

SMALL PELAGICS FISHERY IN SONORA, GULF OF CALIFORNIA

MSC Fishery Assessment Report

Public Certification Draft Report

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For

Cámara Nacional de la Industria Pesquera (CANAINPES)
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Glossary

ASAP	Age Structured Assessment Program
ASI	Accreditation Services International
BAC	Biologically Acceptable Catch
B_0	Unfished biomass
B_{MSY}	Biomass at maximum sustainable yield
CAB	Certification Assessment Body
CCNN	<i>Comités Consultivos Nacionales de Normalización</i> (National Consulting Normalization Committees)
CEPA	<i>Consejos Estatales de Pesca y Acuacultura</i> (State Councils for Fisheries and Aquaculture)
CICESE	<i>Centro de Investigación Científica y de Educación Superior de Ensenada, Baja California</i> (Center for Scientific Research and Higher Education in Ensenada, Baja California)
CICIMAR	<i>Centro Interdisciplinario de Ciencias Marinas</i> (Interdisciplinary Center for Marine Sciences)
CITES	Convention on International Trade in Endangered Species
cm	Centimeter
CNPA	<i>Consejo Nacional de Pesca y Acuacultura</i> (National Council for Fisheries and Aquaculture)
COBI	<i>Comunidad y Biodiversidad</i>
CNP	<i>Carta Nacional Pesquera</i> (National Fisheries Chart)
COI/IOCARIBE	<i>Comisión Oceanográfica Intergubernamental/la Zona Costera de la región del Caribe</i> (Intergovernmental Oceanographic Commission/the Caribbean Shoreline Zone)
COFEMER	<i>Comisión Federal de Mejora Regulatoria</i> (Federal Commission for Regulatory Improvement)
CONAPESCA	<i>Comisión Nacional de Pesca y Acuacultura</i> (National Commission of Fish and Agriculture)
CPUE	Catch Per Unit Effort
CRIP	<i>Centro Regional de Investigación Pesquera</i> (Regional Center for Fisheries Research)
DAT	Default Assessment Tree
DOF	<i>Diario Oficial de la Federación</i> (Diary of the Official Gazette)

ETP	Environmentally Threatened or Protected
ERA	Ecological Risk Assessment
ESD	Ecologically Sustainable Development
F	Fishing rate/catching rate
FAM	Fisheries Assessment Methodology v2.1
FAO	Food and Agriculture Organization [of the United Nations]
FCM	Fishery Certification Methodology v6.1
F _{LIM}	Fishing rate at which catchability will be impaired
F _{MSY}	Fishing rate at which catchability is sustainable and at a maximum
g	Gram (0.001 kg)
INAPESCA	<i>Instituto Nacional de la Pesca</i> (National Fisheries Institute)
IPI	Inseparable or practicably inseparable
IUCN	International Union for Conservation of Nature
LFMN	<i>Ley Federal Sobre Metrología y Normalización</i> (Federal Law on Metrology and Standardization)
LFRA	<i>Ley Federal de Responsabilidad Ambiental</i> (Federal Environmental Liability Law)
LGEEPA	<i>Ley General del Equilibrio Ecológico y la Protección del Ambiente</i> (General Law for the Ecological Equilibrium and the Protection of the Environment)
LGPAS	<i>Ley General de Pesca y Acuacultura Sustentables</i> (General Law for Sustainable Fishing and Aquaculture)
LTL	Low Trophic Level stocks
LRP	Limit reference point
mm	Millimeter
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yield
MT	Metric Ton
NCMC	National Coalition for Marine Conservation
NGO	Non-Governmental Organization
nm	Nautical mile (1nm = 1.852 km)
NOS	<i>Noroeste</i> (northwest)
PCAC-LME	Pacific Central American Coast-Large Marine Ecosystem
PROFEPA	<i>Procuraduría Federal de Protección al Ambiente</i> (Federal Attorney for Environmental Protection)

SAGARPA	<i>Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación</i> (Secretariat of Agriculture, Livestock, Fisheries and Food)
SCS	Scientific Certification Systems
SG	Scoring guidepost
SICA	Scale Intensity Consequence Analysis
SL	Standard Length (from tip of closed mouth to end of fleshy body)
SNI	<i>Sistema Nacional de Investigadores</i> (National Investigators System)
SPMP	Small Pelagics Management Plan
SSB and R	Spawning Stock Biomass and Recruitment
SST	Sea Surface Temperature
TAB	Technical Advisory Board [of the MSC]
TAC	Total Allowable Catch
TL	Total length
TRP	Target reference point
VPA	Virtual Population Analysis
WWF	World Wildlife Fund

1. Executive Summary

This report presents the Marine Stewardship Council (MSC) assessment of the small pelagics fishery, targeting pacific sardine (*Sardinops sagax*) and thread herring (*Opisthonema spp.*), harvested by purse seine nets operating off the coast of the state of Sonora in the central-northern Gulf of California in Mexico. Each target species is considered to be a separate Unit of Assessment (UoA). Within the report, the UoAs will be referred to as the Sonora small pelagics fishery. The assessment was conducted and prepared by SCS Global Services (SCS), an MSC-accredited, independent, third-party Conformity Assessment Body (CAB), in accordance with the MSC Principles and Criteria for sustainable fishing. The evaluation uses the assessment tree found in the MSC Certification Requirements v1.3 (January 2012), the associated guidance v1.3 (January 2012) and process considerations followed the FCR v2.0 (April 2015). Where emergent issues not covered in v1.3 were encountered, the team referred to guidance to the Certification Requirements v2.0 (April 2015). The Pacific sardine (*S. sagax*) stock in the Northern/Central Gulf of California was determined to be a key Low Trophic Level (LTL) stock and considerations were given for its assessment as such under Principle 1.

Table 1. Unit of Certification(s) and Unit of Assessment(s) for the small pelagic fishery operating in Sonora, Gulf of California.

Stock/Species (FCR V2.0 7.4.7.1)	Method of Capture (FCR V2.0 7.4.7.2)	Fishing fleet (FCR V2.0 7.4.7.3)
Northern/Central Gulf of California Pacific sardine (<i>Sardinops sagax</i>)	Purse seine nets	46 purse seine vessels registered under the Mexican Chamber of the Fishing Industry (CANAINPES)
Northern/Central Gulf of California thread herring (<i>Opisthonema spp.</i>)	Purse seine nets	46 purse seine vessels registered under the Mexican Chamber of the Fishing Industry (CANAINPES)

Fishery Operations Overview

The 46 vessels in the Sonora fleet operating in the northern-central Gulf of California are members of the National Chamber of the Fishing Industry (CANAINPES, *Cámara Nacional de la Industria Pesquera*).

All vessels operate within the Mexican Exclusive Economic Zone (EEZ) and solely target small-pelagic species using purse-seine gear. Fishing vessels are typically 25-28 long with a 120-180 metric ton capacity, a main engine of about 520 HP, and are often equipped with refrigeration. Mean crew size is eight fishermen. Nets have a mesh size of 25 mm. Fishing trips are usually short, one to two days, and are often guided by aerial surveys. The fishery takes place in the central-northern Gulf of California, in Northwest Mexico. All catch is landed in the ports of Guaymas and Yavaros in the state of Sonora. The principal commercial species captured are Pacific sardine (*Sardinops sagax*), thread herring (*Opisthonema spp.*), and Pacific anchoveta (*Cetengrulus mysticetus*), the latter is referred in this report by its common Mexican Spanish name, *bocona* sardine. Other small pelagic species caught in smaller proportions include chub mackerel (*Scomber japonicas*), California anchovy (*Engraulis mordax*), red-eye round herring (*Etrumeus teres*) and leatherjackets (*Oligoplites spp.*).

Assessment Overview

The team selected to undertake the assessment includes two team members that collectively meet the requirements for MSC assessment teams. These are:

- Dr. Carlos Alvarez, Team Leader and Principle 1 and 3 Expert
- Ms. Sandra Andraka, Principle 2 Expert

Support was provided to the assessment team by staff at SCS headquarters, by Ms. Gabriela Anhalzer who provided coordination and technical support, and by Sian Morgan who provided quality oversight of selected sections of the report.

Prior to the onsite-meeting, the Client presented supporting documents to the assessment team. The original announcement for the assessment indicated that the Risk based framework (RBF) would not be used, this was confirmed from information provided prior to, and during, the onsite-meeting. The team met with fishery representatives, scientists and stakeholders in the offices of CANAINPES in Guaymas, Sonora on July 20 and 21, 2016. During the onsite-meeting fishery representatives, fisheries scientists and NGO stakeholders presented their latest findings to the assessment team. Stakeholders were notified of the onsite-meeting via email, and invited to speak with the team regarding any concerns. Prior to the onsite-meeting SCS received letters from stakeholders (See *Appendix 3 Stakeholder Submissions*). During the onsite-meeting stakeholders also participated and shared their comments (See *Section 4.4.1 Site Visits*).

After the onsite-meeting the team convened on July 22, 2016, to discuss evidence and preliminary scores. With the aim to strengthen credibility and acceptance of certification-decisions, the team consulted with the client and other key stakeholders to compile and analyze information needed to determine the key Low Trophic Level (LTL) status of Pacific sardine stock (See *Section Low Trophic Level Species (LTL)* p.37.) The additional consultation resulted in delays in the original timeline, a modified timeline was uploaded to the MSC website on December 27, 2016. The Client Draft of the Report was finalized and submitted to CANAINPES on February 6, 2017. After the review of the client draft, the client representative presented a Client Action Plan for conditions associated with the re-assessed fishery on March 2, 2017. The assessment team and CAB reviewed the sufficiency of the Client Action Plan and provided feedback to the client. On March 7, 2017 the report was submitted to revision by the Peer Reviewers. The assessment team received the comments from both Peer Reviewers by March 27, 2017. The receipt of the Public Comment Draft Report by MSC was intended for March 21st 2017, within the nine months from the date of the re- assessment announcement submitted for publication on June 21st, 2016. A variation request to MSC CR v2.0 7.3.4 was submitted on March 9, 2017 to MSC requesting an elongation of 4 weeks after the 9 month deadline to submit the PCDR to MSC by April 21st, 2017.

Summary of Findings

In this report, we provide detailed rationales for scores presented for each of the Performance Indicators (PIs) under Principle 1 (Stock status and Harvest Strategy), Principle 2 (Ecosystem Impact) and Principle 3 (Governance, Policy and Management System) of the MSC Standard. No PIs failed to reach the minimum Scoring Guidepost (SG) of 60, and the average scores for the three Principles remained above SG80. The team issued **fourteen PI level conditions** for PIs that did not meet SG80 level. The fishery received in Principle 1 three conditions for Pacific sardines and four for thread herring, four conditions were awarded in Principle 2 and three in Principle 3. A Client Action Plan, detailed in Appendix 1.2., was produced to meet the conditions.

In Principle 1 for Pacific sardine three PIs (1.1.2, 1.2.1 and 1.2.2) received scores under SG80, which are related to the use of appropriate reference points, a strong harvest strategy and a functional harvest control rule. For thread herring three PIs two out of the three conditions overlapped with those of Pacific sardine (1.2.1 and 1.2.2) and a new condition was placed on PI 1.2.3 related to information and monitoring. The fishery was found to have made important improvements in its stock assessment models (PI 1.2.4) since its last full assessment was completed in 2012, and also received high scores on stock status (PI 1.1.1). A condition was placed for lack of peer review of the stock assessment (PI 1.2.4).

In Principle 2 four of the PIs (2.1.2, 2.3.2, 2.3.3. and 2.5.2) received scores under SG80, these are related to the need for better implementation measures to manage the impact of the fishery on main retained species (Chub mackerel and *bocona* sardine), Endangered Threatened and Protected (ETP) bird species, and overall ecosystem structure and function. Additionally, the team also identified the need for improvements in the collection of comprehensive information about the effects of the fishery on ETP species. The fishery obtained an SG80 for all performance indicators related to outcome, demonstrating that the fishery is not causing serious or irreversible harm to non-target species populations, habitats or ecosystems.

In Principle 3 three of the PIs (3.2.2, 3.2.3, and 3.2.5) received scores under SG80, these are related to decision making process, compliance and enforcement, and evidence that there has been evaluation of the management system. Overall the fishery scored highly on the governance and policy section of Principle 3, thanks to the existence of a solid legal framework for fisheries management at the national level. In this report we provide the rationales for all scores proposed, which support the assessment that the fishery is recommended for certification.

2. Authorship and Peer Reviewers

2.1 Assessment Team

Dr. Carlos Alvarez – Oceanides Conservación y Desarrollo Marino A.C., Consultant – Lead Auditor, P1 & P3 Expert

Dr. Carlos Alvarez-Flores was born in Mexico City and obtained Bachelors of Science and Master of Science degrees at the National University of Mexico. He later moved to Seattle, USA to obtain a Doctor of Philosophy degree at the School of Fisheries of the University of Washington. His research interests are focused on the management and conservation of wildlife and fisheries. This includes abundance estimation; assessment of population status; estimation of population parameters; the effect of human intervention; direct harvest; bycatch and associated environmental effects; projections based on biological potential; population viability; risk assessment; design of alternative management strategies. His training was related to large, pelagic, data rich fisheries, and some of his investigations involved the bycatch of dolphins in the pelagic purse seine tuna fisheries of the Eastern Tropical Pacific, the hunt of beluga whales in West Greenland, the hunt of bowhead whales in Canada, the bycatch of albatrosses in pelagic fisheries of the central Pacific. In contrast, his current assignments are related to small-scale, coastal fisheries that are very data poor. Therefore, his present challenges are to combine ideas, techniques, knowledge and experience to improve the performance of these problematic fisheries in developing countries. Most of his experience has been focused on practical investigations applied to population and fishery assessment and management as a consultant for governments, NGOs and the private sector of different countries. To the present, he has worked for SCS for over two years in MSC pre-assessments, assessments and surveillance audits of different types of fisheries in different countries.

Ms. Sandra Andraka– EcoPacific Plus Consulting S.A., Consultant – Principle 2 Expert

Ms. Sandra Andraka has conducted an MSC pre-assessment for SCS as well as undertaken SCS additional training in MSC process and scoring. Her varied background includes marine conservation, fisheries management (industrial and small-scale) and policy work and advocacy, both nationally and internationally, for adoption of conservation measures for better practices in fisheries for more than ten years. She is been working in conservation projects in Latin America for more than 18 years, including Marine Spatial Planning, bycatch mitigation, projects linking marine turtles and cetaceans conservation with communities livelihoods, planning and implementation of conservation result-based management projects. She is currently an international consultant for NGOs, government and private sector and she has commissioned to work on assessment of the capacity needs towards implementation of the FAO Port State Measures Agreement, a proposal writing for developing a public-private sustainable marine commodities platform to mainstream sustainability in the large pelagic value chain in Costa Rica and to build capacity to develop onboard observer programs, among others. She has several publications, which meet the CR requirements for Principle 2 and 3. Ms. Andraka earned her advance degree in Environmental Planning from the International Centre for Mediterranean Studies (CIHEAM), in Spain, and a degree in Biology from the Complutense University of Madrid, Spain.

2.2 Peer Reviewers

The peer reviewers were selected based on their qualifications and competencies.

Dr. Richard Parrish, Independent Consultant

Dr. Parrish holds M.Sc. and Ph.D degrees from Oregon State University and has worked for Victoria Fisheries and Wildlife Department (Melbourne), at the California Department of Fish and Game (in pelagic fisheries and then as Chief of the ground fish program) and then held a position as a fisheries biologist with the Pacific Environmental Group (NMFS) in Monterey California (now the Environmental Division of the Southwest Fisheries Center). Dr. Parrish's work on coastal pelagic species is relevant to the fishery under assessment.

- **Fish stock biology /ecology:** Dr. Parrish has over five years of experience working with fisheries biology and population dynamics. Dr. Parrish has researched the relationships between physical oceanographic factors and fisheries. He supported the work of the California spiny lobster Fisheries Management Plan and his assessment on the spiny lobster for the South Bay Cable was a major part of the analysis for the FMP
- **Fish stock Assessment:** Dr. Parrish has over five years of experience applying relevant stock assessment techniques being used by this fishery. He developed a yield-per-recruit model of the California segment of the California spiny lobster for the South Bay Cable/Fisheries Liaison Committee. Dr. Parrish also worked as a Research Manager for Del Monte Food's in the Sultanate of Oman, conducting fishery and fishery independent research using a wide variety of fishing gear (gillnets, bottom trawls, mid-water trawls, benthic longlines, fyke nets and seine nets,) and fisheries science methods (e.g. hydro-acoustic surveys, tagging and port sampling programs and otolith reading).

Dr. Andrés Cisneros-Montemayor, University of British Columbia, Post-Doctoral Fellow

Andrés Cisneros-Montemayor (PhD) is a resource economist specializing in marine ecosystems, and is currently a Post-Doctoral Fellow with the NEREUS Program and the Ocean Canada Partnership at the University of British Columbia. Dr. Cisneros-Montemayor has several years of fishery work experience and current knowledge of Mexico fishery context and the language qualify him as a peer review for this assessment.

- **Biology fishing impacts on aquatic Ecosystems:** Linking field and theoretical work, he studies the economics of ecotourism, competing fishing sectors, alternative management strategies, and ecosystem and social-ecological approaches to policy in multi-stakeholder contexts. An important aspect of this work involves the dynamics between commercial, recreational, social and cultural benefits from shared ecosystems. All of these studies highlight applications of novel theoretical qualitative and quantitative models to real-world settings, both in developing and developed regions

- **Fishery management and operations:** Dr. Cisneros-Montemayor has published several papers on Mexican fisheries on topics including the application of an ecosystem management approach, IUU and conservation planning for marine flagship species.

Description of the Fishery

2.3 Unit(s) of Assessment (UoAs) and Scope of Certification Sought

2.3.1 UoA and Proposed Unit of Certification (UoC) - Considered Final as Published in the Public Certification Report

The two Units of Assessment (UoAs) include the (1) Northern/Central Gulf of California Pacific sardine and (2) thread herring stock complex, caught by the 46 purse seine vessels members of the National Chamber of Fisheries and Aquaculture Industries (CANAINPES) and licensed by the Mexican government (See *Appendix 6 Supporting Evidence: 13.1 Vessel List*). All of the catch is landed in the state of Sonora, Mexico. The CANAINPES fleet's capacity and fishing gear characteristics are regulated by the Mexican federal government via the applicable Official Mexican Standard 003-PESC-1993 (*Norma Oficial Mexicana (NOM) 003-PESC-1993*). At present the scope of the UoA when considered across the three Principles simultaneously, is the same as that of the proposed Unit of Certification (UoC).

This assessment consider the Pacific sardine and thread herring UoAs as 'sister' units, as they share the same fleet, gear type/operations and management system, and only differ in regards to the Principle 1 target stock. For this reason both Principle 2 and Principle 3 are scored jointly for the two UoA. This report does not include the target P1 species of each 'sister' UoAs, in a separate P2 section of the other 'sister' UoA. This is because each target stock in the CANAINPES fleet that was assessed under Principle 1 and obtained an overall score >80 for Principle 1, will have already be assessed under a higher standard of performance than those applicable to main retained under Principle 2. Therefore, any species passing P1 in a 'sister unit' is expected to obtain a score >80 for the relevant Principal Indicators under P2, such that scoring each target stock again under P2 of the 'sister' UoA would only create duplicative work that is not material to the assessment. If in a subsequent assessment one of the target P1 target species fails, or departs the MSC system for some other reason, and is no longer considered as certified, it will then be scored as an element under Principle 2.

In addition to the 46 vessels in the CANAINPES fleet there are approximately eight independent vessels also licensed to target the Pacific sardine and thread herring stocks in the northern-central Gulf of California. These vessels are not part of the client group (CANAINPES) identified as part of the UoC, but would be eligible to gain access to the certification if the client group were to request an extension of the proposed UoC and additional information was reviewed. The impacts of the independent vessels has already been considered in this assessment in Principles 1 and 2. The impact on the target stocks of the eight vessels independent from CANAINPES is considered under Principle 1, as accounted by landing records and the stock assessments, and under Principle 2, as the observer program also covered the independent vessels. Additional work would be required to examine vessel specific behavior in Principle 2 and 3, particularly with regard to implementation of measures for management of non-target species and compliance and enforcement as related to PI 3.2.3.

The thread herring complex in this UoA belongs to a different management unit than the thread herring complex harvested in the southern portion of the Gulf of California (Sinaloa & Nayarit) by another fishery

awarded MSC certification on October 2016. While there is nominal overlap of the stocks with the scope of these two UoAs, it is possible to separate the complexes for management purposes because the three species present in the northern (Sonora) and southern (Sinaloa & Nayarit) stock complexes differ significantly in their relative distribution and species composition. In the northern population evaluated in this fishery, the majority of the population is comprised of *O. libertate*, in contrast to the southern population, where depending on the year *O. bulleri* and *O. medirastre* can be a significant component of the overall thread herring landings. Due to these differences in species composition, the northern and southern UoAs do not share stock assessments. The two UoA are managed under the same federal management system for small pelagics (e.g. management plan and NOM) and thus relevant aspects of this overlaps are considered relative to harmonization as given in this report in *Section 4.1 Harmonized Fishery Assessment* (p 113). This fishery has been found to meet scope requirements (FCR v2.0 7.4) for MSC fishery assessments as it

- Does not operate under a controversial unilateral exemption to an international agreement, use destructive fishing practices, does not target amphibians, birds, reptiles or mammals and is not overwhelmed by dispute. (FCR 7.4.1.1, 7.4.1.2, 7.4.1.3, 7.4.2)
- The fishery does not engage in shark finning, has mechanisms for resolving disputes (FCR 7.4.2.1), and has not previously failed assessment or had a certificate withdrawn.
- Is not an enhanced fishery, is not based on an introduced species, and does not represent an inseparable or practically inseparable species (FCR 7.4.3, 7.4.4, 7.4.13-15)
- Does not overlap with another MSC certified or applicant fishery (7.4.16),
- And does not include an entity successfully prosecuted for violating forced labor laws (7.4.1.4)
- The Unit of Assessment, the Unit of Certification, and eligible fishers have been clearly defined, traceability risks characterized, and the client has provided a clear indication of their position relative to certificate sharing (7.4.6-7.4.12).

Table 2. Units of Assessment (UoAs) and Units of Certification (UoCs).

Units of Assessment: Defined as the species, gear, and fleet assessed	
UoA: Species & Stock (FCR V2.0 7.4.7.1)	(1) Northern/Central Gulf of California pacific sardine (<i>Sardinops sagax</i>) (2) Thread herring (<i>Opisthonema spp.</i>)
UoA: Gear Type (FCR V2.0 7.4.7.2)	Purse seine nets
UoA: Vessels (FCR V2.0 7.4.7.3)	46 purse seine vessels member of CANAINPES
Further information: <i>Geographic Area</i>	The fishery takes place Mexican territorial waters in the central-northern Gulf of California, in NW Mexico
Further information: <i>Management System</i>	The regulation of fishery resources in Mexican territory is ruled by the National Fisheries Law (<i>Ley General de Pesca y Acuacultura Sustentables; DOF 2007</i>). The National Fisheries Chart (<i>Carta Nacional Pesquera, CNP</i>) is a document summarizing the state of a large number of fisheries in Mexico, including the small pelagic fishery in the Gulf of California. The CNP also includes general provisions and recommendations that must be observed by the fishing authorities when adopting and implementing instruments and measures to control fishing effort. Measures specific to the small pelagic purse seine fishery in the federal waters of the Gulf of California are outlined in Mexican National Standard 003 (<i>Norma Oficial Mexicana Oficial Mexicana 003-PESC-1993</i>). Measures in NOM-003-PESC-1993 include gear and fleet capacity regulations, and a seasonal closure. A Fisheries Management Plan (SPFMP) published in 2012 outlines the harvest strategy for the small pelagic fishery.
Unit of Certification: Defined as the vessels allowed to use the MSC ecolabel for catch from the Unit of Assessment (defined as the species, location and gear assessed against the MSC standard).	
Client Group	CANAINPES- Cámara Nacional de la Industria Pesquera
Fishers in the UoC for the chosen stock	46 purse seine vessels member of CANAINPES
Other Eligible Fishers that may join the certificate for the chosen stock	There are approximately eight additional vessels licensed to capture the target species, at the moment these are partially evaluated (i.e. Principle 1 and 2 scores consider the impacts of these vessels) but not fully. Therefore, these vessels cannot be considered eligible to join the certificate, unless the client group were to request an extension of the proposed UoC, where additional evaluation would be focused on Principle 3 for only the independent vessels.

2.3.2 Total Allowable Catch (TAC) and Catch Data

Table 3. Catch data for Pacific sardine and thread herring captured by purse seine nets during the 2013-14 and 2014-15 fishing seasons (November through July) in the Northern and Central area of the Gulf of California (Nevárez-Martínez et al 2016c)

				Pacific sardine	Thread herring
TAC	Year	No TAC established	Amount	No TAC established	No TAC established
UoA share of TAC	Year	NA	Amount	NA	NA
UoC share of total TAC	Year	NA	Amount	NA	NA
Total green weight catch by UoC	Year (most recent)	2014-2015 Fishing season	Amount	4,455 mt	120,919 mt

2.3.3 Scope of Assessment in Relation to Enhanced Fisheries

There is no evidence of enhancement in this fishery.

2.3.4 Scope of Assessment in Relation to Introduced Species Based Fisheries (ISBF)

There is no evidence of introduced species in this fishery.

2.4 Overview of the Fishery

2.4.1 History of the Fishery

The catch of small pelagics represents around 30% of the total landings in Mexico, with more than 80% of the harvest taking place in the Gulf of California. The fishery for small pelagic fish in the Gulf of California began at the end of the 1960's. Landings increased to a peak in 1988-89 to nearly 300,000 mt, whereupon the fishery declined abruptly to less than one third of landing the following year. This collapse caused the loss of several thousand jobs and the closure of about half of the fleet and processing plants. Landings have been highly variable since that time, increasing in the last five years (2010-2015) to more than 500,000 mt (Nevarez-Martinez et al 2016c).

A growing body of evidence suggests that environmental factors play a determinant role in explaining variability in the abundance, distribution and species composition of small pelagic fish (Nevarez-Martinez et al 2001; Checkley et al, 2009; Zwolinski and Demer 2014; Lluch-Cota et al. 1999; Lluch-Belda et al, 1986; Bakun et al. 2009).

Pacific sardines (*S. sagax*) are at times the dominant species, representing up to 94% of total landings in the multi-species purse seine fishery in the Gulf of California. During cold years Pacific sardines and chub mackerel (*Scomber japonicus*) tend to predominate whereas during warmer years, thread herring (*Opisthonema spp.*) and other species dominate (Arvizu-Martinez, 1987).

Roughly 25-30% of the fish captured is canned and sold for human consumption in the domestic Mexican market. The remaining product is used to make fishmeal and fish oil, which is sold in Mexico or exported to several other countries among them China, Chile and countries in Eastern Europe (DOF, 8th November 2012).

2.4.2 Organization and User Rights

The purse-seine fishery targeting small pelagics in the general area of Northwest Mexico is organized into four fleets, according to the regions where they operate and the location of their landing ports (See Figure 1). Two of the fleets' fish in the area west of the states of Baja California and Baja California Sur and the two other fleets operate inside the Gulf of California. The fleets within the Gulf of California are arranged into the southern fleet fishing off the coast of the State of Sinaloa and Nayarit and landing in Mazatlán and the northern fleet fishing off the coast off the State of Sonora and landing in the ports of Guaymas and Yavaros (DOF, 8th November 2012). The Sinaloa fleet, which targets captures mostly thread herring was evaluated against the MSC standard v1.3 and received their certification on October 2016. The Sonora fleet, the largest of the four fleets, which primarily targets Pacific sardines and secondarily targets thread herring, is evaluated in this report.

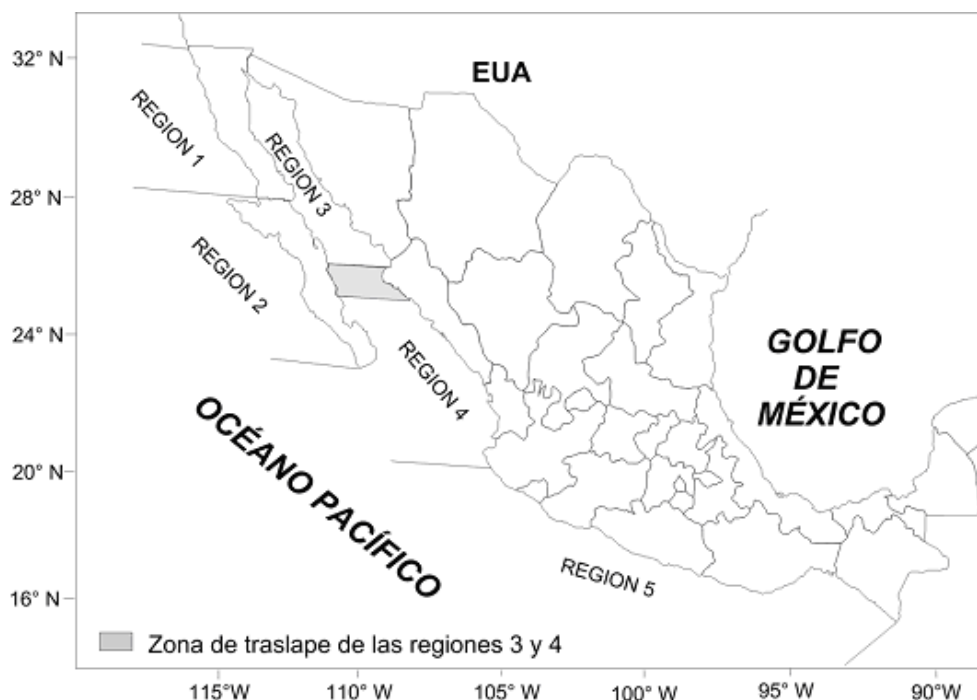


Figure 1. Map of the Gulf of California with the geographic regions for proposed operation of the authorized vessels for small pelagic fishery. The unit assessed in this report, Sonora small pelagic fisheries operates in “Region 3”, the shaded region indicates the overlapping area between region 3 and 4. (From Diario Oficial de la Federación 2014)

NOM-003-PESC-1993 cites controls to limit entry of new vessels to the small pelagics fishery. The small pelagics fishing permits in Mexico were issued on broad geographic scope, allowing operation in all Mexican Pacific waters, without clear criteria of regionalization. At present in this fishery there is a total of 76 vessels with fishing permits for small pelagics (in addition to two recent operational boats added to the area of Isla Cedros). Several licensed vessels switched base ports from the western coast of the Baja California Peninsula to Guaymas and Yavaros where the sardine fishery under assessment is based. The number of vessels operating in Sonora remained stable at around 30 boats from 1993 to 2005, then increased steadily until 2011 to around 50 boats operating in this fishery (Figure 2). Not all permitted vessels are fully operational in all fishing seasons. For the 2014/15 fishing season INAPESCA reports 50 vessels operating in norther/central area in Sonora.

In response to the lack of clarity and existing legal gaps regarding regionalization criteria of permits, the small pelagics management plan (SPFMP) recommends the following: (*Gaceta Parlamentaria*, Número 3974-VII 2015; DOF 2014; DOF, 8th November 2012).

It is recommended, in order to maintain nominal travel in the current range, not to allow fleet movement between fishing zones, particularly to prevent BC [Baja California] ships from moving to the Gulf of California. The official log of the fleet in each area should be distributed as follows: 40 ships in Sonora, 21 ships in BC (includes 2 in Isla Cedros), 5 in BCS and 12 in Sinaloa

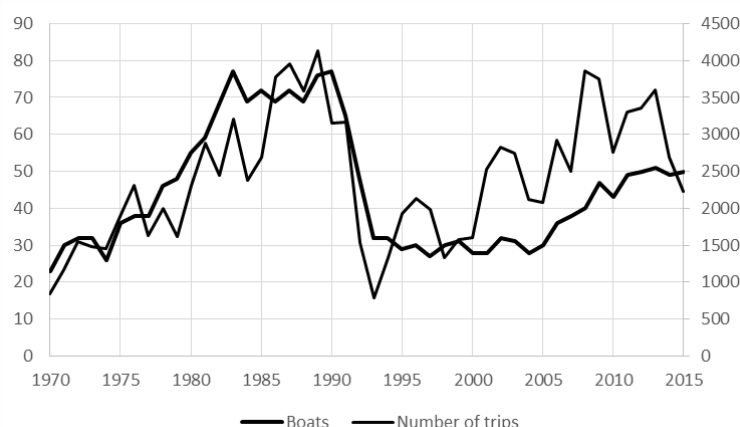


Figure 2. History of effort in number of boats and trips in the fishery of small pelagic fish in the Gulf of California Mexico. Data from Nevarez-Martinez et al. (2016c).

The 50 vessels in the Sonora fleet operating in the northern-central Gulf of California include 46 vessels members of the National Chamber of the Fishing Industry (CANAINPES), an agency that groups and represents the private fishing sector in Mexico. The main function of CANAINPES is to act as a representative of the general interests of the national fishing activity. CANAINPES has been operating since 1949 and its members include individual or corporations that engage in the extraction, cultivation, capture and even processing of fishing products. CANAINPES has representation on several national organizations including the executive board of the Confederation of Industrial Chambers (Concamin), the

Committee of Standardization for Responsible Fishing and a number of other permanent Commissions pertinent to the fishing sector.

The central office of CANAINPES is located in Mexico City and there are eleven delegations and representations across the country. The Sonora delegation represents the 46 vessels targeting small pelagics in the north and central areas of the Gulf of California. The list of active boats that are part of the UoC that will be operating in 2017 are listed in this report in Appendix 13.1 *Vessel List* (p. 313)

The CANAINPES Sonora delegation works in close collaboration with INAPESCA, and has supported INAPESCA staff on the activities required to close conditions of the previous certification cycle of the Pacific sardine fishery (i.e. observer program, evaluation of ecosystem impacts).

2.4.3 Areas

The small pelagics fishery operates in the north and central section of the Gulf of California. The Gulf of California is a 1,130 km long and 80 to 209 km wide semi-enclosed sea located between the mainland of Mexico and the Baja California peninsula (Lluch-Cota et al. 2007). The 8° range of latitude includes both subtropical and subarctic influences. Marine depth ranges from less than 10 m in the north to a maximum of ~3,600 m at the entrance. Located between the shelf-like, Northern Province and the deep southern province, is an archipelago containing sills, channels, basins, and two large islands, Angel de la Guarda and Tiburón. The Gulf of California is a semi-enclosed sea, unique as the only large evaporation basin in the Pacific Ocean (Roden and Groves 1959). It is characterized by pronounced seasonality in temperature, circulation, winds, upwelling and productivity.

Optimal physical conditions for larval survival and growth occur where physical forces provide retention, concentration, and enrichment (Parrish et al. 1981; Lasker 1985; Cury and Roy 1989; Bakun et al. 1991; Hunter and Alheit 1995; Bakun 1996). The circulation in the Gulf of California provides an ideal combination of factors for larval survival, by aiding the retention of eggs and larvae in the highly productive central gulf region. Two major gyre systems have been described, one in the upper gulf, and the other in the central/southern region (Bray 1988; Marinone and Ripa 1988; Beier 1997). Lanz et al. (2008) describe the geological characteristics and oceanographic conditions that make the Gulf of California a subtropical sea with complex hydrodynamics and high productivity:

“[...] It geomorphology consist of a series of basins, separated each by a sill and midriff islands (Pegau et al. 2002). The mountains on both sides of the gulf tend to polarize the winds so that they flow along the axis of the gulf. The winds then cause important physical and biological process in both coasts, such as upwelling, particularly in the midriff islands region (Alvarez-Borrego 1983, Pegau et al. 2002). Ocean circulation in the GC [Gulf of California] is determined mainly by the tidal and winds, among others. Residual currents in the gulf are responsible of the net transport of substances (Lavin et al. 1997). Satellite measurements of sea surface temperature and ocean color have been used to study the circulation in the Gulf of California (Badan-Dangon et al. 1985, Navarro-Olache 1989, Paden et al. 1991, Lavin et al. 1997) and to provide an understanding of the biological production in the gulf (Gaxiola-Castro et al. 1999). Recent studies in the GC arises the existence of small areas where biological activity is particularly high, which has been used to regionalize the gulf based on several levels of primary productivity (Santamaría-del-Ángel et al. 1994, Lluch-Cota and Arias-Aréchiga 2000), which are named as "Biological Action Centers" or BAC, and it appear to be fixed in space, tied to coastal features, and tend to show little seasonal variation in their level of productivity. These areas are the preferences of small pelagic fishes and are related to aggregation of commercial species (Lluch-Cota and Arias-Aréchiga 2000, Lluch-Belda et al. 2003). [...]”

The influence of oceanographic conditions and climate variability on the population of small pelagics are discussed in more detail in the Principle One Background section of this report: “*Environmental considerations and the potential effect of El Niño on current sardine availability*” (p. 44).

Due to its high productivity, the Gulf of California supports a number of important commercial fisheries, in addition to the small pelagics fishery, including the giant squid (*Dosidicus gigas*) fishery, and the artisanal and industrial shrimp fishery, the latter is considered to be one of the most important fishery in Mexico in terms of income and employment. Several species of large pelagic fish are also taken including tuna, billfishes and sharks. Artisanal fisheries catch numerous species of bony fishes, elasmobranchs, mollusks, and crustaceans.

