PESC‐1993 is the management tool that regulates particular aspects of the fishing activities for shrimp in the whole country. Several amendments have been developed since it was enacted in 1993. All the fleets (Industrial and Artisanal) are regulated by this NOM.

Controlling fishing pressure

In the past, managers indicated that all shrimp stocks were fully exploited and that fishing mortality should be decreased (INAPESCA, 2000). Various regulations are designed to reduce effort, including:

Gear specifications

- In inshore waters of the Pacific and the Gulf of Mexico, only small-scale boats with engines up to 85.76 kilowatts of power could be used (115 Horsepower)

The only gears authorized for the artisanal fleet and its restrictions are:

- Cast net (Mesh size of 1 ½ inches)

- Suripera (only allowed in Coastal lagoons of North of Sinaloa and Magdalena Bay

- Gillnets only permitted in:

    - Coastal zones of Sonora (from the border with Sinaloa to Puerto Peñasco, Sonora)

    - Inside the coastal lagoons and bays of Sonora and Sinaloa

    - Within the buffer zone of the biosphere Reserve of the Upper Gulf of California (with the exception of the Vaquita protection area, where a permanent ban was recently announced to be effective in September 2016).

- Light trawler net (RS‐INP‐MEX) in the Upper Gulf of California

For offshore waters, the industrial fleet restrictions are:

- Within the buffer zone of the Biosphere Reserve of the Upper Gulf of California (with the exception of the Vaquita Refuge), the vessels are authorized to use only with trawling nets with the characteristics specified in Appendix C of the NOM‐002‐1993.

- In the Gulf of Mexico and the Caribbean, the limits on the mesh size are of 1¾ inch in the collecting bag and 1½ in the body of the net.

Seasonal Closures

Closed seasons vary by coast and fishing area. The Mexican Pacific shrimp fishery is closed between March and September for all fishing areas. The GOM is generally closed between May and September, with small variations in closure dates for coastal and oceanic fisheries (DOF 2006) for all fleets.

Year-round closures

Industrial trawling is prohibited completely within the marine section between 0 and 9.14 meters of depth, with the only exception of the Seabob fishery in the marine areas of Campeche and Tabasco in the Gulf of Mexico. All trawling activity (industrial or artisanal) is also prohibited within the 9.25 km (5 miles) distance from the mouth of coastal lagoons and estuaries in the Mexican Pacific. Official norm NOM-064-PESC-2006 establishes regulations on fishing gears, including a ban on trawls in estuaries, lagoons and bays, a ban of all gear types and nets on reefs, and a ban on trawling at depths less than 9.2 meters (NOM-002-PESC-1993).

Buyback program

In 2005, CONAPESCA began to allocate money (around 27 million pesos or US$2.54 million) to help reduce fishing pressure on the shrimp fisheries and to implement a voluntary decommissioning of the Mexican fleet. The program sought to reduce the quantity of industrial vessels by 30% between 2005 and 2010 (Dubay et al. 2010) Overall, the program was effective in reducing the industrial shrimp fleet by 50% from 1,536 vessels in 2006 to 757 in 2013 (Dubay et al. 2010) (Table II). The artisanal fleet seems to remain constant (Dubay et al. 2010)

*Table II Vessel reduction program (*RNP = National Fisheries Register in Mexico that has information about the fleets, mandatory in order to access permits)*

State	**# of Industrial vessels**				**Reduction (2006 to 2013)**
	2006	**2010**	**2011-RNP***	**2013 RNP ***	
Baja California	41	38	8	10	0.76
Baja California Sur	27	27	4	1	0.96
Sonora	521	454	243	244	0.53
Sinaloa	767	682	449	463	0.4
Nayarit	20	16	7	6	0.7
Colima	34	31	14	1	0.97
Michoacán	1	1			1
Guerrero	6	6			1
Oaxaca	86	72	33	30	0.65
Chiapas	33	25	3	2	0.94
Total	**1536**	**1352**	**76**	**7**	**0.51**

Artisanal fleet

According to a draft of the unpublished Mexican Shrimp management plan, about 56,412 small-scale boats

were registered in Mexico in 2012, and of these, about 85% fished for shrimp (INAPESCA-CONAPESCA 2004). In Sinaloa, a census developed in 2011 found that around 11,300 boats were involved in the shrimp fishery in the state (INAPESCA 2012). According to the Registro Nacional Pesquero (RNP, National Fisheries Registry; a system that gathers the authorized vessels in Mexico), in 2015, the number of artisanal vessels registered in the Mexican Pacific was about 27,968 (Table III) (CONAPESCA website database 2016).

Table III. Number of small-scale boats registered in the Mexican Pacific by state (CONAPESCA database)

State	# Vessels Registered
SINALOA	8,892
JALISCO	3,582
BAJA CALIFORNIA SUR	3,155
SONORA	2,797
GUERRERO	2,714
CHIAPAS	2,638
MICHOACAN	2,461
NAYARIT	1,312
BAJA CALIFORNIA	1,162
OAXACA	1,055

However, there is no specific information on the numbers of vessels authorized to catch shrimp (in number of permits) and how the reduction in number of active vessels, actually reduced the fishing effort in the water. Since one of the recommendations in the National Fisheries Chart is to reduce effort, it is not clear if this is happening with the small-scale fleet. According to INAPESCA, around 263 permits have not been renewed since 2005, which accounts for a decline of 38.5% of fishing effort in the country (INAPESCA 2016); however, no information on how many of these permits belong to the small-scale fleet is included.

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, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

Moderately Effective

The main concerns in the trawl fisheries are turtles and many different types of finfish (including the critically endangered totoaba in the Upper Gulf of California). All shrimp trawl fisheries have been required to use turtle excluder devices for nearly 20 years, and they have been required to use finfish excluder devices from 2016 (many were using them voluntarily before 2016; this includes the Magdalena I trawl fishery). These measures are likely to be effective in mitigating bycatch. The 2016–2017 season was the first where use of FEDs was mandatory. According to observer data, changes in the bycatch composition allowed for the increase in retention of some of the bycatch. For example, Pacific grunt, which in 2014 was reported to generate an extra $25,000 USD income for the fleet (Rodriguez-Preciado et al. 2014). Discards as a percentage of the catch declined from 81% to 72% (INAPESCA 2017). We have therefore deemed bycatch management in the trawl fisheries as "moderately effective."

Justification:

Turtles

Cooperative international efforts to protect and restore sea turtle populations and habitats have been in place for several years. The Inter‐American Convention for the Protection and Conservation of Sea Turtles (IAC) is one of these international efforts. As part of the collaboration with IAC, the U.S. government through NOAA designed the modern turtle excluder device (TED). TEDs were found to be 97% effective in excluding turtles when used properly (Henwood et al. 1992)

Following the rules of the U.S. government, which requires that export nations should fish in conditions that minimize the impact on turtle populations in order to be eligible for export to the U.S. market, a mandatory use of TEDs for trawl nets (industrial and artisanal) has been in place since 1997. An annual certification program is in place for nations that seek to import shrimp into the US. NOAA inspects portions of the nation’s fleets for adequate use of TEDs. A positive certification indicates that the country has adopted a program governing the incidental capture of sea turtles in its shrimp fisheries; it is comparable to that of the program in effect in the US and has an incidental take rate comparable to that of the US. Mexico has consistently been certified to import shrimp since the implementation of the program in 1996, with exception of 2010, when NOAA inspectors found some problems with the use of the devices by the Mexican fleet. Mexico regained the certification in 2011 and since then has been certified every year, most recently in May 2016 (US DOS 2016).

Finfish

Most recently, managers and the industrial sector have been working together to implement Fish Excluder Devices (FEDs), which was mandatory for all trawl gears for the 2016–2017 season (NOM‐002‐PESC‐1993). The FEDs have been tested and proved to be highly effective to reduce finfish bycatch (Jackson and Spalinger 2007).

It is unclear, however, whether bycatch numbers have been reduced to appropriate levels, because no targets have been set and data of volume and species catch as incidental catch data are not available. Cooperative international efforts to protect and restore sea turtle populations and habitats have been in place for several years.

MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF MEXICO, CAST NETS, MEXICO
MEXICO / GULF OF MEXICO, TRAPS (UNSPECIFIED), MEXICO

Highly Effective

There are no particular bycatch concerns in cast net fisheries or charangas fisheries (see Criterion 2), so bycatch management is deemed "highly effective" for these gears.

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA

Moderately Effective

The greatest bycatch concern in the Mexican shrimp fisheries is of vaquita, which has been reported to be caught incidentally in gillnet fisheries in the Upper Gulf of California (UGC), including those for shrimp. Gillnetting for shrimp in the region is now banned to protect the vaquita. This fishery will switch to the use of alternative gears that will not interact with vaquita (i.e. light trawl, currently in experimental phase). Because the gillnet fishery is banned, it is not included in this report; later versions of this report may cover the light trawl fishery as data become available for it)

In other shrimp gillnet fisheries operating in Sonora and Sinaloa, the main bycatch concern is of sharks and rays. Some efforts to mitigate the impact on these species are in place through the Mexican Official Norm (NOM) NOM‐029‐PESC‐2006. This norm stipulates specific rules to reduce or completely eliminate the use of gillnets in known important reproductive areas (i.e., coastal lagoons of La Reforma and Altata in Sinaloa and Almejas Bay in B.C.S) (NOM‐029‐PESC‐2006), the creation of sanctuaries (i.e., a five-km radius of Espiritu Santo Island in BCS), and places limits on mesh size along the coast (NOM‐029). For these reasons bycatch management is deemed "moderately" effective for all gillnet fisheries.

Justification:

Gillnets are used by the artisanal fleets in Sinaloa‐Nayarit and Sonora Central‐South. Fishing shrimp with gillnets in the Upper Gulf of California has been banned since April 2015 due to the catch of the critically endangered vaquita; however, there is one exception— fishing for corvina, which potentially allows access to gillnet fishing for other species, using different mesh size nets (CIRVA 2016). The newly announced permanent ban on gillnets does not specify the ban for corvina fishing using nets, but it is believed that alternative gears will be implemented in the region.

The main bycatch species of concern in the other areas of the Pacific are elasmobranchs such as rays (including guitarfish) and sharks. In 2006, an official norm that regulates the catch of sharks and rays was enacted by Mexican managers (NOM‐029‐PESC‐2007). Under this norm, a set of regulations were put in place designed to guarantee the sustainable use of these species, some of these regulations are:

- A no fishing season from May to July (spawning season).
- A ban on the use of gillnets within the five‐km wide zone around coral reefs, river mouths, known turtle nesting beaches, and sea lion communities.

- In the Baja Peninsula, gillnets and longlines are also banned from December to April and in Nayarit and Jalisco all year around.

Refugee areas, where the use of gillnets is prohibited in June every year to protect reproductive areas for sharks and rays, were created (NOM‐029‐PESC‐2007) in:

- Bagdad Beach in Tamaulipas
- Terminos Lagoon in Campeche
- Usumacinta and Grijalva Rivers in Tabasco
- Yalahau Lagoon in Quintana Roo
- Magdalena Bay in Baja California Sur
- Santa Maria la Reforma coastal lagoon in Sinaloa.

MEXICO / GULF OF CALIFORNIA, SURIPERA, MEXICO, SINALOA-NORTH-CENTRAL

Moderately Effective

The proportion of shrimp‐bycatch for the suripera fishery has been reported to be as low as 1 kg of shrimp to 0.1 kg of bycatch to up to 1:1 by (Amezcua et al. 2006). The authors recognized the gear as a highly selective net; however, in 2009, (Amezcua et al. 2009) recognized that although no species of concern were found to be caught in the suripera fishery, the gear could interact with species that use the areas as nursery grounds, and this should be studied (Amezcua et al. 2009). Despite this, authors concluded that considering the small proportion of bycatch—against other gears like small trawls or gillnets—they recommended the use of suripera inside the coastal lagoon; (Amezcua et al. 2009) encourage the implementation of a program to monitor bycatch levels constantly in order to understand better the changes and discard practices.

The fishery has been FairTrade certified since 2016. Cooperatives that are included in that certification (around 90% of the total producers) implemented a bycatch monitoring process in 2011, in collaboration with INAPESCA (SFP 2016). The results supported the earlier findings by (Amezcua et al. 2006) described above, where a small amount of bycatch was present within the fishery. During the FIP implementation, a bycatch monitoring program was in place in coordination with auditors. After the certification was granted (January, 2016), the client hired scientists from the National University in Mexico in Mazatlán to support the program (pers. comm., Sergio Castro, Certification holder 2016). For these reasons, the bycatch management is deemed "moderately" effective for suripera in Sinaloa.

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.

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF CALIFORNIA, SURIPERA, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

Moderately Effective

Shrimp stocks are regularly monitored through both commercial catch data and survey data, and these data are used to set the open season each year. Historically, limited analysis has been conducted on these data relative to identifying a sustainable level of catch, but analyses to determine these levels are now being conducted for some stocks, most recently in (INAPESCA 2016). More work is needed to assess the impacts of the fishery on shrimp populations through more robust and comprehensive stock assessments, but enough research and monitoring is occurring on shrimp to be moderately effective for understanding the effects of fishing on these target populations.

Bycatch monitoring is far less developed in most fleets, a major weakness in those fleets that incidentally catch species of concern (e.g., rare, endangered, threatened, depleted, or overfished species). This includes all fleets except the charanga (which catch only shrimp, though some of those populations are of concern) and cast net fleets in the Gulf of Mexico and the Pacific. Where there are data on bycatch, it is generally collected through logbooks and offseason surveys, of which neither method can provide robust enough data to properly assess the impacts on bycatch species' populations.