2.4.4 General Management

All fisheries in Mexico are regulated by the national *Ley General de Pesca y Acuacultura Sustentables* (The Fisheries Law, DOF 2007). The *Carta Nacional Pesquera* (CNP) is a formal document synthesizing the present state of a large number of fisheries in Mexico including the small pelagic fish. The CNP includes also general provisions and recommendations that must be observed by fishers and authorities. Management measures specific to the small pelagic fishery are outlined in the Mexican National Standard, (NOM-003-PESC-1993: *Norma Oficial Mexicana 003-PESC-1993, para regular el aprovechamiento de las especies de sardina, piña, crinuda, bocona, japonesa y de las especies anchoveta y macarela, con embarcaciones de cerco, en aguas de Jurisdicción Federal del Océano Pacífico, incluyendo el Golfo de California*). A proposed draft for the modification of Official Mexican Standard NOM-003-PESC-1993 was approved by the National Advisory Committee on Agro-Food Standardization on October 6th, 2014. The proposed draft was then submitted for public consultation. A letter from the Director of Normativity dated July 25th 2016 indicates that the public consultation period concluded and that comments were being analyzed; once the review is finalized, CONAPESCA is expected to submit the proposed NOM for approval by the Subcommittee on responsible Fisheries and by the National Consultative Committee for Food and Crop Normalization which leads to the final publication in the Official Gazette (*Diario Oficial, DOF*).

2.4.5 Description of Fishing Practices: Gear and Seasons

The fleet consists of purse seiners targeting small pelagics from November through July. Fishing vessels are typically 25-28 meters long with a capacity of 140-180 metric tons, a main engine of about 520 HP, and are often equipped with refrigeration. Net dimensions vary depending on the size of the vessels, with mesh size ranging from 13 to 25 mm, some vessels use mixed nets with different mesh sizes. Fishing trips are usually short, 1-2 days, and are often guided by aerial surveys and have a mean crew size of eight fishermen.

2.5 Principle One: Target Species Background

2.5.1 Catch and Effort of the Small Pelagics Fishery

Data on catch and effort is collected from the official '*Aviso de Arribo*' or landing notification form provided and collected by the regional offices of CONAPESCA. The data are processed and analyzed by INAPESCA and results presented in official reports of fishery catch and effort (e.g. Nevarez-Martinez et al. 2015).

The catch history of the Pacific sardine and other species shows two periods with different patterns of exploitation. In the first period, the classic development pattern of a fishery is evident as described by Cisneros-Mata et al. (1995), with a clear exploration phase followed by development, stabilization and decline. During this period, catches of other species were low with only two episodes where catches increased slightly in the early 80s and during the decline of the Pacific sardine in the early 90s. Catches of other species remained particularly low during the period of high sardine catch volume between 1984 and 1988 (Figure 3). After the crash of the Pacific sardine in the early 90s, the fishery for this species presents alternating episodes of increasing and declining catch with an unusually high peak in seasons 2007/08 and 2008/09. Catches of non-Pacific sardine species increased steadily, only interrupted in the late 2000s by the sharp increase in Pacific sardine availability and catch. During the second phase, even in years when Pacific sardine catches were high, catch of other species continued increasing and compensated the low catch of Pacific sardines between 1999 and 2005.

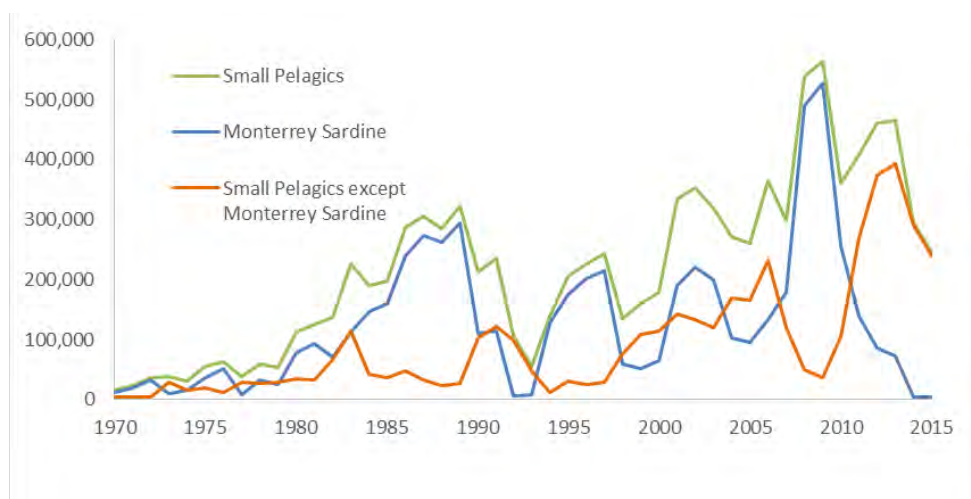


Figure 3. Comparative trends of catch history for Pacific sardine vs all other small pelagic species in the fishery of the northern/central Gulf of California, Mexico. From data of Nevárez-Martínez et al. 2016a

Thread herring has generally been the second main small pelagic species in landings. Unlike Pacific sardine, for this species there are no evident trends from fluctuating landings (Figure 4). Since 2000, *bocona* sardine landings have exceeded those of thread herring on several occasions, which had never occurred before in the pre-2000 history of the fishery. In the 2011/2012 fishing season there was a notable increase in the catch of *bocona* which more than doubled landings of thread herring and anchoveta (Figure 4).

The total catch of small pelagics for the 2010/2011 season, when the thread herring fishery entered Expedited P1 assessment was 407,114 t, of which Pacific thread herring represented 18% (73,507 t). The absolute and relative catch of Pacific thread herring decreased in the 2011/2012 fishing to 11% of the overall landings (51,780 t). By 2012/2013 the catch of thread herring increased from the previous season and represented 16% of the catch on all small pelagics and by seasons 2013/14 and 2014/5 the catch reached historic highs of 133, 452 and 120,019 (Figure 5) even with a reduction in nominal effort (fishing trips) that were approximately 25% and 38% lower than in season 2012/13 (Table 4; Table 5 and Figure 6).

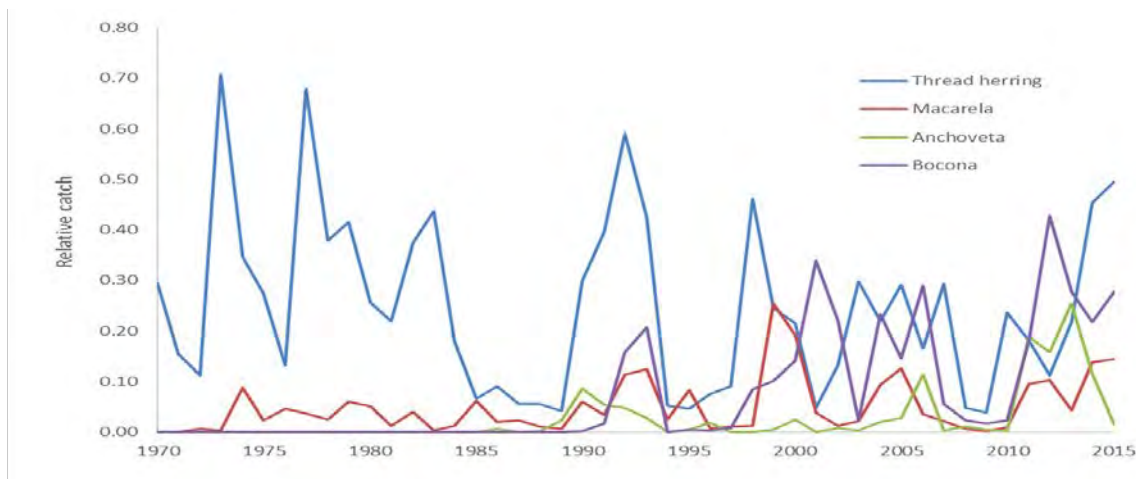


Figure 4. Catch history of the main species of small pelagic fish that are not Pacific sardine relative to the total catch of small pelagics in the Gulf of California, Mexico. From data in Nevarez-Martinez et al. (2016a).

The total catch of small pelagics for the 2014/15 season was 244,465 mt, which is 221,021 mt smaller than the 2012/13 season. Out this total, the Pacific sardine represented only 2% of the catch (4,455 mt), second lowest catch of Pacific sardine in the history of the fishery, which declined more than 90% from the catch in the 2012/13 season.

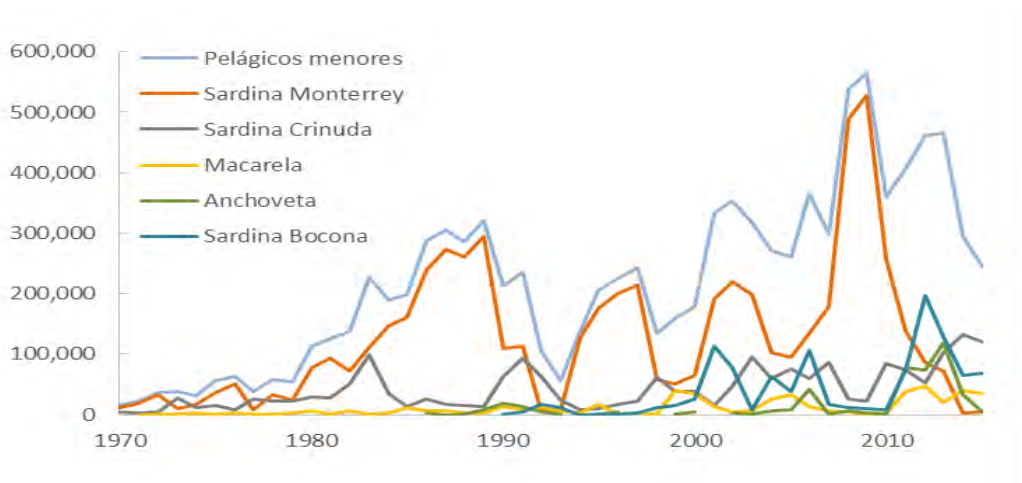


Figure 5. Catch history of all pelagic species in the fishery of the central Gulf of California, Mexico. From data in Nevarez-Martinez et al. (2016a).

**Table 4. Total landings (mt) of small pelagic species in the Gulf of California purse seine fishery.
Data from Nevarez-Martinez et al. (2016c).**

Year	Total Landings	Pacific sardine <i>Sardinops sagax</i>	Thread Herring <i>Opisthonia spp.</i>	Chub Mackerel <i>Scomber japonicas</i>	Red-eye round herring <i>Etrumeus teres</i>	California Anchovy <i>Engraulis mordax</i>	<i>Bocona</i> sardine <i>Cetengraulis mysticetus</i>	Leather-jackets <i>Oligoplites spp.</i>	Mixed Species	No vessels	Nominal effort (trips)
99/00	178,902	65,593	38,510	34,240	5,006	4,493	25,229	4,741	1,091	28	1,603
00/01	333,370	190,862	15,834	13,003	345		112,954	277	75	28	2,533
01/02	353,903	220,360	46,666	4,493	270	2,853	78,261	890	110	32	2,827
02/03	318,379	198,757	94,956	6,992	4,889	1,100	7,682	3,309	693	31	2,745
03/04	271,638	102,034	59,685	25,507	8,858	5,717	63,253	5,494	1,090	28	2,121
04/05	260,859	94,559	76,183	32,943	4,683	7,354	38,031	4,233	2,874	30	2,074
05/06	365,164	133,567	60,560	13,191	7,178	41,820	106,062	945	1,841	36	2,922
06/07	297,867	178,205	87,172	6,616	3,088	1,271	16,491	2,530	2,495	38	2,499
07/08	538,669	488,639	25,726	3,988	698	5,885	12,303	238	1,190	42	3,861
08/09	564,298	528,094	21,564	963	422	2,620	9,537	212	885	47	3,757
09/10	360,952	256,409	85,116	3,527	5,545	481	8,315	520	1,039	50	2,761
10/11	407,114	138,068	73,507	38,762	3,040	76,849	74,067	2,382	441	49	3,306
11/12	461,058	86,470	51,780	47,600	2,560	73,124	197,354	666	1,503	50	3,358
12/13	465,486	72,802	101,814	20,557	12,587	118,833	129,296	3,947	5,649	51	3,601
13/14	293,686	3,571	133,452	40,640	6,684	33,772	64,135	10,869	564	49	2,685
14/15	244,465	4,455	120,919	35,503	7,173	3,888	67,960	4,168	399	50	2,223

Table 5. Percentage of small pelagic species landed in the Gulf of California sardine purse seine fishery by weight since the 1999-2000 fishing season. From data in Table 4.

Year	Total Landings	Pacific sardine <i>Sardinops sagax</i>	Thread Herring <i>Opisthone ma spp.</i>	Chub Mackerel <i>Scomber japonicas</i>	Red-eye round herring <i>Etrumeus teres</i>	California Anchovy <i>Engraulis mordax</i>	<i>Bocona</i> sardine <i>Cetengraulis mysticetus</i>	Leather-jackets <i>Oligoplites. Spp</i>	Mixed Species
99/00	178,902	37	22	19	3	3	14	3	1
00/01	333,370	57	5	4	0	0	34	0	0
01/02	353,903	62	13	1	0	1	22	0	0
02/03	318,379	62	30	2	2	0	2	1	0
03/04	271,638	38	22	9	3	2	23	2	0
04/05	260,859	36	29	13	2	3	15	2	1
05/06	365,164	37	17	4	2	11	29	0	1
06/07	297,867	60	29	2	1	0	6	1	1
07/08	538,669	91	5	1	0	1	2	0	0
08/09	564,298	94	4	0	0	0	2	0	0
09/10	360,952	71	24	1	2	0	2	0	0
10/11	407,114	34	18	10	1	19	18	1	0
11/12	461,058	19	11	10	1	16	43	0	0
12/13	465,486	16	22	4	3	26	28	1	1
13/14	293,686	1	45	14	2	12	22	4	0
14/15	244,465	2	49	15	3	2	28	2	0

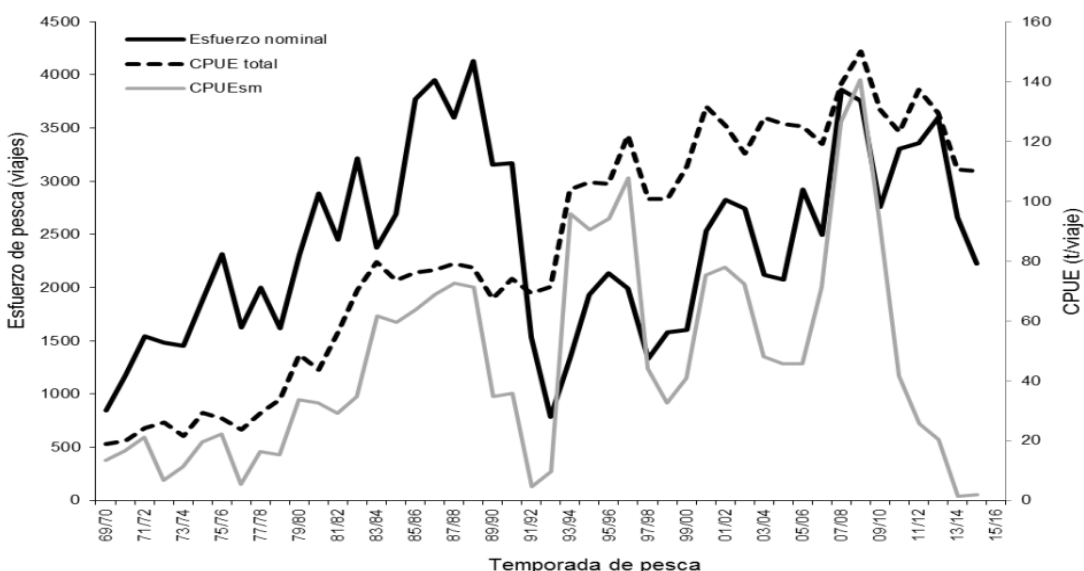


Figure 6. Nominal effort/*Esfuerzo nominal* (trips), total CPUE (all small pelagics) and CPUE of Pacific sardine (CPUEsm) in fishing seasons 1969/70 through 2014/15. Reproduced from Nevarez-Martinez et al. (2016c).

The time series of effort on small pelagics shows two well-marked, similar periods that span from season 1969/70 to 1989/90 and from 1992/93 to 2014/2015 (Figure 6). The first period of effort ended with a sharp decline from 90/91 through 92/93 and in contrast, the second period didn't drop as low as the first period most likely because when Pacific sardine availability was low, the fishery shifted to other small pelagic species. In both time periods, although effort shows marked fluctuations, the overall trend is to increase steadily. Although also clearly fluctuating, the overall trend in CPUE of all small pelagics shows a relatively stable increasing trend along the entire history of the fishery. During the second period, CPUE approximately follows the trend in effort reaching a maximum in 2007/08 and 2008/09, followed by a decline that starts in 2009/10. Despite the steady increase in overall effort on small pelagics, the CPUE of Pacific sardine declined from season 2009/10 to season 2014/15. The opportunistic nature of the small pelagic fleet makes it difficult to interpret CPUE on a particular species, as the fleet prefers Pacific sardine, but if necessary will capture any of the marketable small pelagic species it encounters. However, the steady increase in effort closely follows (with the exception of seasons 2007/08 and 2008/09 when Pacific sardine availability was unusually high) the increase in catch of non-Pacific sardine that started in the mid-90s (Figure 3). It can therefore be assumed that even if Pacific sardine availability was highly variable, effort continued increasing as other species helped to compensate the loss in yield of sardines.

2.5.2 Management

Mexican Official Standard (NOM-003-PESC-1993)

The fishery for small pelagic fish has been regulated and managed by the federal government of Mexico since 1993 under the Mexican Official Norm/*Norma Oficial Mexicana* (NOM) 003-PESC-1993. The development of a NOM is a collaborative effort between federal authorities, fishing organizations and other nongovernmental organizations and drafts are made available for public comment (Hernandez and Kempton 2003). A new version of the NOM-0003-PESC-1993 is under revision, more detailed information on the process and the proposed modifications are covered in this report under *Section 2.7.6 Consultation Processes* (p. 107).

The NOM specifies a minimum length size limit for different species of small pelagic fish. Minimum size for Pacific sardines is 150 mm of standard length (SL) and for thread herring 160 mm of SL. Additionally, no more than 30% of the catch of Pacific sardine is allowed to be fish smaller than 150 mm SL to protect juveniles and avoid growth overfishing. *Bocona* sardines don't have minimum size restrictions. The NOM 003 also regulates fishing gear and fleet capacity, requiring that the fishery be closed in times and areas where the majority of sardines are spawning.

The NOM does not include restrictions in the form of allowable catch or quotas, effort in the NOM is restricted by prohibiting an increase in effort north of 20°N. This prohibition includes the addition of vessels to the fleet unless they replace old active boats that will be retired. The permitting system is described in detail in the overview section of this report (See 2.4.2 *Organization and User Rights*, p. 19). At the moment there are 50 vessels operating in Sonora, out of which 46 are part of the UoC assessed in this report.

The NOM also specifies the size of the purse seiner net by vessel size, and the regulations to follow in order to close the fishery season. The season period (generally November to July) was established to protect adults during the spawning season.

The NOM recognizes in article 0.4 that the abundance of Pacific sardine and other small pelagic species fluctuates with environmental conditions but can also be influenced by fishing (DOF, 8th October 1993). As part of the harvest strategy, before the fishing season starts, a research cruise is carried out on board a fishing or research vessel. The goal of the cruise is to assess the reproductive state of the adult sardines and the proportion of juveniles (less than 150 mm SL) in the samples from the fishing areas (Figure 1). During the cruises the oceanographic conditions are also gathered, mainly by sea surface temperature distribution. Based on these results, the date for the opening of the fishing season is decided by agreement between the fisheries researchers and the fishery operators during official meetings were agreements are signed by the participants.

In addition to the NOM, the *Carta Nacional Pesquera* (Fisheries National Charter) periodically reviews the fishery and establishes conditions and regulations for the fishery. These are published in the *Diario Oficial de la Federación* (Official Gazette). The full management system is described with greater detail in this report under Principle Three: Management System Background.

Fisheries Management Plan

The Small Pelagics Fisheries Management Plan (SPFMP) was passed into law in November of 2012 (DOF, 8th November 2012). The SPFMP includes definitions for indicators and reference points. The language doesn't explicitly identify "limit" or "target" reference points, but the equivalent are summarized in Table 6.

Table 6. Conceptual correspondence among different definitions of target and limit reference points.

MSC Terminology	MSC Definition	SPFMP Terminology and Definition	Assessment Team Observations/ Interpretations	Estimations
Limit reference point	The point beyond which the state of a fishery and/or a resource is <u>not considered desirable</u> and which management is aiming to avoid.	<i>Biologically Acceptable Catch (BAC)s</i> are a prudent catch level, which may range from 5% to 25% of the estimated biomass. [...] overfishing in the small pelagic fishery occurs whenever the catch exceeds BAC [...]. <i>Passively managed species:</i> "The general MSY control rule, for passive management species, determines the BAC for the entire stock equal to 25% of the most recent of estimate of spawning biomass."	The assessment team defines BAC as the limit reference point, since the point beyond BAC is considered 'not a desirable state', were overfishing occurs.	BAC is estimated as C (target level of capture) using the harvest control rule. BAC must be computed annually.
Target reference point	The point which corresponds to a state of a fishery and/or resource which is <u>considered desirable</u> and which management is trying to achieve.	<i>Optimum Yield (OY)</i> is defined as the quantity of fish that provides the greatest benefit to the nation, particularly with respect to food production and employment, and taking into account the protection of the marine ecosystem; and is prescribed on the basis of maximum sustainable yield (MSY). In this case OY for small pelagics will be that level of catch that is equal to or less than a BAC, estimated using the MSY [...] In particular, OY must be lower than BAC, to the extent required to avoid overfishing.	The assessment team defines OY as the target reference point, since the OY is smaller than BAC to prevent overfishing from occurring.	OY currently can't be calculated because the fraction less than BAC that generates OY has not been defined.
Total Allowable Catch (TAC):	The TAC is the total catch allowed to be taken from a	NA	The term TAC is not used in the SPFMP but is identical in concept to the BAC. If a TAC were	The BAC implicitly acts as a TAC. See above how the BAC is computed.

	resource in a specified period (usually a year), as defined in the management plan. The TAC may be allocated to the stakeholders in the form of quotas as specific quantities or proportions.		established, it might also be set at OY.	
Harvest Control Rule	A set of well-defined pre-agreed rules or actions used for determining a management action in response to changes in indicators of stock status with respect to reference points	<p><i>The MSY control rule, for the actively managed stocks of small pelagics, will be that which reduces exploitation when the biomass declines.</i></p> <p>A general formula would be as follows:</p> $C = (B - B_{MIN}) * FRACTION$ <p>C is the target catch level, B_{MIN} is the lowest estimated biomass level at which directed capture is allowed and FRACTION is the proportion of biomass above B_{MIN} that can be captured by the fishery. B is generally the estimated biomass of fish age 1 and older.</p> <p><i>If FRACTION is approximately equal to FMSY, then the capture rate in the MSY control rule will not exceed FMSY.</i></p>	<p>C = BAC</p> <p>FRACTION is a harvest rate (C/B), which can be seen by rearranging terms in the HCR (FRACTION = Catch/Biomass).</p> <p>The language in the SPFMP, "If FRACTION is approximately [...]", indicates that the FRACTION term can, in practice, take any value. However, in the SPFMP FRACTION has been set at F_{msy}. This is a conceptual mistake in the SPFMP because while the harvest rate and F may be similar when F is small, the two values will diverge quickly as F gets large.</p>	<p>Where in 2014: BIOMASS = 572,000 mt; FRACTION = 0.2398 – 0.2798, and B_{MIN} = 9,500 – 52,000 mt</p> <p>BAC = 134,900 mt – 145,500 mt</p>
PRI	Point of Recruitment Impairment – the stock level below which recruitment may be impaired.	<p><i>B_{MIN}: Lowest estimated biomass level at which directed catch is allowed [...]</i></p> <p><i>The purpose of B_{MIN} is to protect the stock when the biomass is low</i></p>	Assessment team interprets B _{MIN} = PRI.	B _{min} calculated based on allele effect.

Limit Reference Point Analogue

A Biologically Acceptable Catch (BAC) (equivalent to a LRP) is computed as a fraction of the estimated MSY. The rationale behind this approach comes from results of a simulation study finding that, for the Pacific sardine, a fishing mortality rate that is 90% of the F_{msy} “would not only produce higher economic returns and be safer biologically, but will reduce intrinsic population oscillations” (Nevarez-Martinez et al. 1999). Under this principle, the SPFMP states that the BAC is a “prudent level of catch” that can vary between 5% and 25% of the estimated biomass. The SPFMP defines that overfishing “occurs when fishing takes place at a rate that is high enough to risk the stock’s ability to continuously produce MSY on the long term” and that operationally, “overfishing occurs if the catch exceeds the BAC”. This condition is approximated if the predictive model projections indicate that the fishing mortality or the harvest rate will exceed the BAC over a period of two years.

Target Reference Point Analogue

In the language of the SPFMP, the equivalent of the Target Reference Point is the Optimum Yield (OY) and is defined as a “catch level that is equal or less than the BAC”, but that in practice, “[...] must be smaller than the BAC as much as needed to avoid overfishing”.

These reference points are required to be consistent with the MSY because the strategy is expected to be able to provide biomass levels, at least as high as the F_{msy} approach while the catch is “relatively high and consistent”.

If overfishing occurs, the SPFMP defines emergent actions that are implemented “if pertinent and possible”. These actions include: a) temporal or area closures applied to one or more species; b) change in the size limits or definition of new limits for one or more species in a single area or more; c) definition or change of allowable catch; d) restrictions on fishing effort.

The SPFMP describes that some species are to be actively managed, while others will be passively managed. The purpose of these two categories of management is to use institutional resources as efficiently and effectively as possible to meet management goals. Species in each group are given in Table 7.

Table 7. Small pelagic species categorized for two main forms of management in the November 2012 Fisheries Management Plan for Small Pelagics in the Gulf of California Mexico.

Actively Managed	Passively Managed
Pacific sardine: <i>Sardinops sagax</i>	Japanese sardine: <i>Etrumeus teres</i>
Blue thread herring: <i>Opisthonema bulleri</i>	Bocona sardine: <i>Cetengraulis mysticetus</i>
Machelete thread herring: <i>Opisthonema medirastre</i>	Anchovy: <i>Engraulis mordax</i>
Thread herring: <i>Opisthonema libertate</i>	Charrito: <i>Trachurus symmetricus</i>
(Chub) Mackerel: <i>Scomber japonicus</i>	Pineapple sardine: <i>Oligoplites</i> . spp.

Harvest Control Rule

There are two MSY-based control rules in the SPFMP, one that is applied to passively managed species and another that applies to actively managed species. Both the Pacific sardine and the thread herring are species under the active management regime (DOF, 2012).

For passively managed species, the control rule determines that the BAC is simply 25% of the most recent estimate of the SSB. This represents the use of a fixed harvest rate (0.25) for all species at all times.

For species that are actively managed the SPFMP the control rule uses a harvest rate that can vary among species at different times but is constrained between 5 and 25% of the estimated SSB. The rule also forces the biologically acceptable catch to be reduced if the SSB declines until eventually, if a biomass threshold (B_{min}) is reached, the fishery stops operating.

The general formula for the harvest control rule is as follows:

$$C = (B - B_{min}) * FRACTION$$

Where: C is the target catch level which will be used as the BAC, B_{min} is the lowest level of estimated biomass at which the directed harvest is allowed and FRACTION is a harvest rate, the proportion of the SSB above B_{min} that can be captured by the fishery. B is generally estimated biomass of fish age 1 and older, the SSB. The purpose of B_{min} is to protect the stock when the biomass is low. At present, FRACTION is being computed either as the default 0.25 value used for passively managed species or from the estimate of F_{msy} obtained in the stock assessment. The default value was obtained by means of computing the F value that would maximize the catch in a simulation study of the Pacific sardine fishery (Nevarez-Martinez et al. 1999). In this report, 0.25 was found to be a convenient fishing mortality rate that would produce high economic returns while being biologically safe because it was smaller than F_{msy} , it also reduces population oscillations which is convenient for management purposes.

The Small Pelagics Fisheries Management Plan indicates that to compute B, different sources of information can be used, including catch and fishery data (catch and effort, sizes, ages and weights) as well as fishery independent data (census of eggs and larvae, hydroacoustic data etc.).

Different values of B_{min} , provided in Table 8, are calculated every time a new stock assessment is conducted. The calculation of B_{min} using the Allee effect approach depends on the stock-recruitment relationship which may be different with every assessment. Data from 2013 produced a B_{min} value in the range of 22,000 to 126,000 mt and was computed by INPESCA based on an analysis of stock recruitment and the potential for Allee effects in the sardine population (Morales-Bojorquez and Nevarez-Martinez 2005). Estimates of abundance for 2013 obtained with hydroacoustic methods were in the range of 515,000 to 711,000 mt (Martinez-Zavala, et al. 2014). Therefore a BAC could have been obtained using the control rule, but this quantity was not produced, nor was it used for decision making process.

For data in 2014 a different range of B_{min} values (9,500 to 52,000 mt) was presented and an overall population estimate of 572,000 mt (possible estimate for 2014 from acoustic surveys) which would have

produced a range of BAC between 130,000 to 140,625 mt in 2014. However, in the INAPESCA presentation given during the onsite-meeting, the slide indicated that the BAC for 2014 should have been in the range of 134,900 to 145,500 mt

It was then estimated that the BAC for 2015 should be in the range of 87,000 to 90,000. The stock assessment on the other hand, did not present the numbers used in calculating the BAC, but it presented a range between 128,367 and 147,702 metric tons.

The assessment team evaluated the values for Bmin, abundance and BAC from the most recent stock assessment. However, in some cases it was useful to consider the historic trend in estimated BAC values or previous estimates of Bmin.

The estimates of Bmin have all being computed under the definition that this quantity needs to provide a minimum biomass to protect recruitment. However, under the MSC requirements for key low trophic level species, minimum biomass levels must be determined based on ecosystem needs. Research on this front is being led by Dr. Arreguin-Sanchez and his team – SCS received internal CICIMAR reports with advances on research focused on Ecosystem entropy and harvest rates and balanced harvesting for ecosystem production (Arreguin-Sanchez et al. 2016a; 2016b). The assessment team recommended that research into ecosystem based management continues and that new Bmin or FRACTION values are computed to obtain allowable catch levels that allow biomass to remain for ecosystem requirements.

The SPFMP also proposes the use measures to supplement the harvest control rule. These measures will be supported via official recognition of the Technical Committee for the Study of Pelagic Juveniles (CTIPM) and working Sub-committees. This requires that the CTIPM and the Sub-committees are legally recognized, it's currently unknown whether these groups have already gained legal recognition. The subcommittees shall have as one of their functions to develop and propose to the competent authority an *ad hoc* scheme for each stock, which must be incorporated into the SPFMP. This must include decision tables based on benchmarks chosen by consensus.

Table 8. Reference points (RP) for the Pacific sardine in the Gulf of California Mexico. Table reproduced from document sent by M.A. Martinez-Zavala, complemented with data from CRIP (2015).

Reference Points (RF)/ <i>Spanish</i>	Reference Points (RF) Source	P. sardine (2014) RP for 2013	P. sardine (2015) RP for 2014	P. sardine (2016) RP for 2015
Minimum advisable stock abundance (individuals) <i>Tamaño mínimo del stock (Número)</i>	INAPESCA 2015	269 X 10 ⁶ - 1,569 X 10 ⁶	-	-
Minimum advisable stock abundance (biomass, mt) <i>Tamaño mínimo del stock (en Biomasa, t)</i>	<i>Reference?</i>	22,000 – 126,000 t	9,500 – 52,000	185,000 (65,000 “for ecosystem”)
Advisable exploitation rate <i>Tasa de explotación (E) recomendable</i>	(Carta Nacional Pesquera)	0.25/year	0.25/year	
Fishing mortality rate (F) <i>Tasa de mortalidad por pesca (F)</i>	Cohort Analysis 2011/12 (CRIP)	0.189/year	-	
Fishing mortality rate (F) <i>Tasa de mortalidad por pesca (F)</i>	Cohort Analysis 2012/13 (CRIP)	0.218/year	-	
Fishing mortality rate producing MSY (F_{msy}) <i>Tasa de mortalidad por pesca que produce el Rendimiento Maximo Sostenible (Frms)</i>	ASAP (Nevarez-Martinez 2015) ASAP (Nevarez-Martinez 2016)	-	0.28	0.290
Exploitation rate (E) <i>Tasa de explotación (E)</i>	Cohort analysis (2011/12) (CRIP)	0.161/year	NA for 2013/14	
Exploitation rate (E) <i>Tasa de explotación (E)</i>	Cohort analysis	0.183/year	-	
Actual biomass (B) <i>Biomasa actual (toneladas)</i>	(estimated by hydroacoustics)	515,000 – 711,000 t	-	
Actual biomass (B) <i>Biomasa actual (toneladas)</i>	probably estimated by hydroacoustics, estimated for ASAP	-	572,000 t ~750,000 t	420,000

Table 9. Reference points for thread herring in the Gulf of California. Table produced from documents sent by M.A. Martinez-Zavala in 2014-2015 and data from Nevarez-Martinez et al. (2016).

Reference Points (RP)	Source RP	Thread Herring Values using ASAP (1972-2012)	Thread herring Values using ASAP (1972-2014)	Thread herring Values using Bdm
FMSY <i>Fishing mortality rate producing maximum sustainable yield</i> <i>Mortalidad por pesca en el RMS</i>	INAPESCA 2014 Nevarez-Martinez et al. 2016	0.879/year	0.312	0.5195
Foy <i>Fishing mortality rate at optimal yield</i> <i>Mortalidad por pesca óptima</i>	INAPESCA 2014	0.621/ year	NA	NA
Fcurrent <i>Actual fishing mortality rate</i> <i>Mortalidad por pesca actual</i>	INAPESCA 2014	0.110/ year	0.04	NA
MSY <i>Maximum Sustainable Yield</i> <i>Rendimiento máximo sostenible</i>	INAPESCA 2014 Nevarez-Martinez et al. 2016	101,484 t	170,949 t	290,257 t
OY <i>Optimum Yield (tonnes)</i> <i>Rendimiento óptimo (toneladas)</i>	INAPESCA 2014	97,945 t	NA	NA
Exploitation rate (E) <i>Tasa de explotación (E)</i>	INAPESCA 2014 Nevarez-Martinez et al. 2016	0.185/ year	0.072-0.109	NA
Biologically Acceptable Catch (BAC)	Nevarez-Martinez et al. 2016	NA	258,000 – 213,000	NA
Exploitation rate (E) <i>Tasa de explotación (E)</i>	<i>Carta Nacional Pesquera</i> (2012), 68-69 p.	0.25/ year	NA	NA
Fishing mortality rate (F) <i>Tasa de mortalidad por pesca (F)</i>	Cohort analysis (2011/12) (CRIP)	0.163/ year	NA	NA
Fishing mortality rate (F) <i>Tasa de mortalidad por pesca (F)</i>	Cohort analysis (2012/13) (CRIP)	-	NA	NA
Exploitation rate (E) <i>Tasa de explotación (E)</i>	Cohort analysis (2011/12) (CRIP)	0.143/ year	NA	NA
Exploitation rate (E) <i>Tasa de explotación (E)</i>	Cohort analysis (2012/13) (CRIP)	0.183/ year	NA	NA
Minimum biomass (Bmin) <i>Biomasa mínima (Bmin) (toneladas)</i>	INAPESCA 2015 - 2016 Based on Method by Morales-Bojorquez and Nevarez-Martinez (2005)	3,000 t (preliminary)	52,700 t	NA

2.5.3 Pacific Sardines

Biology

Taxonomic Classification

Class: Actinopterygii

Order: Clupeiformes

Family: Clupeidae

Genus: *Sardinops*

Species: *sagax*

The Pacific sardine (*Sardinops sagax*) is also known as Monterrey sardine, California sardine, California pilchard and South American pilchard and may be similar to other baitfish species, but since 2009, the World [Registar of Marine Species](#) identifies only *S. sagax* (Jenyns 1842) as the only accepted species in the genus. For consistency within this report, *S. sagax* is used throughout, although several reports and publications also refer to this species as *S. caeruleus* or *S. sagax caeruleus*.

Behavior

Pacific sardines are small schooling forage fishes, up to ~40 cm at the northern distribution areas and ~20 cm at the Gulf of California. While predominantly coastal, they are occasionally found as far as 200 nm offshore. Pacific sardines are low level consumers that attain large biomasses and are therefore usually restricted to high productivity areas. The species is potentially omnivorous, with juveniles consuming zooplankton and adults primarily preferring phytoplankton (Kawasaki 1983). Sardines have fine gillrakers enabling them to consume a wider range of particle sizes compared to other forage fish such as anchovy or thread herring (Lopez-Martinez et al. 1999). As many as 13 phytoplankton and 41 zooplankton genera have been identified in the stomachs of sardines from the Gulf of California. Sardines are indeterminate batch spawners (oviparous), producing a large number of eggs in batches spread over many months. Eggs and larvae are pelagic (free floating) and adults may live as long as 25 years (Matarese et al. 1989).

Growth and Natural Mortality

The Pacific sardine has been estimated to grow rapidly during the first two years of life reaching an average length of 13 cm at that age. Consequently the growth parameter k of the von Bertalanffy equation has been estimated by different studies in a range of 0.32 to 2.07 which even at the lowest end represents rapid growth (Nevarez-Martinez et al. 1996). It's been also noted that differences among different studies may be the result of different metabolic rates promoted by different environmental conditions in temporal and spatial scales (Nevarez-Martinez et al. 1996; De Anda-Montañez et al. 1999).

Maximum length has been estimated in a wide range from 160.4 to 290.3 (Nevarez-Martinez et al 1996) but different reports coincide that maximum age is about seven years, with the commercial catch mostly removing ages 2 to 4 (Wong 1973; Nevarez-Martinez et al. 1996; De Anda-Montañez et al. 1999). This age

was used by Cisneros-Mata et al. (1996) to compute a base natural mortality rate of 0.6 although a value of 0.77 was used by Nevarez-Martinez et al. (1999).

Reproduction and Recruitment

The Pacific sardine is a multiple asynchronous spawner (Melo-Barrera et al 2010). The reproductive biology of the Pacific sardine in the Gulf of California was summarized by Wong (1973) as follows. Reproduction takes place from January to April along the east coast while juveniles are found on the west coast. Movement of fish towards the spawning areas starts in October. Average fecundity was estimated to be independent of age at an average of 16,000 eggs per female but females are “much more numerous” than males. The length at which 50% of females is mature has been estimated to be 150 mm.

Distribution and Stock Structure

The distribution and abundance of the Pacific sardine is highly variable and at times it has been the most abundant fish species along the west coast of North America. At the northern end of its range, its occurrence is seasonal. At its greatest range, the Pacific sardine is abundant from the southern end of the Baja California Peninsula to southeastern Alaska and into the Gulf of California (Hill et al. 2011), but at times of low abundance, it is scarce north of Baja California. There is paleo-sedimentary evidence of the presence of sardine in the Gulf at least during the last 250 years (Holmgren-Urba et al. 1993). Pacific sardines are also distributed off South America, along the coasts of Chile and Peru.

It is generally understood that sardines off the west coast of North America are categorized into three separate subpopulations or stocks: one stock expanding from northern Baja California to Alaska, the second stock off the coast of Central Baja California and Southern Baja California and a third stock in the Gulf of California (Hill et al. 2015, OPC 2016).

Low Trophic Level Species (LTL)

The Pacific sardines stock in central/northern Gulf of California met the MSC criteria for identification of key Low Trophic Level (LTL) stocks and was designated as a key LTL stock for this assessment (Espinosa et al. 2016).

It is one of the species types listed in Box CB1 and in its adult life cycle phase the stock holds a key role in the ecosystem, such that it meets at least two of the following sub-criteria i, ii and iii.

Pacific sardines belong to the family Clupeidae, which are listed in Box CB1 as one of the species types that are defined as ‘key LTL stocks’.

i. A large proportion of the trophic connections in the ecosystem involve this stock, leading to significant predator dependency;

Pacific sardine contributes to more than 10% of the diet of sea lions (*Zalophus californianus*), Heermann's gull (*Larus heermanni*), elegant terns (*Sterna elegans*), brown boobies (*Sula leucogaster*), brown pelicans (*Pelicanus occidentalis*) and striped marlin (*Tetrapturus audax*). Species diet data collected from different sources was used to calculate the average of Pacific sardine contributions to predator diet for each functional group and to estimate the Supportive Role to Fishery ecosystems (SURF) value. The SURF calculated surf equaled 0.1765, a value greater than .001, which indicated that Pacific sardine met criterion (i) for designation of key LTL stock (Espinosa et al. 2016).

ii. A large volume of energy passing between lower and higher trophic levels passes through this stock;

In contrast, the Pacific sardine did not qualify as a key LTL species under the Proportional Connectance value analysis which resulted in a value of 4.57% which is lower than the 8% normally associated with key LTL species (CR v1.3 GSA2.2.9). The review of predator diet composition indicates that there is a number of other small pelagic fish that could provide a similar contribution of energy although the information appears to show predator preference for particular species (e.g. *C. mysticetus* to sea lions and brown boobies; *E. mordax* to Heermann's gull and the elegant tern; *Anchoa sp.* to brown boobies and *S. japonicas* to the striped marlin).

iii. There are few other species at this trophic level through which energy can be transmitted from lower to higher trophic levels, such that a high proportion of the total energy passing between lower and higher trophic levels passes through this stock (i.e. the ecosystem is 'wasp-waisted').

Lastly, the Pacific sardine can be a predominant species in the catch but at times can be equally important relative to all other species together or may be practically insignificant (Espinosa et al. 2016; Figure 7). It is relevant to mention that during the re-assessment onsite-meeting, ecosystem experts explained how environmental variability promotes the predominance of other species in the ecosystem. For example, presence of larger suspended particles in the water column that are more easily filtered by species with larger gill rakers; this results in larger availability of the species with larger gill rakers and lower of those with smaller. This consolidates the argument on the influence of environmental variability to drive the availability of different species.

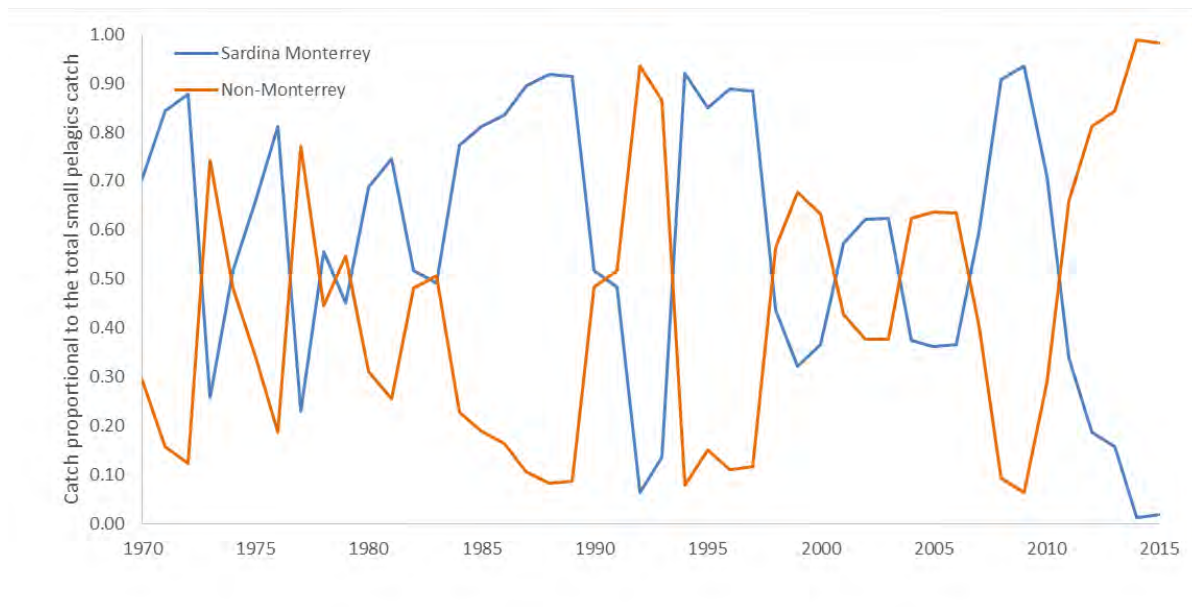


Figure 7. Proportional contribution of the Pacific sardine to the total catch of small pelagic fish in the central Gulf of California compared to all other small pelagics in the catch.

After the various analyses associated with the MSC process for determining whether species are “low trophic level”, a discussion followed, suggesting that determination of the Pacific sardine as a key LTL species should take into account the specific moment where the species would play this role. Del Monte-Luna (email communication on September 19th 2016) suggested based on ecosystem analyses (Arreguin-Sanchez et al. 2016a; 2016b) that the proportion of Pacific sardine in the diet of its predators changes as much as the sardine population varies. Del Monte-Luna added that applying the MSC methodology to determine if the sardine is a key LTL species with data from 2008 would conclude that the species was in fact a key LTL species but this result would be different if the analysis was done in 2016, resulting in a non-key LTL species. However, Del Monte Luna mentioned that there is not enough data to perform the same analyses to determine the status of sardines in the last three years with the exception of the average catch of sardine and the proportion it represents relative to the total catch of small pelagic fish. Catch of Pacific sardine averaged over 61,000 mt between seasons 2010/11 to 2014/15 which is barely above the 50,000 mt suggested in GCB2.3.13 for “small scale fisheries” as guidance to determine if the stock may not be considered as key. It is also below the 100,000 mt suggested as the lower bound for catches to be considered large enough where the stock is more likely to be of a key LTL species. The catch for season 2010/11 is however still quite large (138,068 mt) relative to the catch in season 2014/15 (4,455 mt), therefore, if the catch next season (2015/16) is smaller than 80,000 mt, then the average of the last five years will be under 50,000 mt. Following these considerations, the review team (Espinoza, Nevarez-Martinez and Del Monte Luna) concluded that the most appropriate description of the Pacific sardine role in the Gulf of California, based on the MSC approach and available data, is that the stock can at times be a key LTL and at different times be a non-key LTL stock.

A summary of the analysis made by the review team is found in Appendix 13.2 *315 Summary Results for Determination of Pacific Sardines as Key LTL* (p. 315). Relevant aspects of this review are, that an analysis

made in 2001 concluded that nearly 80% of the variability in abundance was explained solely by temperature and upwelling. The consequence of this was also discussed by Del Monte in his overview at the onsite-meeting, indicating that sardine variability as determined by environmental conditions, influences the fate and abundance of all predators that depend on them, including the fishery; if the sardine stock is abundant and available, predators thrive; if the sardine population declines or becomes unavailable, predators are affected. At the ecosystem level the analysis presented in the review indicates that an estimated threshold harvest rate of 36% is needed to risk an irreversible disruption of ecosystem structure and function (i.e. catches greater than 36% of the estimated SSB would irreversibly alter current ecosystem structure and function).

An ongoing point of discussion in this system has been what drives sardine abundance and how the fishery impacts other dependent populations. An analysis of Velarde et al. (2015) concluded that:

[...] warm SST anomalies are the main factor determining the proportion of tern population nesting away from the Midriff (path coefficient $\phi = 0.67$, $P < 0.0001$), but that fishing effort and total landings during the previous year also play a significant role ($\phi = 0.36$, $P = 0.006$, and $\phi = 0.25$, $P = 0.03$, respectively).

It is noted however that the path from SST at time t-1 only points to fishing effort and sardine landings without an intermediate step on Pacific sardine abundance (Figure 2H in Velarde et al. 2015). In this way, fishing effort and landings must be operating as surrogates or proxies of Pacific sardine abundance which makes the causality effect appear as directed from fishing to nesting when it could also be dependent on sardine fluctuations and not necessarily fishing, which would be consistent with Del Monte's proposition.

The CR v1.3 states in CB2.3.14 that "Teams shall determine whether a species is to be considered a key LTL species based on its status at the time of assessment. The determination shall be reviewed at each surveillance audit". The Guidance to the CR v1.3 (GCB2.3.14) clarifies that this means that a stock can presently be a non-key LTL species but may change in the future to be a key LTL species and that CABs need to be aware of changes in ecosystem productivity and structure at assessments, re-assessments and surveillances. Because of the inconclusive nature of the evidence on the history of the dynamics of the Pacific sardine inside the GoC, the time series of the catch, the different approaches to determine the role of the sardine in this ecosystem, the information on environmental variability, and expert opinion, the team agreed that the stock can sometimes be a key LTL species and some other times would not, it is therefore possible that the stock back in 2007 to 2010 was indeed a key LTL species while in years 2013 to 2016 is not. Because of this, it would be expected that the management system should have a mechanism to account for these environmentally driven changes such that the status of the stock would be re-evaluated at every surveillance, particularly in terms of the contribution of Pacific sardines to the total small pelagics catch and prey composition in the diet of predators, particularly sea birds. However, even with the vast amount of oceanographic, biological and fisheries data, there was not enough information to reach a clear conclusion about the latest state of the stock relative to the current environmental conditions. It was therefore proposed to follow a precautionary and practical (simpler to implement) approach to assume that the Pacific sardine in the Gulf of California is **at all times** a key LTL stock and will be evaluated henceforth as such for MSC assessments. The proposal was accepted by the review group and the client.

Abundance and Stock Assessment

Estimates of abundance independent of the fishery have been obtained from hydroacoustic surveys carried out in the Gulf of California from 2008 to 2016 (Nevarez-Martinez et al. 2015; Gonzalez-Maynez et al. 2016). The survey itinerary has remained the same in all years. On the coasts of Sonora perpendicular transects were made up to the 200 m isobaths and every 10 nm (mn). In the western Gulf, zigzag transects were done from Isla Angel de la Guarda to Loreto, Baja California South (BCS). Reports of hydroacoustic surveys conducted by INAPESCA had identified that it would be necessary to continue working on ground-truthing methods to assign the overall acoustic energy to the different species in order to generate more reliable estimates of abundance. This issue was raised again in the 4th surveillance audit, and although the issue was not satisfactorily resolved during the audit, a telephone conversation with Dr. Hector Villalobos on June 4th 2015, the acoustics expert working with INAPESCA, the team was informed that certainly the signal discrimination process needs to be improved, but that the improvement is not expected to modify the results significantly and that in the current condition of the index it would be an under-estimate of the true abundance. Under this scenario, the approach is to consider the index as a relative abundance estimate that is below the true abundance. Furthermore, the expert indicated that the bias was constant in time and therefore, the trend will not change after resolving methodological problems in the acoustic signal. The acoustic indices are considered appropriate to support the control rule because the reliability in the trend and because it is inserted into a fisheries and population model in conjunction with other indices that have provided consistent results in the stock assessment.

Results indicate that there is high variability in the biomass of Pacific Sardine, but also that biomass estimates differed depending on the assumption about the signal target strength (TS) because models are known to be sensitive to this parameter (Demer, 2004). Findings indicate that there was a general biomass decrease in sardine biomass from 2008 to 2010 and after a couple of years of slight increment, it declined and has stabilized from 2013 to 2016 at an average biomass range of 469,000 to 647,000 mt (Figure 8).

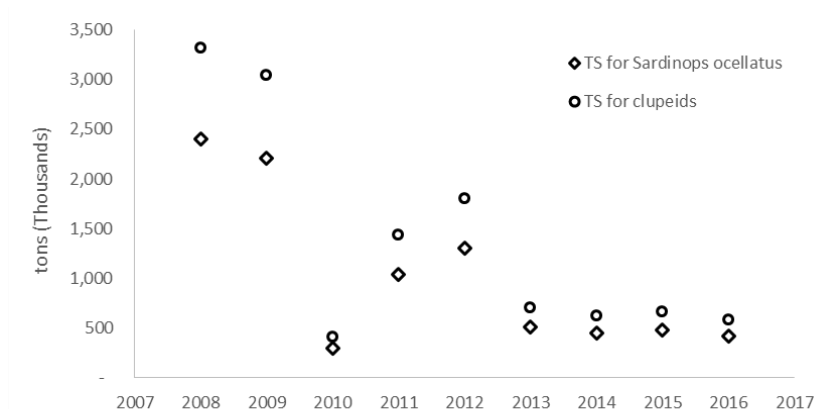


Figure 8. Estimates of Pacific sardine biomass in the Gulf of California obtained with hydroacoustic methods. Abundance is considered to be underestimated and used as relative indices in stock assessments. Data from Nevarez-Martinez et al. (2015) and Gonzalez-Maynez et al. (2016). Abundance in 2014 is approximated from proportions reported in Gonzalez-Maynez et al. (2016).

Introduction to the stock assessment

In recent years the status of the Pacific sardine has been of concern because the evidence showed a sharp decline in catches from a historic high around half a million tons in seasons 2007/08 and 2008/09 down to 3,571 tons in season 2013/14 and 4,455 tons in season 2014/15 (Figure 3; Table 4). Although these catches were obtained in seasons when the fleet agreed to suspend the effort on Pacific sardine, the records represent historic lows for the fishery. Stock assessments using regular Virtual Population Analysis (VPA; Cisneros-Mata et al. 1995), length based (Jones') VPA (Nevarez-Martinez 2014) and statistical catch at age using ASAP (Nevarez-Martinez et al. 2015; Nevarez-Martinez et al. 2016) concluded that recruitment is highly variable and suggested that environmental conditions may play an important role in such variability. These assessments also indicate that total abundance closely follow the trend in recruitment (Figure 9). However, the analysis of Cisneros-Mata (1995) warns that overfishing may have played a role in the fall of the stock in the early 90s. This is consistent with the reported trend in the catch compared to the estimated historic values of the Biologically Acceptable Catch (computed following the HCR equation in the Management Plan). The comparison shows that in early 90s, the actual catch may have been close to the BAC or exceeded it (Nevarez-Martinez et al. 2016). A similar pattern appears in the latest years starting around 2008 in the analysis by Nevarez-Martinez et al. (2016) where strong anomalous conditions led the stock to a vulnerable situation where overfishing may have taken place momentarily by not accounting in advance for the unfavorable environmental conditions.

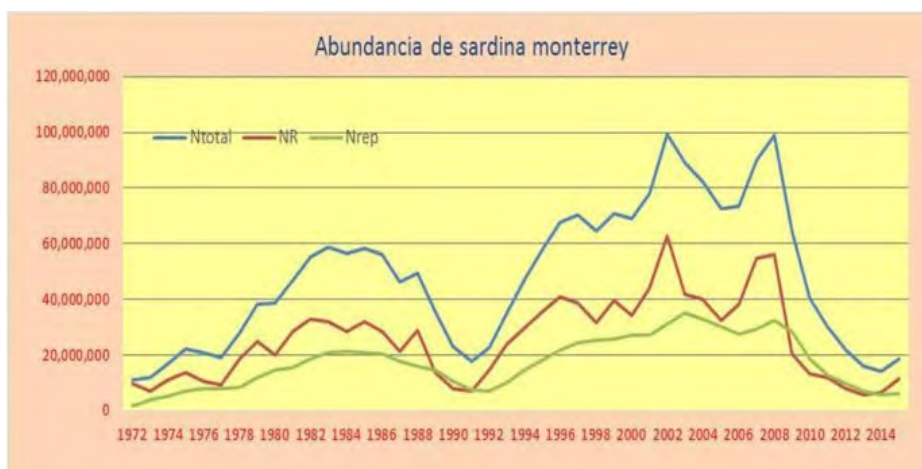


Figure 9. Abundance of Pacific sardine in the Gulf of California estimated using the ASAP analysis. N total = total numbers, BR = recruit abundance, Brep = adult abundance. Reproduced from Nevarez-Martinez et al. (2016).

At different times during the last certification cycle different hypotheses were discussed to explain the decline in catches as a result of environmental conditions. Given that by 2014 the decline in the catch continued, the fishery was required to provide additional abundance information independent of the fishery and more evidence to support the hypothesis that the Pacific sardine had shifted distribution to deeper layers in the water column and away to regions far from the reach of the sardine fishing fleet. These requirements were associated to re-scoring PI 1.1.1 to request evidence that the stock was above the point where recruitment could be impaired.



Figure 10. Comparison of catch records (green line) of Pacific sardine in the Gulf of California with the estimated Biologically Acceptable Catch (bars) obtained with the control rule in the Management Plan. Reproduced from Nevarez-Martinez et al. (2016).

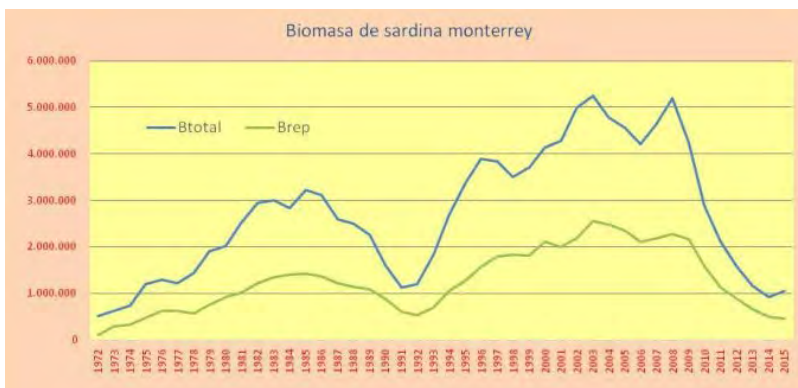


Figure 11. Total Biomass of Pacific sardine and adult biomass estimated using ASAP in the Gulf of California. Reproduced from Nevarez-Martinez et al. (2016).

As shown in Figure 6, biomass was estimated to be near half a million tons from 2013 to 2015 by means of acoustic methods, but the acoustics expert considers these as under-estimates of the true abundance given issues that still need to be resolved with the discrimination signal (H. Villalobos pers. comm.). In addition, the assessment of Nevarez-Martinez et al. (2016) estimated total biomass at nearly one million tons whereas adult biomass was estimated to be around 420,000 tons between 2013/14 and 2014/15 (Figure 9).

Environmental considerations and the potential effect of El Niño on current sardine availability

Because the influence of environmental variability was invoked as a critical factor to explain the fall of the catch of Pacific sardine, a thorough review of the literature was conducted to provide a wider context to the discussion. Early descriptions about the behavior of sardine populations indicated that the availability of sardines depends on wind patterns and inter-annual fluctuations in temperature in the central Gulf of California related to the El Niño Southern Oscillation (ENSO), in particular, the penetration of warm surface water will cause the spawning and nursery areas to be confined and compressed in the cooler northern areas of the Gulf (Hammann et al. 1988). The process is also favored by a water circulation pattern that keeps eggs and larvae in these highly productive waters (Hammann et al. 1998). It was further observed that despite the fishery collapsing down to less than 3% of the production maximum, there is historical evidence of the stock's capacity to recover quickly in 1993-94 after two years (1989-90) of low catches (Lluch-Cota et al. 1999). The authors proposed that the recovery was explained by processes of enrichment, retention and concentration in the sardine spawning habitat. It was also proposed that during periods of low sardine abundance, the fish concentrate around the large midriff islands of the Gulf of California, where cool water from tidal currents creates a region of high productivity called Center of Biological Activity, and although reproduction may be reduced, the Center of Biological Activity is serving as refuge in extremely adverse conditions (Nevarez-Martinez et al. 2001). These authors also gathered evidence indicating that sardines have the ability to extend their distribution vertically and can be found down to 200 m deep. This proposition was later supported by findings reported by Lluch-Belda et al. (2003), suggesting that the central part of the Gulf of California, in particular the Canal de Ballenas, contrary to other regions, have high productivity throughout the year supporting large sardine biomass and serving as long term refuge during adverse environmental conditions. Additional evidence of the

physical characteristics of the Gulf of California during extreme El Niño and la Niña was presented by Lluch-Cota et al. (2010) observing in particular the presence of a cool area around the Midriff Islands (Figure 12). The dynamics of sardine populations in terms of large temporal scale changes in abundance coupled to their spatial distribution was developed by Rodriguez-Sanchez et al. (2001) and Rodriguez-Sanchez et al. (2002). They found that regime shifts drive changes in population abundance at the same time with large redistributions of the bulk of sardine biomass. They concluded that these changes explain the disappearance and reappearance of sardines along the California Current. It was also concluded that smaller temporal scale changes in abundance such as those caused by the ENSO are embedded in the large scale process. An important observation that determines the distribution of spawning grounds was also made by Hammann et al. (1998), who found that there was a probability of 5% or less of finding eggs in waters warmer than 24 °C.

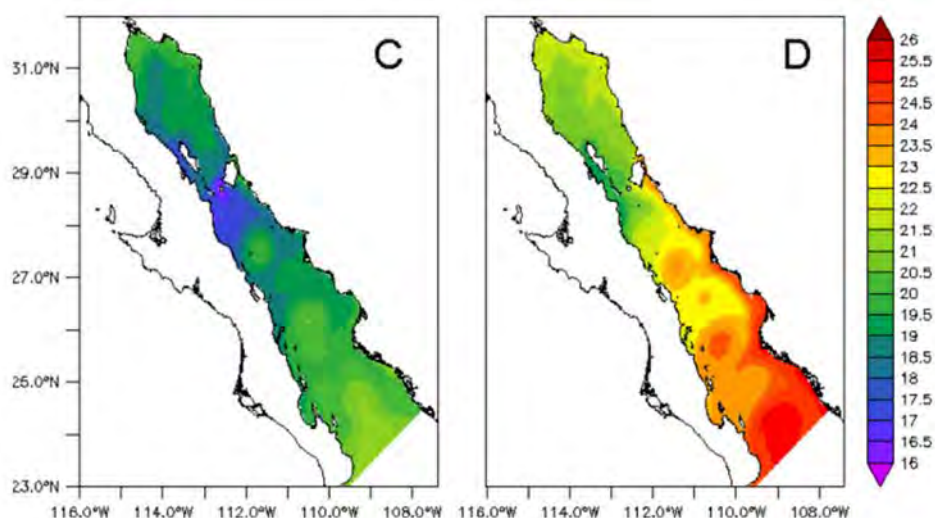


Figure 12. Oceanographic model results for extreme La Niña (C) and El Niño (D) winter conditions of SST. From Lluch-Cota et al. (2010).

The occurrence of a strong El Niño event was confirmed in 2015 (Takahashi and Dewitte 2015) and the NOAA El Niño/Southern Oscillation Diagnostic Discussion Web Site, as of November 12th 2015 reported that “A strong El Niño continued during October as indicated by the well above-average seas surface temperatures (SSTs) across the central and eastern equatorial Pacific Ocean” (Figure 13) (http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensodisc_nov2015/ensodisc.html).

Such atmospheric and oceanographic conditions reflect a strong and mature El Niño episode, adding that it could rank among the top three strongest episodes going back to 1950. Figure 13 shows the incursion of warm water into the Gulf of California with temperatures that are between 1 and 2 centigrade degrees above the base line of the series. Light to moderate positive anomalies started to develop inside the Gulf as early as February 2014 and by June the anomaly was already in the range of 2 to 3 centigrade degrees (Figure 13). The incursion of warm water into the Gulf is more evident in Figure 14, comparing surface temperatures between October and December in 2013 and 2014 respectively, temperatures in 2014 were warmer but waters around the midriff islands were cooler (Martinez-Zavala et al. 2015b).

Nevarez-Martinez et al. (2001) observed that “nonlinear multiple regression analysis based on surface temperatures (T) and upwelling (IS) explained 78.8% of the observed relative abundance variance”. Short term fluctuations in CPUE of Pacific sardine were also observed to show mild positive correlation with sea surface temperature (Zuñiga-Flores et al. 2015). Long term projections of abundance in the California current have been obtained after cyclical patterns in upwellings, sea surface temperature and the ocean-atmosphere dynamics were identified. It was concluded that the expectation is for the abundance of Pacific sardine to continue at low levels until the 2020s. An increase is then expected to peak in the 2040s-50s to gradually decline again in the 2070s-80s (Saldivar-Lucio et al. 2015).

Under the oceanographic conditions described above and considering past Pacific sardine history in the Gulf and the associated theories about population response to climate variability at different scales, the INAPESCA Small Pelagics Program staff has proposed that the best possible explanation for the low catch is that the stock has shifted distribution to the north of the Gulf, and to deeper waters, and as described in sections above, making the fish unavailable to the fishery. Fisheries independent cruises, with the ability to detect biomass to a depth of 250 m conducted by INAPESCA in 2014, showed that most small pelagic species, including the Pacific sardine, were scattered and in low abundance which reflected the low availability to the fishery (Alvarez-Trasviña et al. 2015), which operates between 40 and 100 m.

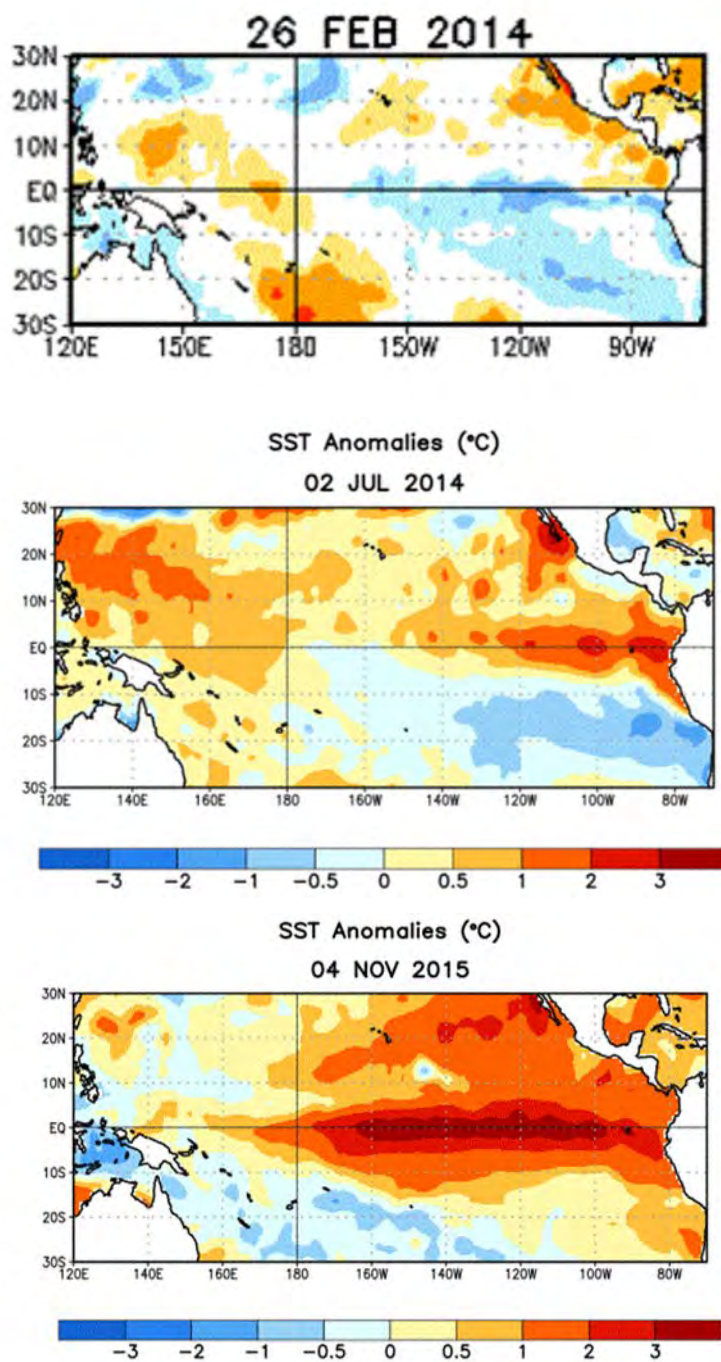


Figure 1. Average sea surface temperature (SST) anomalies (°C) for the week centered on 4 November 2015. Anomalies are computed with respect to the 1981-2010 base period weekly means.

Figure 13. From top to bottom, average sea surface anomalies in °C for weeks centered on February 26 2014, July 2nd 2014 and November 4th 2015. Reproduced from the NOAA El Niño/Southern Oscillation Diagnostic Discussion Web Site.

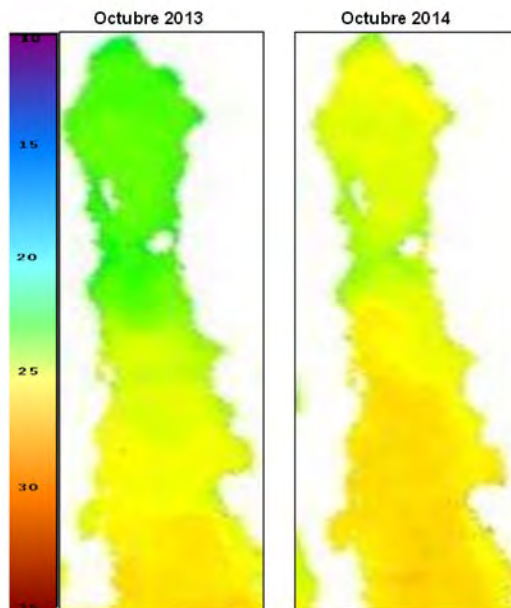


Figure 14. Satellite images comparing surface water temperatures in °C in the Gulf of California during October and December 2013 and 2014. Reproduced from Martinez-Zavala et al. (2015b).

Assessment of Stock Status

As mentioned in the introductory section, the Pacific sardine has been assessed using different methodological approaches. Because of the inconsistency in the catch trend and the estimated biomass from VPA analysis, one of the main demands that have been presented to this fishery was the inclusion of auxiliary information generated independently from the fishery. In principle, abundance indices obtained with acoustic methods were available, but it was later recognized that other sources of information were already at hand (See Figure 15) and it was only required to adapt them to a methodology that would allow their simultaneous use in one single evaluation of the status of the stock. This landscape suggested the use of a statistical catch at age approach coupled with likelihood theory to simultaneously incorporate all sources of information and their associated observation uncertainty. Although the general Stock Synthesis model has been suggested as the best analytical approach, the INAPESCA staff opted for using the Age Structured Assessment Program (ASAP) model of Legault and Restrepo (1999) to reconstruct the biomass trajectory and estimate parameters relevant to make management decisions (Nevarez-Martinez et al. 2015).

The current assessment of Nevarez-Martinez et al. (2016) used as auxiliary information a series of CPUE values from scientific cruises, the indices of abundance from acoustic surveys, an index of eggs and larvae, an index representing spawning probability and the proportion of sardines in the diet of seabirds (Figure 15).

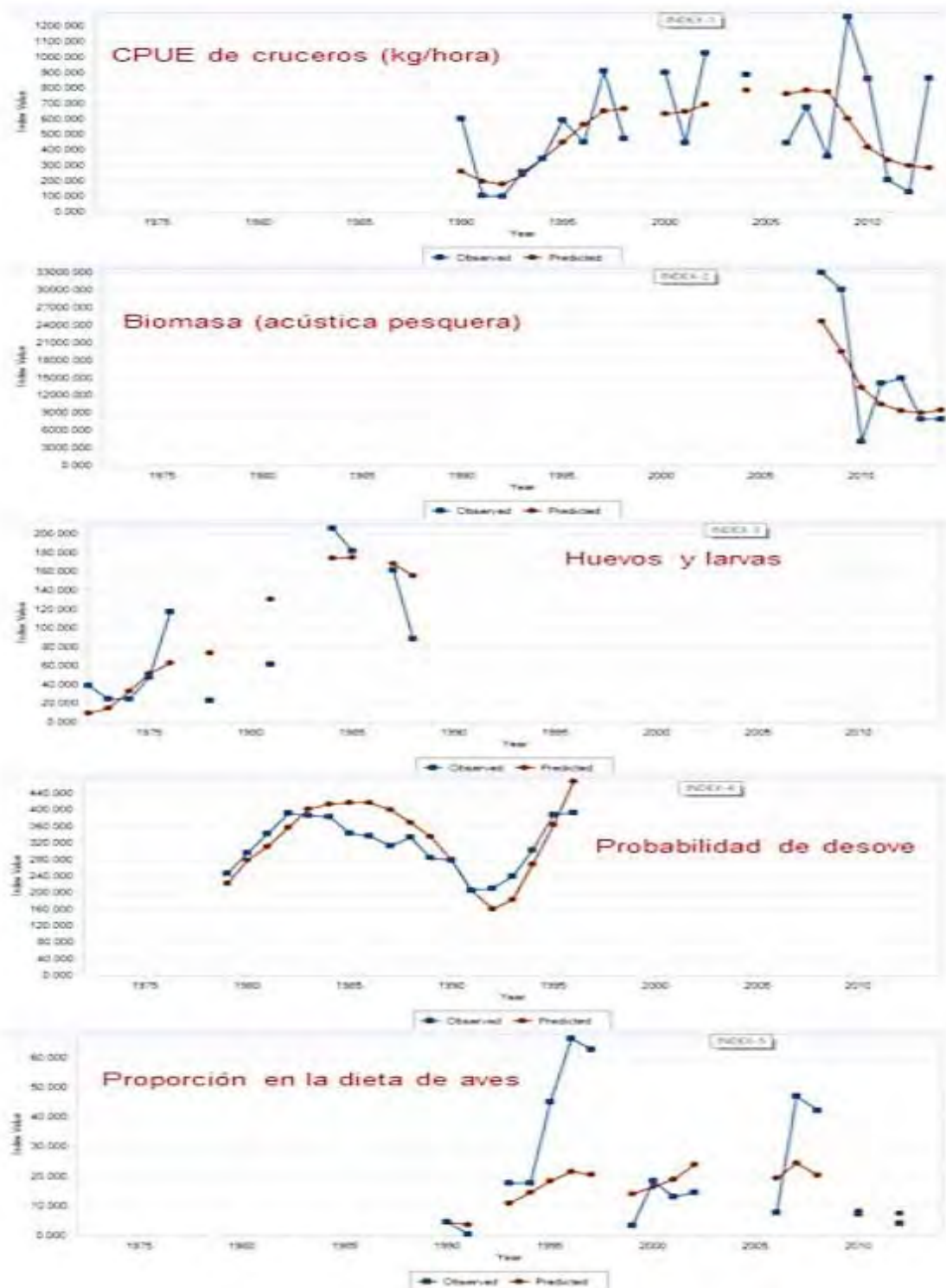


Figure 15. Indices of abundance independent of the fishery used in the ASAP analysis. Blue and red lines represent observed and predicted values respectively. Reproduced from Nevarez-Martinez et al. (2015).