There are few observer programs in place in Mexican shrimp fisheries. The industrial fleet in the Pacific (including the Gulf of California) had one from 2004 to 2010 with a variable percentage coverage from 1 to 4.3% of the fleet; this program was restarted for the 2015–2016 (0.5% coverage) and 2016–2017 season (1.5%) (INAPESCA 2017). Higher levels of coverage will ultimately be needed to have more confidence in the accuracy of the data (INAPESCA's goal is to have at least 5% coverage). The Magdalena I and suripera fisheries are currently in fishery improvement projects that have established monitoring programs, including observer programs, in those fleets. It is important to mention that only the cooperatives working with Del Pacifico Company in Sinaloa and Thai Foong in the West coast of Baja are currently implementing these efforts (these account for some 90% of the suripera and Magdalena 1 producers). These programs have only recently been implemented (2011 in the suripera fishery, and 2010 in the Magdalena I fishery). The data has been used to monitor bycatch, and will continue be used to detect changes in bycatch and retained species, including monitoring the status of the bycatch populations. For these reasons, bycatch research and monitoring for charanga and cast nets are deemed "highly effective" and suripera and trawls in the Pacific (including Magdalena I) are "moderately effective." All others are scored as "ineffective."

Justification:

Shrimp

INAPESCA monitoring and research is used in the implementation of closed seasons in the Gulf and Pacific regions. INAPESCA researchers developed periodic monitoring and systematic assessments of most of the important fisheries. Since shrimp is one of the most important fisheries in Mexico, it is also one of the most studied fisheries in the country and receives a huge proportion of INAPESCA's human and financial resources (INAPESCA 2000). Most recently, increased interaction with other institutions is providing the capacity to effectively address the research gaps identified. In recent years, collaboration with other research institutions

(CIBNOR, CICESE, CICIMAR, UABC, USON, UAS, UAN, ICMyL, ITMAR), government agencies (SEMARNAT, CONANP, INE), and NGOs (WWF, NOS, EDF) has improved significantly. This has resulted in a considerable expansion of (shrimp) fishery research programs, and in a broader dissemination of results.

Bycatch

The industrial fleet is required to report bycatch in logbooks, and provide a copy of the report to local fisheries offices along the coast. An onboard observer program was in place within the industrial fleet from 2004 to 2010 (INAPESCA 2012) and was not in place for five seasons until the 2015–2016 and 2016–2017 seasons. As part of the constant monitoring of abundance data, INAPESCA also records bycatch during the off-season surveys, and some of these data have been made available to the public (see Appendix 1).

In the case of the artisanal fleets, some groups are taking part in fisheries improvement projects (Magdalena I fishery in Magdalena Bay) or were recently certified by FairTrade (suripera fishery in Sinaloa), and as part of these projects, bycatch levels have been constantly monitored and reported. In these fisheries, bycatch composition and volumes are continuing to be monitored. In the suripera fishery in Sinaloa, from the 56 species identified in the bycatch, no species of particular concern were reported (Del Pacifico 2016). In Magdalena Bay during 2014, the bycatch information collected showed nine fish species as predominant in the fishery bycatch; in terms of volume, the fishery generates an average of 1 kg of shrimp per kg of bycatch, as one of the trawl fisheries with the lowest shrimp-to-bycatch ratio (Magdalena Bay 2016). As part of the FIP strategy, bycatch is continually monitored in order to assess changes in bycatch proportion and inform improved management.

MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF MEXICO, CAST NETS, MEXICO
MEXICO / GULF OF MEXICO, TRAPS (UNSPECIFIED), MEXICO

Highly Effective

See text under trawls above.

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY

Ineffective

See text under trawls above.

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.

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF CALIFORNIA, SURIPERA, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

Moderately Effective

Illegal fishing was identified in the past as one big and complex problem within fisheries in Mexico, including shrimp (SAGARPA-INAPESCA 2000) (Cisneros-Montemayor et al. 2013). Cisneros-Montemayor et al. (2013) analyzed landings from 1950 to 2010 and estimated that total landings for shrimp in Mexico could be as much as twice as high as official reports due to illegal fishing (Cisneros-Montemayor et al. 2013). More conservative estimations calculated illegal fishing could have accounted for 30% of the registered catch across all species (not just shrimp), and that high-value species like shrimp were part of these findings (Cisneros-Montemayor et al. 2013). In the Gulf of Mexico, SAGARPA and INAPESCA reported a high level of noncompliance when fishing for white shrimp in 2012 (87% of vessels had illegal nets onboard) (SAGARPA-INAPESCA 2014). Illegal fishing is a particular concern in countries like Mexico, where there is a very long coastline and an artisanal fleet that numbers on the order of 100,000 vessels (including perhaps 50,000 that fish for shrimp; see criterion 3.1), factors which make monitoring very difficult (CCC et al. 2013).

Industrial fleets

Since these accounts were published, the enforcement program in the shrimp fisheries has been strengthened. All industrial fleets are subject to the following regulations:

- A satellite vessel monitoring system for all industrial vessels
- Mandatory use of TEDs for all trawlers
- Predeparture inspection to corroborate that fishing gear specs are complying with the specifications of the official norm (NOM-002), and that TEDs are in place and working properly (NOM-061)
- Random water enforcement activities to revise correct use of the TEDs while fishing

Reports from CONAPESCA indicate that the number of enforcement actions has increased over the last few years, and that compliance in the industrial fleet with at least some regulations has increased (see detailed rationale below for more information). For example, industrial vessel compliance with VMS transmitting requirements is now around 98% (not just for shrimp), and the number of vessels found to be operating inside closed areas declined from 80 in 2013 to 12 in 2015 (CONAPESCA 2016). CONAPESCA also reports that more than 4,000 inspection actions around TED compliance were conducted between 2013 and 2015, and as a result 17 sanctions and catch confiscations were reported (CONAPESCA 2016). The TED program is also verified annually by NMFS (this includes compliance checks), and has been certified as being comparable to the one implemented in the US from 1997 to 2016 (failing only in a single year: 2010) (DOS, 2010). It is thus likely that the measures in place for the shrimp industrial fleet are "moderately effective."

Artisanal Fleets

There are similar measures in place for the artisanal fleet, including TEDs for all trawl vessels since 1997

(NOM-002-PESC-1997), but excluding VMS; however, there is little recent information on compliance in the artisanal fisheries. In their assessment of enforcement in the Upper Gulf of California related to the two-year ban on gillnet fishing to protect the critically endangered vaquita, (CIRVA 2016) provides evidence that illegal fishing is still occurring in the region. Although it is unclear if this illegal activity results in shrimp landings, the fact that illegal fishing continues in one of the regions that is a focus for enforcement efforts indicate illegal fishing is still likely a problem in at least some artisanal fisheries. Until there is strong evidence that compliance has improved in the artisanal fleet, we deem enforcement ineffective for all artisanal fisheries except the Magdalena I and suripera fleets.

Magdalena I and suripera

Within the workplans of the Magdalena I FIP and the suripera FairTrade certified fisheries, enforcement is a combination of local self-enforcement by the fishing cooperatives involved in the FIPs and FairTrade certification, and support of the government authorities (CONAPESCA, SEMAR, etc.). The suripera fishery uses a satellite system on their vessels to monitor the areas where the fishers work as part of the traceability and enforcement efforts. Two members of the cooperatives during part of the certification were ejected after they were found guilty of fishing in areas that were not authorized (pers. comm., Juan Manuel Caudillo SFP). Among the internal regulations within the FIP are:

- Monitoring of launch and arrival of the boats from single dock points
- Continuing satellite monitoring
- Review of all members permits and other fishing regulations previous to the season
- During the off-season, buyer provides funding as credit to cover enforcement patrolling cost in collaboration with local authorities (as part of the certification, 30% of the premium will be allocated to this enforcement cost)
- Internal enforcement committees within the cooperatives are in place, which enforce their members' conduct (pers. comm., Sergio Castro, Certification holder).

Enforcement for the Magdalena I and Suripera fisheries is deemed "moderately effective."

Justification:

CONAPESCA recognizes enforcement as a high priority (CONAPESCA 2016), and has implemented a number of measures over the years to improve compliance with fishing regulations (DOF 2007). These measures are implemented by CONAPESCA and the Mexican Navy through the National Program of Enforcement and Monitoring (CONAPESCA 2016). There is also coordination with local state offices and with the U.S. NOAA fisheries' Office of Law Enforcement (NOAA 2015).

Since 2011, CONAPESCA also opened the opportunity to fishing organizations to be part of the efforts providing federal accessibly funds to the fishing industry through the "Enforcement and Monitoring Fishing and Aquaculture Program," which allows fishers to apply for funds up to 6 million pesos/year (approx. $320,000 USD) as a group, or 2 million ($108,000 USD) as a single person to cover costs of enforcement activities (CONAPESCA 2016).

Artisanal and industrial fishing organizations have thus been collaborating with CONAPESCA in enforcement activities since 2013. The industry provides the use of their vessels on the water, which act like motherships for smaller vessels along the coast, with particular focus in the most productive areas (Sinaloa coastal lagoons and Sonoran coast). The funds are used to cover cost of operation of the vessels, mostly fuel, but also technical services as well as campaigns to inform public about enforcement actions and to report illegal activities. This program has increased the involvement of fishers on enforcement activities.

Vessel monitoring

VMS has been in place since 2004 for the industrial fleet operating in the Gulf of Mexico, the Gulf of California and the Pacific coast of Mexico, and it was made mandatory in 2008 (CONAPESCA 2006). The regulations of this program are contained in the Mexican official norm, which regulates the use of the satellite systems and defines which vessels must have VMS (NOM062ISAG/PESCI2014). Among other things, it allows CONAPESCA to know the exact location of the route taken by boat along the trip and the fishing area; improve information for technical and scientific fisheries research; improve the management of fisheries resources and verify respect for closures, as well as areas that are restricted or prohibited; and capture the degree of incidence or recurrence of boats. In 2015, there were 1,981 vessels monitored (not just shrimp vessels), of which 98% were recorded as transmitting appropriately (up from 34% in 2007) (CONAPESCA 2016). GPS data are provided every hour, 24 hours a day to CONAPESCA through the Sistema Satelital de Monitoreo de Embarcaciones Pesqueras (SISMEP), and an alert is given to the SISMEP and vessel operators when a vessel enters a closed area. The number of vessels found to be operating in a closed area has declined from 80 in 2013 to 12 in 2015 (CONAPESCA 2016). VMS is not in place for most of the artisanal fleet because it is not practical for a fleet of many tens of thousands of vessels. The only exception for shrimp fisheries is that of the suripera fishery in Sinaloa, which does have an autonomous tracking vessel system as a requirement for FairTrade certification and is managed by Del Pacifico company and only covers the cooperatives that are involved in the certification. This system, run by a thirdIparty company called Pelagic Data Systems, records positions of the boat every second and is used as a tool to monitor compliance with enforcement and traceability issues that are required within the certification process and workplan (Del Pacifico 2016).

Turtle Excluder Device compliance

As a signatory to the InterIAmerican Convention for the Promotion and Conservation of Sea Turtles, Mexico implemented measures for the protection of sea turtles with the use of turtle excluder devices (TEDs), which are required by law (NOMI002ISAG/PESCI2013) (DOF 1993).

Managers in CONAPESCA collaborate with the Secretary of Environment and its enforcement agents on the field, PROFEPA (Environmental Protection Agency) as well as the Mexican Navy, to develop enforcement actions on the correct use of TEDs in the water (CONAPESCA 2016). According to the 2010 to 2012 enforcement plan and the interIagencies collaboration, at least 70% of enforcement activities must be conducted while vessels are fishing, and 30% of these actions should be conducted during night operations.

CONAPESCA reports state that between 2013 and 2015, more than 4,000 inspection actions were conducted with the industrial fleet in the Pacific and Gulf of Mexico combined (See Appendix 1); as a result, 17 sanctions were issued (four in 2013, four in 2014, and eight in 2015) and around 22 t of shrimp caught was confiscated (CONAPESCA 2016).

In addition, Section 609 of U.S. Public Law prohibits imports of shrimp into the U.S. unless the export nation has been certified by NOAA that it has a program in place that reduces incidental capture of sea turtles that is comparable to the one implemented in the U.S. The certification was issued for Mexico from 1997 to 2016 (US DOS 2016), with only one exception—2010, when NOAA officials reported misuse of the excluding devices during inspections.

OffIseason enforcement

In 2013, coordination efforts between the CONAPESCA and the Mexican Navy were formalized with the creation of the "Enforcement plan for the shrimp fishery during the offIseason" (INAPESCA, 2015). This plan is implemented during the offIseason along the Pacific and Gulf of Mexico coasts. The aim of this campaign is to prevent acts of illegal fishing carried out during the offIseason (INAPESCA 2015) (See Appendix 1). Specific measures are applying to both industrial and artisanal fisheries, and include:

- Random inspections to small‐scale vessels and trawlers on the sea
- Road checkpoints along most of the most important landings sites
- Inspection of storage and processing plants and other infrastructure existing at the beginning and end of the ban, in order to verify the inventory of shrimp and random inspections during the whole closed season to verify that inventory reports are accurate.

Compliance today

Despite the amount of enforcement effort that has been implemented (particularly in recent years), there are concerns that illegal fishing may still be occurring in some regions. Perhaps one of the best studied is that of continued gillnet fishing in the Upper Gulf of California, which was closed to all gillnetting except for corvina from April 2015 to protect the critically endangered vaquita (see Criterion 2) (DOF, 2017).

In May 2016, CIRVA experts reported their concerns about the continuous findings of illegal activities still in place in the region despite the huge amount of enforcement by Mexican authorities (CIRVA, 2016). During the meeting, the Mexican Navy reported that as part of their operations more than 122 boats were seized, more than 70 people detained and 177 totoaba swim bladders were recovered in the last year. Meanwhile, Sea Shepherd Conservation Society (SSCS) which coordinates with CIRVA and Mexican authorities gathered evidence reported in the same meeting that "The greatest threat to the vaquita is the continuing demand for totoaba swim bladders in China" (CIRVA, 2016).

SSCS filmed poachers hauling nets, retrieved more than 40 illegal gillnets and 16 illegals longlines, and report to have encountered at least two dead vaquitas in March 2016. The SSCS concluded that, despite the investment of the government of Mexico, the high value of the swim bladder represents a big incentive for fishers to risk been caught. In addition, Sea Shepherd reported they have witnessed many trawlers inside the vaquita refuge (CIRVA, 2016), although they did not specify if the vessels were fishing or not. According to official reports, on December 2015, one trawler was detected by CONAPESCA's VMS system and was detained by Environmental Protection Agency staff (PROFEPA) (PROFEPA 2015).

The shrimp fishery in Mexico is one of the most enforced fisheries in the country due to its economic and social value (CONAPESCA 2015). Since 2007, CONAPESCA has been improving coordination efforts with local authorities (state and municipal) to support the enforcement activities of their agents, who have received support of state and municipal police during their operations (SAGARPA 2015). Between 2007 and 2012, 28 state enforcement committees were created (SAGARPA 2015), more than 5,000 t of illegal product was confiscated, and more than 7,000 individual fishing gears were retained (SAGARPA 2013). In 2015, more than 300 small vessels, 380 vehicles and 130 people were detained as a result of the enforcement processes along the Pacific and Gulf of Mexico (PROFEPA 2015).

MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA
MEXICO / GULF OF MEXICO, CAST NETS, MEXICO
MEXICO / GULF OF MEXICO, TRAPS (UNSPECIFIED), MEXICO

Ineffective

See text under trawls above.

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.

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, SURIPERA, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY
MEXICO / GULF OF MEXICO, CAST NETS, MEXICO
MEXICO / GULF OF MEXICO, TRAPS (UNSPECIFIED), MEXICO
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

Highly Effective

Due to the high economic value and the number of fishers (artisanal and industrial) that depend on the fishery, its management has long been complicated and controversial. In 2012, VasquezlLeon stated that, even though fisheries reforms have been implemented and accepted in the name of sustainability, small-scale fishers have a disadvantage and find themselves more vulnerable as the state withdraws support from their sector in favor of industrial producers in offshore fisheries (Vasquez-Leon 2012).

Managers have established an open process to review, evaluate, and revise management regulations, often based on demand by producers and fishermen (CONAPESCA 2012). In particular, for the shrimp fishery, stakeholders (including NGOs, universities, and researchers) are allowed to participate in the development process of Mexican Official Norms (NOMs). Federal laws govern the public's access to information, including fisheries information. The government generates reports and analyses, which are available to the public (CONAPESCA b 2016). Since the management process is transparent and includes some stakeholder consultation, stakeholder inclusion of the Mexican Pacific and GOM industrial and artisanal shrimp fisheries is deemed "highly 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
Mexico / Gulf of California / Bottom trawls / Mexico / Nayarit	2	0	Moderate Concern	Yellow (2.449)
Mexico / Gulf of California / Bottom trawls / Mexico / Sinaloa South	2	0	Moderate Concern	Yellow (2.449)
Mexico / Gulf of California / Bottom trawls / Mexico / Sinaloa-North-Central	2	0	Moderate Concern	Yellow (2.449)
Mexico / Gulf of California / Bottom trawls / Mexico / Sonora	2	0	Moderate Concern	Yellow (2.449)
Mexico / Gulf of California / Bottom trawls / Mexico / Upper Gulf of California	2	0	Moderate Concern	Yellow (2.449)
Mexico / Gulf of California / Gillnets and entangling nets (unspecified) / Mexico / Sinaloa-North-Central	3	0	Moderate Concern	Yellow (3.000)
Mexico / Gulf of California / Gillnets and entangling nets (unspecified) / Mexico / Sonora	3	0	Moderate Concern	Yellow (3.000)

Mexico / Gulf of California / Cast nets / Mexico / Nayarit	3	0	Moderate Concern	Yellow (3.000)
Mexico / Gulf of California / Cast nets / Mexico / Sinaloa South	3	0	Moderate Concern	Yellow (3.000)
Mexico / Gulf of California / Suripera / Mexico / Sinaloa-North-Central	3	0	Moderate Concern	Yellow (3.000)
Mexico / Gulf of Mexico / Traps (unspecified) / Mexico	3	0	Moderate Concern	Yellow (3.000)
Mexico / Gulf of Mexico / Bottom trawls / Mexico	2	0	Moderate Concern	Yellow (2.449)
Mexico / Gulf of Mexico / Bottom trawls / Mexico / Seabob fishery	2	0	Moderate Concern	Yellow (2.449)
Mexico / Gulf of Mexico / Cast nets / Mexico	3	0	Moderate Concern	Yellow (3.000)
Mexico / Pacific / Bottom trawls / Mexico / Gulf of Tehuantepec	2	0	Moderate Concern	Yellow (2.449)
Mexico / Pacific / Bottom trawls / Mexico / West Coast of Baja	2	0	Moderate Concern	Yellow (2.449)
Mexico / Pacific / Magdalena - Artisanal bottom trawl / Mexico / West Coast of Baja	2	0	Moderate Concern	Yellow (2.449)

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, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

2

Blue, brown, white, pink, seabob, whiteleg and yellowleg shrimp caught with large trawls in the industrial fleet and small trawls (including the Magdalena I) and suripera nets in the artisanal fleets are often found on a variety of bottom substrate types in the Mexican Pacific and GOM. The effects of bottom contact trawl gear on marine benthic habitats have been well documented and are known to vary depending on gear configuration and benthic habitat type (Steele 2002). The shelf areas in the GOM, where shrimp are commonly fished, are shallow sand and mud environments scattered with coral reef assemblages that are thought to be affected primarily by sedimentation after trawl passes (Barnette 2001). In the Mexican Pacific, offshore areas between 9 and 64 meters in depth are targeted (FAO 2008). There is evidence that industrial trawls have had impacts on softbottom environments and epibenthic communities (INAPESCA/CONAPESCA 2004). Therefore, the impact of fishing gear in trawls in the Pacific and GOM industrial and artisanal fleets is scored 2.

Justification:

SEMARNAT and CONAPESCA have shared responsibilities for administering MPAs and are responsible for regulating fisheries activities in those areas. Current MPAs and notake zones cover around 1% of the Mexican coast. Permanent protected areas and temporary closed seasons protect the main spawning season (Lopez, M. J. et al. 2005), promote the growth of preadult life stages (SAGARPA-INAPESCA 2012) and protect threatened and endemic species (Aragon-Noriega et al. 2010). Although Sala et al. suggests that these areas should be expanded to cover 40% of the rocky reef habitat in the Gulf of California (Sala et al. 2004), it is important to note that existing MPAs and restricted areas have not been as effective as expected in recovering and conserving artisanal fishing resources. According to Rife et al., these areas become problematic when they are poorly enforced and when they displace fisherman in areas where there are no alternative fishing grounds (Rife et al. 2012).

MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, SURIPERA, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF MEXICO, CAST NETS, MEXICO
MEXICO / GULF OF MEXICO, TRAPS (UNSPECIFIED), MEXICO

3

Cast nets are a gear type used by artisanal fishermen in both the Mexican Pacific and GOM due to their low cost and simple operability (FAO 2008) (INAPESCA 2000). Cast nets are retrieved rapidly after deployment, and only come into contact with the seafloor where they are set (DOF 2012). The suripera net has a really low impact of sediment removal and bottom interaction (Dr. Antonio Calderon ICMyL-UNAM Mazatlan pers. Comm.

2016). Recent research on the impact of this gear has been developed by independent research from the Institute of Marine Sciences in Mazatlán, Sinaloa. The fixed charanga net, used by artisanal fisherman in the GOM, is set in coastal lagoons from Tamaulipas to northern Veracruz (INAPESCA c 2012). Shrimp enter the wedge‐shaped net as they migrate offshore and are concentrated into a smaller net known as yagual. Fishermen land the shrimp using a small boat and a hand‐held net. The charanga, while fixed, does come in contact with the ocean floor but with a small footprint, and little bycatch is observed when using this gear type (INAPESCA 2000). Shrimp gillnets or gillnets, though not mobile, do come into contact with the seafloor (SAGARPA 2012b). These gears all score 3.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, SURIPERA, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY
MEXICO / GULF OF MEXICO, CAST NETS, MEXICO
MEXICO / GULF OF MEXICO, TRAPS (UNSPECIFIED), MEXICO
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

0

Managers have established some areas for specific management throughout the Mexican Pacific and GOM (CONAPESCA 2008). Some of these areas, like the Biosphere Reserve of the Upper Gulf and Cabo Pulmo, are Marine Protected Areas that limit or prohibit fishing activities, and regulate the use of some gears within their borders, according to their management plans.

Other areas that limit the use of some gears are the river mouths and coastal lagoons; the use of any kind of trawling gear (Artisanal or industrial) inside the lagoons and within 5 miles from river mouths is prohibited (NOM‐002‐PESC‐1993).

In addition, NOM‐002‐PESC‐1993 prohibits any trawling activity within the 0 to 9 meters of depth along the whole Mexican coast. It is important to recognize that these regulations help to protect some zones from degradation; however, the extent of these areas represents only about 1% of the Exclusive Economic Zone of Mexico (INAPESCA 2016).

Efforts have also been made to reduce the fishing effort throughout Mexico through a buyback program (see Criterion 3.1) (FAO 2008) (Dubay et al. 2010). Although the industrial fleet was successfully reduced by more than 50% (from 1594 vessels in 2005 to 761 vessels in 2013; refer to Table III) it is currently unknown with certainty if there has been a reduction in the level of effort for the artisanal fleet. For these reasons, the Mexican Pacific and GOM industrial and artisanal fisheries do not meet the standards for +0.5 for mitigation

measures.

Justification:

SEMARNAT and CONAPESCA have shared responsibilities for administering MPAs and are responsible for regulating fisheries activities in those areas. Current MPAs and no‐take zones cover around 1% of the Mexican coast. Permanent protected areas and temporary closed seasons protect the main spawning season (Lopez et al. 2005), promote the growth of pre‐adult life stages (SAGARPA-INAPESCA 2012), and protect threatened and endemic species (Aragon-Noriega et al. 2010). Though Sala et al. suggest that these areas should be expanded to cover 40% of the rocky reef habitat in the Gulf of California (Sala et al. 2004), it is important to note that existing MPAs and restricted areas have not been as effective as expected in recovering and conserving artisanal fishing resources. According to Rife et al., these areas become problematic when they are poorly enforced and when they displace fisherman in areas where there are no alternative fishing grounds (Rife et al. 2012).

Factor 4.3 - Ecosystem-Based Fisheries Management

MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, BOTTOM TRAWLS, MEXICO, UPPER GULF OF CALIFORNIA
MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, NAYARIT
MEXICO / GULF OF CALIFORNIA, CAST NETS, MEXICO, SINALOA SOUTH
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA
MEXICO / GULF OF CALIFORNIA, SURIPERA, MEXICO, SINALOA-NORTH-CENTRAL
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO
MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO, SEABOB FISHERY
MEXICO / GULF OF MEXICO, CAST NETS, MEXICO
MEXICO / GULF OF MEXICO, TRAPS (UNSPECIFIED), MEXICO
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, GULF OF TEHUANTEPEC
MEXICO / PACIFIC, BOTTOM TRAWLS, MEXICO, WEST COAST OF BAJA
MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

Moderate Concern

Ecosystem‐based management has not been formally implemented at any fishery in Mexico, although for shrimp, some policies are in place to protect ecosystem functioning (restricted areas, ban of certain practices, TEDs and FEDs use, etc.). Also, some initiatives have been implemented with the goal to promote better fishing gears with lower environmental impacts (e.g., experimental nets in the Upper Gulf of California).

Nonetheless, the Mexican shrimp fisheries generate a high level of bycatch, including key ecological species such as sharks (Lopez-Martinez, J. et al. 2010) (Meltzer et al. 2012). The diversity of species caught as bycatch creates impacts on the overall ecosystem (Jennings and Kaiser 1998), but the extent and nature of those impacts remains unclear. Therefore, management of the ecosystem and food web impacts of the fishery is deemed a "moderate" concern.

Justification:

A range of bycatch reduction modifications is being tested to reduce the impact of trawl gear on habitats and ecosystems. In a study by the Packard Foundation (Foundation), lighter weight chains weigh 45 kg (an almost

89% decrease in weight from typical weight chains) were used on trawl footropes (Balmori-Ramirez et al. 2012). This decrease in weight allowed the net to remain 10 to 12 inches off the floor during trawl drags, resulting in no capture of species associated with the seabed, including soft coral, sponges, and rays.

Other modifications commonly used to reduce trawl impact on seafloors include the use of lighter trawl nets (Dyneema® and Spectra® brands) and smaller, more hydrodynamic trawl doors to reduce both fuel reduction and drag on sensitive seafloor habitats.

Scenarios evaluated by Lopez-Martinez et al. (1996), however, suggest that bycatch reductions of 10%, 25% and 50% could lead to increased predation on shrimp, with corresponding 0.8%, 5.5% and 10.7% reductions in shrimp populations. (Garcia-Caudillo et al. 2000) make the point that these predicted historical landings in the Gulf of California do not support ecosystem effects. Demersal fish that prey on shrimp have been subject to fishing pressure for the last five decades and shrimp populations have yet to show any increase associated with reduced predation.

Studies of ecosystem impacts associated with industrial scale fishing in the Mexican Pacific and Gulf of Mexico point alternately to high levels of ecosystem disturbance and long‐term ecosystem stability. Limited scientific and anecdotal evidence suggest that marine ecosystems in Mexican waters have changed dramatically over the last 40 years. In particular, (Naval‐Romo 1994) observed a decrease in the diversity and biomass of bycatch in Mexican fisheries. (Sala et al. 2002) documented marked shifts in fisheries in the Gulf of California. Historically, large, high-trophic-level species were the target catch in artisanal fisheries in the Gulf of California; in recent years, fishermen have instead been targeting small species at much lower trophic levels.

On the other hand, a number of theoretical studies suggest that Mexican ecosystems have maintained relative stability despite inter‐annual climatic fluctuations and increased anthropogenic pressure. The outputs of an Ecopath with Ecosim model—a mass‐balance model that simulates biomass changes in interacting populations of marine species in the northern Gulf of California under different exploitation scenarios—suggest that functional groups were impacted more by predation and competition than by fishing pressure (Morales-Zarate et al. 2004).

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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

BIGSCALE ANCHOVY

Factor 2.1 - Abundance

MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

Moderate Concern

A stock assessment relative to reference points is not available for this species. This species is listed as "Least Concern" by the IUCN (Iwamoto et al. 2010). Given the age of the IUCN assessment (published in 2010), vulnerability is also assessed using the Productivity-Susceptibility Analysis (PSA) (see justification). Big scale anchovy has a low vulnerability, and a "Least Concern" status from the IUCN, but there is no quantitative stock assessment or reference points. For these reasons, abundance is deemed a "moderate" concern.