Biomass and recruitment were estimated to be very variable (Figure 9). It should be noted however, that CPUE indices, the acoustic abundance indices and the index of seabird diet, show an even more intense and frequent, but consistent variability than the ASAP model as parameterized was unable to capture, mostly because of the use of a deterministic stock-recruitment function (see panels 1, 2 and 5, from top, in Figure 15).

The estimated total biomass reached a maximum of over 5,000,000 mt in 2002/03 and 2007/08 while the vulnerable biomass reached a maximum of more than 2,000,000 between 1999/2000 and 2008/09 (Nevarez-Martinez et al. 2016a). The biomass decreased then sharply to a total of one million mt and nearly 500,000 mt of adult biomass in 2014/15 (Figure 11).

The stock assessment of Nevarez-Martinez et al. (2016a) also reports estimates of the annual fishing mortality rate and a measure of exploitation or harvest rate. These quantities in this stock assessment need some explanation before the results are shown. The fishing mortality rate as computed by ASAP is age and time specific, but to make it age dependent, the separable approach of the model requires that a basic value (termed by Deriso et al. 1985 “full-recruitment fishing mortality”) needs to be modified by gear selectivity under the assumption that at least one age shows selectivity of 1 making the selectivity at age and time the same as the base rate of that year. This particular value should be the annual fishing mortality rate which depends on the catchability coefficient and effort, both variable in time but not age. However, the approach of Nevarez-Martinez et al. (2015) computes the annual fishing mortality rate by means of an average of the age and time rates, weighted by the abundance at age and time. This approach has the potential to underestimate the actual annual fishing mortality rate and should be avoided in future assessments as a measure of actual fishing mortality rate. It is understood that even if biased, this measure of fishing intensity if computed the same way along a time series, produces a trend that is representative to the process that is comparable (as trend) with the trend of the true fishing mortality rate. Because of the different ways to represent fishing intensity, the values in the table of F related reference points (e.g. F_{msy}) in p. 18 of Nevarez-Martinez et al. (2015) are not comparable with the reported F_y values as weighted average.

The measure of exploitation rate is also inconvenient because it is applied in the HCR as equivalent to the variable called “FRACTION”. In the report of Nevarez-Martinez et al. (2015), the exploitation rate (E_y) is the ratio of the annual fishing mortality rate to the sum of the annual fishing mortality rate and the natural mortality rate ($F_y / (F_y + M)$). This ratio which can be used as another measure of fishing intensity, is in reality the contribution of fishing to the total mortality rate (Z). This can be easily explained using the Baranov catch equation where this ratio is applied to the total fraction of the population that does not survive to the following time step. The product of the fraction dying times the contribution of fishing yields the actual harvest rate which is also the ratio of the catch of the year to the biomass of the year (C_y / B_y). In the HCR of the Small Pelagics Management Plan, the allowable catch is computed as the product of FRACTION to some biomass level $C_y = \text{FRACTION} * \text{Biomass}$, where Biomass is adjusted to protect the stock from falling to the point where recruitment is impaired by Allee effects. Under such definition, $\text{FRACTION} = C_y / \text{Biomass}$, which by definition is a harvest rate, the proportion of harvestable biomass removed by the fishery.

It is possible that using these two quantities in a relative way to determine if current fishing intensity is above an estimated value of the same quantity associated to MSY is useful to determine if overfishing is taking place. But it should be clarified that F_y is not the actual fishing mortality rate but a surrogate and that the ratio $F_y / (F_y + M)$ is a measure of fishing intensity but is not equivalent to FRACTION. Because of the latter, the ratio $F_y / (F_y + M)$ cannot be used as FRACTION in the HCR to compute the allowable catch. If FRACTION is assumed to be related to a target reference point assumed to be consistent with MSY it will always yield a rate higher than the actual harvest rate C_y / B_t at MSY.

During the onsite-meeting this problem was discussed and it was showed that if the actual expression of harvest rate derived from the Baranov equation was used, the resulting BAC would be slightly lower than currently reported, but different enough to make the recorded catch higher than the BAC in a few years when sardine abundance and catch were the highest. The discussion ended with the proposition to use an alternative formulation that is closer to the actual harvest rate as described above and was adopted by consensus. As a result of this, the stock assessment was revised and an updated version was submitted (Nevarez-Martinez et al. 2016).

The value of FRACTION that has been assumed to be related to a rate slightly smaller to that producing MSY (0.25) was computed in the analysis of Nevarez-Martinez et al. (1999) as a fishing mortality rate that would produce higher economic returns at the same time that would better protect the stock. This F value has been applied directly as if operating as a harvest rate. Any value can be used as harvest rate in the control rule, however this is not the actual intent when taken from an analysis that associates certain properties to such value, including that it is an F value, not a harvest rate.

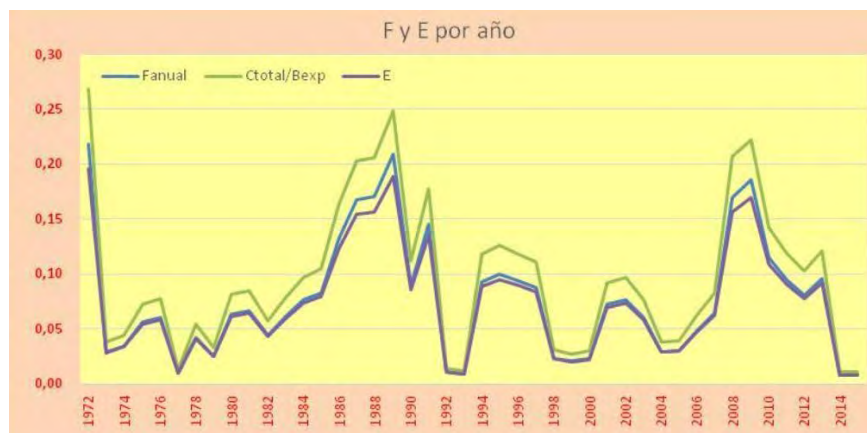


Figure 16. Estimated Fishing mortality F and exploitation rates E in the Pacific sardine fishery of the Gulf of California, Mexico. Exploitation rates expressed as $E = F/Z$ and $E = C_{tot}/B_{vulnerable}$. Reproduced from Nevarez-Martinez et al. (2016). See text for description of the F parameter depicted in this figure.

The stock assessment of Nevarez-Martinez et al. (2016) estimated that F_y and E_y were for most of the time series under 0.15 with the exception of the previously mentioned periods in the late 80s/early 90s and from 2008 to 2013 (Figure 14). It should be noted that the harvest rate C_y/B_y from 1986 to 1990 and 2007/2009 exceeded 0.18 corresponding to 0.29, the ASAP estimate of the fishing mortality rate producing MSY (F_{msy}). It is therefore estimated that except for the aforementioned periods, the stock

has not been through periods of overfishing. This is consistent with results in Figure 10, comparing the estimated allowable catch computed using the HCR in the SPFMP with the catch records from the early 70s to 2014 (Nevarez-Martinez et al. 2016). The figure shows that for the most part the catch has been under what would have been the Biologically Acceptable Catch (BAC) with the exception of the same years mentioned in the discussion of the harvest rate trend in Figure 16.

2.5.4 Thread Herring

Biology

The second UoA is composed of the thread herring, which is a generic name to identify three species, *Opisthonema libertate*, *O. bulleri* and *O. medirastre*. However, a review conducted by INAPESCA (Martinez-Zavala 2013) observed the species composition in the catch from 28 samples obtained from the fishing season 2007/08 to 2011/12 (five seasons) and found 96% of *O. libertate* and 3.6% *O. bulleri*. Although the review recognized that species composition changes from season to season, it was concluded that *O. libertate* is the dominant species in this region of the Gulf of California.

Taxonomic Classification

Class: Actinopterygii

Order: Clupeiformes

Family: Clupeidae

Genus: *Opisthonema*

Species: *libertate*, *bulleri*

Opisthonema libertate

Pacific thread herring (*Opisthonema libertate*) is considered a main retained species in the Gulf of California small pelagics fishery. They are named for the last thread-like ray on their dorsal fins. Other common names include deep-bodied thread herring and *Sardina crinuda* (Mexico). *O. libertate* is distinguishable from other Pacific ocean *Opisthonema spp.* only by the number of gill rakers, with *O. libertate* having between 63 and 100.

Opisthonema bulleri

Like other members of the genus *Opisthonema*, *O. bulleri* is distinguished by the long filamentous ray on the dorsal fin and may be very difficult to distinguish from other *Opisthonema* species. The species is about the same size, and presents the same number of rays in the dorsal and anal fins as other species of the same genus. The most distinctive feature of this species is the presence of 25 to 36 lower gillrakers in fish over 14 cm, which is the lowest number of gillrakers found in *Opisthonema*. The species is found in coastal/pelagic waters of the eastern Pacific, from Mazatlán, Mexico to Punta Picos in Peru.

Behavior

Pacific thread herring are small forage fishes (usually ~12-25 cm in length, up to ~30 cm). While predominantly coastal and preferring to remain near the surface, they have been known to occur up to 100 m deep.

Pacific thread herring are low level consumers and form very dense schools that attain large biomasses between 50 t and 80 t, and are therefore usually restricted to high productivity areas. The thread herring is omnivorous, consuming both phytoplankton and zooplankton throughout its lifetime. Pacific thread herring are indeterminate batch spawners (oviparous), producing a large number of eggs in batches spread over many months. Eggs and larvae are pelagic (free floating).

Growth and Natural Mortality

Estimates for natural mortality for *O. libertate* are inconsistent across different publications. Gallardo-Cabello et al. (1993) mention that the maximum age for *O. libertate* is 8.94 years and the natural mortality (M) of 0.335. Jacob-Cervantes (2012), using the constant method of Jensen (1996), computed M = 0.65. These values differ from the high value of M= 0.86 published in FishBase, these variations are most likely due to different values in K. Using the regression approach of Hewitt and Hoenig (2005) with the maximum age of 8.94 gives a M = 0.47, if age was reduced to 7 years, M = 0.6. Uncertainty in somatic growth rate and longevity are the main impediments to obtain a consistent estimate of natural mortality for this species.

Reproduction and Recruitment

In the waters off Sinaloa, *O. libertate* spawns at a water temperature range from 25 to 29°C, mostly in the summer-autumn months with a high incidence of immature animals in winter. Different values of length at maturity (L_{50}) have been computed for this thread herring species, but the latest approach estimated a mean length (no specification of what type of length measurement) at maturity of 162 mm (Cotero-Altamirano et al. 2014a).

Distribution and Stock Structure

The Pacific thread herring *O. libertate* is distributed along the eastern Pacific coast extending from the Gulf of California northward to Southern California, USA, and southward to Peru, including the Galapagos Islands. This species is abundant throughout most of its range, with the exception of the outer coast of Baja California, where it is considered to be rare (Watson and Sandknop. 1996). Local distribution of thread herring and other small pelagic species may be found in Figure 1.

Low Trophic Level Species (LTL)

The thread herring in the Gulf of California was evaluated as a simple LTL species and not a key LTL stock by observing the definitions in MSC Certification Requirements and the Guidance to MSC Certification

Requirements. The question arises in PI 1.1.2 at SG80 “For key low trophic level species, the target reference point takes into account the ecological role of the stock”. Point CB2.3.13 states that a stock is considered key LTL if the species is listed in Box CB1 and meets at least two out of three criteria that are related to connectivity of the species with other elements of the ecosystem, its relevance in the flow of energy and the relative importance of the stock compared to other species that contribute to the energy flow.

In early stages of the assessment, the team did not receive evidence related to the role of the thread herring in the ecosystem in the Gulf of California. At best, two articles (Velarde et al. 2004; Bakun et al. 2009) emphasized the critical importance of the Pacific sardine as the dominant species of the system, which could drive the analysis towards accepting it is a key LTL species in the operational area of the fishery for small pelagics in the Gulf of California. Because of such lack of evidence, the team followed the MSC Guidance for details in each of the three main components that are used to judge the role of the stock in the ecosystem¹.

Subsequently, the team received a thorough discussion on connectivity, energy transfer and the possible role of the thread herring as a key LTL species in the central GOC. The evidence in that report is presented below to support the team’s position, but it was decided to keep the original arguments as they work in support of the decision taken.

¹ In relation to energy transfer, the Guidance (page GC66/67) says (see bottom of next page):

Although the size of the catch of a key-LTL stock is not directly indicative of its likely importance in energy transfer, nevertheless, in approximate terms catch size can be assumed to relate to ecosystem importance and may be used to support a plausible argument that a LTL species meets, or does not meet, criterion CB2.3.13.b.ii:

- LTL stocks that are subject to small catches (<50,000 t average total catch from the stock over the last 5 years) by small scale fisheries will not normally be key LTL stocks. Catches less than this threshold may still indicate key LTL stocks in cases where they are taken from unusually small ecosystems.
- The situation with LTL stocks that are subject to large catches (e.g. >100,000 t total catches from the stock over the last 5 years) in respect of key-LTL status is less easy to predict. CABs should, however, not assume that these fisheries are accessing non-key LTL stocks.

The thread herring is right on the border because from 97 the average may be around 50,000 tons, and in few years may go up close to 100,000 but not more.

On the other hand, in page GC67 of the Guidance, when discussing the condition of “wasp-waisted-ness” of the system requires that “*there are few other species at this trophic level through which energy can be transmitted from lower to higher trophic levels, such that a high proportion of the total energy passing between lower and higher trophic levels passes through this stock*”. In this regards, the Guidance goes further to consider catch records to suggest that “*Examination of catch statistics of other species of the types listed in Box CB1 or CB2.3.13bi within the same ecosystem may also allow determination of whether there are few significant catches of other species at this trophic level*”. And adds, “*In ecosystems where the catches of the candidate LTL stock are less than those of all other species at the same trophic level, the ecosystem may be regarded as not wasp-waisted and the candidate stock will not normally be a key LTL stock*”. The thread herring catch record is certainly not less than those of all other species, but is considerably less than that of the Pacific sardine which is considered to be the key LTL stock in the region. Finally, an interesting example is presented to show that a species can be a key LTL stock in one area at one time but in another place at a different time may well not be. The “sardine would be considered a key LTL species in the southern Benguela current system but not in the northern Humboldt system in its current state (as at 2010); if the Humboldt were to shift to a sardine-based rather than an anchovy-based system, it would once again become a key LTL species in that ecosystem.

A technical report by Espinosa-Romero (2013) analyzed the role of the thread herring in the Gulf of California ecosystem and the potential impact of the fishery. The following bullets are quoted from the Espinosa-Romero (2013) report summary results:

No evidence of large connections (number of interactions) between thread herring and other elements of the ecosystem is present. However, there is evidence of a strong connection between thread herring and the blue-footed booby, in a particular site, Isla El Rancho, Sinaloa. Other species show to have a greater contribution to the variety of predator diets such as: *Sardinops sagax* (to marine mammals, sea birds, billfish), *Cetengraulis mysticetus* (to marine mammals, sea birds and fish species), *Engraulis mordax* (to seabirds), *Anchoa sp* (to seabirds), *Opisthopterus dovii* (to sharks), *Harengula thrissina* (to fish species), *Scomber japonicas* (to fish species). Thread herring proportional connectance equals to 3.26%, which suggests that it may not be a non-key LTL species. Thread herring catch is 66,385 tons, which represents 16% of the total catch (average in the last five years, 18% in the last 10 and 15 years). These points lead to the conclusion that thread herring is not the main species in its functional group, and may not be the main source of energy from lower to higher trophic levels and may not create predator dependency, except for blue-footed booby.

It should be noted that blue footed booby colony at Isla Rancho is located in the southern portion of the GOC and probably not affected by the fraction of the stock subject to this fishery.

The above considerations were used to conclude that the thread herring in the Gulf of California is not a key LTL stock. Under this conclusion, the fishery is evaluated in terms of reference points and performance as a non-key LTL stock.

Abundance and Stock Assessment

As described for Pacific sardine, fisheries independent data of small pelagic fish populations are being collected via hydroacoustic surveys which began in 2008: findings were summarized for the period between 2008 and 2012 (Nevarez-Martinez et al. 2013a; Villalobos et al. 2013), for 2013 in Nevarez-Martinez et al. (2015) and updated for 2015 and 2016 in Gonzalez-Maynez et al. (2016). The work included over five acoustic surveys carried out in the Gulf of California during spring aboard INAPESCA research vessels. The survey itinerary was approximately the same in all years where on the coasts of Sonora (*Bahia de Puerto Obos Agiobamp*) perpendicular transects were made up to the 200 m isobath and every 10 nm (mn). In the western Gulf, zigzag transects were done from Isla Angel de la Guarda to Loreto, BCS.

Estimates of abundance specifically obtained for thread herring are only available for 2016 and are presented in Table 10. These estimates of abundance are not used in the stock assessment and there is no explanation of why this was the case.

Table 10. Estimated biomass of thread herring in the Gulf of California during spring of 2016 by means of hydroacoustic surveys. Estimates differ depending on the value of the TS parameter used.

Año	Talla promedio (mm)	Peso (gr)	b ₂₀	TS	Individuos por área	Biomasa promedio	Biomasa
2016	148	74.5	-70.5	-47.09	492,248.8	36.69	355,924
			-71.9	-48.49	679,492	50.65	491,312

Stock Assessment

The status and productivity of the stock, as well as the performance of the fishery has been analyzed in assessments using three different analytical approaches. First, a simple (not tuned) virtual population analyses (VPA) (Nevarez-Martinez et al. 2012), secondly using the ASAP model (Nevarez-Martinez et al. 2014) and using a biomass dynamics model (Nevarez-Martinez et al. 2015). In the first two cases, the methods require a record of catch at age, therefore, samples of catch at length were transformed to catch at age using an age key obtained through otolith growth line analysis.

The VPA analysis allowed the calculation of abundance and recruitment as well as the annual fishing mortality rates. Although previous analyses using different methodologies computed a rate of natural mortality of $M=0.729$ (Martínez-Zavala et al. 2006), the VPA assessment assumed $M=1.13$. Noteworthy results (Figure 17 left) include an evident overall increasing trend in biomass abundance starting in 1992. However, after 2003/04 the slope of this trend leveled off and appears to be almost stable at an average around 1,750,000 tons. If the overall trend appears to be almost stable, the biomass trend shows cycles that span 3-4 years and have an average intensity of nearly 400,000 tons. These oscillations are also evident in the trend of recruitment. In 2007 recruitment reached a maximum high near 1,000,000 tons with total biomass also at a maximum of nearly 2,000,000 tons. Fishing mortality (Figure 17 right) presented the highest peak in 1991/92 when it reached a level close to 0.2. From 1994 until 2002 fishing mortality (F) remained at low levels averaging somewhere around 0.025, except in 1998 when it went up to nearly 0.075. From 2003 to 2007 fishing mortality averaged around 0.05. The years 2008 and 2009 presented the historically lowest value close to 0.01. F saw an increase again in 2010 to the highest level in almost 20 years with a value of 0.1.

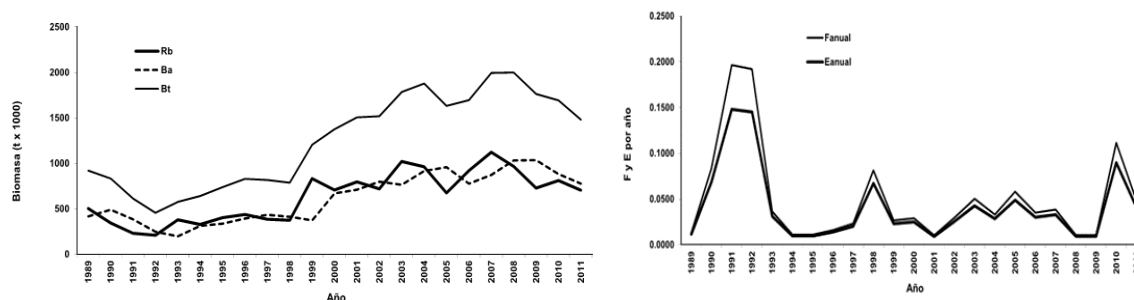


Figure 17. Time series of recruit (Rb), adult (Ba) and total (Bt) biomass (left) and fishing mortality (right) of thread herring in the Gulf of California as estimated using VPA. Reproduced from Nevárez-Martínez et al. (2012). See section on *Assessment of stock status* in the background of Pacific sardine for a discussion on the meaning of F and E in these assessments.

Overall VPA is an evaluation method that is still in use in fisheries that have many years of accurate data on catch at age coupled with abundance surveys to tune the computations. Those assessments have also intensively investigated the effect of assumptions and have compared the performance of the methodology with other approaches (e.g. Northern cod, see Butterworth and Rademeyer, 2008). Presently more efficient methodologies such as statistical catch at age and integrated analysis are already available and preferred elsewhere (NRC, 1998; Cope, 2013; Methot and Wetzel, 2013). The assessment conducted using VPA didn't test the robustness of results to the assumptions used in the computations (no acknowledgment of model error) and there was no estimate of the uncertainty introduced with observation error. Maybe the most concerning feature of the assessment was that comparison of the state of the fishery regarding the harvest rate control rule was made using a reference point that is very acceptable for other species, but no discussion was made about the potential problems of using such value when critical assumptions for the Pacific sardine are different than those for the thread herring.

A second type of assessment (Nevárez-Martínez et al. 2014) was delivered to the team in February 2014 and July 2016. This approach used a form of a statistical catch at age using the software ASAP (Legault and Restrepo 1999). The analysis included the same catch and catch-at-age data used in the VPA analysis. Two relative abundance indices obtained independently from the fishery were added, catch in kg of biomass per tow (in research cruise sets) and biomass based on eggs and larvae per 10 square m. Because the model is implemented within a likelihood statistical framework, the approach could be useful to explore the viability of a set of assumptions regarding the population dynamics and control parameters given the available data. Use of this analytical approach was restricted however to reproducing the trend in biomass and fishing mortality and to obtain point estimates of management quantities such as MSY or Fmsy. Natural mortality as in the VPA work was assumed in the 2014 assessment to be 1.13. The assumption changed in the 2016 assessment to a value of $M = 0.97$.

The trends in abundance estimated by Nevarez-Martinez et al. (2014b) with the ASAP software are shown in (Figure 18 left). As with the VPA model, the biomass shows an increasing trend, however, the estimated abundance from ASAP is in general three times higher (6 million tons and levels off at around 5 million) than the estimates obtained with the VPA. Recruitment in the VPA assessment was about the same as the breeder population but in the ASAP analysis recruits are usually about 50% more abundant than the adults.

Estimated fishing mortality (Figure 18 right) in the 2014 ASAP assessment was on average around 0.15 with a peak in 1983 of 0.75. These values are also higher than using VPA where F was generally under 0.05 with a peak in 1991 of 0.2. Considering the increase in the estimated abundance and that the catch was the same in both the VPA and ASAP assessments, it's contradictory that the exploitation rate instead of being smaller in the later, resulted a value substantially higher than the previous estimates. The use of the ASAP software allowed calculation of a MSY of 101,484 tons and F_{msy} of 0.879. Optimum yield was estimated at 97,945 and F_{opt} at 0.621. These values strongly contrast with previous estimates of MSY of 54,000 tons in 1991-1996 and 41,200 in 1996-1998. Fishing mortality near MSY (90%) is assumed to be a generic value of 0.25 in the SPFMP and the *Carta Nacional Pesquera* (CNP) and is used as a reference point.

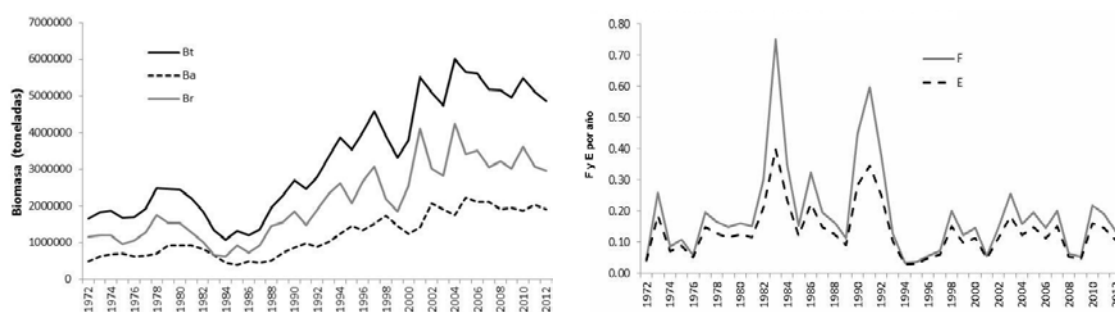


Figure 18. Time series of recruit (Br), adult (Ba) and total (Bt) biomass (left) and fishing mortality rate (right) of thread herring in the Gulf of California obtained in the 2014 ASAP assessment. Reproduced from Nevarez-Martinez et al. (2014b). See section on *Assessment of stock status* in the background of Pacific sardine for a discussion on the meaning of F and E in these assessments.

In the 2016 ASAP assessment, Nevarez-Martinez et al. (2016b) reported that the estimated biomass trend is again different from the previous ASAP results, with wide fluctuations but an overall increasing trend not stabilizing at any particular level and a maximum peak at 6 million tons of total biomass in 2011 (Figure 19 left). Estimated fishing mortality and harvest rate trends are similar than in the 2014 assessment (Figure 19 right), but their absolute value in 2016 are at least half the level of 2014 but the maximum of 1983 was estimated at nearly 0.18 in the 2016 assessment (compare to $F \sim 0.75$ in the 2014 assessment). The fishing mortality producing MSY was estimated to be 0.312 which corresponds to a harvest rate of 0.268 which was used as FRACTION to compute BAC values of 258,000 and 213,000 tons for 2014/15 and 2015/16 respectively.

Nevarez-Martinez et al. (2016d) used a biomass dynamics model which included process error with environmental forcing. The results of this approach appear promising but also show several problems that need to be addressed before using the results to make management decisions. In particular, the fit of the model predicted catch to the observed catch is very poor (Figure 20), and partly because of this, the resulting biomass trends is very flat although with some light fluctuations caused by the added process error (Figure 21). The trend in

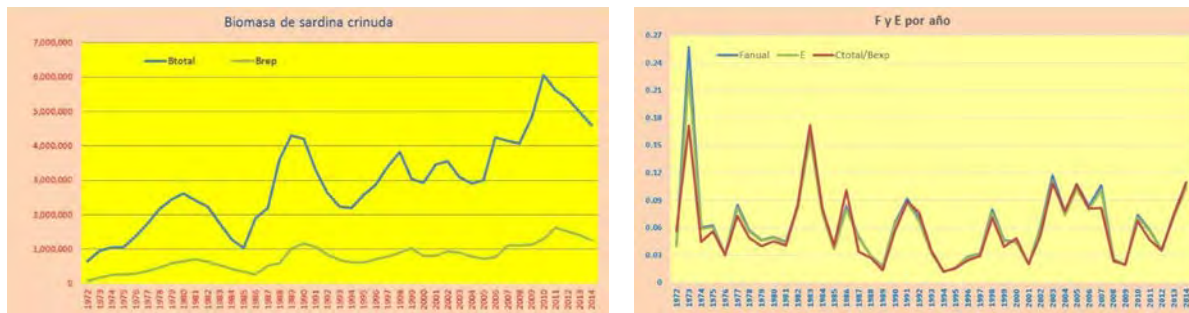


Figure 19. Time series of, adult (Brep) and total (Btotal) biomass (left) and fishing mortality rate (right) of thread herring in the Gulf of California obtained in the 2016 ASAP assessment. Reproduced from Nevarez-Martinez et al. (2016b). See section on Assessment of stock status in the background of Pacific sardine for a discussion on the meaning of F and E in these assessments.

thread herring biomass is linked to bocona biomass in the model structure by pooling their catch together. This allows estimation of bocona biomass trend simultaneous with that of the thread herring. Both biomass trends also show a sudden initial increase in biomass, although this is more evident in the bocona trend. This increase appears to be an artifact of model misspecification that needs to be resolved as well. Unfortunately, the report doesn't include enough details about the population model and how it is linked to the data through the statistical model. Despite these limitations, fishing mortality rate at MSY was estimated to be 0.575 and MSY about 354,000 ton.

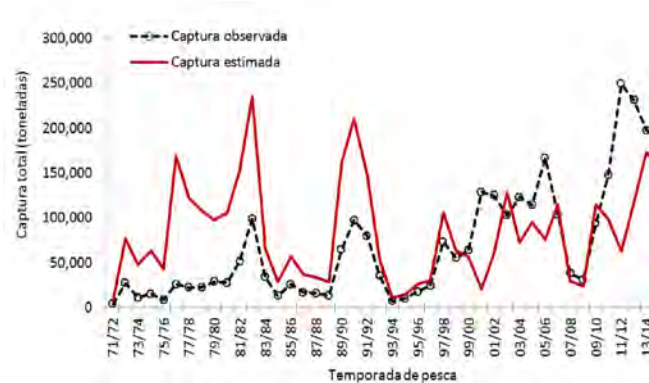


Figure 20. Catch recorded (broken line) and model predicted catch (continuous line) of thread herring and bocona sardine pooled together in the Gulf of California. Reproduced from Nevarez-Martinez et al. (2016d).

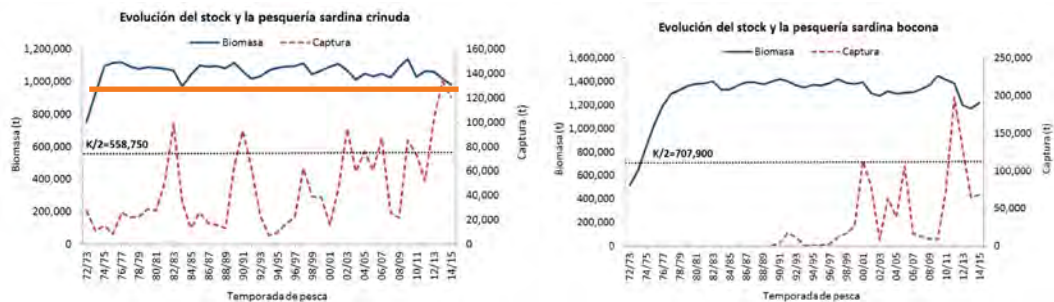


Figure 21. Biomass trajectories of thread herring and bocona sardine in the Gulf of California estimated using a biomass dynamics model with environmental forcing. Reproduced from Nevarez-Martinez et al. (2016d).

The status of the stocks were represented using Kobe plots showing that the biomass is about twice the level producing MSY while the fishing mortality rate has been much lower than the level producing the MSY (Figure 22).

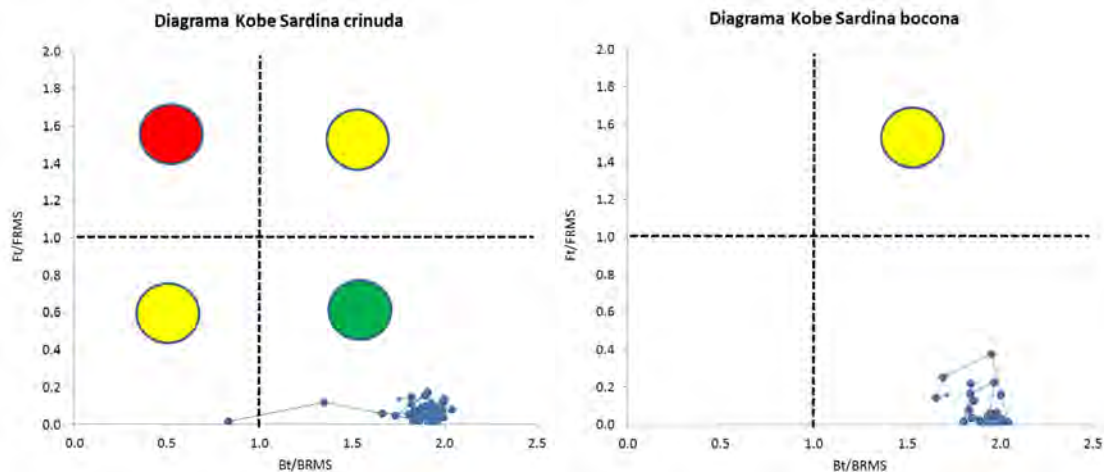


Figure 22. Kobe plots with stock status history of thread herring and bocona sardine in the Gulf of California. Reproduced from Nevarez-Martinez et al. (2016d).

2.6 Principle Two: Ecosystem Background

All species affected by the fishery not evaluated in Principle 1 are considered under Principle 2. This includes species that are retained for sale or personal use (assessed under Performance Indicator 2.1), bycatch species that are discarded (Performance Indicator 2.2), and species that are considered endangered, threatened or protected (ETP) by the government in question or are listed by the Convention of International Trade of Endangered Species (CITES) (Performance Indicator 2.3). This section contains an evaluation of the total impact of the fishery on all components in P2 and includes both observed and unobserved fishing mortality. Unobserved mortality may occur from illegal, unregulated or unreported (IUU) fishing, biota that are injured and subsequently die as a result of coming in contact with fishing gear, ghost fishing, waste, or biota that are stressed and die as a result of attempting to avoid being caught by fishing gear. This section also considers impacts on marine habitats (Performance Indicator 2.4) and the ecosystem more broadly (Performance Indicator 2.5).

2.6.1 Observer Programs

In response to the conditions placed on several Principal Indicators during the 2011 full assessment (PI 2.2.2, 2.2.3 and 2.3.1), CANAINPES with the support of CRIP-Guaymas (INAPESCA) and the Mexican NGO Community and Biodiversity, AC (COBI), developed and implemented an observer program. Funding was secured from Fundación Productor and the Walton Family Foundation to develop a collaborative, multi-sectorial observer program for the fishery. The observer program trained nine observers through a series of courses including: identification of marine birds, marine mammals, fish and turtles, and vessel safety and protocols.

The observer program operated for two fishing seasons, the first season covered from January 2013 to August 2013 and the second season from November 2013 to July 2014. The regular fishing season expands from November to July, thus coverage for 2012/13 season was partial. The program stopped in 2014 and did not continue for the last two fishing seasons (2014/15 and 2015/16). During the 2012-13 and 2013-14 fishing seasons the commercial fleet recorded a total of 4,881 trips (*esfuerzo nominal*). With a total of 608 trips observed (García and Gastelum 2015) the observer program is estimated to have covered 10% of the trips of the fleet in the two fishing seasons. Trips were observed on a total of 25 CANAINPES vessels that are part of the Unit of Certification (UoC) and on five purse-seine vessels that also operate in the northern Gulf of California small pelagics fishery, but are not part of the client group.

According to García and Gastelum (2015) from the observed sets 33% had not catch, 33% were dominated by thread herring, 5% were dominantly Pacific sardine and the remaining 24% captured dominantly other small pelagic species, including anchovy, bigmouth sardine and mackerel. The assessment team examined the data from all the observed sets.

Observers were provided with species identification guides and information was collected to the species level. For each fishing trip, observers registered information on all species, besides small-pelagics, that interacted with the fishery, including fish, marine mammal, sea turtles and seabirds. For all sea bird species, marine mammals, sea turtles and some shark species, observers recorded the number of

individuals and noted the condition, whether the specimen was only observed/captured, and whether it was retained/ released and the condition alive/dead/ poor condition. For the remaining species, mostly bony fish species, no information was provided beyond the volume captured for every species (Padilla-Serrato 2015; García and Gastellum 2015).

The assessment team identified some important consideration of the observer program and the ensuing analysis and evaluation of the findings. Below background for these issues is provided below:

1. Discrepancies in mortality of seabirds

COBI (García and Gastelum, 2015) and INAPESCA (Padilla-Serrato 2015) independently analyzed the data collected by the observer program and produced separate reports. There are some variations in the data presented by the two reports, which may be attributed to differences in interpretation and to the sampling scope of the data analyzed. COBI analyzed the data of 29 boats while INAPESCA analyzed data from 31 boats. The main variation detected between the two reports was in the number of reported mortality rates of seabirds, seemingly originating from different interpretations of what would be qualify as 'mortality'. Particularly, there were differences in opinion of survivorship of seabirds exposed to fish oil doing the fishing operations. Discrepancies in recorded mortality for seabirds and potential impacts of fish oil are discussed in more detail in Section: (p.) of this report.

2. Continuity of the observer program

Garcia and Gastelum (2015) noted that species accumulation curves for recorded species had not yet reached an asymptote, therefore the continuation of the on-board observer program is likely to record new species. Padilla-Serrato (2015) and García and Gastellum (2015) agree that the observer program is still under development. The performance of the program itself has been evaluated (for example, analysis of the performance of the observers, productivity time per observer (number of trips and hauls) which is fundamental for the design of an observer program.

During the second and third surveillance audits of the previous assessment cycle, and at the onsite-meeting for the present full assessment, the team raised concerns regarding the long-term funding strategy affecting the continuity of the observer program. In early 2017 CONAPESCA with INAPESCA completed a training workshop for an Observer Program intended to cover the small pelagics fishery in Northeast Mexico, including the Gulf of California (<https://www.gob.mx/conapesca/prensa/concluye-capacitacion-de-observadores-a-bordo-de-la-flota-sardinera-para-fortalecer-la-sustentabilidad-de-la-actividad>).