Justification:

PSA score = 2.53. For this reason, the species is deemed "low" vulnerability (based on PSA scoring tool). Detailed scoring of each attribute is shown below.

Productivity Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Average age at maturity	*12 months* (Peterson 1956)	*1*
Average maximum age	5 years (Peterson 1956)	1
Average maximum size	25 cm (Love et al. 2005)	1
Fecundity	<20,000 per year (Peterson 1956)	1
Reproductive strategy	Broadcast spawner	1
Trophic level	2.7 (Froese and Pauly, 2016)	1

Susceptibility Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Areal overlap (Considers all fisheries)	Distribute from inshore along sandy beaches and in tide streams. Juveniles up to 7 cm occur on beaches and in bays, thereafter moving further from the shore. (Whitehead and Rodríguez-Sánchez 1995) area of operation of Magdalena I.	3
Vertical overlap (Considers all fisheries)	Depth distribution 0–50 meters (Whitehead et al. 1988). No fisheries target the species.	2
Selectivity of fishery (Specific to fishery under assessment)	Species is incidentally encountered and is not likely to escape the gear, but conditions under "high risk" do not apply. Default value.	3
Post-capture mortality (Specific to fishery under assessment)	Unknown	3

Factor 2.2 - Fishing Mortality

MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

Low Concern

The big scale anchovy is a common species along the Pacific with a wide distribution, and in Mexico, when captured, is used mostly as bait (Iwamoto et al. 2010). The bycatch information from Magdalena I, shows a low number of organisms captured during the bycatch analysis (7 organisms in 56 sets in 2010) (Juan Manuel Caudillo 2010). This species is listed as "Least Concern" by the IUCN (Iwamoto et al. 2010). Due to the species' wide distribution, no major threats (Iwamoto et al. 2010), and low presence in the catch, it is unlikely that the Magdalena I fishery is a substantial contributor of fishing mortality. For these reasons, fishing mortality is deemed a "low" concern.

Factor 2.3 - Discard Rate

MEXICO / PACIFIC, MAGDALENA - ARTISANAL BOTTOM TRAWL, MEXICO, WEST COAST OF BAJA

< 100%

See table above.

CORTEZ SWIMMING CRAB

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA

Low Concern

Although biological information for Cortez swimming crab (also known as green crab) has been generated in recent years, no abundance targets or conservation goals have been established by managers. In 2012 Cisneros-Mata et al. (2014), evaluated the evolution of the biomass for the green and blue crabs in the Mexican Pacific using the Martell and Froese methodology (2012) (Cisneros-Mata et al. 2014). Based on Cisneros-Mata et al. (2014) results, biomass for green crab in Sonora ($B_{SON2013}$>52.3%) and Sinaloa ($B_{SIN2013}$>51.2%) is not showing signs of being overfished. For this reason, the factor is rated as "low" concern.

Justification:

This method employed by Cisneros-Mata et al. (2014) is based on Schaefer's Biomass Dynamic Model (1954) that uses catch data and "*stock resilience*" estimates (*r*) to calculate the Maximum Sustainable Yield (MSY). The authors found that green and blue crab biomass in Sinaloa and Sonora were three times bigger than the rest of the states in the Mexican Pacific; however, the two-state fisheries are close to their sustainable limits (Cisneros-Mata et al. 2014). The study results can be seen in the figure and table below.

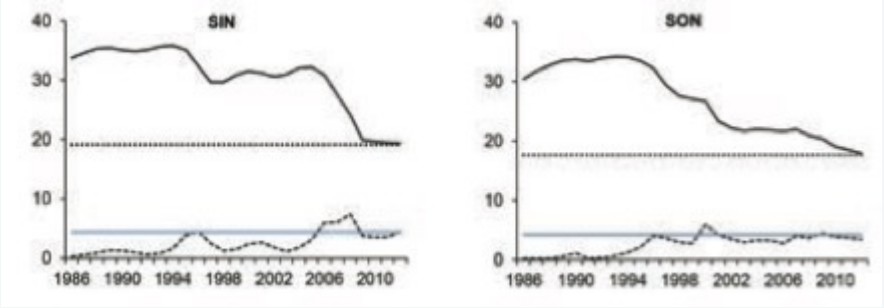

Figure 45

Stock evaluation of green crab (*Callinectes bellicosus*) in Sinaloa and Sonora. Y axis shows metric tons (thousands) while X axis shows time (years). Dark and continuous line = Biomass. Dotted line = k. Blue line = MSY and Dash line = Reported catches. Source: (Cisneros-Mata et al. 2014).

Table. Carrying capacity "k" (t), MSY (t/year) and current biomass (2013) related to k (B%) by state (Cisneros-Mata et al. 2014)

State	K	MSY	B%
Sonora	37,129	4,246	52.3
Sinaloa	38,030	4,410	51.2

According to the CNP, managers rated the status of the Green crab fishery at its maximum sustainable level (DOF, 2012).

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA

Moderate Concern

A trap fishery targets Cortez swimming crab in the Gulf of California. Current values of F_{MSY} for the green crab fishery in the Gulf of California are unknown; landings for the fishery have evolved from low catches in the beginning (1980s), to maximum levels (1990s), to relatively stable on landings during recent years (2006 to 2012) (CONAPESCA 2016). A bycatch report of the shrimp gillnet fishery of 2012, shows that *Callinectes bellicosus* is the most important bycatch species, representing almost 50% of the bycatch (Juan Manuel Garcia Caudillo, internal report). Landings for the target fishery have been relatively stable during recent years, so the current impact of the shrimp fisheries might be low enough to not adversely affect population; however, since there is no further evidence of this, fishing mortality is deemed of "moderate" concern.

Factor 2.3 - Discard Rate

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA

< 100%

See table above.

ARCHED SWIMMING CRAB

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA

Moderate Concern

A stock assessment relative to reference points is not available for this species, and it has not been assessed by the IUCN. For this reason, this factor is rated using the Productivity-Susceptibility Analysis (PSA) (see justification). Arched swimming crab has a low vulnerability; there is no quantitative stock assessment for this

stock, and it is believed this population is stable (landings information); therefore, abundance is deemed a "moderate" concern.

Justification:

PSA score = 1.79. For this reason, the species is deemed "low" vulnerability (based on PSA scoring tool). Detailed scoring of each attribute is shown below.

Productivity Attribute	**Relevant Information**	**Score (1 = low risk, 2 = medium risk, 3 = high risk)**
Average age at maturity	*12 months (Estrada-Valencia, 1999; Fischer and Wolff 2006)*	*1*
Average maximum age	4 years (Rosas-Correa and Navarrete 2009)	1
Fecundity	872,000 eggs/y (Estrada-Valencia 1999)	1
Reproductive strategy	Brooding (conservative)	2
Trophic level	3.3 (Morales-Zarate, et al. 2002)	3
Density dependence (invertebrates only)	No depensatory or compensatory dynamics demonstrated or likely	2

Susceptibility Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Areal overlap (Considers all fisheries)	*Default value used*	3
Vertical overlap (Considers all fisheries)	*Default value used*	3
Selectivity of fishery (Specific to fishery under assessment)	Traps and rings have proven to be highly effective to catch crab species (Balmori et al. 2012) It is unlikely that organisms escape the gear, with the exception that small sizes can escape through gear modifications (e.g., traps)	1
Post-capture mortality (Specific to fishery under assessment)	With the exception of the sizes that are retained, small size organisms are released alive and in good condition (Balmori et al 2012) (pers. comm., Loaiza-Villanueva CEDO AC *2017)*	1

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA

Low Concern

The arched crab is captured mostly in Sinaloa by a target fishery (Traps). Landings of this fishery in Sinaloa have been relatively stable for the last years (CONAPESCA 2016). Based on the bycatch report analysis from (Balmori-Ramirez et al. 2012), arched swimming crab, is a frequent species in the catch (~7% of the total of the catch) (Balmori-Ramirez et al. 2012); however, based on the stability of the landings by the fishery that targets the species, and the low vulnerability, it is unlikely that the gillnets fishery is a substantial contributor of fishing mortality. For these reasons, fishing mortality is deemed "low" concern.

Factor 2.3 - Discard Rate

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA

< 100%

See table above.

SPOTTED SAND BASS

Factor 2.1 - Abundance

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA

Moderate Concern

A stock assessment relative to reference points is not available for this species. The species is listed as "Least Concern" by the IUCN (Smith-Vaniz et al. 2010). Given the age of the IUCN assessment (2010), inherent vulnerability was evaluated using a Productivity-Susceptibility Analysis (PSA) (see justification). Although spotted sand bass has a medium vulnerability and IUCN "Least Concern" status, there is no quantitative stock assessment for this stock. For these reasons, abundance is deemed a "moderate" concern.

Justification:

PSA score = 2.72. For this reason, the species is deemed “medium” vulnerability (based on PSA scoring tool). Detailed scoring of each attribute is shown below.

Productivity Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Average age at maturity	18 months (Shanks and Eckert 2005)	1
Average maximum age	20 (Froese and Pauly 2016)	2
Fecundity	68,000 (Shanks and Eckert 2005)	1
Reproductive strategy	Broadcast spawner	1
Trophic level	4.2 (Froese and Pauly 2016)	3

Susceptibility Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Areal overlap (Considers all fisheries)	This species inhabits reefs adjacent to sandy bottoms along the Gulf of California (Froese and Pauly 2016), areas used by the gillnets shrimp fishery.	3
Vertical overlap (Considers all fisheries)	Associated to reefs and sandy areas from the coast up to 60 m depth. (Eschemeyer et al. 1983)	3
Selectivity of fishery (Specific to fishery under assessment)	Species is incidentally caught and is not likely to escape the gear; however, conditions under "high risk" do not apply.	2
Post-capture mortality (Specific to fishery under assessment)	Unknown Default value.	3

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA

Moderate Concern

Spotted sand bass is considered an associated species for gillnet fisheries that target other species (e.g., snappers, groupers) (DOF 2012). During the most recent analysis of the Sonora gillnet shrimp fishery bycatch, spotted sand bass represented ~5% of the total bycatch of the fishery (Garcia-Caudillo 2015); however, the impact that gillnets have on the stocks is unclear. The species is listed as "Least Concern" by the IUCN (Smith-Vaniz et al. 2010), and considering the species "medium" vulnerability, fishing mortality is deemed "moderate" concern for gillnets in Sonora.

Factor 2.3 - Discard Rate

MEXICO / GULF OF CALIFORNIA, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), MEXICO, SONORA

< 100%

See table above.

LINED SEAHORSE

Factor 2.1 - Abundance

MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

High Concern

Northern seahorse is listed as vulnerable by the IUCN (Czembor et al. 2012) (Project Seahorse 2003). Therefore, Seafood Watch deems Pacific and northern seahorse abundance a "high" concern.

Factor 2.2 - Fishing Mortality

MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

Moderate Concern

Northern seahorses have been recorded as bycatch in the GOM Mexican shrimp fishery (Baum and Vincent 2005). Studies have shown that incidental catch of northern seahorses in the GOM shrimp fisheries may impact species abundance in these regions (Czembor et al. 2012) (Project Seahorse 2003). On the coast of Mexico, 21 of the 29 fishers in five locations reported declines in seahorses due to the shrimp trawl fishery. Of the 14 fishers who provided quantified catch estimates, 8 estimated declines between 75 to 90% in the past 10 to 30 years (Baum et al. 2003); however, the extent of these impacts is unknown. For these reasons, fishing mortality of northern seahorses the GOM trawl fishery is deemed a "moderate" concern.

Factor 2.3 - Discard Rate

MEXICO / GULF OF MEXICO, BOTTOM TRAWLS, MEXICO

≥ 100%

Fishery	Estimate (reference)	SFW category
Mexican Pacific		
Industrial Fleet—Trawls	400% (INAPESCA 2017)	>100%
Artisanal Fleet—Gillnets	50% (Balmori-Ramirez et al. 2012)	<100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%
Artisanal Fleet—Magdalena I Trawl	55.6% of catch (INAPESCA b 2000)	<100%
Artisanal Fleet—Suripera nets	50% (Balmori-Ramirez et al. 2012)	<100%
Gulf of Mexico		
Industrial Fleet—Trawls	300% to 600% (INAPESCA 2014 b)	>100%
Artisanal Fleet—Small trawl ▌Seabob Fishery	600% (Wakida-Kusunoki 2005)	>100%
Artisanal Fleet—Cast nets	High selectivity, low discard mortality (Garcia-Caudillo 2016)	<100%

Artisanal Fleet—Charanga nets	high selectivity, low discard mortality (SAGARPA 2004)	<100%

Appendix B: List of By-catch Species for the Shrimp fishery in Mexican Pacific

Data from INAPESCA's surveys from the campaigns of 2004 to 2014. IAR= Relative abundance index (INAPESCA 2016). The categories are Abundant (*"abundante"*) Frequent (*"frecuente"*), Common (*"comun"*) and rare (*"rara"*).