3. Total mortality estimates

The observer program reported only results from the observer samples. In absence of an estimate of total bycatch/ETP interactions, and in order to have an estimate of the total impact of the fishery, the assessment team extrapolated the observer samples over the rest of the fishery for the two fishing seasons, assuming that the results from the observer program were representative of the whole fishery.

The observer samples may not be properly stratified to be representative of the whole fishery, introducing bias. Thus the assessment team advises that whenever total estimates are provided in this report they should be treated with caution.

2.6.2 Overview of Non-Target Catch

The analysis for Principle 2 is made considering that the UoA and the UoC are the same and composed by the CANAINPES small pelagic purse seine fleet operating in the north-central Gulf of California. For the purposes of a MSC evaluation, retained and bycatch species are those in the catch, and within the scope of the MSC program (fishes or shellfish), and not defined by the client as the target – which by definition is evaluated under Principle 1.

Retained species

These are species retained due to their commercial value or due to management rules controlling discard of catch. When these species are commercially important they tend to be harvested under some management regime, sometimes there are also available reference points.

Bycatch species

Bycatch species are those that have been taken incidentally and are returned to the water, usually because they have no commercial value. Bycatch species are also considered to be all species that are out of scope of the standard (birds/ mammals/ reptiles/ amphibians) and that are not ETP species. These types of species could in some cases represent incidental catches that are undesired but somewhat unavoidable in the fishery. Given the often unmanaged status of these species, there are unlikely to be reference points for biomass or fishing mortality in place, as well as a general lack of data availability.

ETP species

ETP species under the MSC standard are those that are recognized by “national legislation and/or binding international agreements” or those listed on CITES Appendix I (CR v1.3 req. CB 3.11.1). The World Conservation Union also provided risk-based threat categories for species in all parts of the world, however, these listing (unlike national listings and CITES listings) are not legally binding unless invoked as such under national legislation: IUCN listings therefore, are not used to categorize species as ETP in the MSC process, but they may be used by expert team members to identify species with particular vulnerability, depletion or population-level risks that may be germane to status against limits, management needs or information deficiencies.

Main and Minor species

For ‘retained’ and ‘bycatch’ species may be considered ‘main’ based on either vulnerability or catch volume. Species that are not ‘main’ are ‘minor’. In the MSC system, a species that comprises less than 5% of the total catch by weight may normally be considered to be a ‘minor’ species in the catch, unless it is of high value to the fisher or of particular vulnerability, or if the total catch of the fishery is large, in

which case even 5% may be a considerable catch. A species that normally comprises 20% or more of the total catch by weight would almost always be considered a ‘main’ retained species (GCB3.5.2, GCB3.8.2 GCR V1.3 2013). Main and Minor species must meet different Performance Indicators (PIs) in P2.

Species Designation

To designate categories for Principle 2 species in the Sonora small pelagics fishery the assessment team used data from landing records and from the observer program. Landing records are available for fishing seasons back to the 1970s, but these only include only small pelagic species, thus information for all other species was obtained from the reports of the two seasons of the observer program.

Padilla-Serrato (2015) identified a total of 113 fish species, six crustacean species, four mollusk species, one cnidarian species and 17 bird species and two marine mammals. Garcia and Gastellum (2015) identified a total of 114 fish species, 29 invertebrate species (12 crustacean species and 17 cephalopods, gastropods and one cnidarian species), one algae species, two reptiles, 17 bird species and four marine mammals.

The assessment team designated 123 species captured by the small pelagic fleets as ‘retained’. This includes five species of small pelagics, which are also targeted by the fishery and used to make fishmeal: *bocona* sardine (*Cetengraulis mysticetus*), California anchovy (*Engraulis mordax*), chub mackerel (*Scomber japonicus*), red-eye round herring (*Etrumeus teres*), and leatherjacket (*Oligoplites* spp.). In the previous full assessment completed in 2011 thread herring was considered as a retained species, but in this assessment it is evaluated under Principle 1 as a target species.

Environmental variations exert significant influence on the abundance of small pelagic species. Available data series of effort and catches of the Sonora small pelagics fleet, show considerable fluctuations across the years in total landings of the different small pelagic species. Effects of environmental factors on abundance and catch are explained in the background section (See *Environmental considerations and the potential effect of El Niño on current sardine availability* p.44). Following MSC Guidance the assessment team considered the temporal trends in catches of small pelagics and examined landings data for the last 25 years (1990-2015) to determine which small pelagic species would be considered as ‘main’. (MSC GSA3.4.2 Guidance v2.0). This period was selected because it encompasses at least one oscillation cycle for Pacific sardine as described by historical catch data. Low catches of Pacific sardine are observed in 1972-1973, 1991-1992 and the latest in 2013-2014. Landings data of the first cycle period 1970’s to 1990 was not selected because there is limited understanding regarding data quality in historical time series, and some species are missing in the historical landings data prior to this date.

Generally, there are three retained species that represent more than 5% of the total catch of the UoA during this 25 year period: *bocona* sardine, chub mackerel and California anchovy (Figure 23). From 1990 to 2015, catch of *bocona* sardine represented on average 14% of catch of the UoA. For 16 out of the 25 fishing seasons evaluated, catch of *bocona* sardine was over the ‘main’ 5% threshold, and has remained a significant contributor to the fishery in the last fishing seasons, accounting for close to 30% of landings in 2015-15. Chub mackerel catch averages 7% of catch of the UoA during 1990 to 2015, for 11 out of the 25

fishing seasons evaluated, catch of chub mackerel was over the 'main' 5% threshold. Consequently, both *bocona* sardine and chub mackerel were classified as 'main' retained species. Although catch for California anchovy, was significant from 2010-2014, it was above the 5% 'main' threshold for only for five out of the 25 fishing seasons, averaging 4% of catch for the fleet from 1990 to 2015. Abundance of California anchovy under the cycle evaluated was not considered to qualify as 'main' for most of the fishing seasons, this species was classified as 'minor' retained. The other remained small pelagic species; red-eye round herring and leatherjackets were also designated as 'minor' based on their relative low contribution to catch, on average below 0.5% (Figure 23).

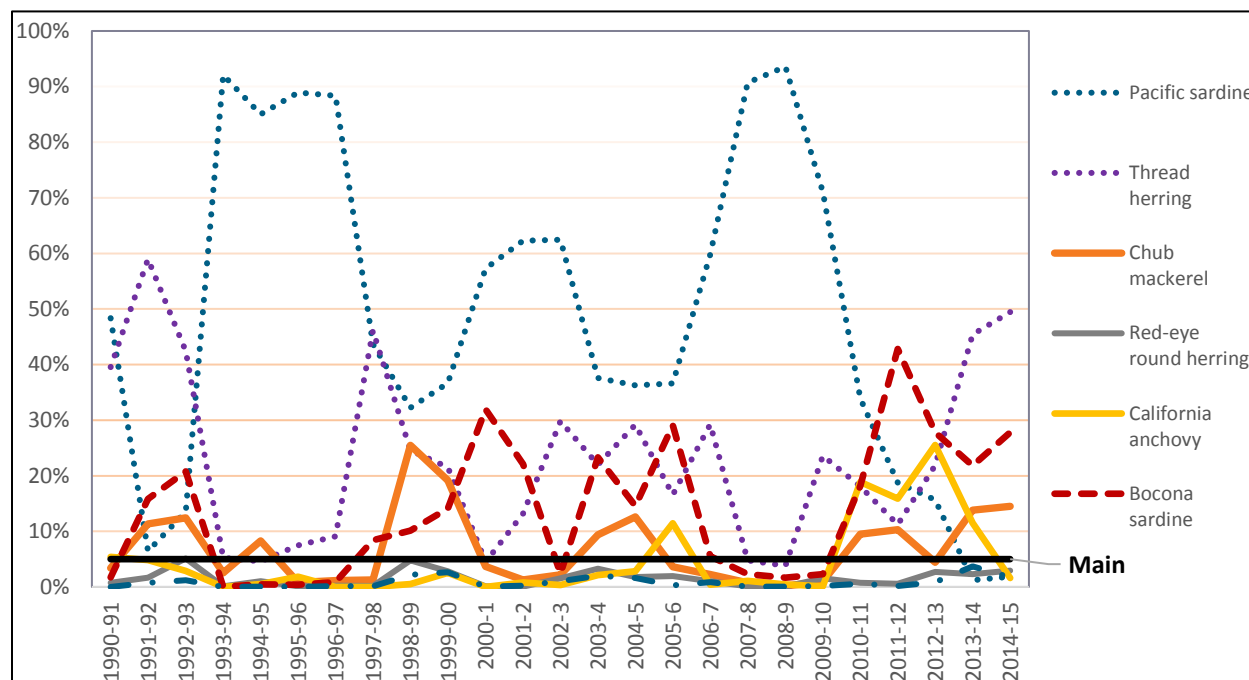


Figure 23. Catch composition in terms of percentage of catch of UoA for pelagic species in the fishery of the central Gulf of California, Mexico from 2005 to 2015. From data in Nevarez-Martinez et al. (2016).

Aside from small pelagic species, the fleet is reported to capture approximately 113 fish species, and 29 invertebrates. Eight fish species were designated as ETP, and the remaining fish and invertebrate species were categorized as 'retained'. The volume of all of these species accounts for <0.3% of the catch of the Sonora small pelagics fishery (See Appendix 13.1 p. 313). During the onsite-meeting staff responsible for the observer program explained that due to the operational challenges of separating these 'non-target' species from the rest of the catch of small pelagics, they are mostly retained. Without information on the amounts that were retained vs. discarded, all of these species were designated as 'retained' in this assessment. On basis of volume all of these retained species are categorized as 'minor'. Thirteen elasmobranch species were recorded (See Table 15 p. 75), all captured at very low levels, and none are listed as ETP. Some of the shark and ray species may be considered to be vulnerable, including scalloped hammerhead (*Sphyrna lewini*), spotted eagle ray (*Aetobatus narinari*), Pacific cownose ray (*Rhinoptera steindachneri*), and dusky shark (*Carcharhinus obscurus*). Despite the large catch of the UoA (>400,000mt

in 2012-13), the relative catch of these ‘vulnerable’ species was considered low to risk the species’ populations, and thus designated as ‘minor’.

Of the remaining species associated with the fishery, 10 of the 17 seabird species encountered were not designated as Endangered Threatened and Protected (ETP), these species are not protected under any national legislation or listed in the CITES Appendix I, and thus were classified and scored under ‘bycatch’. According to the IUCN the status of all these seabird species are considered to be stable. For these reasons the 10 seabird species evaluated as ‘bycatch’ were designated as ‘minor’ on basis of their vulnerability.

A total of 21 species, were designated as ETP, these included the remaining seven seabird species, four marine mammals, two sea turtle species and eight fish species.

Non-target species categorized by different scoring elements for this evaluation are listed in Table 11. A comprehensive list of all non-target species, including minor species can be found in this report in Appendix 13.3.

Table 11. Summary of Principle 2 species for the Sonora small pelagics fishery categorized by elements for evaluation.

Evaluation Element	Common name	Scientific name	MSC Classification	Reason for classification
Retained (PI 2.1.X)				
Bigmouth sardine	Bigmouth sardine	<i>Cetengraulis mysticetus</i>	Main retained	>5% catch of UoA
Chub mackerel	Chub mackerel	<i>Scomber japonicas</i>	Main retained	>5% catch of UoA
Other small pelagics and fish species	<i>See list in Appendix 13.1</i>	<i>See list in Appendix 13.1</i>	Minor retained	<5% catch of UoA
Bycatch (PI 2.2.X)				
Sea Birds (Not ETP)	Western Grebe Black-headed Gull Magnificent Frigatebird Ring-billed Gull Least Storm-Petrel Double-crested Cormorant Brandt's Cormorant Black-necked Grebe Brown Booby	<i>Aechmophorus occidentalis</i> <i>Chroicocephalus ridibundus</i> <i>Fregata magnificens</i> <i>Larus delawarensis</i> <i>Oceanodroma microsoma</i> <i>Phalacrocorax auritus</i> <i>Phalacrocorax penicillatus</i> <i>Podiceps nigricollis</i> <i>Sula leucogaster</i> <i>Thalasseus maximus</i>	Minor bycatch	<5% catch of UoA
ETP (PI 2.3.X)				
Blue footed boobies	Blue footed boobies	<i>Sula nebouxii</i>	ETP	National legislation: NOM 096
Brown pelicans	Brown pelicans	<i>Pelecanus occidentalis</i>	ETP	National legislation: NOM 096
Other Sea birds	Pink-footed shearwater Black-vented shearwater Heermann's gull Yellow-footed gull Elegant Tern	<i>Puffinus creatopus</i> , <i>Puffinus ophistomelas</i> , <i>Larus heermanni</i> <i>Larus livens</i> <i>Thalasseus elegans</i>	ETP	National legislation: NOM 096
Marine mammals	Short-beaked common dolphin Spotted dolphin Bottlenose dolphin Californian Sea Lion	<i>Delphinus capensis</i> , <i>Stenella attenuate</i> , <i>Tursiops truncates</i> , <i>Zalophus californianus</i> ,	ETP	National legislation: NOM 096

Sea turtles	Olive ridley turtle	<i>Lepidochelys olivacea</i> ,	ETP	National legislation: NOM 096
	Black turtle	<i>Chelonia agassizii</i>		
Fish and shark Species	Giant seahorse	<i>Hippocampus ingens</i>	ETP	National legislation NOM 096 NOM 017 NOM 029
	Cortez angelfish	<i>Pomacanthus zonipectus</i>		
	Striped marlin	<i>Kajikia audax</i>		
	Sailfish	<i>Istiophorus platypterus</i>		
	Totoaba	<i>Totoaba macdonaldi</i>		
	White shark	<i>Carcharodon carcharias</i>		
	Smoothtail mobula	<i>Mobula munkiana</i>		
	Whale shark	<i>Rhincodon typus</i>		

2.6.3 Retained Species

Main Retained Species

Biology & Status

Bocona Sardine

Bocona sardine (*Cetengraulis mysticetus*) is primarily an inshore species, residing over mudflats. *Bocona sardine* forms large schools, and their range spans from southern California to northern Peru, including the Revillagigedo and the Galapagos Islands. The population is considered stable, with particularly high abundance in Nicaragua and Panama. In Panama, the species is associated with upwelling in the Gulf of Panama, migrating to shallower waters between February and April (Cotto et al., 2010).

FishBase reports the maximum length of the *bocona sardine* at 22cm, with maturity reached at 12.9cm. The maximum recorded age for the species is three years. Juvenile *bocona* feed primarily on diatoms and silico-flagellates, as well as dinoflagellates and small crustaceans. Adults feed on benthic diatoms. *Bocona* are oviparous and have pelagic larvae.

Bocona are a highly commercial species, and is primarily used as a baitfish for tuna, or processed into fishmeal or oil. It is mainly caught within 8km of shore using lamps, with cast nets for local consumption, or purse seines for the commercial fishery. Harvests tend to fluctuate, with peaks every 2-4 years. However, it is not believed that commercial fishing is having a detrimental impact on populations (Cotto et al. 2010).

The catch of *bocona sardine* gained importance starting in 1990, with a first peak in the 1991/92 fishing season, where it accounted for 16 % of catch for the fleet, followed by a decline and peaks 2000/01, 2005-06 and in 2011-12, the latter fishing season accounted for the highest landings recorded (197, 354 mt) representing 43% of catch for the small pelagics fleet (Nevárez-Martínez et al. 2016d). The trend for *bocona* suggests the stock has remained stable throughout the history of the fishery.

Using a biomass dynamics model Nevárez-Martínez et al. (2016d) calculated biological reference points for *bocona sardine*. The fishing mortality rate at MSY was estimated to be 0.2620 and MSY equal to 185,485 mt (See Table 12). No estimates of fishing mortality rates using ASAP are available for *bocona*, but FishBase reports an intrinsic population growth rate that is several times higher than that of the thread

herring. Therefore, given the high productivity of the species and the opportunistic nature of the catch, it is reasonable to assume the species is being harvested at levels that are highly likely to keep the stock within biologically based limits.

Table 12. Biomass model parameter and biological reference points for *bocona* sardine (*Cetengraulis mysticetus*) in the Central-Northern Gulf of California fishery. From Nevárez-Martínez et al. 2016d

Parameter	<i>Bocona</i> sardine
R	0.5240
K	1,415,800
B ₀	360,000
B _{MSY}	707,900
MSY	185,485
F _{MSY}	0.2620
f _{MSY}	3,885
Q _{med}	6.7452E-05

The biomass dynamics model pools catch of *bocona* sardine and thread herring, allowing estimation of *bocona* biomass trend simultaneous with that of thread herring. Recorded catches for *bocona* appear below estimated BMSY for most of its trajectory, except in fishing season 2011-12 where it surpasses BMSY (See Figure 24). Estimated biomass is also expected to be above BMSY, however, interpretations of biomass trends are limited due to problems with poor model fit which are discussed in more detail in the background section for thread herring (See *Stock Assessment* (p. 56).

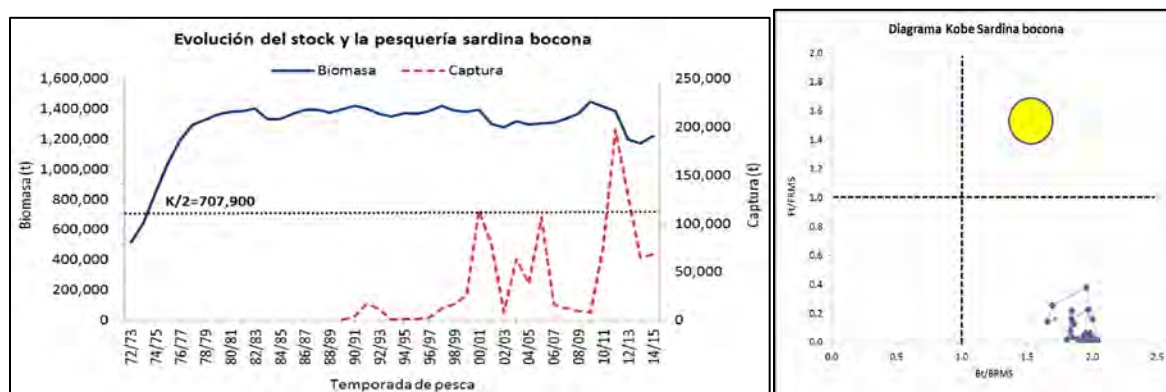


Figure 24. (Left) Biomass trajectories of *bocona* sardine in the Gulf of California estimated using a biomass dynamics model with environmental forcing. Reproduced from Nevárez-Martínez et al (2016d). (Right) Kobe plots with stock status history of *bocona* sardine in the Gulf of California. From Nevárez-Martínez et al. 2016d

The status of the stocks were represented using Kobe plots for the last three fishing seasons (2012/13, 2013/14 and 2014/15), show that the biomass is about twice the level producing MSY while the fishing mortality rate has been much lower than the level producing the MSY, indicating that overfishing is not taking place.

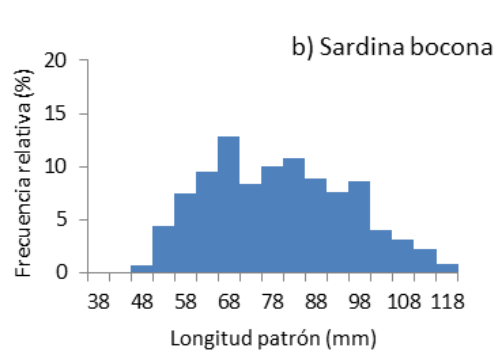


Figure 25. Frequency distribution of sardine bocona fishing season 2014/15. From Nevárez-Martínez et al. 2015a

Samples for size composition for *bocona* sardine, during three samples, show an average length of 79.3 mm, with records of sizes between 38 and 118 mm (Figure 25). A preliminary estimate conducted for the Sinaloa area, in the southern Gulf of California, indicates a mean maturity length (L50) of 148 mm for *bocona* sardine (Cisneros-Mata et al. 1988 in DOF, 8th November 2012). FishBase reports *bocona* sardine maturity is reached at 129 mm in length. Spatial variations for reproduction size are encountered in other small pelagic species, as evidenced with Pacific sardine, however, with the available size reference points the current catch distribution for *bocona* sardina appears to be composed entirely of juveniles.

Chub Mackerel

Chub mackerel (*Scomber japonicus*) is a cosmopolitan species distributed in tropical and subtropical waters of the Atlantic, Indian and Pacific Oceans, as well as in their marginal seas (Collette and Nauen 1983). In the Eastern Pacific, the most important population is distributed in the California Current System, including the Gulf of California, where it is associated with marginal, near-shore upwelling. In the Gulf of California, this fish is distributed in the central and southern provinces in near-shore waters (Roedel 1948; Walker 1953). Chub mackerel tends to “forms schools segregated by size, can also form mixed schools with other species” (Collete 1995 in DOF, 8th November 2012).

For the Gulf of California the reproductive period is reported from late fall to winter-spring, generally from November to April, with a maximum between January and March, the main spawning areas are Guaymas and Yavaros (DOF 2012). “Spawning most often occurs at water temperatures of 15° to 20°C. Spawn in several batches with 250 to 300 eggs per g of fish with the total number of eggs per female ranging from 100,000 to 400,000.” (Collette and Nauen, 1983). The mean maturity length (L50) for the Gulf of California is of 228.0 mm (DOF, 8th November 2012).

Chub mackerel has been present in the catch of the Sonora small pelagics fleet from the start of the fishery in the early 1970s, although initially with low volumes. As the other small pelagic species, chub mackerel also presents trends of variable abundance. Peaks appear to be on an approximate five year cycle. The highest landings over 40,000 mt are recorded in 1998/99 (40,535 mt) when it accounted for 25% of catch composition of the fishery, in 2011-12 (47,600 mt) representing 10% of total catch and in 2013-14 (40,640 mt) with 14% of catch. Nevarez-Martínez et al. (2016) indicates that some investigations estimated

mackerel yield and biomass (Table 13). Martinez-Zavala et al. (2006) report that the Gulf mackerel show no signs of overexploitation.

Table 13. Maximum sustainable yield (MSY) and associated mean biomass of Gulf of California chub mackerel, using the predictive model of Thompson Bell, with input values the results of cohort analysis (Sparre et al. 1989). Reproduced from Nevárez-Martínez et al. 2016e

Period	MSY (t)	Associated mean Biomass (t)	Authors
1991/92 - 1992/93	10,039	8,742	Cisneros-Mata <i>et al.</i> 1997
1993/94 - 1995/96	11,243	10,228	Cisneros-Mata <i>et al.</i> 1997
1996/97 - 1997/98	2,494	1,680	Martínez-Zavala <i>et al.</i> 2000
1998/99 - 1999/00	43,383	38,629	Martínez-Zavala <i>et al.</i> 2006
2000/01 - 2002/03	8,168	7,820	Martínez-Zavala <i>et al.</i> 2006

Using a biomass dynamics model Nevárez-Martínez et al. (2016e) calculated biological reference points for *bocona* sardine. The fishing mortality rate at MSY was estimated to be 0.350 and MSY at 70,000 mt (See Table 14). As with *bocona* sardine, no estimates of fishing mortality rates using ASAP are available for chub mackerel.

Table 14. Biomass model parameter and biological reference points for chub mackerel (*Scomber japonicus*) in the Central-Northern Gulf of California fishery. From Nevárez-Martínez et al. (2016e).

Parameter	Chub mackerel
R	0.700
K	400,000
B ₀	360,000
B _{MSY}	200,000
MSY	70,000
F _{MSY}	0.350
f _{MSY}	1,964
q _{med}	1. 78E-04

The biomass dynamics model pools catch of chub mackerel indicate that recorded catches are far below the estimated B_{MSY} for all of its trajectory (See Figure 26Figure 24).

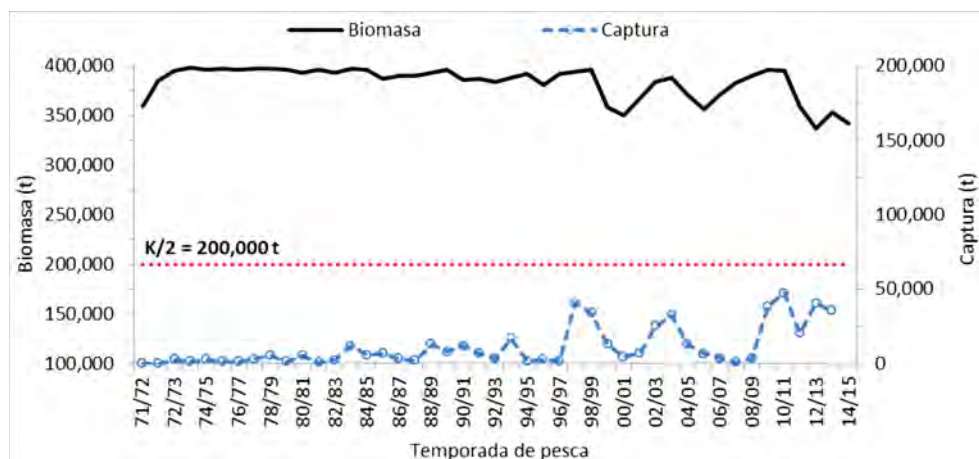


Figure 26. Biomass trajectories of chub mackerel in the Gulf of California. Reproduced from Nevarez-Martinez et al. (2016e).

Kobe plots for the assessment of chub mackerel show positive results in terms of exploitation and current state of the population, with all years indicating that estimated biomass is above B_{MSY} and average fishing mortality rate remains below F_{MSY} , thus there is no risk of overfishing (Figure 27) (Nevárez-Martínez et al. 2016e).

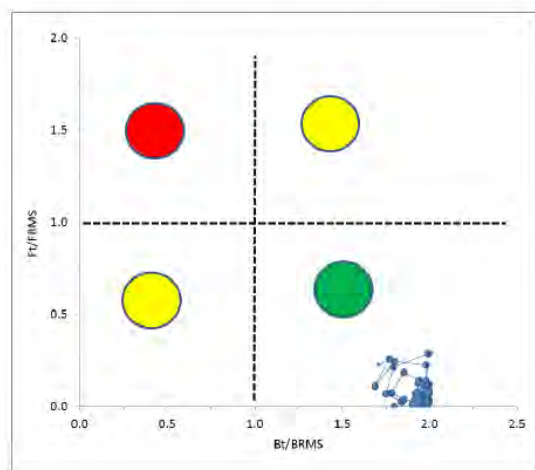


Figure 27. Kobe plots with stock status of mackerel (*Scomber japonicus*) in Gulf of California. Reproduced from Nevárez-Martínez et al. 2016e

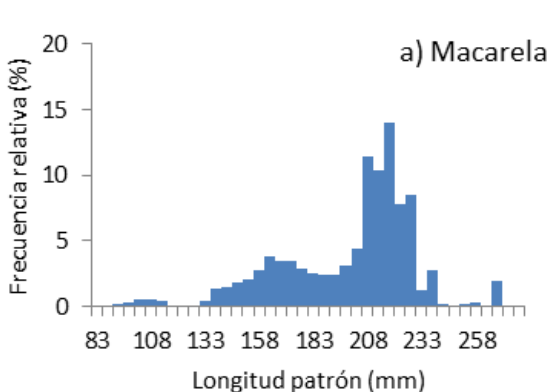


Figure 28. Size frequency distribution of chub mackerel fishing season 2014/15. From Nevárez-Martínez et al. 2015a

Samples for size composition for chub mackerel, show an average length of 199.9 mm, with records of sizes between 83 and 278 mm. (Figure 28). As described in the biology section the mean maturity length (L50) for the Gulf of California is estimated to be 228.0 mm (DOF, 8th November 2012).

Management

As part of the fishery for small pelagics *bocona* sardine and chub mackerel are managed by the federal government of Mexico since 1993 under the provisions outlined in the Norma Oficial Mexicana (NOM) 003-PESC-1993. The NOM 003 also regulates fishing gear and fleet capacity, and size restrictions.

The implementation of management provisions are guided and informed by the 2012 Small Pelagics Fishery Management Plan (SFMP) and the National Fisheries Charter (CNP). The basic management strategy for the multispecies purse-seine fishery in the Gulf of California, as advised in the National Fisheries Charter is to stay at or below the exploitation rate of 0.25F, which is equal to 0.9 FMSY (Nevárez-Martínez et al. 1999). Based on this premise the SFMP provides of guidance for the establishment of conceptual reference points intended to maintain the sustainability of the stocks. The SFMP defines a “prudent level of catch” as Biologically Acceptable Catch (BAC) (equivalent to a Limit Reference Point), where operationally overfishing occurs if the catch exceeds the BAC. For a more complete description of the management systems for the Gulf of California small pelagics fishery see Background Section 3.3.2 *Management* (p. 28).

Under the 2012 SFMP *bocona* sardine is designated under the ‘passive management’ category which is intended for those stocks “[...] that do not require intensive management and where monitoring of landings and abundance indices are considered sufficient for handling.” For species that are passively managed BAC is equal to 25% of the estimated spawning biomass. When the projected catches for the species or species are expected or estimated to exceed the CBA, emergent actions may be adopted to establish or modify allowable catch levels by species. This may require moving species from passively to actively management categories.

Chub mackerel is designated under the ‘active management’ category. For species that are actively managed the SFMP has added an MSY-based control rule that, based on the application of a harvest

rate, forces the catch to be reduced if the biomass declines until eventually, if a biomass threshold is reached, the fishery stops operating.

The SFPM lists other types of control rules including CPUE, minimum size, and emerging management actions that can be taken when reaching or exceeding one or more reference points; temporary or zone closures, establishment or change of minimum size limits, change of allowable catch levels by species and effort restrictions. For some species such as Pacific sardine, there are size restrictions, this is not the case for *bocona* sardines.

As part of the scientific research objectives in the SPFMP commercial fisheries landings are monitored. The status of the stock of these species are assessed every 3-4 years. For chub mackerel there is also a work plan for future evaluations in the near future, including: processing of biological data (growth parameters, mortality indices), processing of size distribution, application of independent abundance indices, processing of information from the acoustic data and application of age based methods to the stock status.

Information

The catch and effort statistics information for *bocona* sardine and chub mackerel come from the landing tickets (*Aviso de Arribo*) of the smaller pelagic catches from the Guaymas and Yavaros ports, Sonora, which are provided by the Federal Fishing Offices-SAGARPA. For *bocona* sardine there are available annual series of catch and effort for 26 fishing seasons (1989/90 - 2014/15).

Observations from on board boats and interviews with fishermen, indicate that there are discards of small pelagic species when the fenced school is too large and does not fit in the hold or when small sizes are caught (Del Monte 2008). However, no information has been provided for discards of *bocona* sardine or chub mackerel.

Dynamic biomass models were used to assess the state of the *bocona* and chub mackerel stocks. For *bocona* sardine biomass trajectories for this model are flat and the fit of the model predicted catch to the observed catch is very poor. Additionally, no confidence intervals are presented for this model. Dynamic biomass models require trends in abundance index, or at least time periods with significantly different values of abundance which are related to changes in catch to fit the data. Without more details about the data and the model no clear determinations can be made.

Minor Retained Species

A comprehensive list of all minor retained species can be found in Appendix 13.1 (p. 313). In both fishing seasons, catch does not exceed 0.12% of the total catch of small pelagics catch. The species here include representatives of families of bony fish, such as families: Gerreidae (*mojarras*), Carangidae (jacks), Scombridae (sierras), Sciaenidae (drums or croakers), Ariidae (catfish) and Mugilidae (mullets). There was incidence of various genus of cartilaginous fish such as rays (*Myliobatis*, *Urobatis*, *Rhinoptera*) and sharks (*Alopias* and *Carcharhinus*), and also crustacean species families were presented such as Penaeidae (blue

shrimp and brown shrimp) and *Portunidae* (blue crab and brown crab). Less frequently presented were mollusk species, including the giant squid (*Dosidicus gigas*) and a clam (*Magapitaria squalida*). Within cnidarians species occurred in purse seines cannonball jellyfish (*Stomolophus meleagris*) was present.

During the fishing season 2012-2013, 77 species representing a total weight of 52.18 tons were identified, the biggest catch species were catfish of genus *Ariopsis* sp. (29.5%); followed by bronze-striped grunt (*Orthopristis reddingi*) (20.9%); Gerridae (*mojarra*) (15.5%) and flathead grey mullet (*Mugil cephalus*) (8.3%). In contrast, in the fishing season 2013-2014 89 species representing 36.7 tons in weight were identified, major captures are represented by striped *corvina* (*Cynoscion reticulatus*) (39.7%); gulf croaker (*Micropogonias megalops*) (11.8%); Gerridae (11.7%) and Pacific sierra (*Scomberomorus sierra*) (9.7%). These estimates do not consider seabird species, which were quantified by number of individuals and not by weight.

Padilla-Serrato et al. (2015) estimate the Biological Value Index (BVI) (Sanders, 1960) for bycatch species in the Observer Program Report of INAPESCA. The results indicate that *rayadillo* or bronze-stripped grunt (*Orthopristis reddingi*); *Balistes polylepis* and *Scomberomorus sierra* are the most important fish species. Bronze-stripped grunt was the most abundant species of all fish captured as bycatch. There is currently no population information available for this species. The IUCN lists it as Least Concern, with a wide distribution along the Mexican coast and no major threats (Allen & Robertson, 2010).

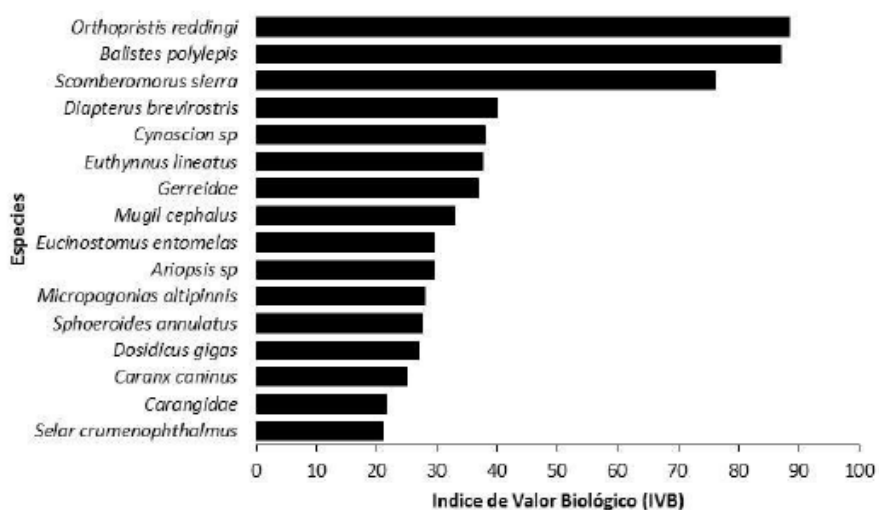


Figure 29. Captures of fish, by abundance, as bycatch in the small pelagic purse seine fishery January 2013 – August 2014 (Padilla Serrato et al. 2015).

Thirteen elasmobranch species were recorded, all captured at very low levels, and none are listed as ETP species either under Mexican NOM-059 or under CITES Appendix I. (See Table 15). As explained previously, there is no information on discards, thus all of these species are assumed to be retained. *Sphyrna lewini* is '[...] heavily exploited through its range in the Eastern Pacific [...] S. lewini aggregation site in the Gulf of California (Espiritu Santo seamount) has declined sharply since 1980.' (Baum et al. 2007). This species is categorized as Endangered by the IUCN Red List and included in CITES Appendix II. Despite their

vulnerable status, relative catch volumes of the thirteen shark and ray species are negligible, and are not considered to be significant enough to affect their respective populations.

Table 15. List of sharks and rays encountered by the fishery and their IUCN Red List conservation status

	Common Name	Scientific Name	IUCN Status	Pop. Trend	CITES
1	Dusky shark	<i>Carcharhinus obscurus</i>	Vulnerable	Decreasing	
2	Pacific cownose ray	<i>Rhinoptera steindachneri</i>	Near Threatened	Unknown	
3	Scalloped hammerhead	<i>Sphyrna lewini</i>	Endangered	Unknown	II
4	Spotted eagle ray	<i>Aetobatus narinari</i>	Near Threatened	Decreasing	
5	Shortfin Mako*	<i>Isurus oxyrinchus</i>	Vulnerable	Decreasing	
6	Horn shark	<i>Heterodontus francisci</i>	Data Deficient	Unknown	
7	Diamond stingray	<i>Dasyatis dipterura</i>	Data Deficient	Unknown	
8	Ocellated electric ray	<i>Diplobatis ommata</i>	Vulnerable	Unknown	
9	Bat eagle ray	<i>Myliobatis californica</i>	Least Concern	Unknown	
10	Giant electric ray	<i>Narcine entemedor</i>	Data Deficient	Unknown	
11	Stingray	<i>Urobatis sp</i>	-	-	
12	Shovelnose guitarfish	<i>Rhinobatos productus</i>	Near Threatened	Decreasing	
13	Pacific smalltail shark	<i>Carcharhinus cerdale</i>	Not Evaluated		

* Information only for Lamnidae common name mako assumed to be Shortfin Mako due to distribution

Under Mexican law the management of shark and ray species is regulated by NOM 029, which applies to the directed shark and ray fishery, as well as those fisheries that catch these species as bycatch (Clause 1.2). Specific operational measures articulated in NOM-029 relevant to sharks and rays include the following possible activities and requirements: (1) fishers who don't target but may capture shark and ray species that they carry logbooks on board their vessels to record catches of these species (Clause 0.20) and use identification guides (Clause 0.21). Lastly, all shark individuals must be retained on board commercial fishing vessels for full use except for protected species. The exclusive use of the fins of any shark species is prohibited and in no case shark fins can be landed whose bodies were not on board. (Clause 4.2.1.).

2.6.4 Bycatch Species

Out of the 17 seabird species recorded by the observer program, ten sea bird species categorized as 'bycatch' are covered in this section, the remaining seven seabird species are categorized as 'ETP' and are reviewed in next section of the report.

During the onsite-meeting, COBI provided a breakdown of mortality estimates based on data from the observer program, where seabirds exposed to fish oil were designated as 'oiled' with presumably low post-release survivorship, effects of fish oil on birds are discussed in this report (See Sectio: nETP Seabirds p. 83).

Table 16. List of non-protected seabird species bycaught in the small pelagic fishery in Gulf of California. Preliminary results of analysis of the number of non-protected dead seabird individuals based on information from the observer program aboard the Sonora sardine fleet (COBI, 2016 unpublished data).

	Species	Spanish Common name	English Common Name	IUCN Status	Harmed	Oiled	Dead
1	<i>Aechmophorus occidentalis</i>	Achichiliquepico amarillo	Western Grebe	Least Concern			
2	<i>Chroicocephalus ridibundus</i>	Gaviota reidora	Black-headed Gull	Least Concern			
3	<i>Fregata magnificens</i>	Fragata magnifica	Magnificent Frigatebird	Least Concern	0	14	1
4	<i>Larus delawarensis</i>	Gaviota pico anillado	Ring-billed Gull	Least Concern	0	20	0
5	<i>Oceanodroma microsoma</i>	Paiño menor	Least Storm-Petrel	Least Concern			
6	<i>Phalacrocorax auritus</i>	Cormoran orejudo	Double-crested Cormorant	Least Concern	0	75	7
7	<i>Phalacrocorax penicillatus</i>	Cormoran de Brandt	Brandt's Cormorant	Least Concern	0	13	7
8	<i>Podiceps nigricollis</i>	Zambullidor orejudo	Black-necked Grebe	Least Concern	0	28	9
9	<i>Sula leucogaster</i>	Bobo café	Brown Booby	Least Concern	2	100	113
10	<i>Thalasseus maximus</i>	Charran real	Royal Tern	Least Concern			

All seabirds species in are listed Least Concern by IUNC. According to the data obtained by the observers, the brown booby is the non-ETP seabird species with the highest number of dead individuals, followed by the double-crested cormorant. A brief summary of the available information on the status of these two species is provided below.

Brown booby

Brown booby (*Sula leucogaster*) is a species with an extremely large range found throughout the pantropical oceans. The global population is estimated to number > 200,000 individuals (del Hoyo et al. 1992 in BirdLife International, 2015). In the Eastern Pacific the brown booby is a ubiquitous seabird with several nesting colonies through the Gulf of California, where pairs were estimated to be about 50, 000-60,000 in the early 80's (Mellink et al. 2001). The population trend for this species is considered to be decreasing. However, due to its large range and population, the brown booby does not approach the not approach the thresholds for 'Vulnerable' under the IUCN Red List Assessment criterion and is thus evaluated as 'Least Concern' (BirdLife International, 2015).

According to Mellink et al. (2001):

Despite being widespread and common, little information about the ecology of Brown Boobies has been published. Knowledge of their diet is important because of their abundance and because of the large numbers of other fish eating homeotherms with which they share the habitat. It is also important because of the presence of an intensive fishery near some of the breeding colonies.

Their diet is diverse and varies regionally and seasonally. Studies of the diet of brown boobies in the Gulf of California include they fed on Pacific sardines (*Sardinops sagax*), northern anchovies (*Engraulis mordax*), flying fish (*Cheilopogon papilio*), chub mackerel (*Scomber japonicus*), and halfbeaks (*Hyporhamphus sp.*)

(Mellink et al. 2001). Studies of diet at Isla San Jorge in the Gulf of California suggest that when abundance of small pelagics species decreased, brown boobies replaced their diet with a wide number of other species (Mellink et al. 2001).

Double Crested Cormorant

According to Ward (2000):

Double-crested cormorants breed across North America, as far north as southern Alaska. They winter in North America as far south as Sinaloa, Mexico, and are common on marine and inland waters throughout their range. (Hatch and Weseloh, 1999; Pearson, 1936; Perrins, 1990)

Populations of double-crested cormorants have increased dramatically over the last thirty years. This species has no special protection under CITES or the Endangered Species Act. It is, however, protected under the U.S. Migratory Bird Act.

An assessment of the status for double-crested cormorants in western North America in 2009, “[...] estimated that cormorant numbers in the Pacific Region (British Columbia, Washington, Oregon, and California) increased 72% from 1987–1992 to circa 2009” (Adkins et al. 2014). However, double-crested cormorants nesting in northwestern Mexico were excluded in this study because of “[...] the lack of availability of recent and possibly future survey data and greatly differing management of colonies in that region” (Adkins et al. 2014).

Double crested cormorants are protected in in the United States and Mexico under the Migratory Bird Treaty Act.

2.6.5 Endangered, Threatened and Protected (ETP) Species

Both the INAPESCA (Padilla-Serrato et al. 2015) and the COBI (García and Gastellum 2015) reports provided information on number of encounters and mortalities for ETP species (Table 18). Based on the reported mortalities and taxonomic groups, the assessment team grouped the 21 reported ETP species into six scoring elements: (i) brown pelican, (ii) blue-footed booby, (iii) other sea birds species, (iv) marine mammal species, (v) sea turtles and fish and (vi) sharks species (Table 11).

Morales-Bojórquez (in press) concludes that ETP fauna attracted by fishing operations of the Mexican Pacific sardine fishery was lower in the east coast compared to the west coast of the Gulf of California. The results from the observer program showed a latitudinal gradient of endangered and threatened marine fauna attracted by fishing operations. The region of the upper Gulf of California showed low spatial and temporal frequency of species attracted by fishing operations (zones I, II and VII Figure 2). The sardine fishery showed limited activity in this region because the upper Gulf of California is an important site for spawning, mating and nursing for numerous species of commercial and ecological importance, and fishing activity is limited and/or forbidden (Morales-Bojórquez in press).

Table 17. ETP species recorded by 10% observer coverage from fishing season 2012-13 and 2013-14. National legislation NOM-059-SEMARNAT-2010: Extinct in the wild (E), Endangered (P) threatened (A) and of species concern (Pr). Reproduced from data from Padila-Serrato (2015) and Garcia-Gastellum et al. (2015).

English Common Name	Spanish Common Name	Species	National legislation	IUCN	CITES
Fishes / Peces					
Giant seahorse	Caballito de mar	<i>Hippocampus ingens</i>	NOM-059 (A)	VU	II
Cortez angelfish	Ángel de Cortés	<i>Pomacanthus zonipectus</i>	NOM-059 (Pr)	LC	II
Striped marlin	Marlín rayado	<i>Kajikia audax</i>	NOM-017-PESC-1994	NT	
Sailfish	Pez vela	<i>Istiophorus platypterus</i>	NOM-017-PESC-1994	LC	
Totoaba	Totoaba	<i>Totoaba macdonaldi</i>	NOM-059 (P)	CR	I
White shark	Tiburón blanco	<i>Carcharodon carcharias</i>	NOM-059- (A) NOM-029-PESC-2006	VU	II
Smoothtail mobula	Manta diablo	<i>Mobula munkiana</i>	NOM-029-PESC-2006	NT	
Whale shark	Tiburón ballena	<i>Rhincodon typus</i>	NOM-059- (A) NOM-029-PESC-2006	VU	II
Sea turtles / Tortugas					
Olive ridley turtle	Tortuga golfina	<i>Lepidochelys olivacea</i>	NOM-059- (P) NOM-162- SEMARNAT-2012	VU	I
Black turtle	Tortuga prieta	<i>Chelonia agassizii</i>	NOM-059- (P) NOM-162- SEMARNAT-2012	EN	I
Seabirds / Aves					
Pink-footed shearwater	Pardela pata rosada	<i>Puffinus creatopus</i>	NOM-059- SEMARNAT-2010 (Pr)	VU	
Black-vented shearwater	Pardela mexicana	<i>Puffinus ophistomelas</i>	NOM-059- SEMARNAT-2010 (P)	NT	
Blue-footed booby	Bobo pata azul	<i>Sula nebouxii</i>	NOM-059- SEMARNAT-2010 (Pr)	LC	
Brown pelican	Pelicano pardo	<i>Pelecanus occidentalis</i>	NOM-059- SEMARNAT-2010 (A)	LC	
Heermann's gull	Gaviota ploma	<i>Larus heermanni</i>	NOM-059- SEMARNAT-2010 (Pr)	NT	
Yellow-footed gull	Gaviota pata amarilla	<i>Larus livens</i>	NOM-059- SEMARNAT-2010 (Pr)	LC	
Elegant tern	Charrán elegante	<i>Thalasseus elegans</i>	NOM-059- SEMARNAT-2010 (Pr)	NT	
Marine mammals / Mamíferos marinos					
Short-beaked common dolphin	Delfín común	<i>Delphinus capensis</i>	NOM-059- SEMARNAT-2010 (Pr)	LC	II
Spotted dolphin	Delfín manchado	<i>Stenella attenuata</i>	NOM-059- SEMARNAT-2010 (Pr)	LC	II
Bottlenose dolphin	Delfín nariz de botella	<i>Tursiops truncatus</i>	NOM-059- SEMARNAT-2010 (Pr)	LC	II
Californian Sea Lion	Lobo marino	<i>Zalophus californianus</i>	NOM-059- SEMARNAT-2010 (Pr)	LC	

Table 18. List of ETP species recorded by observer coverage by number of organisms encountered and number of mortalities (approximately 10% fleet coverage. Reproduced from data from Padilla-Serrato et al. (2015) n=2,134 sets and from García and Gatellum (2015) n=2,059 sets

Species	Estimated Capture Rate (%)		No. Org. Encountered		No. Mortalities	
	Padilla	G&G	Padilla	G&G	Padilla	G&G
Fishes						
<i>Giant seahorse</i>	0.42	0.39	9	8	5	8
<i>Cortez angelfish</i>	0.093	0.05	2	1	2	1
<i>Striped marlin</i>	0.14		5		5	
<i>Sailfish</i>						
<i>Totoaba</i>		0.19		4		4
<i>White shark</i>				1		1**
<i>Smoothtail mobula</i>	0.04		4		4	
<i>Whale shark</i>	0.09	*	1	4	-	0
Turtles						
<i>Lepidochelys olivacea</i>	0.14	0.15	3	3	-	0
<i>Chelonia agassizii</i>	0.14	0.15	3	3	-	0
Birds						
<i>Puffinus creatopus</i>	0.99	0.5	34	412	-	11
<i>Puffinus ophistomelas</i>	1.6	*	43	39	-	0
<i>Sula nebouxii</i>	12.23	2.2	9,236	9,624	101	46
<i>Pelecanus occidentalis</i>	61.15	38.6	67,357	65,313	83	794
<i>Larus heermanni</i>	25.39	3.4	22,438	22,010	2	70
<i>Larus livens</i>	3.23	0.7	687	1,743	-	15
<i>Thalasseus elegans</i>	0.75	0.1	230	718	-	2
Marine mammals						
<i>Delphinus spp</i>	4.4		1,085		34	
<i>Delphinus capensis</i>		0.7		704		8
<i>Stenella attenuata</i>		0.7		15		0
<i>Tursiops truncatus</i>		0.7		190		10
<i>Zalophus californianus</i>	46.11	54.0	9,375	8,954	1	0

*only observed no interaction with gear

** Where some of most individuals were retained

ETP Regulations

In Mexico, ETP species are defined by NOM-059-SEMARNAT-2001 (DOF 20² that includes a list of species and their conservation status in Mexico based on their risk category. The species listed in this norm are protected by the Penal Federal Code (*Código Penal Federal* DOF 18-07-2016) that considers as an offense any illegal activity for the purpose of trafficking, capture, possession, transport, collection, introduction to the country, extraction of the country, of species found in NOM-059-SEMARNAT-2010 (Article 420, Section IV, DOF 18-07-2016). It employs the following categories: extinct in the wild (E), endangered (P) threatened (A) and of species concern (Pr). The use and management of species and populations at risk

² For a quick view of definition of the categories visit

http://www.biodiversidad.gob.mx/v_ingles/species/riskMexico.html

must be carried out in accordance with the provisions of article 87 of the *Ley General del Equilibrio Ecológico y la Protección del Ambiente* (LGEEPA), and articles 85 and 87 and other applicable in *Ley General de Vida Silvestre* (LGVS).

Complementary, the General Fisheries Law (2015) tasks the Secretariat of the Environment and Natural Resources (SEMARNAT, *Secretaría de Medio Ambiente y Recursos Naturales*) and the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) with the execution of five objectives for environmental conservation, among them “to issue measures to protect chelonians, marine mammals and aquatic ecosystems subject to a special state of protection and determined with the participation of the Secretariat and other competent agencies. It shall also establish the closures, total or partial, relating to these species” (*Ley General De Pesca Y Acuacultura Sustentables* 2015: Article 9o). Under the Fisheries Law ETP species are treated as ‘incidental capture’, thus subject to any incidental capture volumes determined by SAGARPA for each fishery according to zones, seasons and fishing gear (article 66). Additional regulations protecting marine species include NOM-029-PESC-2006 for sharks, NOM-017-PESC-1994 for species restricted for sport fishing and NOM-162-SEMARNAT-2012 for sea turtles (See Table 8).

The assessment team did not identify any “quantitative mortality limits” for ETP species in this fishery.

Fish and Other Species

For the eight registered ETP fish and shark species, the overall estimated capture rate was below 0.5%. Though post-capture mortality is high for most of the species, with the exception of whale shark (*R. typus*) that was only observed but did not interact with the net. For the other species the numbers of individuals captured are extremely low even with assumed 100% post-capture mortality.

Only four individuals of Totoaba (*Totoaba macdonaldi*) are registered as captured, there are records that at least two of these individuals were retained for consumption by the crew. This species is endemic to the Gulf of California and considered to be ‘Critically Endangered’, and the current population trend is believed to be continuing to decrease (Findley, L. 2010.) This species is protected under NOM-059-SEMARNAT-2010 and its commercialization is forbidden.

A single individual of great white shark (*C. carcharias*) was captured and retained. Only four individuals of smoothtail mobula were recorded as captured, there is no confirmation whether these individuals were retained or discarded, however, observer data indicates that species identified as ‘*Mantas*’ were retained. Though this numbers are extremely low, these species are protected by NOM-029-PESC-2006, which indicates that under no circumstances is it permissible to capture and retain individuals and that these species may not be retained, live, dead, whole or some of its parts and therefore may not be subject to human consumption or marketing (NOM-029-PESC-2006, Clause 4.2.2.) .

Similarly there are records that individuals of sailfish and marlin which were retained for consumption by the crew. These species are protected under NOM-017-PESC-1994, which permits targeted fishing of these species only for sport fishing and prohibits commercialization. The number of individuals of sailfish

and marlin caught were negligible and were not commercialized. The remaining two species of protected fish giant seahorse and Cortez angelfish are recorded as discarded.

Of the two species of sea turtles recorded (*Lepidochelys olivacea*) and (*Chelonia agassizzi*), two and three individuals respectively were captured and released live.

Marine Mammals

Three species of dolphins were recorded, there are some discrepancies between the number and species of dolphin mortalities recorded between the two observer program reports. The COBI report includes three dolphin species (*Delphinus capensis*, *Stenella attenuate*, *Tursiops truncatus*) with eight recorded mortalities for *D. capensis* and 10 for *T. truncatus*, while INAPESCA reports 34 mortalities for *Delphinus spp.* The assessment team speculated that genus *Delphinus spp.* may be referring to *Delphinus capensis*, as it is a common species in the Gulf of California. Unprocessed data collected by the observer program from January 2013 to November 2013 was provided to the assessment team. This information reports dead or injured dolphins in at least seven different sets from four different vessels and on different fishing trips.

The long-beaked common dolphin (*Delphinus capensis*) is 'Data Deficient' by the IUCN Red List (Hammond et al. 2008):

Although the species is widespread and its aggregate abundance probably numbers in the high tens or low hundreds of thousands, in several areas (most notably West Africa, the east and west coasts of South America and East Asia) there are known incidental and directed takes of unknown, but possibly large, magnitude, making it difficult to make a reliable assessment of the impact on the species. Therefore, the Long-beaked Common Dolphin is listed as Data Deficient (Hammond et al. 2008).

Common bottlenose dolphin (*Tursiops truncatus*) is categorized as 'Least Concern' by the IUCN Red List and its population trend is 'unknown' (Hammond et al. 2012)

U.S. National Marine Fisheries Service surveys have estimated 52,000 Bottlenose Dolphins in the northern Gulf of Mexico (3,708 [CV=42%] in oceanic waters beyond the shelf edge (Mullin 2006), 25,320 [CV=26%] on the outer continental shelf, 17,602 in coastal waters, and 5,063 in estuaries, bays, and channels – Waring et al. 2008) [...] Incidental catches of Common Bottlenose Dolphins are known from throughout the species' range, in gillnets, driftnets, purse seines, trawls, long-lines, and on hook-and-line gear used in commercial and recreational fisheries, but the level of mortality is often poorly documented (Wells and Scott 1999).

The Californian sea lion (*Zalophus californianus*) is considered to be of 'Least concern' and current population trend is believed to be increasing. This species was present in >40% of observed sets, but mortality was negligible (n=1).

ETP Seabirds

Estimates of Direct Mortality

Generally purse seine is considered a ‘medium-risk’ gear type for seabirds (Wiedenfeld 2016):

These types of nets can pose risks to all kinds of seabirds, including diving and surface foragers. However, the risk is not as high as it is for other gear types, such as longlines and gillnets. Seabirds usually face greatest risk when shooting or hauling the seine nets [...] During shooting, seabirds may be attracted to discards or remnants from previous fishing, and can become entangled, dragged under, and drowned when attempting to take the food items from the net [...] during hauling, seabirds are attracted to the catch and may be caught in the net as it is being brought to the surface and on board. The birds face risk of drowning and, importantly, being pulled through machinery, such as winches.

The observer program collected data on observed mortalities, injured birds, and birds exposed to fish oil. Mortality estimates included seabirds observed as dead or injured and excluded seabirds that were only observed outside the maneuver and individuals that were released unharmed.

Three different estimates for seabird mortality in the 2013-2014 observed trips were presented to the assessment team (Table 20). Prior to the onsite the assessment team received the reports from Padilla (INAPESCA) and G&G (COBI). During the 2016 onsite-meeting, the differences in recorded mortalities between the two reports, gave place to a discussion amongst the authors of the different approaches for determining mortality. The assessment team was unable to explicitly identify the causes for the differences in analysis of each report, however, it was agreed that a main source of discrepancy is whether the analysis considered the impact of exposure to fish oil on seabird survivorship. Anecdotal evidence (Enriqueta Velarde) suggests that seabirds are exposed to fish oil during fishing operations, and that such exposure may affect seabird’s survivorship. Impacts of oil on seabirds is discussed in the next subsection.

The analysis published by Padilla (INAPESCA) did not consider in the analysis seabirds exposed to fish oil. In the G&G(COBI) and (COBI unpublished) seabirds exposed to fish oil were designated as ‘oiled’ with presumably low post-release survivorship. After the onsite-meeting a third estimate was provided (COBI unpublished), the assessment team used relied on this estimate as it provided with a breakdown of ‘injured’ ‘oiled’ and ‘dead’ (See Table 21).

Table 19. Estimated mortalities for ETP seabird species *only* in observed trips during 2013-2014 aboard the northern Gulf of California small pelagics fleet. Observer coverage is estimated to be 10%. Padilla-Serrato 2015, García and Gastellum 2015 and COBI unpublished data 2016.

Common Name	Species	Estimated No. Mortalities		
		Padilla	G&G	COBI Unpublished
Pink-footed shearwater	<i>Puffinus creatopus</i>	0	11	-
Black-vented shearwater	<i>Puffinus ophistomelas</i>	0	0	2
Blue-footed booby	<i>Sula nebouxii</i>	101	46	344
Brown pelican	<i>Pelecanus occidentalis</i>	83	794	2,168
Heermann's gull	<i>Larus heermanni</i>	2	70	58
Yellow-footed gull	<i>Larus livens</i>	0	15	6
Elegant Tern	<i>Thalasseus elegans</i>	0	2	1

Table 20. Preliminary results of analysis of the number of affected ETP seabird individuals based on information from the observer program aboard the Sonora sardine fleet. (From unpublished data by COBI 2016).

	Common name	Species	Injured	Oiled	Dead	Total
1	Heermann's gull	<i>Larus heermanni</i>	0	49	9	58
2	Yellow-footed gull	<i>Larus livens</i>	0	6	0	6
3	Brown pelican	<i>Pelecanus occidentalis</i>	18	1963	187	2168
4	Black-vented shearwater	<i>Puffinus ophistomelas</i>	0	2	0	2
5	Pink-footed shearwater	<i>Puffinus creatopus</i>	-	-	-	-
6	Blue-footed booby	<i>Sula nebouxii</i>	0	232	112	344
7	Elegant Tern	<i>Thalasseus elegans</i>	0	1	0	1

As Moradin and O'Hara (2014) explain "feathers are important for both insulation and buoyancy on water; feather microstructure, made up of barbs and barbules, creates an interwoven mesh structure with trapped air, which results in a waterproof barrier" There studies indicating that petroleum oils disrupt feather's microstructure which can result in "water penetrating plumage, displacing the layer of insulating air, which may result in hypothermia and death". Moradin and O'Hara (2014) propose that edible oils, such as fish oil may likewise impact seabird feather structure. Feathers were collected from common murre (*Uria aalge*) and rhinoceros auklet (*Cerorhinca monocerata*) carcasses from fisheries incidental take in British Columbia waters, were exposed to crude sardine oil. The results of the experiment concluded that "[...] even the thinnest sheens we tested (0.04 μ m) caused measurable and significant oil and water uptake by feathers." Moradin and O'Hara (2014) explain that the study was initiated in response to a "discharge of approximately 940 l of crude sardine oil, into the marine environment from a vessel 220 km west of Vancouver Island". Additional anecdotal evidence of fish oil impacts only discussed "oil discharged from wet processing at a fish plant and ship holds".

There are no studies published on the effect of sea bird exposure to fish oil during purse-seine fishing operations. A preliminary study of oil concentration in the low in the small pelagic fishery in the southern Gulf of California, concluded that fishing operation/maneuver has no effect on oils concentration in water and that average values of oil are low and unlikely to pose a harm to birds (Cervantes-Jacob et al. 2016b).

Due to the lack of verifiable evidence, beyond anecdotal evidence, that exposure to fish oil during fishing operations affects survivorship of seabirds, the assessment team did not consider this as a certain source of mortality when scoring the ETP species outcome (PI 2.3.1). However, because seabirds are vulnerable to fishery activities, and there is an important overlap of breeding colonies in the fisheries operation area, the assessment team evaluated the impact of fish oil as it relates to information to determine the ETP species outcome (PI 2.3.3).

The observer program recorded interactions with seven species of seabirds protected by the Mexican legislation under NOM-059-SEMARNAT-2010, most species are under the 'species of concern' category, except the black-vented shearwater which is categorized as 'protected' and brown pelican as 'threatened'. According to the IUCN Red List the pink-footed shearwater is categorized as vulnerable and black-vented shearwater, Heermann's gull and elegant tern as 'Near Threatened' while the remaining three species (Blue-footed booby, brown pelican and yellow-footed gull) are considered to be of 'Least Concern'.

Based on the data provided the assessment team found very low to no recorded mortality for five of these bird species: elegant tern, black-vented shearwater, yellow-footed gull, pink-footed shearwater and Heermann's gull. The impact was considered minor and consequently these five species were grouped as one scoring element. The two species with higher mortalities, brown pelican and blue-footed booby, were scored individually.

As discussed in Section 2.6.1 *Observer Programs* (p. 61) of this report, the observer program provided estimates only for the observed samples and not an estimate of total mortalities by the fleet. In some cases the assessment team extrapolated the observer ratios over the whole fleet in order to have an estimate of the total impact of the fishery.

The assessment team also note that the types of cumulative impacts that has been pointed out are dealt with in v2.0 which the fishery will eventually move onto in 5 years-time. Continued monitoring will be important.

Brown Pelicans

Status

Brown pelicans (*Pelecanus occidentalis*) are primarily found in the Americas where they breed along the Pacific and Atlantic coasts and range from as far south as Tierra del Fuego to as far north as Canada. The species is colonial, and movements and migrations tend to depend on local conditions.

The California subspecies (*P. o.californicus*) is considered a metapopulation, composed of colonies of nesting pairs. California brown pelicans disperse north seasonally, along the Pacific coast from nesting areas in the south in search of food, with small numbers dispersing as far as southern British Columbia. California brown pelicans feed primarily on small schooling fishes, including Northern anchovies, Pacific sardines, and Pacific mackerel. Although fluctuations in ocean conditions and forage fish abundance may cause periodic fluctuations in brown pelican populations (Stinson, 2014).

The population is believed to be increasing, though there is uncertainty for some subpopulations. Brown pelicans were considered endangered in North America in the 1970s, primarily due to pesticides such as DDT. Today, they have been delisted from the ESA due to recovery and are considered a species of 'Least Concern' by the IUCN. The Pacific coast and Gulf of Mexico populations were delisted by the U. S. Fish and Wildlife Service under the Endangered Species Act in 2009. These populations were originally listed in 1970 in response to widespread pollutant-related reproductive failures and the population declines that directly resulted (Stinson, 2014).

The total metapopulation of California brown pelicans was estimated to be $70\,680 \pm 2\,640$ breeding pairs in 2006 (Anderson et al. 2013). Anderson et al. 2013 hypothesize that the California Brown Pelican metapopulation is organized into subpopulation zones (Figure 30). The breeding colonies of the GOC subpopulation are believed to be connected by migrations to the subpopulations of the Southern California Bight (SCB) and the Southern Baja-Pacific (SBP). This metapopulation is a "presumed structure" that "should be considered preliminary and subject to future testing".

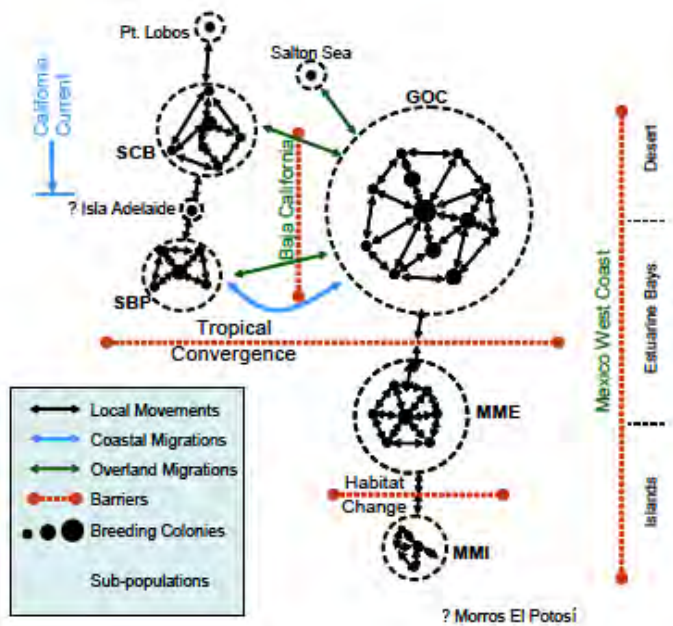


Figure 30. Hypothesized subpopulation zones within the presumed California Brown Pelican metapopulation, Southern California Bight (SCB), Southern Baja-Pacific (SBP) Gulf of California (GOC), Mexican Mainland, Estuarine (MME), Mexican Mainland, Island (MMI) (Reproduced from Anderson et al. 2013).

The largest breeding aggregation of this metapopulation are found in the Gulf of California (GOC) with an estimated $43\,350 \pm 230$ of breeding pairs mainly concentrated in the Midriff Island Area, particularly in the following islands or island groups: Encantadas, Puerto Refugio, Piojo, San Lorenzo Archipelago, San Pedro Martir, San Pedro Nolasco and Chaperona. Approximately 24.4% of the California brown pelican metapopulation is found among two or three island of the San Lorenzo Archipelago (Anderson et al. 2013; Hernandez-Vázquez 2011).

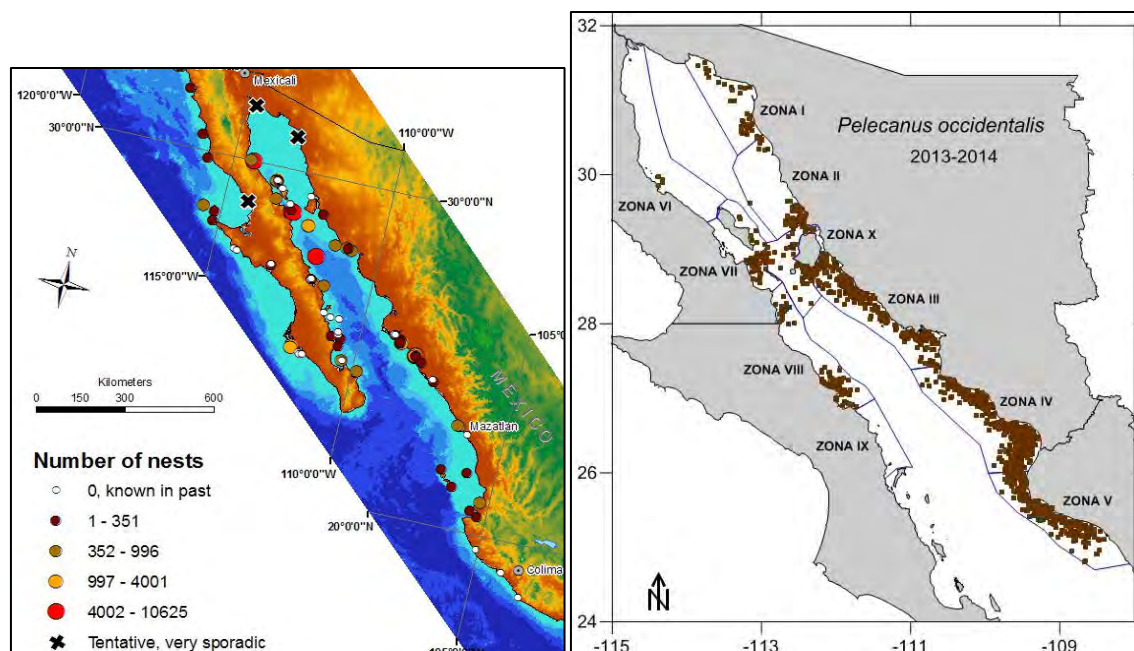


Figure 31. Left: Nesting colonies of California Brown Pelican on the Gulf of California. Reproduced from Anderson et al. 2013). Right: Distribution of observed brown pelicans in the observer program for the small pelagics fleet in the northern Gulf of California. Reproduced from García and Gastellum 2015

Censuses conducted in the northern islands of the GOC in 2004 showed an increase in nesting colonies of brown pelican compared to the 1998 and 2003 ENSO events (Godínez-Reyes et al. 2006). However, since 2006 recent censuses conducted in the region point to a decrease in nesting numbers in the colonies in the southernmost area close to Baja California (Piojo Island and the San Lorenzo Archipelago) (Velarde, 2014 unpublished data)

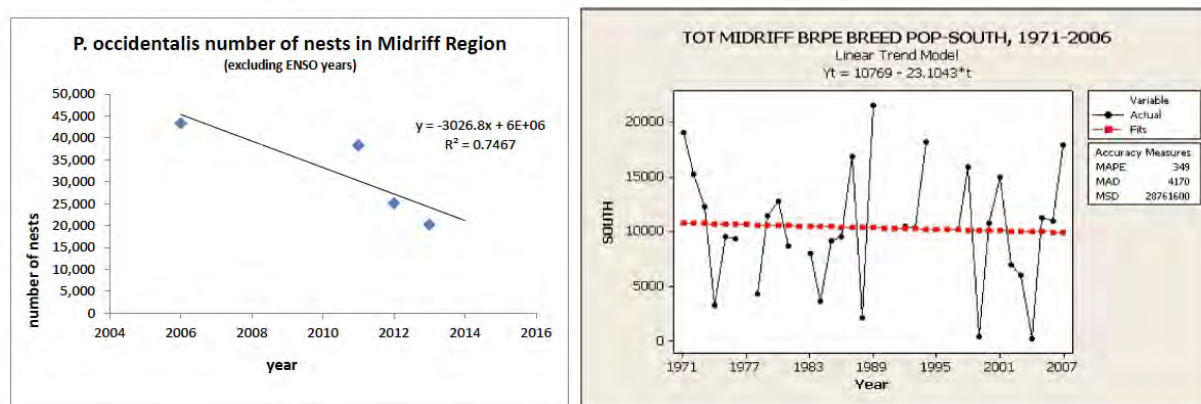


Figure 32. Number of brown pelican nests per year in Midriff Region for 2006, 2011, 2012 and 2013 (Reproduced from Enriqueta Velarde -data provided by D.W. Anderson). Data of number of nests between 1971 and 2007 (Reproduced from Enriqueta Velarde 2014 unpublished).

Variations in size of nesting colonies of brown pelicans in the Gulf of California are affected by the El Niño/Southern Oscillation phenomenon (ENSO) (Ainley et al. 1988 in Anderson et al. 2013). Studies for

other seabird species in the gulf suggest a link between reproductive success and food availability as a result of variations in abundance of small pelagic species (Velarde et al. 2004).

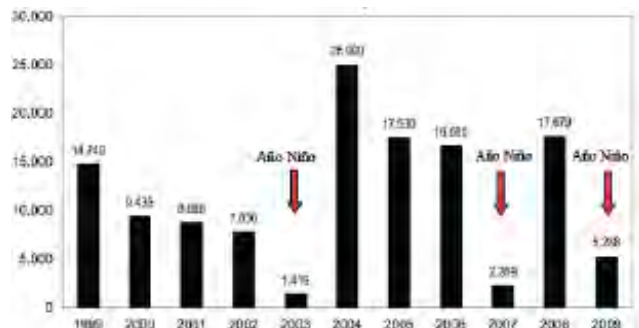


Figure 33. Total number of breeding pair in nesting colonies of brown pelicans in Piojo, Partida, Las Ánimas, San Lorenzo, Ángel de la Guarda (Puerto Refugio) and San Luis, from 1999 to 2009 (Reproduced from Área de Protección de Flora y Fauna Islas del Golfo de California, Ensenada (2009)).

Impacts

Brown pelican are the most common species recorded by observers, with 44% of total sightings reported in the 2013-2014 season. The majority of interactions of this species with the fishery occurred in fishing area V (See Figure 31) mainly during winter months (December to March). COBI (2015, unpublished) indicate these seasons are when pelicans are arriving to their nesting areas and are found to be more dispersed. It is this same area where the most number of pelicans are captured in a single set (up to 100 per set). The fishing areas IX and X also indicate that a large number of pelicans captured in a single set (up to 80).

Numbers of brown pelican mortality in the small pelagics fishery recorded by the observer program during 2013-14 fishing seasons ranges from 83 to 2,168 birds. As no breakdown of oiled vs direct mortality was provided for how García and Gastellum (2015) estimated mortality, only the information from Padilla et al. (2015) and the unpublished data from COBI was used. All individuals recorded as injured were assumed to have a 100% mortality post-release. The numbers for direct mortality or injury range from 83 (Padilla et al. 2015) to 205 (COBI unpublished data, 2016). Though the assessment team acknowledged that a linear extrapolation fails to properly account for spatial and temporal variability, with the aim of understanding potential impacts of the fishery on brown pelicans, mortality was extrapolated to the whole effort of the fleet based for the two fishing seasons, based on the 10% observer coverage. Using the latest nesting population available for the Gulf of California (GOC) ($43,350 \pm 230$ pairs) (SOURCE). The highest estimate of recorded mortality for the two fishing seasons represents ~2% of the nesting population of brown pelicans.

As discussed previously, there are also concerns regarding indirect mortality of seabirds due to oiling. Roosting and loafing sites are important for brown pelicans, because their feathers can become waterlogged; after feeding, they roost out of the water while they dry and preen their plumage (Stinson,

2014). Interactions with fishing gear such as purse seine fisheries known to introduce oil to feathers, may cause problems for pelican or other seabirds, increasing their tendency to become water-logged and to regulate temperature (*Impacts of Oil on Seabirds*). While this relates to crude oil, research indicates that fish oil may have many of the same impacts (Moradin and O'Hara 2014). Birds reported as 'oiled' where those which plumage was exposed to oil from the fish occurring in the closing of the net during the fishing operation (Velarde 2016, unpublished data. According to COBI (2016 unpublished data) approximately 2000 birds were recorded as oiled, which when extrapolated it is estimated to represent approximately 19% of the nesting population in the Gulf of California.