Especie	IAR	Clasificación
Portunus asper	4.8629	Abundante
Callinectes arcuatus	4.0921	Abundante
Luidia foliolata	3.3316	Abundante
Selene peruviana	2.9604	Abundante
Xiphopenaeus riveti	2.8841	Abundante
Pomadasys panamensis	2.5425	Abundante
Chloroscombrus orqueta	2.3951	Abundante
Haemulopsis nitidus	2.3424	Abundante
Urobatis halleri	2.3166	Abundante
Porichthys analis	2.144	Abundante
Syacium ovale	2.0821	Abundante
Diapterus peruvianus	2.073	Abundante
Larimus effulgens	2.0439	Abundante
Prionotus stephanophrys	1.8772	Abundante
Eucinostomus currani	1.846	Abundante
Etropus crossotus	1.7594	Abundante
Orthopristis chalceus	1.7379	Abundante
Eucinostomus gracilis	1.6846	Abundante
Pseudopeneus grandisquamis	1.6803	Abundante
Stellifer illecebrosus	1.6566	Abundante
Luidia brevispina	1.5372	Abundante
Haemulopsis axillaris	1.47	Abundante
Eucinostomus argenteus	1.4081	Abundante
Citharichthys gilberti	1.3544	Abundante
Hepatus kossmanni	1.3226	Abundante

Cathorops fuerthii	1.3189	Abundante
Achirus mazatlanus	1.1812	Abundante
Diplectrum macropoma	1.1484	Abundante
Synodus scituliceps	1.1376	Abundante
Centropomus robalito	1.093	Abundante
Astropecten armatus	1.0833	Abundante
Bothus constellatus	1.0155	Abundante
Citharichthys platophrys	0.8918	Frecuente
Syacium latifrons	0.8832	Frecuente
Diplectrum pacificum	0.8407	Frecuente
Urotrygon nana	0.7686	Frecuente
Scorpaena sonorae	0.6454	Frecuente
Eucinostomus dowii	0.6422	Frecuente
Paralabrax maculatofasciatus	0.6336	Frecuente
Pliosteostoma lutipinnis	0.6046	Frecuente
Cyclopsetta panamensis	0.5787	Frecuente
Lolliguncula panamensis	0.5744	Frecuente
Orthopristis reddingi	0.5508	Frecuente
Haemulopsis elongatus	0.533	Frecuente
Urotrygon chilensis	0.5137	Frecuente
Larimus acclivis	0.511	Frecuente
Stellifer ericymba	0.5072	Frecuente
Diapterus aureolus	0.4954	Frecuente
Balistes polylepis	0.4674	Frecuente
Isophistus remifer	0.4674	Frecuente
Polydactylus approximans	0.4448	Frecuente
Arenaeus mexicanus	0.4378	Frecuente
Synodus evermanni	0.4324	Frecuente
Peprilus medius	0.3959	Frecuente
Lile stolifera	0.3835	Frecuente
Renilla amethystina	0.3792	Frecuente

Urotrygon munda	0.3776	Frecuente
Symphurus chabanaudi	0.3744	Frecuente
Occidentarius platypogon	0.3711	Frecuente
Symphurus leei	0.3706	Frecuente
Sphoeroides annulatus	0.3625	Frecuente
Ophioscion strabo	0.3496	Frecuente
Cyclopsetta querna	0.3394	Frecuente
Stellifer furthii	0.3319	Frecuente
Lepophidium prorates	0.3243	Frecuente
Sphoeroides lobatus	0.3216	Frecuente
Prionotus birostratus	0.3195	Frecuente
Cathorops steindachneri	0.3028	Frecuente
Dardanus stimpsoni	0.3028	Frecuente
Chaetodipterus zonatus	0.2657	Frecuente
Scorpaena russula	0.2657	Frecuente
Diplectrum labarum	0.2512	Frecuente
Polydactylus opercularis	0.248	Frecuente
Diplectrum eumelum	0.2447	Frecuente
Synodus lucioceps	0.2399	Frecuente
Stellifer melanochier	0.235	Frecuente
Euphilax robustus	0.2307	Frecuente
Bagre panamensis	0.2302	Frecuente
Urobatis maculatus	0.2275	Frecuente
Lutjanus guttatus	0.2243	Frecuente
Mugil curema	0.2227	Frecuente
Citharichthys fragilis	0.2189	Frecuente
Haemulopsis leuciscus	0.2189	Frecuente
Trichiurus nitens	0.2157	Frecuente
Trachypenaeus pacificus	0.213	Frecuente
Citharichthys latifrons	0.2108	Frecuente
Bellator xenisma	0.1926	Frecuente

Squilla mantoidea	0.192	Frecuente
Larimus argenteus	0.1883	Frecuente
Micropogonias ectenes	0.1877	Frecuente
Prionotus horrens	0.1872	Frecuente
Prionotus ruscarius	0.1834	Frecuente
Portunus xantusii	0.1829	Frecuente
Anchovia macrolepidota	0.178	Frecuente
Solenosteira gatesi	0.1764	Frecuente
Cantharus pallidus	0.1705	Frecuente
Citharichthys xanthostigma	0.1651	Frecuente
Nortia pristis	0.1646	Frecuente
Cancellaria cancellata	0.1635	Frecuente
Mullinia pallida	0.1581	Frecuente
Sicyonia disdorsalis	0.1533	Frecuente
Haemulon californiensis	0.1528	Frecuente
Centropomus armatus	0.1506	Frecuente
Stomolophus meleagris	0.1501	Frecuente
Cynoscion reticulatus	0.1485	Frecuente
Rhinobatos glaucostigma	0.1345	Frecuente
Pleuronichthys ocellatus	0.1323	Frecuente
Micropogonias altipinnis	0.1291	Frecuente
Caranx caninus	0.1275	Frecuente
Cathorops dasycephalus	0.1216	Frecuente
Urotrygon aspidura	0.113	Frecuente
Haemulon steindachnerii	0.1108	Frecuente
Engyophrys sanctilaurentia	0.106	Frecuente
Calyptraea mamillaris	0.0984	Común
Selene brevoortii	0.0984	Común
Callinectes arcuatus	0.0936	Común
Petrochirus californiensis	0.092	Común
Conus fergusoni	0.0882	Común

Paralonchurus petersi	0.0877	Común
Euvola vogdesi	0.0871	Común
Menticirrhus nasus	0.0828	Común
Calamus brachysomus	0.0823	Común
Etropus peruvianus	0.0818	Común
Albula vulpes	0.0791	Común
Urotrygon rogersi	0.0742	Común
Paralichthys woolmani	0.071	Común
Stomolophus renigi	0.071	Común
Trichiurus lepturus	0.0699	Común
Anchoa nasus	0.0683	Común
Bollmannia stigmatura	0.0678	Común
Cynoscion xanthulus	0.0672	Común
Pristigenys serrula	0.0662	Común
Rhinoptera steindachneri	0.0656	Común
Conodon serrifer	0.0651	Común
Iliacantha hancocki	0.0629	Común
Neverita reclusiana	0.0629	Común
Clibanarius janethaigae	0.0624	Común
Cynoscion squamipinnis	0.0624	Común
Microgobius sp	0.0619	Común
Squilla bigelowi	0.0619	Común
Sycionia disdorsalis	0.0619	Común
Peprilus snyderi	0.0608	Común
Narcine vermiculatus	0.0602	Común
Cathorops seemani	0.0597	Común
Syacium longidorsale	0.0581	Común
Gymnothorax panamensis	0.0576	Común
Loliolopsis diomedeae	0.0554	Común
Squilla panamensis	0.0532	Común
Conus perplexus	0.0527	Común

Distorsio decussata	0.0516	Común
Solenocera mutator	0.0516	Común
Crepidula excavata	0.0511	Común
Bardiella ensifera	0.0506	Común
Pomadasys macracanthus	0.0506	Común
Sphyraena ensis	0.0506	Común
Leptopecten palmeri	0.0479	Común
Paralonchurus goodei	0.0479	Común
Elattarchus archidium	0.0468	Común
Menticirrhus elongatus	0.0463	Común
Achirus scutum	0.0441	Común
Rhinobatus productus	0.0441	Común
Chione kelletii	0.042	Común
Lutjanus peru	0.0414	Común
Paralonchurus rathbuni	0.0414	Común
Gymnura marmorata	0.0409	Común
Neverita helicoides	0.0409	Común
Fistularia corneta	0.0398	Común
Melongena patula	0.0398	Común
Callinectes toxotes	0.0393	Común
Hemicaranx leucurus	0.0393	Común
Oligoplites refulgens	0.0393	Común
Persephona townsendi	0.0366	Común
Anchoa exigua	0.036	Común
Bufonaria nana	0.0355	Común
Caranx otrynter	0.035	Común
Parapsettus panamensis	0.035	Común
Ethusa steyaerti	0.0344	Común
Ophistopterus dovi	0.0317	Común
Sicyonia affinis	0.0317	Común
Trinectes fonsecencis	0.0312	Común

Selene oesterdii	0.0307	Común
Chaetodon humeralis	0.0301	Común
Strombus gracilior	0.0301	Común
Mulloidichthys dentatus	0.0296	Común
Nucula nucleus	0.0296	Común
Squilla aculeata aculeata	0.029	Común
Squilla hancocki	0.0285	Común
Ficus ventricosa	0.028	Común
Scomber japonicus	0.028	Común
Gerres cinereus	0.0274	Común
Lophiodes caulinaris	0.0269	Común
Eupleura muriciformis	0.0264	Común
Umbrina xanti	0.0258	Común
Brotula clarkae	0.0253	Común
Squilla parva	0.0247	Común
Anchoa ischana	0.0242	Común
Argopecten ventricosus	0.0242	Común
Chione gnidia	0.0237	Común
Paradasygyus depressus	0.0237	Común
Etrumeus teres	0.0231	Común
Eucinostomus aureolus	0.0231	Común
Porcellana cancrisocialis	0.0226	Común
Achirus panamensis	0.0221	Común
Stratiotes mclaughlinae	0.0215	Común
Xenichthys xantii	0.0215	Común
Antennarius avalonis	0.021	Común
Notarius troschelii	0.021	Común
Oligoplites saurus	0.021	Común
Stellifer ocellatus	0.021	Común
Stellifer strabo	0.021	Común
Paralichthys californicus	0.0204	Común

Rypticus nigripinnis	0.0199	Común
Orthopristis cantharinus	0.0194	Común
Prionotus albirostris	0.0194	Común
Sardinops sagax	0.0194	Común
Scomberomorus sierra	0.0194	Común
Echinometra vanbrunti	0.0188	Común
Ophidion galeoides	0.0183	Común
Sphoeroides tricocephalus	0.0183	Común
Hemicaranx zelotes	0.0177	Común
Porichthys margaritatus	0.0177	Común
Symphurus fasciolaris	0.0177	Común
Lutjanus colorado	0.0172	Común
Hippoglossina bollmani	0.0167	Común
Anisotremus dovii	0.0161	Común
Epinephelus acanthistius	0.0161	Común
Eugerres axilaris	0.0161	Común
Hippocampus ingens	0.0161	Común
Phyllonotus erthrostoma	0.0161	Común
Calappa convexa	0.0156	Común
Lagocephalus sp	0.0156	Común
Stenorhynchus debilis	0.0156	Común
Xystreurys liolepis	0.0156	Común
Centengraulis mysticetus	0.0151	Común
Dasyatis brevis	0.0145	Común
Megapitaria squalida	0.0145	Común
Bairdiella icistia	0.0134	Común
Eugerres lineatus	0.0134	Común
Hypsopsetta guttulata	0.0134	Común
Ancylopsetta dendritica	0.0129	Común
Diplectrum euryplectrum	0.0129	Común
Gymnothorax equatorialis	0.0129	Común

Lutjanus argentiventris	0.0129	Común
Portunus acuminatus	0.0129	Común
Turritella leucostoma	0.0124	Común
Encope wetmorei	0.0118	Común
Sphoeroides sechurae	0.0118	Común
Bollmannia chlamydes	0.0113	Común
Hippoglossina tetrophthalma	0.0113	Común
Malea regis	0.0113	Común
Neodoclea boneti	0.0113	Común
Umbrina roncador	0.0113	Común
Sycionia penicillata	0.0108	Común
Bispira rugosa monterea	0.0102	Común
Decapterus macrosoma	0.0102	Común
Fusinus dupetitthouarsi	0.0102	Común
Narcine entemedor	0.0102	Común
Symphurus atricaudus	0.0102	Común
Anadara grandis	0.0097	Rara
Caranx caballus	0.0097	Rara
Evibacus princeps	0.0097	Rara
Hexaplex (Muricanthus) nigritus	0.0097	Rara
Larimus pacificus	0.0097	Rara
Luidia elaster	0.0097	Rara
Ophichthus zophochir	0.0097	Rara
Sphyrna lewini	0. 0091	Rara
Crucibulum lignarium	0.0091	Rara
Fistularia commersonii	0.0091	Rara
Knefastia walkeri	0.0091	Rara
Lepophidium pardale	0.0091	Rara
Leptopecten tumbezensis	0.0091	Rara
Ophioscion scierus	0.0091	Rara
Paralichthys aestuarius	0.0091	Rara

Porichthys mimeticus	0.0091	Rara
Alectis ciliaris	0.0086	Rara
Cathorops hypophthalmus	0.0086	Rara
Epinephelus nigritus	0.0086	Rara
Lonchopisthus sinuscalifonicus	0.0086	Rara
Rhinobatos leucorhynchus	0.0086	Rara
Zapteryx exasperata	0.0086	Rara
Zapteryx xyster	0.0086	Rara
Cheilotrema saturnum	0.0081	Rara
Collodes tenuirostris	0.0081	Rara
Hepatus lineatus	0.0081	Rara
Anchoa mundeola	0.0075	Rara
Cynoponticus coniceps	0.0075	Rara
Epinephelus analogus	0.0075	Rara
Epinephelus exsul	0.0075	Rara
Peprilus ovatus	0.0075	Rara
Batrachoides boulengeri	0.007	Rara
Caranx vinctus	0.007	Rara
Cathorops guatemalensis	0.007	Rara
Dasyatis longus	0.007	Rara
Nebris occidentalis	0.007	Rara
Bagre pinnimaculatus	0.0065	Rara
Bollmannia ocellata	0.0065	Rara
Harengula thrissina	0.0065	Rara
Mugil cephalus	0.0065	Rara
Murex recuvirostri recuvirostri	0.0065	Rara
Opisthopterus dovii	0.0065	Rara
Pyromaia tuberculata	0.0065	Rara
Scomberomorus concolor	0.0065	Rara
Trachinotus paitensis	0.0065	Rara
Astropecten regalis	0.0059	Rara