Beyond direct mortality from interaction with fishing gear, brown pelicans may also be indirectly affected by fluctuations in populations of prey species caused by overfishing.

Blue Footed Boobies

Taylor et al. (2011) describe how blue-footed boobies are widely distributed:

Blue-footed boobies (*Sula nebouxii* Milne Edwards, 1882) are distributed throughout the eastern tropical Pacific Ocean, and two subspecies are currently recognized: *S. n. excisa* (Todd), which is endemic to the Galapagos Archipelago; and *S. n. nebouxii*, which breeds along the coast from Mexico to northern Peru (Nelson, 1978). Unlike their tropical relatives, blue-footed boobies breed exclusively in close proximity to areas of cold-water upwelling. Known breeding areas coincide with areas of high chlorophyll a and low sea surface temperature, oceanographic conditions that are also associated with the major prey species of blue-footed boobies: sardines (Clupeidae, *Sardinops* spp.; Weimerskirch et al., 2009) and anchovies (Engraulidae, *Engraulis* spp.; Zavalaga et al., 2007;[...]

The IUCN Red List categorizes blue-footed boobies as "Least Concern", on grounds that this species has a very large range, the population trend is stable and population size is >10,000 mature individuals. However, research into gene flow of this species found "found evidence of high levels of gene flow between colonies within Mexico and between colonies within the southern portion of the range, but reduced gene flow between these regions" which is "indicating essentially no migration between Mexico and colonies to the south of Mexico." (Taylor et al. 2011).

In 1996 the global population of mature individual blue-footed boobies was estimated to range from 100,000 to 499,999 (in Croxall et al. 2012). The American Bird Conservancy in the Seabird Information for Fisheries Assessment Tool cites a population range from unknown to 80,000 individuals. A recent survey of the blue-footed subspecies found in the Galapagos (*Sula nebouxii excisa*) "[...] found ~6400 adults, compared to a rough estimate of 20,000 in the 1960s [...]", decrease in breeding is linked to diet (Achundia et al. 2014):

The poor reproduction seems to be linked to diet. Previous work indicated that sardine and herring (Clupeidae) supported successful breeding, but these fish were mostly absent from the diet during this study[...]. Elsewhere in the eastern Pacific sardine abundance has decreased dramatically by natural processes in the last 15 years, as part of a well-documented and apparently natural cycle. This cyclic change in abundance provides a possible explanation for the recent demographic changes in Blue-footed Boobies in Galápagos.

Census in the early 1990s from the San Pedro Martir Island, the largest breeding colony of this species in the Gulf of California, estimated a population of 110,000 breeding pairs of blue-footed booby (Tershy and Breese 1997). No recent population estimates for blue-footed boobies in the Gulf of California were encountered by the assessment team. Fragmented data of census in the San Pedro Martir Island suggests a reduction in number of nests from 2009 to 2015 (Velarde, nd).

The main diet of blue footed boobies is fish, particularly small pelagic species: anchovies, sardines, mackerel and also flying fish and squid. As with other seabird species reproductive success of blue-footed boobies has been linked to ENSO (Anconca et al, 2011):

Our analyses suggest that in the warm eastern tropical Pacific, ENSO drives inter-annual variation of the blue-footed booby in such critical parameters as breeding participation, timing of breeding, clutch and brood size, hatching success, growth and fledging success, but not egg size and volume.

The precise mechanisms whereby ENSO influences seabird reproduction are uncertain, but they are thought to involve prolonged reductions in prey availability linked to seasonal declines in ocean productivity, warming of surface waters (Barber & Chavez 1983; Ballance, Pitman & Fiedler 2006; Quillfeldt, Strange & Masello 2007) and sinking of the local thermocline (Devney, Short & Congdon 2009). These oceanographic anomalies may lead to diminished foraging success, reduced food intake and provisioning of offspring (Smithers et al. 2003) and, finally, reduced reproductive performance (Montevecchi & Myers 1996; Peck et al. 2004; Jenouvrier et al. 2005; Wanless et al. 2005; Frederiksen et al. 2006; Jodice et al. 2006; Erwin & Congdon 2007; Tierney, Emmerson & Hindell 2009).

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Numbers of direct mortality for blue footed boobies in the small pelagics fishery recorded by the observer program during 2013-14 fishing seasons is approximately 100 birds. No individuals were recorded as injured. A linear extrapolation of mortality for the entire fleet based for the two fishing seasons, based on the 10% observer coverage, indicated a number <1000. Using the only available population estimate the recorded mortality for the two fishing seasons was estimated to represent ~1% of the global nesting population of blue footed boobies. Individuals affected by oiling are estimated to represent 2.4% of the global population.

2.6.6 Mitigation measures

During the onsite-meeting, the assessment team confirmed that the client has made progress on discussing mitigation measures to reduce the impact of the fishery and implementing of education workshops for training captains (June 2013 with fishing vessel operators; December 2014 with 30 captains; September 2015 with 12 captains). The workshops focused primarily for seabirds being the species that appear most capture frequency.

The discussion and training were based on the following initial mitigation measures that were proposed in the INAPESCA Observer Program Report (Padilla-Serrato et al. 2015):

Birds:

- "Scaring, by spraying water with a pressure hose to keep birds away from the buoy line of the net."
- Reproduction of sounds that indicate a hazard. These could simply be loud noise blanks or sounds associated with natural predators in the area (osprey, falcons, and hawks).
- A physical installation to prevent birds from standing on the cables and going through towards the power block. This modification has already been implemented in the Sinaloa Fleet

Turtles and sharks

- Avoid setting on turtle or shark aggregations
- Return to the sea alive, individuals that are captured incidentally

Marine Mammals

- Avoid setting on dolphins.
- Undertake backdown to release marine mammals (dolphins) that may be left inside the net. Backdown occurs when a boat starts moving backwards after loading about two thirds of the net, and tying off the net.
- The weight of the net weighs down the ship, depressing the buoyline near the hull and allowing the release of captured dolphins, but without losing fish."

General

- Undertake discussion each quarter with the crew of the purse seine fleet, with the following objectives: a) Crewmembers be able to identify species that are under some protection scheme. b) Explain mitigation measures for different groups, in order to reduce or eliminate involvement. c) Submit quarterly the Industrial Sector, the results obtained from the implementation of mitigation measures."

Dr. Martin Hall, a bycatch and mitigation expert from the Inter-American Tropical Tuna Commission and Dr. Enriqueta Velarde, sea bird expert from Universidad Veracruzana contributed to find strategies to meet mitigation goals during the workshop that took place in September 2015 to learn from the captains' experience and discuss mitigation measures to reduce the impact of the fishery on sea birds.

Main outcomes of the workshop were to identify critical points in the fishing operation where birds are captured and each stage of fishing maneuver (duration of the maneuver) and the incidence of dead and injured birds and species that are most affected in each of the stages were described in detail. Possible maneuvers or strategies to reduce seabird bycatch were also identified. Among those is included a curtain of water with enough power to not allow entry of birds to the net, especially in the last stage of recovery maneuver.

As a follow up of the workshop agreements, COBI, with the collaboration of both experts recommendations, CANAIPES, INAPESCA-CRIP Guaymas and the Technical Committee for the Study of Small Pelagic, produced an educational brochure on importance of seabirds bycatch reduction and a Bycatch Mitigation Strategy for small pelagic fisheries in the Gulf of California, including the proper use of the pressure hose to distribute to all crew members of the fleet.

The 4th surveillance audit report indicated that:

A long-term program is required to provide sufficient information to detect any significant changes of the impact of the fishery on bycatch species", therefore it was recommended that: "the client presents evidence that the on-board observer program continues to be implemented successfully and that the mitigation measures are working appropriately.

This applies also to the need to document the application of mitigation measures to reduce the likelihood of impacts on seabirds as stated in relation to PI 2.3.1:

To continue to meet SG80 the onboard observer program will need to continue to collect data to demonstrate the efficacy of water curtains and how any remaining mortality, or impacts from oiling, may/may not impact on ETP birds.

Furthermore, it was pointed out that mitigation measures outlined in the Seabird Mitigation Workshop and the on-board observer report would need to be translated into formal management procedures.

During the onsite-meeting a video was presented on the assemble of a hose structure to improve the area span of the water curtain to prevent seabird from entering the net, but there is not further evidence on the implementation of this measure in the fleet during 2016.

With respect to mitigation measure implementation for other ETP species, during the onsite-meeting information was provided on instructions given to one vessel captain who had twice set on dolphins in 2012 and 2013 to avoid this practice.

2.6.7 Habitat Impacts

Overview

The purse seine fleet in the Gulf of California small pelagics fishery operates in mid-water between 40 and 100 meter depths and generally avoids bottom contact. Contact is intentionally avoided as the small mesh nylon netting is easily damaged. Interviews with fishermen during the site visit indicate that in the rare event when gear is lost, it is retrieved due to its high monetary value. In addition, abandoned purse-seine gear has limited capacity to continue fishing because it achieves full functionality only when used at the surface. Gear drift due to bottom currents may occur, although displacement should be limited because of its weight. Therefore, some localized damage of benthic structure and communities may occur. However, gear loss occurrences are very rare. There is no documented evidence that this fishing activity or any purse seining has had irreversible effects on any marine habitat.

According to observer data analyzed by Garcia-Gastelum (2015) 48.8% of the sets were carried out at a depth of less than 10 fathoms (18.52 m), 28.9% between 10 and 20 fathoms, 13% between 20 and 50 fathoms, 1.7% from 50 fathoms to 100 fathoms and 7.7% without depth data. The sets were made at an overall average depth of 12.3 fathoms, although this average varies depending on the fishing zone (Figure 34).

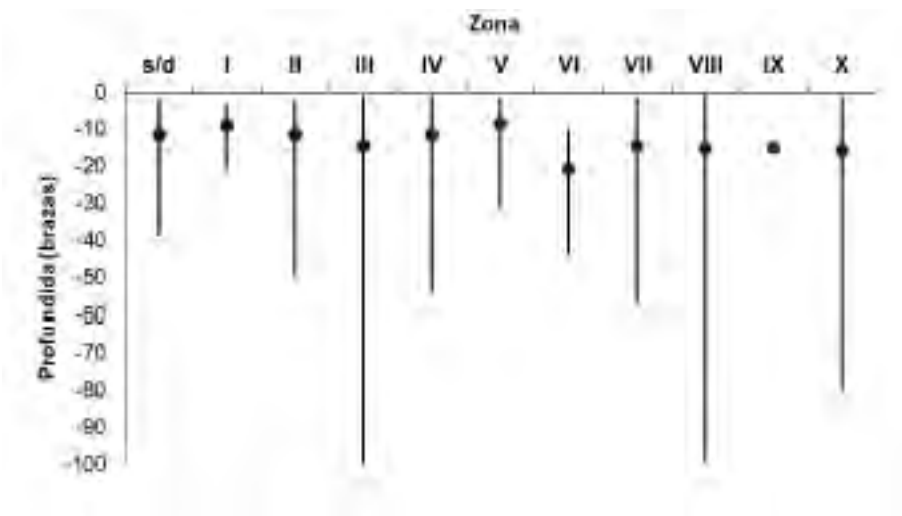


Figure 34. Depth of sets in the small pelagic fisheries of Gulf of California from observer data (18% coverage of fishing effort). Reproduced from Garcia-Gastellum (2015).

The distribution of sediments in the platform of the central Pacific ocean in the central and northern sections of the Gulf of California, where the fishery operates, are dominated by sandy, clay and silt substrates.

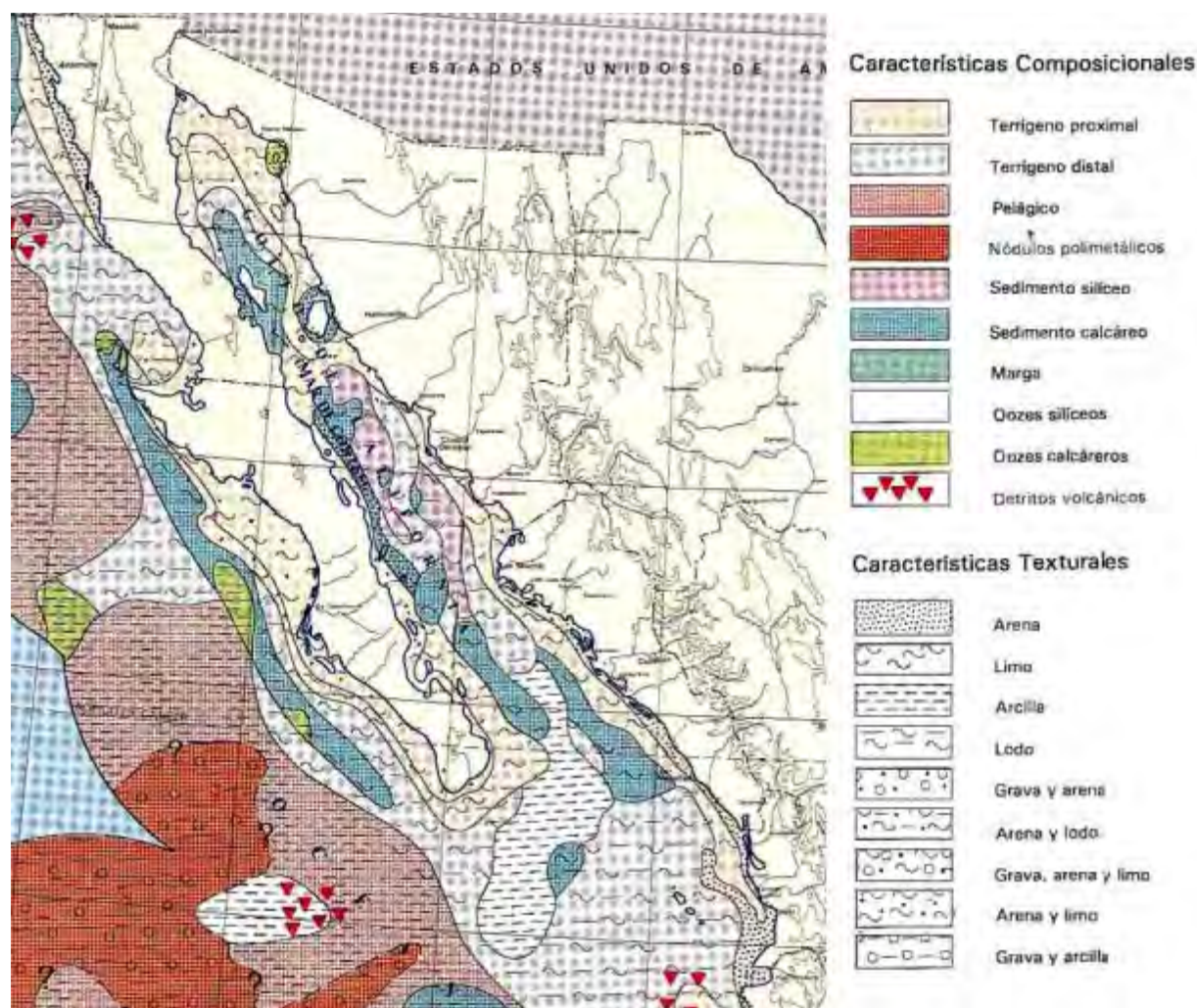


Figure 35. Spatial distribution of the sediment types in the Gulf of California. (Reproduced from Carranza-Edwards y Aguayo-Camargo 1991 in Comisión Nacional de Áreas Naturales Protegidas. 2011).

Research carried out in 2004 by CRIP with Support from SAGARPA-CONACYT evaluated the impact of bottom trawlers from the shrimp and demersal finfish fisheries in the bottom substrates in the Gulf of California. Despite the changes in sediment structure as a result of the suspension and redistribution of organic matter, the study did not find significant changes in benthic communities affected by bottom trawls (López-Martínez et al. 2010). The study suggested that this was due to the high energy process in this area where benthic communities are capable of absorbing the impact of the bottom trawls (Sanchez et al. 2009). There is no documented evidence that this purse seining or purse seine fishing elsewhere, even when touching bottom, has had irreversible effects on marine habitats.

Currently there is no zoning or depth regulation for the small pelagics purse seine fleet apart from protected areas.

Protected areas

The Gulf of California has more than 900 islands and islets that together sum a total of approximately 420,809 Ha. All of them as a whole are decreed as *Protected Area of Flora and Fauna of the Islands of the Gulf of California*, they are part of the international program "Man and the Biosphere" (MAB) and of the UNESCO World Biosphere Reserves Network as a Special Biosphere Reserve. Its conservation and management is carried out through a system of four regional directions of CONANP, but governs a single Management Program, published in 2000, which is complemented by local and specific management programs (at the level of archipelagos).

In the northwest of Mexico there are 21 protected natural areas (PNA), where the main ones that may be related to the fishing activity are those of the *Bahía de Los Ángeles Marine Zone, Whale and "Salsipuedes" Channel, San Lorenzo Archipelago Marine Zone, San Pedro Mártir, El Vizcaíno, Loreto Bay and Gulf Islands* (Table 21), this according to the data obtained in the monitoring of the fishing seasons 2012-2013 and 2013-2014 by the on-board observer program.

Table 21. List of protected areas in the Gulf of California. RB: Biosphere Reserve; PN: National Park; S: Sanctuary; APFF: Flora and Fauna Protected Areas

Category	Official Name	Surface Area (h)	Date established
RB	Alto Golfo de California y delta del río Colorado	934,756.25	10/06/1993
RB	Zona marina Bahía de los Ángeles, canales de Ballenas y Salsipuedes	387,956.88	05/06/2007
RB	El Vizcaíno	2,546,790.25	30/11/1988
RB	Isla San Pedro Mártir	30,165.23	13/06/2002
RB	Islas Marías	641,284.73	27/11/2000
PN	Zona marina del Archipiélago de San Lorenzo	58,442.80	25/04/2005
PN	Zona marina del Archipiélago de Espíritu Santo	48,654.83	10/05/2007
PN	Cabo Pulmo	7,111.01	06/06/1995
PN	Bahía de Loreto	206,580.75	19/07/1996
PN	Islas Marietas	1,383.01	25/04/2005
S	Ventilas hidrotermales de la Cuenca de Guaymas y de la Dorsal del Pacífico Oriental	145,564.808	05/06/2009
APFF	Balandra	2512.73075	30/11/2012
APFF	Cabo San Lucas	3996.049136	29/11/1973

These PNAs protect the most important nesting colonies in the GoC of the brown pelican (*Pelecanus occidentalis californicus*) in the *Área de Protección de Flora y Fauna de las Isla del Golfo de California*, in the Archipelagos Angel Island, San Lorenzo and San Luis Gonzaga / Encantadas Islands, colonies concentrating 90% of global nesting of Heermann's gull (*Larus heermanni*) and elegant tern (*Thalasseus elegans*) in Isla Rasa in the Biosphere Reserve Bahía de los Angeles, the 4th larger nesting populations of blue-footed booby globally, and the most important colony for California Sea lion in San Esteban Island and Angel Island. There are regulations for fishing by gear, season and zoning in the PNAs to protect the natural resources, particularly for seabirds, sea turtles, marine mammals, rays and sharks. Fishing activities that incidentally captured species endangered or protected are not allowed.

Aproximately 85% of the observed sets took place in the east coast of the Gulf of California (Zones I-V). Zone X represents a central area in the Gulf of California; in this site the frequency of the fishing operations was observed around the Isla Tiburón. The spatial distribution of observed sets by fishing zone are shown in Figure 23.

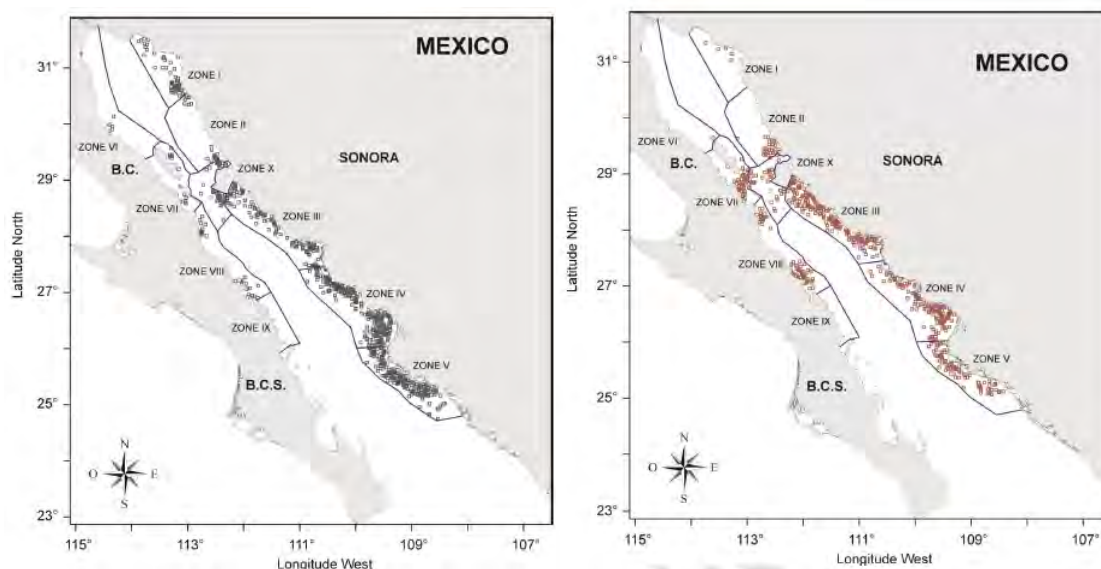


Figure 36. Fishing grounds and geographical location of observer sets during 2013 (left) and 2014 (right). Reproduced from Morales-Bojórquez (2016).

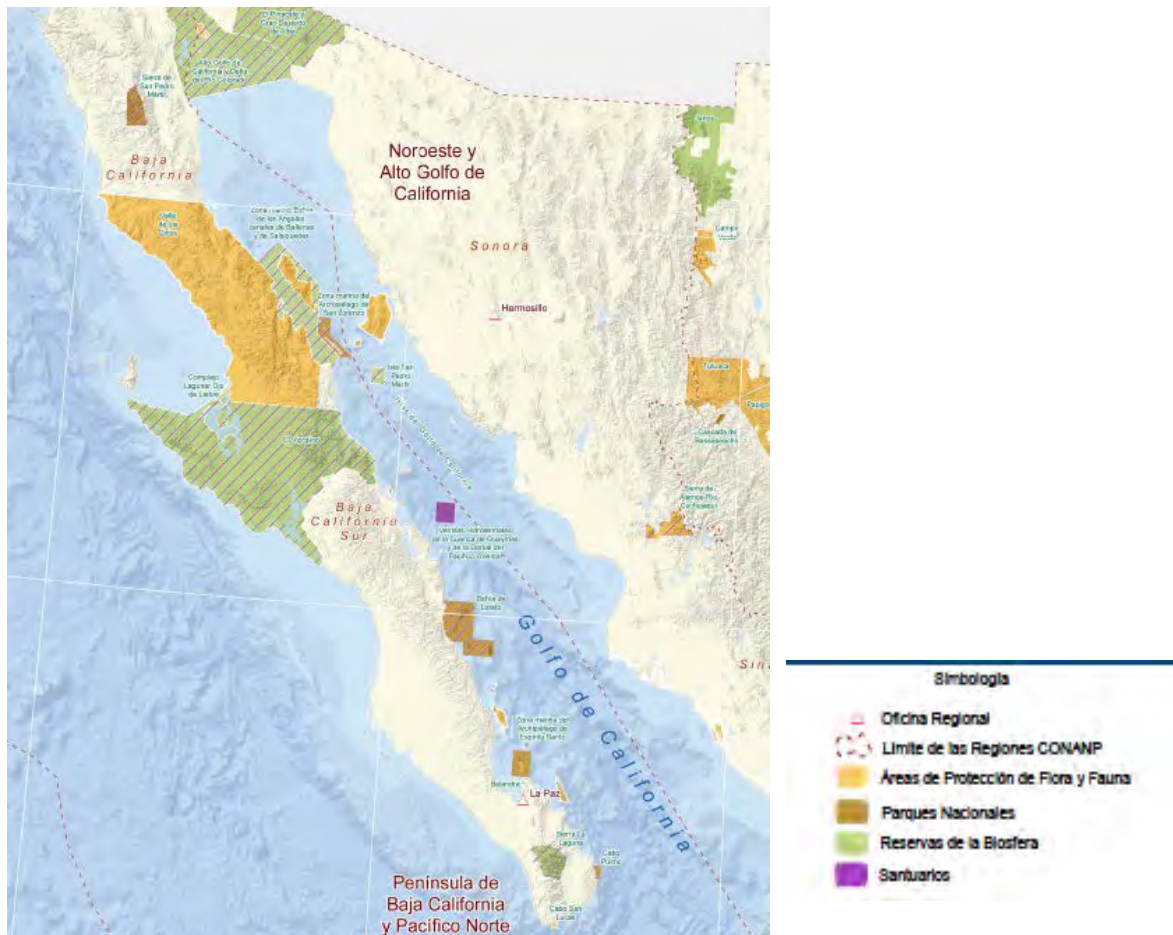


Figure 37. Protected areas in Baja California Peninsula and North Pacific Region and Northwestern and Upper Gulf of California Region.

2.6.8 Ecosystem Impacts

Status

Due to its unique topography and oceanographic conditions the Gulf of California (GoC) exceptionally high rates of primary productivity due to a combination of its topography, warm climate, and systems of upwelling (See Section 2.4.3 Areas p. 21).

The GoC is highly productive because of the high incidence of solar radiation, mix as tidal effect, and seasonal upwelling (Morgan et al. 2005). In many areas of the Gulf of California phytoplankton bloom are very common, promoted by rich-nutrients subsurface waters upwelling (Álvarez-Borrego & Lara-Lara 1991). The winds from the Southeast in summer have an average speed of 3 m.s⁻¹ (Carriquiry & Sánchez 1999), which produce rains in Sonora and Sinaloa and upwelling phenomena along the western coast of the Gulf (Badan-Dagon et al. 1985). During winter and spring, the winds flow from Northwest at an average speed of 5 m.s⁻¹ (Carriquiry & Sánchez 1999) and generate the upwelling processes and phytoplankton bloom on the Eastern coast of the Gulf (Marinone & Lavín 2003). The high primary productivity of the Gulf, supports large populations of Pacific sardine, thread herrings, and many species of anchovies (*Anchoa*, *Anchovia*, *Cetengraulis*, and *Engraulis*) which are in turn the main food source of a whole array of piscivorous species, including squids, fishes, seabirds, dolphins and whales.

Trophic Relationships

Ecosystem interactions relevant to the northern Gulf of California small pelagic fishery include the impacts of the removal of low trophic level fish biomass on the structure and function of the Gulf of California ecosystem. Removing lower trophic-level species has the potential to impact the dynamics and abundance of their predator populations (Cury et al., 2000). Scoring for ecosystem performance indicators will be harmonized with the Sinaloa Gulf of California portion of the fishery unless the unit can demonstrate that it has a stronger understanding of ecosystem dynamics in the southern region of the Gulf.

Trophic role of Pacific sardine is also described in Section: *Low Trophic Level Species (LTL)* (p. 37) and for thread herring in Section: *Low Trophic Level Species (LTL)* (p. 53). Pacific sardine is a low trophic level species, and has been described as an important component of the Gulf of California Ecosystem (Lluch-Cota et al. 2007; Arizmendi-Rodríguez et al. 2015). For purposes of this audit, the sardine has been considered key LTL species while herring is not considered Key.

Hernández-Padilla et al. (2015) analyzed the importance of the ecological role of thread herring in the southern Gulf of California as base of the trophic chain in the ecosystem where the Small-Pelagics fishery operates in the Gulf of California. with 39 functional groups (21 fish, 12 invertebrates, 2 primary producers and one for birds, sea turtles, zooplankton and detritus each). The findings indicate a higher value for key species index (k) for *bocona* sardine while thread herring sardine was found to have higher ascendancy indices as related to the arrangement of functional groups in trophic networks. Removals of thread herring are reflected in the ecosystem order maintenance, whereas removal of *bocona* relates to ecosystem decay. The authors suggest that their results only provide a visualization of the role of these species in the ecosystem and don't offer conclusions to help establish permissible

harvest rates. However, they conclude that these results do provide information in a precautionary sense about which species will warrant greater attention when generating measures that regulate exploitation (Hernández-Padilla et al. 2015).

Arizmendi (2015) conducted a trophic characterization of the ecosystem of the Gulf of California according to trophic levels in the system and biomass flow among them. The study identified Pacific sardine as a vehicle in the flow of matter and energy from the lower to the upper levels of the Gulf of California ecosystem.

Padilla-Serrato et al. (2015) analyzed the behavior of 57 functional groups of predator and prey using the observer program data. The composition of the trophic network observed shows a high complexity and a high degree of interactions between the functional groups, with possible effects caused by species of high trophic levels. As it is common in marine environments, a large number of connections between the functional group exist. The report for the onboard observer program identified large pelagic predator species as of key species in the ecosystem based on an index of closeness estimated from node connections in a predator-prey matrix).

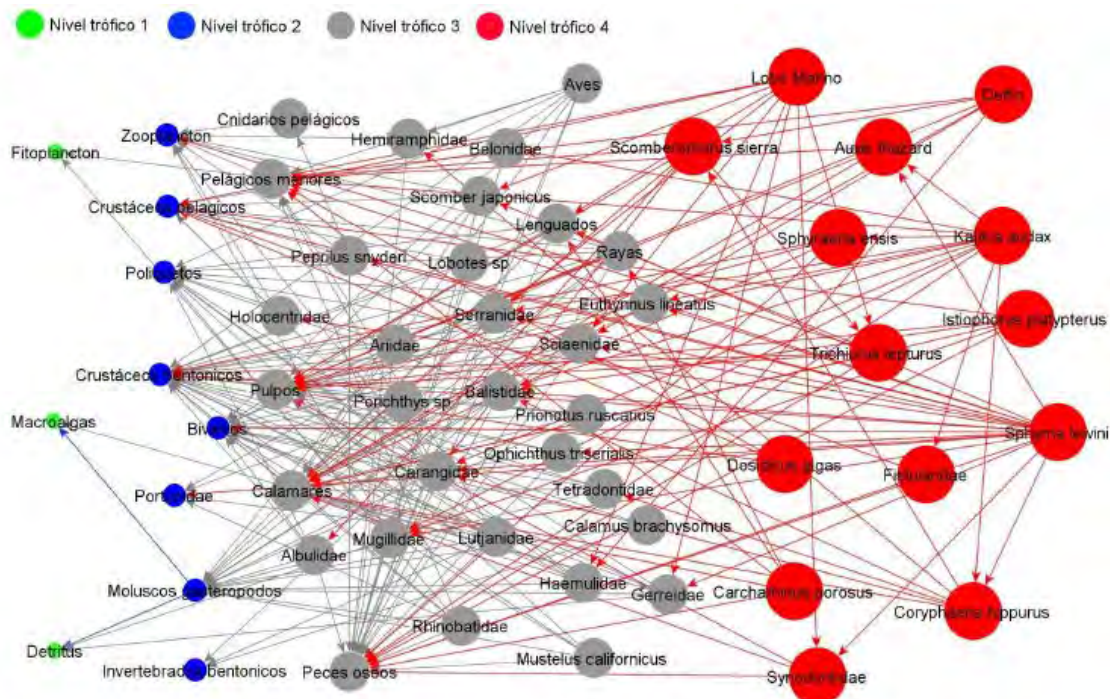


Figure 37. Trophic network of the small pelagic fishery in Gulf of California according to interaction with bycatch species during fishing season 2013. Reproduced from Padilla-Serrato et al. (2015).

Ecological Models

During the past certification cycle, efforts were made to consider the impact of the fishery on the ecosystem due to the lack of enough evidence to assure that the fishery is highly unlikely to disrupt key ecosystem elements. Ecopath model and further research unpublished and an observer program operating for two fishing seasons and the current commitment of INAPESCA and CANAIPES to continue have been conducted.

INAPESCA developed an Ecopath model for 2013 with a total of 23 functional groups (including one group for sea birds, five bony fish, two cartilaginous fish and one marine mammal group)(Arizmendi-Rodriguez et al. 2015). The aim of the work was to describe and understand in more detail the functional relationships of sardines and the effects of abundance in the ecosystem. The database of all Ecopath with Ecosim (EwE) ecosystem models integrated by the Fisheries Center at the University of British Columbia was used for this analysis. This database includes eight models developed for the Gulf of California, Mexico (Arreguín-Sánchez et al. 2002, Arreguín-Sánchez et al. 2004, Arreguín Sanchez in Christensen and Pauly 1993, Cisneros-Montemayor 2012, Diaz-Urbe 2012, Lercari et al. 2010, Rosas L. 2008, and Vidal 2003). Another model (Morales-Zarate et al. 2004) was found at the EwE website (<http://www.ecopath.org>).

The findings for this model conclude that Pacific Sardines play an important ecological role in the ecosystem by participating in the energy flow from low to high trophic levels. Describing a “bottom up” system Arizmendi-Rodriguez et al. (2015) determined that Pacific Sardines are an important component in the diet of seabirds, large pelagics and sharks and that changes in the abundance of small pelagics may influence the distribution of the populations of its predators.

Results from the 2013 Ecopath model indicate that Pacific Sardines are an important component in the diet of seabirds, large pelagics and sharks and that changes in its abundance may influence the distribution of the populations of its predators (Arizmendi-Rodríguez et al. 2015). Hernández-Padilla et al. (2015) analyzed the role of the Thread Herring in the ecosystem, as a first step to determine the biomass level needs for the sustainability of the ecosystem.

Among the aspects analyzed by Del Monte and the review team to determine whether Pacific Sardine is a key LTL species, and estimated threshold harvest rate to risk an irreversible disruption of ecosystem structure and function is established at 36%. As mentioned above, Dr. Arreguin-Sanchez and his team are working on determine Bmin based on ecosystem needs. The unpublished work developed a procedure based on trophic relationships and information theory (Ulanowicz 1986) to estimate harvest rates from deterioration caused by fishing in the ecosystem, expressed as entropy gain. This implies that the management measure is taken from the ecosystem to the exploited populations and not the other way around, as is usually done with similar methodologies.

2.7 Principle Three: Management System Background

2.7.1 Area of Operation and Relevant Jurisdictions

Depending on availability, the small pelagic fishery in the central/northern Gulf of California mainly targets Pacific sardine (*Sardinops sagax*). If the abundance of the main target species declines, other species, mainly thread herring (*Opisthonema libertate*) become important. In the last 15 years, bocona sardine (*Cetengraulis mysticetus*) has also become an important substitute of the Pacific sardine.

The fishery operates within Sonoran waters in the central/northern area of the Gulf of California, Mexico. All catch from vessels in the unit are landed along the Sonoran coastline, although some boats enter Sonoran waters from home ports located outside the state (e.g. Ensenada, Baja California). The fleet is based in the ports of Guaymas and Yavaros, Sonora and during the last 5 years has been stable at about 50 fishing vessels with a hold capacity between 120 to 220 metric tons each and with approximately 10 fishers onboard (See Appendix 13.1 Vessel List p. 313).

According with NOM 003, all vessels fish with purse-seine nets with maximum length of 640 m and 30 to 60 m fall (depth), with a 25.4 mm of mesh size. Depending on the captain's experience and the volume of the catch, the set of the net can last between 1.5 to 3 hours (Doode-Matsumoto, 1999). Because economic reasons or mechanical failures, not all vessels operate the entire fishing season, for example, in season 2014/2015 the number of active boats per month varied between 28 and 48 (see Table 2 in Nevarez-Martinez 2016).

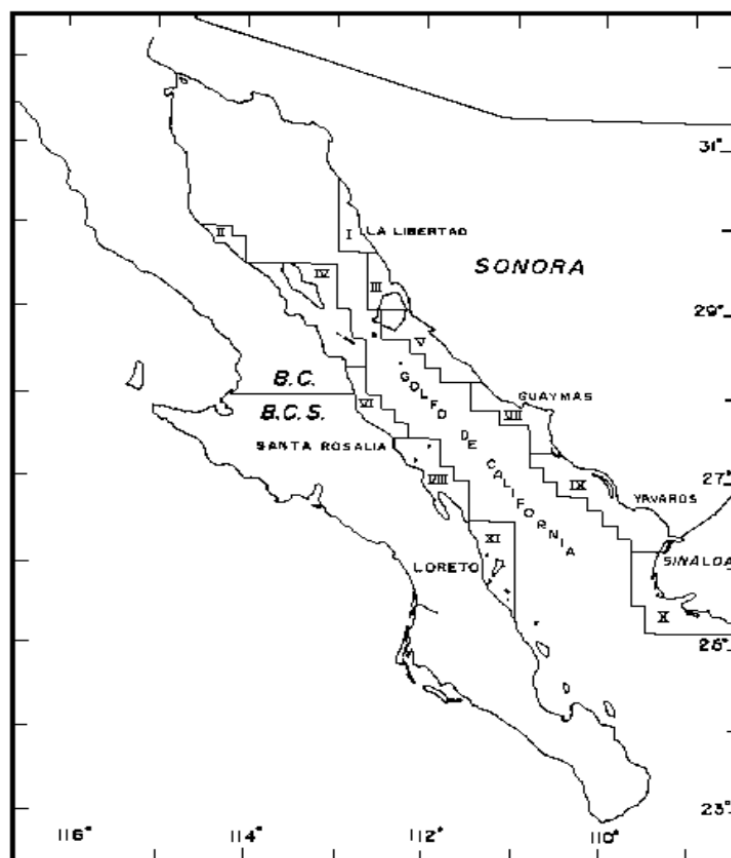


Figure 38. Fishing areas of the small pelagic fish in the central/northern portion of the Gulf of California. Reproduced from Nevarez-Martinez et al. (2016c).