Cancellaria solida	0.0059	Rara
Haemulon scudderi	0.0059	Rara
Panulirus gracilis	0.0059	Rara
Aetobatus narinari	0.0054	Rara
Anchoa helleri	0.0054	Rara
Cymothoa exigua	0.0054	Rara
Haemulon sexfasciatum	0.0054	Rara
Ophioscion iniceps	0.0054	Rara
Stellifer pizarroensis	0.0054	Rara
Architectona nobilis	0.0048	Rara
Heterodontus francisci	0.0048	Rara
Mentichirrus panamensis	0.0048	Rara
Ophichthus triserialis	0.0048	Rara
Squilla californiensis	0.0048	Rara
Albula nemoptera	0.0043	Rara
Bothus leopardinus	0.0043	Rara
Callinectes sapidus	0.0043	Rara
Centropomus nigrescens	0.0043	Rara
Chione amathusia	0.0043	Rara
Diodon hystrix	0.0043	Rara
Diplobatis ommata	0.0043	Rara
Luidia alternata	0.0043	Rara
Mustelus albipinnis	0.0043	Rara
Oligoplites altus	0.0043	Rara
Ophioscion typicus	0.0043	Rara
Sciades dowii	0.0043	Rara
Selar crumenophthalmus	0.0043	Rara
Transenella puella	0.0043	Rara
Bathtcongrus machirurus	0.0038	Rara
Bellator loxias	0.0038	Rara
Cancellaria gemmulata	0.0038	Rara

Centropomus medius	0.0038	Rara
Halichoeres semicinctus	0.0038	Rara
Hemanthias peruanus	0.0038	Rara
Mentichirrus undulatus	0.0038	Rara
Nassarius pagodus	0.0038	Rara
Anchoa lucida	0.0032	Rara
Astraea undosa	0.0032	Rara
Cancellaria balboae	0.0032	Rara
Cantharus obesa	0.0032	Rara
Crassostrea corteziensis	0.0032	Rara
Crucibulum scutellatum	0.0032	Rara
Luidia pragma	0.0032	Rara
Mustelus californicus	0.0032	Rara
Myliobatis californica	0.0032	Rara
Oligoplites remifer	0.0032	Rara
Pleuronichthys verticalis	0.0032	Rara
Portunus acurrichantos	0.0032	Rara
Sanguinolaria tellinoides	0.0032	Rara
Sicyonia dissedwardsi	0.0032	Rara
Trachinotus kennedyi	0.0032	Rara
Aluterus monoceros	0.0027	Rara
Argopecten circularis	0.0027	Rara
Echidna nocturna	0.0027	Rara
Epinephelus niphobles	0.0027	Rara
Heterodontus mexicanus	0.0027	Rara
Mustelus lunulatus	0.0027	Rara
Ophioscion vermicularis	0.0027	Rara
Pecten vogdesi	0.0027	Rara
Polystira nobilis	0.0027	Rara
Pomacanthus zonipitecus	0.0027	Rara
Portunus approximans	0.0027	Rara

Totoaba macdonaldi	0.0027	Rara
Umbrina bussingi	0.0027	Rara
Anadara formosa	0.0022	Rara
Cathorops multiradiatus	0.0022	Rara
Elops affinis	0.0022	Rara
Epinephelus multigutatus	0.0022	Rara
Pecten ventricusus	0.0022	Rara
Phalium centiquadratum	0.0022	Rara
Pleuronichthys ritteri	0.0022	Rara
Raja equatorialis	0.0022	Rara
Rhizoprionodon longurio	0.0022	Rara
Rhynchoconger nitens	0.0022	Rara
Scyacium ovale	0.0022	Rara
Symphurus atramentatus	0.0022	Rara
Urotrygon rogersi	0.0022	Rara
Anadara tuberculosa	0.0016	Rara
Arbacia incisa	0.0016	Rara
Astroscopus zephyreus	0.0016	Rara
Bairdiella armata	0.0016	Rara
Batrachoides pacifici	0.0016	Rara
Cathorops taylori	0.0016	Rara
Chilomycterus reticularis	0.0016	Rara
Cymatium wiegmanni	0.0016	Rara
Cynoscion phoxocephalus	0.0016	Rara
Haemulon maculicauda	0.0016	Rara
Hepatus chilensis	0.0016	Rara
Hippoglossina stomata	0.0016	Rara
Hippolgosina dentritca	0.0016	Rara
Hoplopagrus guentheri	0.0016	Rara
Luidia armata	0.0016	Rara
Monolene asaedai	0.0016	Rara

Neverita obesa	0.0016	Rara
Noetia reversa	0.0016	Rara
Opistognathus punctatus	0.0016	Rara
Panulirus inflatus	0.0016	Rara
Pecten lunaris	0.0016	Rara
Symphurus gorgonae	0.0016	Rara
Synodus lacertinus	0.0016	Rara
Terebra albcineta	0.0016	Rara
Turritela willeti	0.0016	Rara
Aluterus scriptus	0.0011	Rara
Arius osculus	0.0011	Rara
Batrachoides waltersi	0.0011	Rara
Caulolatilus affinis	0.0011	Rara
Diplectrum maximum	0.0011	Rara
Doscidictus gigas	0.0011	Rara
Eupleura sulcidentata	0.0011	Rara
Fodiator rostratus	0.0011	Rara
Gnathophis cinctus	0.0011	Rara
Hemiramphus saltator	0.0011	Rara
Hepatus islerii	0.0011	Rara
Libinia mexicana	0.0011	Rara
Lobotes pacificus	0.0011	Rara
Lutjanus novemfasciatus	0.0011	Rara
Lycengraulis poeyi	0.0011	Rara
Mitra (fusimitra) swaisonil	0.0011	Rara
Mustelus calfornicus	0.0011	Rara
Narcine reticulatus	0.0011	Rara
Notarius lentiginosus	0.0011	Rara
Notarius osculus	0.0011	Rara
Notolapas lamellatus	0.0011	Rara
Octopus chierchiae	0.0011	Rara

Octupus vulgaris	0.0011	Rara
Oliva incrassata	0.0011	Rara
Paralonchurus dumerelii	0.0011	Rara
Pitar lupanaria	0.0011	Rara
Polinices uver	0.0011	Rara
Pseudobalistes naufragium	0.0011	Rara
Raja velezi	0.0011	Rara
Synodus sechurae	0.0011	Rara
Torpedo tremens	0.0011	Rara
Trachurus symmetricus	0.0011	Rara
Vokesimurex libidus	0.0011	Rara
Anadara tuberculosa	0.0005	Rara
Agaronia testacea	0.0005	Rara
Albula esuncula	0.0005	Rara
Albunea lucaSia	0.0005	Rara
Apogon retrosella	0.0005	Rara
Bathyraja trachura	0.0005	Rara
Calappa saussueri	0.0005	Rara
Cancellaria buccinoides	0.0005	Rara
Cancellaria darwini	0.0005	Rara
Caranx speciosus	0.0005	Rara
Carcharhinus porosus	0.0005	Rara
Centropomus viridis	0.0005	Rara
Cephalopholis panamensis	0.0005	Rara
Cetengraulis mysticetus	0.0005	Rara
Chilomycterus affinis	0.0005	Rara
Cronius ruber	0.0005	Rara
Crucibulum monticulus	0.0005	Rara
Crucibulum pectinatum	0.0005	Rara
Cynoscion parvipinnis	0.0005	Rara
Dasyatis dipterura	0.0005	Rara

Dormitator latifrons	0.0005	Rara
Dosinia ponderosa	0.0005	Rara
Encheliophis dubius	0.0005	Rara
Enteromorpha compressa	0.0005	Rara
Epinephelus itajara	0.0005	Rara
Epinephelus niveatus	0.0005	Rara
Fuseramus transbersalis	0.0005	Rara
Halichoeres chierchiae	0.0005	Rara
Haplunnis pacifica	0.0005	Rara
Hexaplex (Muricanthus) regius	0.0005	Rara
Kathetostoma sp.	0.0005	Rara
Lepophidium microlepis	0.0005	Rara
Leptogorgia alba	0.0005	Rara
Lismata cf nayarentensis	0.0005	Rara
Lophiodes spirulus	0.0005	Rara
Lythrulon flaviguttatum	0.0005	Rara
Macrobrachium rosenbergii	0.0005	Rara
Manta birostris	0.0005	Rara
Mesorhoea belli	0.0005	Rara
Muraena argus	0.0005	Rara
Myrichthys tigrinus	0.0005	Rara
Myrophis vafer	0.0005	Rara
Nematistius pectoralis	0.0005	Rara
Notolapas mexicanus	0.0005	Rara
Odontoscion xanthops	0.0005	Rara
Ophistonema bulleri	0.0005	Rara
Opistognathus mexicanus	0.0005	Rara
Orictis analis	0.0005	Rara
Oxyporhamphus micrpterus	0.0005	Rara
Paraconger californiensis	0.0005	Rara
Parastichopus parvimensis	0.0005	Rara

Portunus tuberculatus	0.0005	Rara
Prognchthys tringa	0.0005	Rara
Scarus perrico	0.0005	Rara
Scorpaena guttata	0.0005	Rara
Scorpaena mystes	0.0005	Rara
Scorpaena plumieri	0.0005	Rara
Scurnia mesoleuca	0.0005	Rara
Semicassis granulata centicuadra	0.0005	Rara
Seriola mazatlana	0.0005	Rara
Sphoeroides kendalli	0.0005	Rara
Sphoeroides testinus	0.0005	Rara
Squatina californica	0.0005	Rara
Stenocionops ovata	0.0005	Rara
Syacium xanthulum	0.0005	Rara
Sycionia disedwardsi	0.0005	Rara
Sycionia ingentis	0.0005	Rara
Symphurus callopterus	0.0005	Rara
Symphurus melanopleura	0.0005	Rara
Trachinothuss rodophus	0.0005	Rara
Trachycardium pristipleura	0.0005	Rara
Umbrina analis	0.0005	Rara
Umbrina dorsalis	0.0005	Rara
Urotrygon concentricus	0.0005	Rara
Urotrygon simulatrix	0.0005	Rara
Xiphopenaeus californiensis	0.0005	Rara
Gelidium sclerophyllum	0	Rara
Pagurus annescus	0	Rara
Physiculus nematopus	0	Rara
Polysiphonia johnstonii	0	Rara

Appendix C: Enforcement actions report from CONAPESCA 2013-2015

Acciones de la Flota Camaronera en México (Aspectos relevantes)

Verificación de Dispositivos Excluidores de Tortugas
La pesquería de camarón de aguas marinas constituye, por el impacto social, económico y cultural que significa, una de las más importantes de México, por lo que se vuelve necesario mantenerla en niveles de desarrollo sustentable. La flota camaronera de nuestro país, que destaca a nivel mundial por ser de las mayores, realiza su ac en zonas costeras en las que cohabitan 7 de las 8 especies de tortugas marinas existent por lo que sus poblaciones son susceptibles de ser capturadas incidentalmente.

Estos quelonios marinos están protegidos por las leyes de México, pues desde 1990 se decretaron en veda total e indefinida. Por esta razón el Gobierno Federal ha establecido una serie de regulaciones e instrumentado procesos técnicos a fin de proteger, conservar y propiciar la recuperación de las poblaciones de tortugas marinas y sus áreas de anidación, buscando que exista la menor afectación por parte de las actividades pesqueras.

Entre estas regulaciones destacan la Norma Oficial Mexicana NOM-002-SAG/PESC-2013, para ordenar el aprovechamiento de las especies de camarón en aguas de jurisdicción federal de los Estados Unidos Mexicanos, en la que se establece la obligación de utilizar, en las redes de arrastre para camarón de altamar, un dispositivo excluidor tortugas marinas (DET); y la Norma Oficial Mexicana NOM-061-PESC-2006, Especificaciones técnicas de los excluidores de tortugas marinas utilizados por la flota de arrastre camaronera en aguas de jurisdicción federal de los Estados Unidos Mexicanos, misma que contiene las especificaciones técnicas que deben de cumplir los DET y que actualmente se encuentra en proceso de modificación.

En estos ordenamientos se especifica que la vigilancia del cumplimiento de los mismos, corresponde a la Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA), por conducto de Comisión Nacional de Acuacultura y Pesca (CONAPESCA); a la Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT), por conducto de la Procuraduría Federal de Protección al Ambiente (PROFEPA), así como a la Secretaría de Marina- Armada de México(SEMAR), cada una en el ámbito de sus respectivas atribuciones.

Así mismo, se señala que las violaciones a las disposiciones contenidas en éstas, se sancionarán en los términos establecidos en la Ley de Pesca y su Reglamento, Ley General del Equilibrio Ecológico y su Reglamento y demás disposiciones legales aplicables.

Para cumplir con esta responsabilidad, el Gobierno Federal diseñó y puso en operación desde 2009 un Plan de Acción Inmediato en materia de DET y un Programa de Trabajo de Verificación de DET 2010-2012, mismo que se refrendó en el año 2013 y que a la fecha continúa vigente, con
el objetivo de garantizar que la pesca de camarón de altamar se realice sin afectar las poblaciones de tortugas marinas.

El Plan de acción inmediato (noviembre 2009 – abril 2010), fue implementado con el objetivo de corregir los problemas encontrados en el uso de los DET y atender una serie de medidas de corto plazo, encaminadas a lograr un nivel de "comparabilidad" entre los programas norteamericano y mexicano.

El Programa de trabajo de verificación de DET 2010-2012, comprende los siguientes aspectos:

§ Implementación y Operación del Programa de Verificación de DET, desde el inicio de cada temporada de

pesca de camarón de altamar y en las principales zonas de pesca de este recurso en el país, tanto en el Golfo de México y Mar Caribe, como en el Océano Pacífico incluyendo el Golfo de California.

§ Sostener el índice de inspecciones a buques camaroneros en operaciones de arrastre, preferentemente en zonas de pesca alejadas y en horario nocturno.

§ Se mantiene el compromiso de:

- Inspeccionar la flota camaronera en operación.
- 70% o más de las verificaciones totales deberán ser marinas.
- 30% o más de las verificaciones marinas deberán nocturnas.

§ Continuidad de las inspecciones de DE en barcos camaroneros atracados en muelle.

§ Coordinación de esfuerzos de la SAGARPA-CONAPESCA, SEMARNAT-PROFEPA y la SEMAR, para la realización de verificaciones conjuntas, interviniendo cada una conforme a atribuciones de competencia.

§ E tablecimiento y cumplimiento de metas.

§ Continuidad del programa de capacitación del personal oficial de CONAPESCA y PROFEPA, en materia de verificación de DET, navegación y seguridad de la vida en el mar.

§ Implementación, mediante acuerdo a celebrar con SEMAR, de un programa para la adquisición de lanchas de inspección tipo RHIB y embarcaciones tipo Defender.

§ Fortalecimiento del de navegación de las embarcaciones menores que integran su parque de vehículos acuáticos, tendiente a preservar la seguridad de la vida en el mar

§ Mantener en operación el Sistema de Localización y Monitoreo Satelital de Embarcaciones Pesqueras (SISMEP) de la CONAPESCA, gestionando el flujo de la información satelital con PROFEPA y SEMAR

§ Consolidación del programa de difusión relativo a las disposiciones normativas en el uso de los DET, entre el sector pesquero

§ Determinación de criterios claros y consistentes para la imposición de sanciones a infractores en materia de DET, por parte de CONAPESCA y PROFEPA.

§ Implementación de un programa de capacitación permanente en ambos litorales, dirigido a armadores, capitanes, tripulantes y rederos, en cuanto a nuevas tecnologías de diseño, construcción, instalación y operación de los DET; así como realizar demostraciones de las mejoras tecnológicas y de los beneficios que aportarían a la flota camaronera.

§ La SEMAR participará en la verificación del uso correcto de los DET, a partir de la ejecución de sus programas de inspección y vigilancia en aguas marinas de jurisdicción federal. Así mismo se continuará, con el apoyo de CONAPESCA y PROFEPA, con el programa de capacitación al personal naval en materia de verificación del uso correcto de los DET.

§ La Secretaría de Comunicaciones y Transportes (SCT), a través de la Coordinación General de Puertos y Marina Mercante (CGPMM)/Capitanías de Puerto, participará verificando las Actas de certificación de DET previo a la emisión de los despachos de salida vía la pesca; otorgando acceso estratégico al personal de CONAPESCA y PROFEPA para la inspección de barcos camaroneros y conforme a lo establecido en la Ley General de Pesca y Acuacultura Sustentables, negando los despachos vía la pesca a las embarcaciones pesqueras, en las cuales formen parte de su tripulación capitanes o patrones de embarcaciones infractoras que se les hubiere cancelado las libretas de mar o certificado de competencia.

§ Establecimiento de una política de Cero tolerancia en materia de DET, con base en la estricta aplicación de la ley, para cancelación de libretas de mar a capitanes de embarcaciones infractoras; imposición de multas a armadores, así como, en su caso, decomiso de embarcaciones, artes de pesca, productos pesqueros y revocación y/o suspensión de permisos y/o concesiones de pesca.

§ Propiciar la participación corresponsable del Sector Pesquero, promoviendo éste una campaña hacia el interior de sus organizaciones, para generar conciencia y establecer mecanismos internos de control.

§ Integración de una comisión intersecretarial de evaluación y seguimiento.

En consecuencia, en la aplicación del Programa de trabajo de verificación de DET 2013-2015, considerando cada uno de sus ejes rectores, la CONAPESCA obtuvo los siguientes avances de resultados, en la Implementación y Operación del Programa de verificación en el uso, diseño y construcción de Dispositivos Excluidores de Tortugas Marinas (DET):

El indicador considerado para el cumplimiento de las metas en el Programa, durante los últimos tres años, son las verificaciones de DET, a partir de una inspección a buques camaroneros; que serán evaluadas de acuerdo a la Entidad Federativa y a los totales de verificaciones realizadas, clasificándose para tal efecto, de la siguiente forma:

§ Por ubicación
- En muelle (B/M atracadas en el puerto).

- En aguas marinas (pescando preferentemente).

§ Por horario
- Diurnas (de 6:00 a 18:00 horas).

- Nocturnas (de 18:00 a 6:00 horas)1.

Metas 2013–2015

ENTIDAD FEDERATIVA	2013	2014	2015	2016
BAJA CALIFORNIA	30	37	37	37
BAJA CALIFORNIA SUR	45	49	49	49
CAMPECHE	60	48	48	48
CHIAPAS	50	42	42	42
NAYARIT	60	75	75	75
OAXACA	30	33	33	33
SINALOA	200	182	182	182
SONORA	110	164	164	164
TABASCO	15	13	13	13
TAMAULIPAS	90	91	91	91
VERACRUZ	60	66	66	66
Totales	**750**	**800**	**800**	**800**

1 Para la clasificación por horario sólo se consider las verificaciones en aguas marinas.

Las metas asignadas para cada entidad federativa fueron establecidas con base en tres factores principales:

§ Los registros de actividad de pesca de la flota camaronera, generados por el Sistema de Localización y Monitoreo Satelital de Embarcaciones Pesqueras (SISMEP) de la CONAPESCA. Esto determinó los índices de operación de buques camaroneros durante la temporada de pesca y las zonas de captura del país;
§ Los resultados en la ejecución del Programa por entidad federativa, durante los últimos años de pesca de camarón de altamar (2010-2015), en particular, el índice de infracciones detectadas; y
§ La existencia de puertos de desembarco de camarón en cada entidad federativa, lo que incidirá en las

inspecciones en muelle.

Al inicio de la aplicación del programa, para la temporada pesca de camarón de altamar en el año 2010, se estableció como meta realizar 890 verificaciones. A partir de las temporadas en el 2011, 2012, 2013 y 2014 se estableció la meta de 750 verificaciones anuales, privilegiando el criterio de calidad, sobre el de cantidad en las verificaciones; y a partir del año 2015, se incrementó la meta anual a 800 verificaciones.

El objetivo fundamental de este enfoque es realizar inspecciones mejor planeadas y dirigidas, resultado de un análisis integral de la actividad de pesca de camarón de altamar en cada región del país.
Para esto, es necesario aprovechar los registros de datos recabados en las temporadas anteriores (zonas y periodos de pesca con mayor actividad, comportamiento de la flota, antecedentes de infracción, etc.), así como la información que proporcionan todas las herramientas tecnológicas con que se cuenta, como el Sistema de Localización y Monitoreo Satelital de Embarcaciones Pesqueras de la CONAPESCA (SISMEP).

La consecución de las metas, permitirá evaluar el cumplimiento de los objetivos del Programa.

Para la determinación de las inspecciones totales proyectadas (30% de la flota operando), los porcentajes de verificaciones marinas (70% o más de las verificaciones totales) y las verificaciones nocturnas (30% o más de las verificacion marinas), se consideraron los resultados obtenidos en la ejecución del Programa a partir del año 2009.

A partir de la implementación del Plan de Acción Emergente de DET y el Programa de Trabajo de Verificación de DET 2010 – 2012, existe el firme compromiso de cumplir con estos indicadores.

Verificaciones de DET.Resultados de la ejecución del Programa de Verificación de DET, por entidad federativa y totales de verificaciones realizadas:

Resultados 2013

ESTADO	VERIFICACIONES TOTALES	ZONA		HORARIO (AGUAS MARINAS)		RETENCIÓN PROVISIONA	
		MUELLE	AGUAS MARINAS	DIURNA (6-18 Hrs)	NOCTURNA (18-6 Hrs)	EMBARCACIÓN	ARTE DE PESCA
BAJA CALIFORNIA	40	7	33	26	7	0	
BAJA CALIFORNIA SUR	34	7	27	22	5	0	
SONORA	17	0	17	10	7	0	
SINALOA	210	3	207	141	66	0	
NAYARIT	124	0	124	86	38	2	4
MICHOACÁN	2	0	2	2	0	0	

OAXACA	48	48	0	0	0	0	
CHIAPAS	31	7	24	2	22	0	
TAMAULIPAS	95	40	55	55	0	1	1
VERACRUZ	15	14	1	1	0	0	
TABASCO	23	0	23	14	9	1	4
CAMPECHE	19	12	7	7	0	0	
TOTAL	**658**	**138**	**520**	**366**	**154**	**4**	**9**
Porcentaje	**100 %**	**20.97 %**	**79.03 %**				

Resultados 2014

ESTADO	**VERIFICACIONES TOTALES**	**ZONA**		**HORARIO (AGUAS MARINAS)**		**RETENCIÓN PR**
		MUELLE	**AGUAS MARINAS**	**DIURNA (6-18 Hrs)**	**NOCTURNA (18-6 Hrs)**	**EMBARCACIÓN**
BAJA CALIFORNIA	26	5	21	21	0	0
BAJA CALIFORNIA SUR	50	6	44	28	16	2
SONORA	178	110	68	68	0	0
SINALOA	184	20	164	156	8	0
NAYARIT	93	13	80	67	13	0
MICHOACÁN	3	0	3	3	0	0
OAXACA	33	33	0	0	0	0

CHIAPAS	45	22	23	16	7	0
TAMAULIPAS	99	89	10	10	0	
VERACRUZ	56	34	22	7	15	0
TABASCO	9	0	9	9	0	1
CAMPECHE	30	30	0	0	0	0
TOTAL	**806**	**362**	**444**	**385**	**59**	**3**
Porcentaje	**100%**	**44.01%**	**55.99%**			

2 Los porcentajes del horario de inspección se calculan sobre el total de inspecciones en aguas marinas, excluyendo las
inspecciones en muelle que siempre se realizan de día.

* Los 5.5 kgs en TOTAL DE PRODUCTO, corresponden al recurso langosta.

Resultados 2015

ESTADO	**VERIFICACIONES TOTALES**	**ZONA**		**HORARIO (AGUAS MARINAS)**		**RETENC**
		MUELLE	AGUAS MARINAS	DIURNA (6-18 Hrs)	NOCTURNA (18-6 Hrs)	EMBARC
BAJA CALIFORNIA	88	45	43	33	10	0
BAJA CALIFORNIA SUR	89	4	85	80	5	5
SONORA	118	54	64	56	8	0
SINALOA	252	96	156	148	8	0
NAYARIT	137	16	121	90	31	2
OAXACA	37	17	20	20	0	0
CHIAPAS	30	16	14	3	11	0

TAMAULIPAS	109	87	22	22	0	0
VERACRUZ	70	57	13	13	0	0
TABASCO	4	0	4	4	0	0
CAMPECHE	53	50	3	3	0	1
TOTAL	**987**	**442**	**545**	**472**	**73**	**8**
Porcentaje	**100%**	**45.19%**	**54.81%**			

Resumen de Resultados de Verificaciones DET 2009 - 2015

Entidad Federativa	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Totales**
BAJA CALIFORNIA	41	9	25	0	40	26	88	**229**
BAJA CALIFORNIA SUR	79	31	42	16	34	50	89	**341**
CAMPECHE			52	0	19	30	53	**154**
CHIAPAS	26	81	14	24	31	45	30	**251**
MICHOACÁN	3	0	0	0		3	0	**8**
NAYARIT	47	123	99	105	124	93	137	**728**
OAXACA	38	13	19	46	48	33	37	**234**
SINALOA	300	580	295	194	210	184	252	**2,015**
SONORA	102	113	182	75	17	178	118	**785**
TABASCO	10	8	3	13	23	9	4	**70**
TAMAULIPAS	58	74	70	45	95	99	109	**550**
VERACRUZ	57	65	47	7	15	56	70	**317**
Totales	**761**	**1,097**	**848**	**525**	**658**	**806**	**987**	**5,682**

La SAGARPA-CONAPESCA tiene el objetivo de mantener vigente este Programa de Verificación de DET, pues la estricta observancia de las medidas implementadas, ha dado como resultado que México, no sólo cumpla con las medidas de conservación y protección a las tortugas marinas de una manera comparable, en eficacia, a la flota de los EE.UU., más aún, que nuestro país se haya constituido en un modelo regional de cumplimiento en esta materia.

Todos los componentes de este Programa han contribuido a mejorar la eficacia y aumentar la fuerza disuasiva de las inspecciones de DET en México, lo que permite garantizar que la pesca de camarón realice sin afectar a las tortugas marinas.

México tiene una larga tradición en la implementación de medidas de protección a las tortugas marinas, esto se ha venido reafirmando en las últimas décadas, lo que nos llevado a convertirnos en un santuario de refugio a estos quelonios marinos.

Los resultados históricos obtenidos en la recuperación y protección de las tortugas marinas con la implementación de las políticas públicas de México en la materia, son reconocidos a nivel nacional e internacional.

Además de lo anterior, cabe destacar que la ejecución de este programa es la base de las acciones que, en materia de inspección y vigilancia, desarrollan las autoridades en México con el objetivo de verificar el cumplimiento de las regulaciones establecidas para el aprovechamiento de camarón, que realiza la flota industrial en aguas marinas y se encuentran enmarcadas dentro del Programa Nacional de Protección y Conservación de las Tortugas Marinas, que lleva a cabo nuestro país con el Gobierno de los Estados Unidos de América (EE.UU.). Las autoridades competentes SAGARPA-CONAPESCA y SEMARNAT-PROFEPA, con el apoyo de la SEMAR-Armada
de México, continuarán trabajando conjuntamente con la industria camaronera en una perspectiva de largo plazo, para instrumentar los acuerdos que garanticen el pleno desarrollo de una pesca ecológicamente sustentable.

Capacitación al Sector Pesquero de Camarón de Altamar.
En el 2010 la CONAPESCA, en coordinación con PROFEPA, INAPESCA, INCA RURAL y FIRA, implementó el "Programa emergente de capacitación en la construcción, instalación y empleo eficiente de los dispositivos excluidores de tortugas marinas, DET, para el sector pesquero de camarón de altamar en México". Los excelentes resultados obtenidos en la implementación de este proceso de capacitación durante 2010, contribuyeron significativamente al fortalecimiento del Programa de Trabajo de DET y permitió cumplir con una de las principales recomendaciones emitidas por el gobierno de los Estados Unidos América a nuestro país, cuando se dio a conocer que no se otorgaría a México la certificación para exportar camarón de altamar, capturado con medios mecánicos, a ese país.

Este esfuerzo, desarrollado por las diversas dependencias y entidades de la administración pública federal de nuestro país, conjuntamente con los organismos del sector pesquero, fue ampliamente reconocido por el gobierno de los Estados Unidos de América y fue sin duda, uno de los puntos fundamentales que consideró el Departamento de Estado de ese país para que, el 15 de octubre de 2010 se diera a conocer formalmente que, de conformidad con el artículo 609 de la Ley Pública 101-162, certificaba a nuestro país, al haber adoptado un Programa de Trabajo en DET que incorporaba las medidas cesarias para reducir la captura incidental de tortugas marinas en las pesquerías de camarón de altamar mexicano capturado con medios mecánicos, comparable al programa vigente en los Estados Unidos de América.

En consideración y al seguimiento de capacitación que se ha impartido anualmente desde el año 2010 y hasta el 2015, se llevaron a cabo los cursos para el **fortalecimiento en el uso eficiente de los dispositivos excluidores de tortugas marinas y peces, para el Sector Pesquero de Camarón de Altamar en los Litorales del Pacífico y Golfo de México, logrando una capacitación total de 15,403 beneficiados,** con de acuerdo a los siguientes resultados:

LITORAL	2010	2011	2012	2013	2014	2015	Total Beneficiados

PACÍFICO MEXICANO	4,947	2,568	713	212	820	2,297	11,557
GOLFO DE MÉXICO	1,750	44	967	0	0	1,085	3,846
TOTAL	**6,697**	**2,612**	**1,680**	**212**	**820**	**3,382**	**15,403**

Sistema Satelital de Monitoreo de Embarcaciones Pesqueras
El Centro de Localización y Monitoreo Satelital de Embarcaciones Pesqueras es operado por la Comisión Nacional de Acuacultura y Pesca (CONAPESCA), a través del Sistema Satelital de Monitoreo de Embarcaciones Pesqueras (SISMEP), el cual permite localizar las embarcaciones pesqueras que cuentan con dispositivos GPS (GLOBAL POSITIONING SYSTEM) que navegan en los litorales del Pacifico, Mar Caribe y Golfo de México.

Es obligatorio para los concesionarios y permisionarios que realicen actividades de pesca, excepto deportivo-recreativa, en embarcaciones pesqueras con motor estacionario (intraborda), potencia nominal superior a 80 Hp (caballos de fuerza), cubierta corrida y eslora superior a 10.5 metros, que operen en aguas de jurisdicción federal del Océano Pacífico, Golfo de México y Mar Caribe, dentro de la Zona Económica Exclusiva, así como para aquellas embarcaciones de bandera mexicana que realicen actividades de pesca en Alta Mar.

La **Norma Oficial Mexicana NOM-062-PESC-2007**, publicada en el Diario Oficial de la Federación, señala el uso obligatorio del sistema satelital de localización y monitoreo de embarcaciones pesqueras, a partir del 24 de junio de 2008.

La **Norma Oficial Mexicana NOM-062-SAG/PESC-2014**, indica la utilización del Sistema de Localización y Monitoreo Satelital de Embarcaciones Pesqueras. Fue publicada en el Diario Oficial de la Federación el 3 de julio de 2015. La vigilancia del cumplimiento de esta norma, corresponde a la Secretaría a través de la CONAPESCA, en coordinación con la Secretaría de Marina, Coordinación General de Puertos y Marina Mercante y PROFEPA en el ámbito de sus respectivas atribuciones.
El dispositivo GPS instalado en las embarcaciones pesqueras, emiten su posición geográfica cada 60 minutos S permite r el periodo de tiempo de transmisión del GPS a petición del operador caso de querirlo), por lo que el sistema registra diariamente 24 posiciones geográficas por embarcación. Con la información que se obtiene permite generar gráficamente las rutas de las embarcaciones además de conocer las velocidades de los trayectos.

La operación del SISMEP, se realiza las veinticuatro horas del día durante todo el año. En el sistema se encuentran registradas las áreas restringidas de reserva, así como las zonas prohibidas para la pesca, mediante geocercas, las cuales en caso de cruce de alguna embarcación genera una señal de alerta, la cual notifica al operador lo que acontece en la zona.

Destacando la importancia que representa el Sistema de Monitoreo Satelital, para las distintas Direcciones Generales que conforman la Comisión Nacional de Acuacultura y Pesca, Instituciones Educativas, Instituto Nacional de la Pesca, Secretaria de Marina – Armada de México, Secretaría de Comunicaciones y Transportes, y a la Secretaria de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación, en aspectos tales como estudios sobre el comportamiento de captura de especies, implantación de vedas para una pesca responsable en los litorales del país, control sobre el esfuerzo pesquero en las distintas especies, una eficiente inspección y vigilancia constante sobre áreas restringidas de pesca, suministro de recursos materiales y servicios generales, así como la ayuda a salvaguardar la vida humana en el mar.

En 2007 había 1,744 embarcaciones pesqueras monitoreadas de los cuales el 34% se encontraba transmitiendo y el 66% sin transmitir.

En 2011 había 2,057 embarcaciones pesqueras monitoreadas de los cuales el 90% se encontraba transmitiendo y el 10% sin transmitir.

En 2015 había 1,981 embarcaciones pesqueras monitoreadas de los cuales el 98% se encontraba transmitiendo y el 2% sin transmitir.

De 2009 - 2011 se presenta una disminución del 20% (con motivo del programa de depuración de embarcaciones en mal estado, retiro de flota, conclusión de permiso, etc.) en la flota del Pacifico y un incremento en la flota del golfo de México del 122%, con la inclusión de las pesquerías de pulpo, mero, calamar, escama y de retrospección.

El incremento neto al 2011 de la flota total fue del 18% con respecto a 2007. Tomando en consideración la inserción total de pesquerías.

Hoy en día el 99% de la flota de mediana altura operable mexicana cuentan con Sistema de Monitoreo Satelital. Haciendo mención que las embarcaciones faltantes, en su mayoría no se encuentran en condiciones de pesca.

Atención de Alertas de Pánico

Se ha logrado otorgar apoyo través de información a la SEMAR y Capitanía de Puerto en los diferentes puntos del País en operativos de búsqueda y rescate en el mar, como sucede en casos de recepción de una señal de emerg ncia emitida por embarcaciones que cuenten con el sistema, acciones que han permitido, el rescate a tiempo de personas que se han encontrado laborando en embarcaciones pesqueras en situaciones de riesgo, solamente como dato se precisa.

Desarrollo en actividades de Vigilancia

El Sistema de Localización y Monitoreo Satelital de Embarcaciones Pesqueras, ha permitido la ubicación de embarcaciones en áreas restringidas de pesca, las cuales se establecen de acuerdo a las vedas oficiales, a través de geo cercas en la cartografía náutica marina electrónica que proporciona el Sistema, con lo que ha permitido realizar operativos de vigilancia más eficientes y un mayor control en las actividades de la flota pesquera.

De igual forma ha permitido tener un mayor control y atención de embarcaciones en las zonas de pesca consideradas como Áreas Naturales Protegidas, lo que ha dado como resultado que las autoridades competentes establezcan estrategias de mayor control en esas zonas.

Su relevancia estriba también en aspectos como estudios sobre el comportamiento de captura de especies; implementación de vedas para una pesca responsable en los litorales del país; control sobre el esfuerzo pesquero en las distintas especies; una eficiente inspección y vigilancia constante sobre áreas restringidas de pesca, y apoyo con información a las autoridades encargadas de salvaguardar la vida humana en el mar.

Resultados 2013 -2015 de la operación de Dispositivos Satelitales:

OPERACIÓN DE DISPOSITIVOS SATELITALES ZONA PACIFICO				
ALERTAS	**2013**	**2014**	**2015**	**TOTAL**
EMERGENCIA	92	60	71	223
PESCA PROHIBIDA	80	17	12	109
TOTAL		**77**	**83**	**332**

OPERACIÓN DE DISPOSITIVOS SATELITALES GOLFO DE MÉXICO				
ALERTAS	**2013**	**2014**	**2015**	**TOTAL**
EMERGENCIA	49	60	95	204
PESCA PROHIBIDA	8	1	1	10
TOTAL	**57**	**61**	**96**	**214**

Marco Legal

Observancia de la Norma Oficial Mexicana NOM-062-SAG/PESC-2014:
Es de observancia obligatoria para los concesionarios y permisionarios con derechos vigentes que realicen actividades de pesca, en embarcaciones pesqueras con motor estacionario (intraborda), potencia nominal superior a 80 Hp (caballos de fuerza equivalentes a 59.68 kilowatts, con cubierta corrida y eslora superior a 10.5 metros, que operen en aguas de jurisdicción federal del Océano Pacífico, Golfo de México y Mar Caribe, dentro de la Zona Económica Exclusiva, así como para aquellas embarcaciones de bandera mexicana que realicen actividades de pesca en Alta Mar.

Se exceptúan de la aplicación de esta Norma, a las embarcaciones que se dediquen de manera regular y continua a la navegación interior, deportivo-recreativa, las que refiere la fracción XVII del Artículo 4 de la Ley General de Pesca y Acuacultura Sustentables y aquellas a las cuales aplica el "Acuerdo que establece los criterios para la asignación e instalación de un dispositivo transmisor en las embarcaciones menores de trescientas unidades de arqueo bruto y de más de siete metros de eslora", publicado el 2 de mayo de 2013, en el Diario Oficial de la Federación.

La normatividad vigente constituye infracción la no emisión de señales de posicionamiento GPS sin causa justificada o impedir o distorsionar la transmisión y operatividad de los equipos, o privar de electricidad a los equipos interrumpiendo la transmisión de la señal; falta que resulta plenamente identificada por el Sistema de Seguimiento Satelital, y lo que deriva en la aplicación
de sanciones como multas y/o suspensiones aplicadas a las embarcaciones pesqueras que incurran en las faltas mencionadas.

Destacan de manera relevante, lo siguientes Acuerdos Internacionales y Nacionales en Apoyo a la Seguridad Marítima:

§ Convenios internacionales SOLAS/74 referente a Seguridad de la Vida en el Mar, PBIP/2004 referente a Buques e instalaciones Portuarias y SAR/79 referente a Búsqueda y Rescate, hace necesaria la participación que corresponda a la Secretaria de Comunicaciones y Trasportes a través de las capitanías de puerto; y secretaria de Marina- Armada de México.
§ Plan de Acción Internacional para Prevenir, Desalentar y Eliminar la Pesca Ilegal, No Reportada y No Regulada de la Organización de las Naciones Unidas para la Agricultura y la Alimentación (FAO, 1999)
- Apartado 24.3
§ Programa de Protección de la Vaquita dentro del Área de Refugio ubicada en la porción occidental del Alto Golfo de California, publicada en el Diario Oficial la Federación el 29 de diciembre de 2005.
Las infracciones e incumplimientos a las disposiciones contenidas en esta Norma Oficial Mexicana, se sancionarán de conformidad con lo previsto en la Ley General de Pesca y Acuacultura Sustentables, y demás ordenamientos legales que resulten aplicables.

La normatividad vigente constituye infracción la no emisión de señales de posicionamiento GPS sin causa justificada o impedir o distorsionar la transmisión y operatividad de los equipos, o privar de electricidad a los equipos interrumpiendo la transmisión de la señal; falta que resulta plenamente identificada por el Sistema de Seguimiento Satelital, y lo que deriva en la aplicación de sanciones como multas y/o suspensiones aplicadas a las embarcaciones pesqueras que incurran las faltas mencionadas.

Sin perjuicio de las facultades de la Secretaría de Comunicaciones y Trasportes por conducto de la autoridad marítima prevista en el Artículo 51 de la Ley de Navegación y Comercio Marítimos, queda establecido que la autoridad marítima o coadyuvante no otorgará, ni autorizará despacho vía la pesca a aquellas embarcaciones pesqueras que no cuenten con el equipo del Sistema de Localización y Monitoreo Satelital de Embarcaciones Pesqueras o este no se encuentre en operación.

Así mismo, la CONAPESCA notificará a la autoridad marítima para que no otorgue el despacho a aquellas embarcaciones cuyos armadores no hayan cumplido con lo dispuesto en los Artículos 125 y 132 fracciones XXVI y XXVIII de la Ley General de Pesca y Acuacultura Sustentables, asimismo la Dirección General de Inspección y Vigilancia de la CONAPESCA, pondrá a disposición de la autoridad marina o coadyuvante, teléfonos y correo electrónico para consultar permanente relacionado con el funcionamiento y operación de los equipos transreceptores.

Actualmente se encuentran registrados en el Sistema Satelital de Monitoreo de Embarcaciones Pesqueras 1971 embarcaciones; de las cuales, **1140 son embarcaciones camaroneras** (829 embarcaciones camaroneras en el Pacífico y 311 embarcaciones camaroneras en el Golfo de México).

Appendix D: Tryouts in the Upper Gulf of California with Suripera Net

The implementation of the Vaquita Refuge in 1998 has not been enough to protect the Vaquita. The International Committee for the Recovery of the Vaquita (*Comité Internacional para la Recuperación de la Vaquita or CIRVA*) urged the Mexican Government to generate alternative fishing methods (CIRVA 2016) in the region that do not interact with the species. In 2007, a first experimental net was tested in the region [INAPESCA-WWF 2007]. Since then CIRVA and INAPESCA have been collaborating with a modified version of the light-weight trawl (RS-INP) in the northern Gulf of California from 2009 to 2013. At the end of this period, the small trawl was announced as part of the Mexican Standard for shrimp fishing (DOF 2012).

By 2013, the Mexican authorities released a mandate that explained the use of the small trawl for the Upper Gulf of California shrimp fishery, with a testing phased over three years (CIRVA 2015). The plan pursued the removal of 30% of gillnets during the first year, 30% in the second year and 40% in the third year; however, it was found that the new gear was not compatible and could not be used in the presence of gillnets. Also, fishermen were reluctant to change, among other reasons due to the high cost (fuel consumption and engine depreciation) for their equipment. In addition, further tests were necessary to prove the effectiveness of the gear in the El Golfo de Santa Clara region. On December 2015, tests started in the region, but no results have been published. Trawl nets in fisheries still represent concern because of the level of bycatch and because of damage to the benthos that can result from trawling. Considering this, the RS-INP incorporated devices that look to improve its environmental performance, like the inclusion of turtle and fish excluder devices, double rope to avoid damaging the seabed, progressive reduction in the mesh size along the net, hydrodynamic trawl doors to reduce resistance and increase efficiency (CIRVA 2016) (INAPESCA 2012). During the 2017–2018 season, tryouts of suripera nets will be conducted. Managers believe that suripera represents the best chance to continue artisanal shrimp fishing in the Upper Gulf and protect the vaquita and totoaba populations.