All fishing vessels have a fishing permit issued by CONAPESCA based on the technical opinion issued by INAPESCA. The permits have to be renewed every 5 years and fishing vessels are required to use Vessel Monitoring System equipment (VMS system) for tracking the spatial position of fishing operations. This fishery operates in most of the Gulf of California except the upper Gulf region and the southeast region of the Baja California Peninsula. Effort however is most concentrated from the Midriff Islands region the central/south portion of Sonora and north of Sinaloa. The permitting system for the small pelagics fleet in Northeast Mexico is described in the Overview section of this report 2.4.2 *Organization and User Rights* p. 19.

This fishing area (Figure 38) is located in Pacific waters under the jurisdiction of the United Mexican States (Mexico). Due to the distribution of the fishing operations within the national EEZ and the biology of species, the fishery is considered to be under a single jurisdiction managed by Mexico

2.7.2 National Level Management

Mexico is a federal presidential constitutional republic and its structure is based in the Constitution. The Mexican Constitution, in Article 27, establishes that *“The Nation has full ownership over all natural resources of the continental shelf and the seabed and subsoil of the submarine areas of the islands.”* In order to fulfill this responsibility, the General Law for Sustainable Fisheries and Aquaculture (*Ley General de Pesca y Acuicultura Sustentable, LGPAS*) was decreed in 2007 (DOF, 2007). Execution of the LGPAS is under the jurisdiction of the Secretariat of Agriculture, Livestock, Fisheries and Food (SAGARPA) via the National Commission of Fish and Aquaculture (CONAPESCA). The main purpose of the LGPAS, defined in its first Article, is:

[...]regulating, promoting and managing the use of fishery and aquaculture resources
 [...] establishing the basis for the exercise of those attributions of the federation, states and municipalities, under the overarching principles of concurrences and with the participation of fishers [...] with the purpose of promoting the integral and sustainable development of fisheries and aquaculture.

To assure sustainable fisheries, the objectives of the LGPAS are listed in its Article 2 and include:

- I. To establish and define the principles to regulate, promote and applied an integral management under a sustainable manner.
- III. To establish the basis for the ordination, conservation, protection, repopulation and sustainable utilization of fisheries and aquaculture resources, as well as the protection and rehabilitation of those ecosystems in which these resources are.

Other objectives are related to the quality of life of fishers, the fisheries planning process, access rights, application of the law by all governmental levels, fishers’ participation, support of scientific research, permits system, quality and certification of fisheries and aquaculture products, enforcement, infringement and sanctions, and how to assure that fishing and aquaculture are prioritized for food production.

In 1992, the Federal Law on Metrology and Standardization (*Ley Federal de Metrología y Normalización*) (DOF 1992) established the integration of Official Mexican Norms (Norms/NOMs). The Norms, which are obligatory (legally binding), technical regulations that control a diverse range of production processes including sectors such as manufacturing through to fisheries. In Article 40 the Federal Law on Metrology and Standardization establishes that a Norm *“regulates procedures to assure the preservation of natural resources [...] and if necessary to seek preferential right to access,*

utilization and benefit of fisheries resources to indigenous communities and people [...] in those places that they occupy and inhabit."

Another important legal document for the management of the small pelagics fishery is the National Fisheries Chart (*Carta Nacional Pesquera*, CNP). The CNP is a binding instrument for the fisheries authorities' decision-making process. This Chart includes the diagnosis and the integral assessment of a fishery, fisheries and conservation indicators, and recommendations by the National Institute of Fisheries and Aquaculture (INAPESCA), for the management of the fisheries that are included in the CNP. Updates of CNP are prepared by INAPESCA every two or three years, but before the updates of the CNP are published in the Official Gazette (*Diario Oficial*, DOF), the draft update undergoes a public review process by means of publication in the DOF. This allows the general public, non-governmental organizations and the academic sector, among others, to give an opinion of the fisheries status. The latest version was published in 2012 (DOF, 2012).

Fishery Management Plans (*Planes de Manejo Pesquero*) are elaborated by INAPESCA following the stipulation of the LGPAS. The Small Pelagic Fisheries Management Plan (SPFMP) was published in 2012 (DOF, 8th November 2012). The SPFMP includes a diagnosis of the fishery, the objectives of the plan, a set of management measures, a research program, an estimation of cost of management, enforcement issues and measures for the implementation and update of the plan. The SPFMP is reviewed annually (DOF, 8th November 2012) through an internal process, only when there is a relevant event or amend an updated version of the SPFMP is made public.

Access Rights

The unit of certification falls within a single jurisdiction. The stock does not have an indigenous component, is not considered a stock shared with other countries for demographic supply purposes, is not a straddling stock or highly migratory species, nor does it take place on the high seas.

2.7.3 Fishery-Specific Management

Objectives for the Fishery

NOM-001-PESC-1993

In 1993 the NOM-001PESC-1993 was published to provide a suite of specific regulations for the small pelagic fisheries in the Mexican Pacific coast, to assure the conservation, preservation and rational use of this resources. The NOM establishes operational and biological regulations (DOF 1993) that:

- Control fishing effort by limiting the number of fishing vessels.
- Specify allowable gear (purse-seine nets allowed ranging from 366-640 m length).
- Specify fishing vessels sizes (80 tons to more than 200 tons of hold capacity).
- Request that scientific observers be allowed onboard of the fishing vessels.
- Specify minimum size limits for Pacific sardine and thread herring species.

For more detail on the fishery specific measures and regulation in NOM-PESC-1993 (See section 2.5.2 *Management* p. 28 of this report).

Small Pelagics Fisheries Management Plan

The main objectives of the Fisheries Management Plan for Small Pelagics (SPFMP) are to promote the assessment of the biomass and recruitment of sardines, anchovies, and mackerel and associated species in northwestern Mexico, to preserve the yield and economical benefit of their fisheries, to reduce the impact of their environment interactions, to promote economic benefits to society, and to assure the quality of their fisheries products. The SPFMP includes a diagnosis of the fishery, the objectives of the plan, a set of management measures, a research program, an estimation of cost of management, enforcement issues and measures for the implementation and update of the plan. The SPFMP is reviewed annually (DOF, 8th November 2012) through an internal process, only when there is a relevant event or amend an updated version of the SPFMP is made public.

The SPFMP invokes two main categories of management, a new harvest control with a B_{min} terms to reserve biomass for ecosystem function, and lists details on specific lines of research that include Populations Dynamics, Stock Assessments, Ecosystem Approach, Predicting Models, Habitat, Socio-economics, and Exploratory Fishing. The 2012 SPFMP includes short and long-term objectives associated with the research plan and also contains proper and formal consideration of the role of the resource on the maintenance of the ecosystem and evidence that these considerations have been incorporated into the harvest control rules.

The objectives for the fishery are described in the 2012 FMP. The SPFMP states that the management agency shall reliably diagnose conditions of the small pelagic fishery to establish, with the participation of stakeholders, management policies that include guidelines for research, management arrangements, and regulation and use of resources.

FMP Listed Objectives:

- Retaining stocks at sustainable levels and controlling fishing effort that can be applied by the fishery.
- The fishing permit shall state that the carrying capacity in aggregate is defined as equal to the optimum. The fishing permit also shall include the number and characteristics of vessels, as well as network characteristics that can be used. Define the overall fishing capacity and also optimize the number of permits to operate in the fishery.
- Define the types and characteristics of systems allowable catch in the fishery.
- Monitor the development of the fishery with enough detail to make informed decisions and make necessary adjustments management strategies. This includes the identification and use of biological reference points (or limits) for the main species.
- Protect breeding and / or rearing in coastal and estuarine habitats.
- Promote catch of adequate size to optimize performance and / or unit value of recruits to the fishery. Minimize adverse impacts of management actions that could cause the costs of the fishery.
- Check the catch of juveniles, regulating fishing in areas of refuge.
- Determine the optimum size of capture, by setting minimum sizes for the main species.
- Promote management measures, cost-effective and efficient.
- Provide programming elements for business and planning authority by generating forecasts of fisheries.

- Reduce impacts to the ecosystem
- Minimize ecosystem impacts of fishing methods, particularly in ecologically significant areas.
- Encourage the practice of responsible fishing.
- Promote economic benefits to society
- Save the economic benefits of the fishery, promoting the generation of jobs and income and contributing to the real costs of management, fisheries research, inspection and surveillance.
- Develop and implement mechanisms to ensure that the fishery will continue to generate economic and social benefits.
- Determine the real costs of management, fisheries research and inspection and monitoring of the fishery.
- Ensure that fishery products meet the standards of safety and quality for domestic and international markets.
- Promote best practices available for the capture, handling and processing of small pelagic fish, and to develop and / or implement technology to add more value to the products of this fishery.

For more detail on the fishery specific measures and regulation on the SPFMP (See section 2.5.2 *Management* p. 28 of this report).

Review and Audit of the Management Plan

This has not been established. The most recent fisheries management plan for the small pelagic fishery was released November of 2012.

2.7.4 Decision Making Processes

During the cruises the oceanographic conditions are also gathered, mainly by sea surface temperature distribution. Based on these results, the date for the aperture of the fishing season is decided by agreement between the fisheries researchers and the fishery operators during official meetings were agreements are signed by the participants.

Since 1990 sampling cruises have been made at several times during each year, mostly financed by the industry but also by the state of Sonora government; a report is written and circulated to the industry and government officials. Further meetings take place to jointly agree on particular measures (Cisneros-Mata, et al. 1999).

Since 1993, the *Centro Regional de Investigación Pesquera* (CRIP) in Sonora, a branch of the Instituto Nacional de Pesca (INAPESCA), has conducted pre-season exploratory fishing surveys in the fishing grounds in cooperation with the fishing industry in order to forecast expected catches for the year. If the abundance of fish on the grounds is low, the INAPESCA and the industry can agree to more extensive time and area closures based on fishing areas.

2.7.5 Recognized Interest Groups

Industry – Vessel captains, vessel owners, small pelagic participants from Sinaloa, EO Mexico, are also considering the merits of the MSC process in their region.

Government – INAPESCA, CONAPESCA (see attendees at 2012 and 2013 meetings). Interest in attendance has either related directly to research being undertaken by INAPESCA and material to scoring/conditions for the sardine fishery, or has related to general interest in the process (CONAPESCA).

Artisanal fishers – Artisanal fishers have concerns over the indirect impacts of the fishery on low trophic level species that support species vulnerable to artisanal fishers in the Gulf of California. There are also claims that boats have entered protected waters and/or zoned for use by artisanal fishing. In 2013, a representative from the association of artisanal fishers in the region attended the onsite-meeting.

NGOs – When the Gulf of California Sardine fishery entered full assessment, the national-scale environmental NGO *Comunidad y Biodiversidad* (COBI), raised concerns over the magnitude of current catch and the potential impacts on bycatch. When the draft Pacific sardine report was released for public comment, COBI, in collaboration with interested academics raised an objection to the potential certification. A memorandum of understanding between the client, INAPESCA and the (self-titled) “conscientious objectors” laid out mutually agreed terms of reference for commitments related to withdrawal of the objection. In 2012 COBI initiated collaborative initiatives with industry, obtaining philanthropic funding to fund a one year observer program in 2013.

Academic scientists – Academics with interests in seabirds, ecosystem dynamics and oceanography have all attended onsite-meeting. Core concerns have included the potential to include diet studies of seabird data in future assessments, sufficient transparency and inclusiveness by industry, collaboration or support for hydroacoustic research being undertaken by INAPESCA.

2.7.6 Consultation Processes

Consultation on the formulation of the management plan

The LGPAS establishes that the objectives of the fishery stated in the fishery management plan are defined by the National Council of Fisheries and Aquaculture (*Consejo Nacional de Pesca y Acuicultura*, CNPA) and the State Council of Fisheries and Aquaculture (*Consejo Estatal de Pesca y Acuicultura*, CEPA), and communicated to INAPESCA which is responsible for elaborating aspects of plan implementation (DOF 2007).

Prior to the publication of the Small Pelagics Fishery Management Plan, a period was opened to receive public comments through several meetings in 2012 at the different ports where this fishery is carried out (Guaymas March 16-18; Guaymas April 26-29; Ensenada May 26-27; and Guaymas June 21-24). The annual reviews for the small pelagics fisheries management plan are an internal process, thus the assessment team did not receive any information on how these evaluations are carried out.

Consultation on the modification of NOM-003-PESC-1993

A new version of the NOM-0003-PESC-1993 for the national small pelagic fishery is under revision at the COFEMER (Federal Commission for the Regulations Improvement).

To meet the procedure established by the Federal Law on Metrology and Standardization, the review and amendment of NOM-003-PESC-1993 included the *Programa Nacional de Normalización* in 2014. During this year meeting were held with the Group of Technical Work (*Grupo de Trabajo Tecnico-GTT*), sessions with the subcommittee of Responsible Fishing (*Subcomité de Pesca Responsable*) and the National Advisory Committee on Standardization Agrifood (*Comité Consultivo Nacional de Normalización Agroalimentaria*). In the two meeting held with the GTT, which allowed to define a proposal for the modification of the NORM were carried out the 8th of May and 15th of May, participants included representatives from INAPESCA, CICIMAR and the Direction of Standardization (*Dirección de Normatividad*), the latter meeting also included representatives from the NGO Comunidad y Biodiversidad, A.C. The proposal for the modification of the NOM was published in the Official Gazette (DOF) from 4th of December, 2014 to the 2nd of February for public comment. During this time period 71 comments from 61 plaintiffs were received. The assessment team was informed that at the time this assessment was carried out to the end of 2015, the final analysis of the responses and comments received were being carried out with the GTT and once this was completed the document would be submitted for approval by the Subcommittee on Responsible Fisheries and the CCNNA for its publication in the Official Gazette (DOF). The Client update at the 2016 onsite-meeting indicated that release dates for the modified NOM are unknown.

In the 2012 Management Plan, it is noted that content as follows has been proposed for the updated NOM:

- Capture of Pacific sardine, anchovy or thread herring below the minimum catch size does not exceed 30% of the number of organisms per fishing season by region.
- There will be no further authorization for the entry of more vessels, except for replacement of existing vessel and that existing vessels have good cooling systems and that existing vessels do not increase the current carrying capacity.
- That INAPESCA, based on scientific research carried out with a view to ensuring optimal resource utilization and conservation, undertake monthly reviews of the cumulative percentage of bycatch to determine when it has reached the allowable percentage (bycatch), at which point there will be the requirement to notify the National Commission of Aquaculture and Fisheries.

Technical Committee for the Study of Small Pelagics

The decision-making process incorporates interchange of scientific information and collaboration in research through the *Comité Técnico de Pelágicos Menores*:

The Technical Committee for the Study of Small Pelagics was formed in 1985 as an auxiliary instrument of the then Secretary of Fisheries [SAGARPA], in order to find solutions to the crisis that was going through the country's sardine industry at that time. Subsequently, in 1992, and as a result of another

crisis in the pelagic fishery, the Committee was revived, beginning a series of annual workshops, which have since been carried out uninterruptedly

The Technical Committee for the Study of Small Pelagics has been established as a recognized non-profit organization, consisting of the National Fisheries Institute (INAPESCA), the Interdisciplinary Center for Marine Sciences (CICIMAR), the Center for Scientific Research And Higher Education Center of Ensenada (CICESE), the Center for Biological Research of the Northwest, SC (CIBNOR), the University of Baja California (UABC), the Autonomous University of Sinaloa (UAS), the University of Sonora (UNISON), Sardine industry [represented] through its various chambers and organizations from the states of Baja California, Baja California Sur, Sonora and Sinaloa, and by Civil Society Organizations (CSOs).

The Committee serves as a reference for all those interested in the study of Small Pelagics and issues in its proceeding, product of the annual workshops, the estate of the fishery of these species and recommendations for the different sectors involved in the fishing process and posterior processing.

From <http://www.comitepelagicosmenores.org/>

Invitations to the annual workshops held by the Committee are sent by the client to all participants in the Pacific sardine assessment. Members of the public sector (eNGOs and academics) attended and presented results of their work at these meetings in June 2013. The assessment team regularly receives documentation of the annual meetings of the Technical Research Committee for small pelagic fisheries, with evidence that invitations, including the workshop program are sent to the recognized interest groups.

Other consultation measures:

Several unofficial measures for consultation and collaboration have been initiated since the first certification cycle of the fishery. These measures are not part of an official management system nor is it clear whether they can be considered as 'on-going' at this point:

- "Joint" INAPESCA staff, where industry has contributed salary costs to additional INAPESCA staff based on needs associated with conditions and eNGOs in-kind donation of internal staff resources to work associated with closing conditions in the Pacific sardine fishery (observer program, ecosystem impacts).
- Collaborative design, training and execution of the Observer Program for the Small pelagic fishery.
- Ongoing expansion of stakeholder sectors at onsite-meetings. In 2013, Artisanal fishing representatives were welcomed to the overall meeting by the Client.
- The assessment team confirmed that the website for a variety of aspects related to the fishery is fully functional at <http://sardinagolfodecalifornia.org/>. The site has links to most technical documents used towards certification, minutes of post-certification workshops, technical meetings, the SPFMP and other relevant documents. It was noted in one of the documents that during the last regular meeting of the technical committee stakeholders attended the meeting.

2.7.7 Planned Education and Training for Interest Groups

In 2012, funding was secured from Foundation Productor and the Walton Family Foundation to develop a collaborative, multi-sectoral observer program for the fishery. In November of 2012, training began for the nine observers. Trainings included courses on identification of marine birds, marine mammals, fish and turtles. Data collected by the observer program includes fishing areas, size

structure, reproductive index data, abundance and mortalities. The observer program did not operate in 2015 and 2016 but the fishery indicated that the industry will provide the funds for the program to resume operations for the 2016/2017 fishing season.

In early June 2013, the Client held an educational outreach session with fishing vessel operators (vessel managers) to discuss the value of certification, the importance of good fishing practices and measures to limit the effects of the fleet on particular bycatch species. For more detail refer in this report to section 2.7.4 Mitigation measures.

2.7.8 Monitoring, Control, Surveillance and Enforcement

Since 1993, the *Centro Regional de Investigación Pesquera* (CRIP) in Sonora, a branch of the *Instituto Nacional de Pesca* (INAPESCA), has conducted pre-season exploratory fishing surveys in the fishing grounds in cooperation with the fishing industry in order to forecast expected catches for the year. If the abundance of fish on the grounds is low, the INAPESCA and the industry can agree to more extensive time and area closures based on fishing areas.

Surveillance and Enforcement

The National Inspection and Monitoring Program operates under CONAPESCA's General Directorate of Inspection and Monitoring (*Dirección General de Inspección y Vigilancia, DGIV*). The program has as one of its main objective to establish forceful action from the Federal Government to directly combat the fishing, traffic and trade of illegal products from fisheries and aquaculture. The National Inspection and Monitoring Program operates under several legal frameworks including the Federal Constitution, the CONAPESCA-Inspection and Vigilance, SAGARPA's internal regulations, and the Noms. Specifications about infractions, administrative sanctions, responsibilities and review processes are described and specified in Chapters I, II, III and IV of Fourteenth Title of the LGPAS (DOF 2007).

The General Directorate of Inspection and Monitoring also collaborates with other general Directorates, including the Directorate General for Planning, Programming and Evaluation (*Dirección General de Planeación, Programación y Evaluación - DGPPE*) that is responsible for landing tickets, and the Directorate General for Fisheries and Aquaculture Regulations (*Dirección General Ordenamiento Pesquero y Acuicola, DGOPA*), that is in charge of the verification of permits, concessions and vessels.

Operating under the State Committees for Inspection and Supervision are interinstitutional organisms that carry out the planning and execution of the inspection and surveillance operations. Representatives from three sectors of the government and industry representatives constitute these Committees.

PROFEPA handles environmental disputes related to all types of environmental protected species, such as dolphins. PROFEPA also performs inspections and provides inspection training to SAGARPA staff to help catch and discourage IUU fishing practices that present an environmental threat. Also they can participate during COANPESCA inspection operations in the cases when a protected species is caught or fishing is inside a Natural Protected Area.

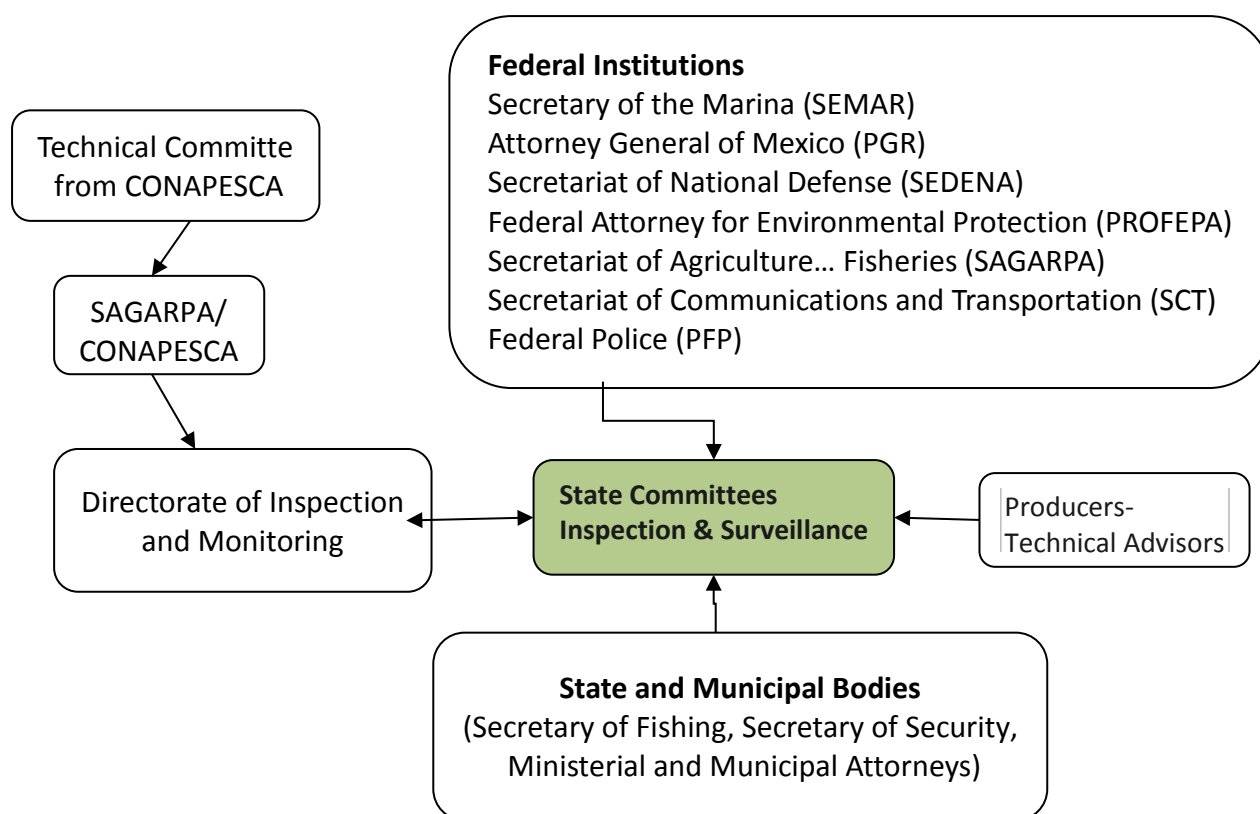


Figure 39. Organization of federal and state agencies involved in fisheries surveillance and enforcement.

Since 2012 the National Inspection and Monitoring Program performs an internal evaluation of the efficiency of its results with a “Logical Framework”. The two indicators are used for measuring performance are related to coverage: (1) Percentage of verifications of verification for compliance with the fisheries and aquaculture regulations and (2) Percentage of fisheries with regulation attended by inspection and surveillance operatives. In 2014 with 26,895 inspection operations of 15 of priority fisheries of the country, fulfilling the goal set by the two indicators in the “Logical Framework” was accomplished. However, as the evaluation report for the National Inspection and Monitoring Program points out, the current evaluation indicators measure coverage, there is no indicator for the actual impact of the program in term of its overarching objectives. There is also no external review of the program and its outputs (CONEVAL, 2014)

Fishing operations are tracked by a VMS system to monitor the location of vessels at all times and to enforce the non-entrance into natural protected areas. At CONAPESCA’s central office the National Centre of Vessels Satellite Tracking and Monitoring is in charge of monitoring all fishing vessels that have to use the VMS system. This center works 24 hours during the 365 days of the year.

The assessment team has witnessed at the CONAPESCA control room operation of the VMS systems that notify CONAPESCA if vessels are in protected waters and moving at speeds associated with hauling gear or of any other irregular activity that could be subject to sanction.

According to records from CONAPESCA’s inspections there are no infractions recorded for this fleet. A single infraction prior to 2010 for a vessel fishing in shallow waters was lifted as there are no

regulations applicable to the small-pelagics fleet regarding depth or fishing areas. According to the client during the inspection trips made by federal agents no retained ETP species were found during 2014 or 2015.

2.7.9 Evaluation for the Management System

There is no formal evaluation of whole management system. However, the integration of Official Mexican Norms has to follow the mechanism established in the Federal Law on Metrology and Standardization (Ley Federal de Metrología y Normalización) (DOF 1992) before its final publication in the National Gazette (Diario Oficial). The procedures for the publication of the Mexican Norms include several rounds of evaluation at several stages of the NOM project carried out by INAPESCA, the Group of Technical Work (GTT), and the Subcommittee for Responsible Fishing (SCPR), approval by the National Advisory Committee on Standardization and a draft is published in the National Gazette for public comments. The same process is followed for the National Fishery Chart and the Fisheries Management Plan. During this consultation process the Sub-committee of Responsible Fishing of the Advisory Committee for the Normalization of Agricultural Food Production have a key role on the review and evaluation of the NORMs, CNP and FMP.

External or International evaluation of the management system does not exist formally. However, international organization such OECD or FAO regularly review Mexican Fisheries policies and statistics (v.g. OECD Review of Fisheries: Policies and Summary Statistics 2013 (DOI: [10.1787/rev_fish-2013-en](https://doi.org/10.1787/rev_fish-2013-en))).

4. Evaluation Procedure

4.1 Harmonized Fishery Assessment

For this assessment harmonization was only required for the “Governance and Policy” component (PIs 3.1.1-3.1.3) with other MSC certified fisheries under the Mexico national management. Harmonization was not mandatory for P1 or P2 as there are no MSC certified overlapping fisheries. Nonetheless, the assessment team took into consideration the scores received, for certain PIs in P1 and P3, by the Southern Gulf of California small pelagics, certified in October 2016, as there are similarities between these two fisheries.

Efforts for harmonization were conducted by team member through reviews of reports from other certified fisheries and when needed conversations were ensued with team members in past assessments.

Principle 1: the small pelagics fishery operating in Sinaloa southern Gulf of California, successfully obtained certification for thread herring complex in October of 2016. The Sinaloa and the Sonora fishery (assessed in this report) target the same biological unit of the *Opisthonema* spp. complex. However, there are significant differences between these two fisheries that discount harmonization:

Differences in the distribution of the stock complex in northern and southern species composition. In Sonoran waters, the *Opisthonema* complex is disproportionately dominated by *O. libertate*, with small amounts of *O. bulleri* and *O. medirastre* present. In contrast, in the Sinaloa southern complex, the three species comprise more equivalent proportions of the overall complex, which are officially managed as a complex and under MSC are assessed as a stock complex.

The two areas are functionally managed as separate stocks by separate regional CRIP – INAPESCA offices, with different information, stock assessments and implementation of management measures.

As the Sonoran small pelagic unit and this Sinaloa & Nayarit-based unit are not managed as the same stock it is not required to harmonize on P1. Nonetheless, the team did consider the scores of the Harvest strategy and Harvest control rules & tools (PI 1.2.1. and PI 1.2.2). For both fisheries conditions were placed for these PIs.

Principle 2: There are no other MSC-certified fisheries that fall within the geographical range of this fishery. As this fishery is certified against CR v1.3, it is not yet subject to the MSC cumulative P2 impacts approach.

Principle 3:

Governance and Policy component: there are several other MSC certified fisheries in Mexico. All fisheries in Mexico are subject to Federal regulatory mandates under the overarching Fisheries Law (LGPAS). This law defines the general long term goal of sustainability and the organizational and procedural structure to achieve the general goal. Elements in Principle 3 that pertain to the general goals, governance and management that are common to all fisheries in Mexico should therefore have consistent background, scores and rationales.

Scores for the Mexican tuna fishery were considered for P3 harmonization but it should be noted that scores for this fishery consider both national management and management by Inter-American Tropical Tuna Commission as the relevant Regional Fisheries Management Organization. All of the other fisheries are exclusively domestically managed.

Fisheries Specific Management System: The Sonoran small pelagics fishery shares elements of the Fisheries Specific Management System Component (3.2.1-3.2.4) with Southern Gulf of California small pelagics fishery. Small Pelagic fisheries in the Gulf of California are regulated by NOM-PESC-003-1993 and the Management Plan for small pelagics. There are several management elements, such as research that are conducted separately for both the northern and southern Gulf of California fisheries. Nonetheless, both fisheries received conditions for the same PIs under P3 (PIs 3.2.2, 3.2.3, 3.2.4, 3.2.5).

Table 22. Fisheries in the MSC System Considered for Harmonization.

	Fishery	Status	Principles for Harmonization	Conformity Assessment Body
1	Southern Gulf of California small pelagics	Certified 2016	P3	SCS Global Services
2	Sian Ka'an and Banco Chinchorro Biosphere Reserves spiny lobster	Withdrawn 2016	P3	MRAG
3	Northeastern Tropical Pacific Purse Seine Yellowfin and Skipjack Tuna Fishery	In assessment, PCDR released	P3	SCS Global Services
4	Red rock lobster, Baja California, México	Re-certified December 2016	P3	SCS Global Services

Table 23. Alignment of Scores for Harmonization

PI	Sonora Sardines (Fishery under assessment)	Southern Gulf of California small pelagics	Sian Ka'an and Banco Chinchorro Biosphere Reserves spiny lobster	Northeastern Tropical Pacific Purse Seine Yellowfin and Skipjack Tuna Fishery	Red rock lobster, Baja California, México	Comments
1.2.1	70	70	-	-	-	
1.2.2	75	70	-	-	-	
3.1.1	95	90	80	80	95	
3.1.2	95	85	85	85	85	
3.1.3	100	100	100	100	100	

3.1.4	80	80	80	80	85	
3.2.1	80	80	-	-	-	
3.2.2	75	70	-	-	-	
3.2.3	75	60	-	-	-	
3.2.4	90	75	-	-	-	
3.2.5	70	75	-	-	-	

4.2 Previous assessments

This fishery has previously undergone full MSC assessment completed in July 2011 by Dr. Chet Chaffee, Dr. Daniel Lluch Belda, Dr. Oscar Sosa Nishizaki and Dr. Sabine Daume, using the MSC Fisheries Assessment Methodology (FAM) Version 1. Copies of this and all assessment downloads are available at the MSC website.

Summary of findings of the 2011 Assessment:

The fishery achieved a normalized score of 80 or above on each of the three MSC Principles independently (Principle 1 – 84.4, Principle 2 – 81.0, and Principle 3 – 85.1). Although the evaluation team found the fishery in overall compliance (a score of 80 or above on each MSC Principle), it also found the fishery's performance on 9 indicators (1.2.4, 2.1.1, 2.1.2, 2.2.2, 2.2.3, 2.3.1, 2.5.2, 3.2.1 & 3.2.4) to be below the established compliance mark (an un-weighted score of 80 for a single indicator). In these specific cases, the MSC requires that the Certification Body set 'Conditions for Continued Certification' that when met bring the level of compliance for the select indicator up to the 80-level score.

Four additional conditions were opened in the second and third surveillance (PI 1.1.1, 2.5.1, 3.2.2, 3.2.3). In the fourth surveillance (2016) of the latest certificate cycle, SCS found that the fishery continued to be in general compliance with the MSC standard and recommended the continued use of the MSC certificate. Three conditions were left open (PI 2.5.1, 2.5.2 and 3.2.3).

SCS and the assessment team examined recent evidence for outstanding conditions from the previous assessments and judged the progress to be adequate to recommend recertification. Details on the progress made in the previous assessment until the PCDR against this condition are included in Table 24.

Table 24. Summary of Previous Assessment Conditions

Condition	PI (s)	Year closed	Justification
-	2.5.1	Closed (Re-Assessment)	<p>This condition was opened on the second surveillance audit: <i>“By the fourth annual surveillance audit, the client should present evidence that the fishery is highly unlikely to disrupt the ecosystem structure to a point where there would be serious or irreversible harm.”</i></p> <p>During the 4th surveillance the assessment team confirmed that progress was being made in the application and publication of ecosystem models that will help determine the required biomass of Pacific sardine to support ecosystem functions. During the preparation of the Client Draft the assessment team received a draft of Evaluations by Arreguin-Sanchez et al. (2016a; 2016b) for ecosystem needs of Pacific sardine estimated threshold harvest rate of 36% as a limit to cause serious or irreversible harm to the ecosystem. Trends of exploitation rates for Pacific sardine and thread herring indicate that the fishery has never exceeded a 25% threshold indicating that the fishery is highly</p>

			unlikely to disrupt the ecosystem structure to a point where there would be serious or irreversible harm, warranting a score of SG80 for PI 2.5.1 and closing the condition.
2-1	2.1.2	Closed, 4 th surveillance Re-opened Re-assessment	<p>The following condition was raised at the full assessment: <i>By the 3rd annual surveillance audit provide basis for confidence to the CB that the partial strategy will work. In order to do so the client shall consider setting harvest rates and assessments for individual species and incorporate these into the management plan.</i></p> <p>Summary of the progress made in the previous assessment: <u>1st surveillance</u>- A new draft version of the Small Pelagics Management Plan was published in July 2011 <u>2nd surveillance</u> – A Fisheries Management Plan for Small Pelagics was formalized into law in November of 2012 that includes a harvest strategy and precautionary reference points. 3rd surveillance - there are elements in the Fisheries Management plan being implemented and , all elements of the harvest control rule are already available and even if some of them are still preliminary, the rule can be computed and implemented. However, there is no evidence of implementation of all measures. <u>4th surveillance</u> – The partial strategy has been demonstrated to be operational by means of continuing monitoring of landings and effort, estimation of fishing mortality rates, season closures and the recent evaluation of stock status, condition is closed <u>Present Re-assessment</u>- The team found some evidence that measures in the partial strategy are implemented (landing monitoring, dynamic models, size sampling), however, at present the harvest control rule for small pelagics is not considered to be 'in place' (See PI 1.2.1 and corresponding condition). The absence of evidence of evidence of monitoring and enforcement of to implement the harvest strategy and stop the fishery operation as BAC is approached, preclude the partial strategy from being considered as 'successfully' implemented.</p> <p>The condition is being reformulated to: <i>By the third annual surveillance the client shall present some evidence that the partial strategy is being implemented successfully.</i></p>
2-2	2.5.2	Open, on target	<p>The following condition was raised at the full assessment: <i>"By the third annual surveillance audit, develop a strategy to restrain impacts of the Sardine fishery on the Gulf of California ecosystem and provide evidence to the CAB that the strategy has been implemented successfully."</i></p> <p>Summary of the progress made in the previous assessment: <u>1st surveillance</u>- The small pelagics management plan which includes ecosystem considerations is published. The on-board observer program is initiated to help identifying and quantifying bycatch associated with fishing operations, to help identify "key elements" of the ecosystem and the fisheries' impact. <u>2nd surveillance</u> – Discussions start with COBI to initiate development of ecosystem models <u>3rd surveillance</u> - Ecopath model indicate that Pacific Sardines are an important component in the diet of seabirds, large pelagics and sharks. <u>4th surveillance</u> –Team confirmed that work is underway to better understand how much unfished Pacific sardine's biomass is necessary to support ecosystem functions. Client presents estimated ranges for Bmin which were calculated with considerations for spawning biomass and recruitment. The team considers that the utilization of Bmin and reference points accounts for the state of the stock, but are not considering biomass required for ecosystem functions.</p>

			<p><u>Present Re-assessment-</u> Results from evaluations by Arreguin-Sanchez et al. (2016a; 2016b) provide a minimum threshold for a harvest rate that includes ecosystem function considerations, providing progress towards development of an ecosystem based management approach.</p> <p>The assessment team recognized that achieving a performance level of 80 for this PI took longer than the 5-year certification period, and accounts this to the exceptional circumstances due to the importance of the target species as low trophic level to ecosystem functioning. Initially delays were due to the time required to collect and evaluate information on the impact of the fishery on the ecosystem structure and function. Thereafter the measures expected to restrain impacts of the fishery are part of the small pelagics management system, and changes to such measures require collaboration from different government agencies, requiring extensive time periods.</p> <p>The assessment team concludes the progress to be sufficient to be qualified as 'on target' as it has been continuously made to improve ecosystem models to inform measures to manage ecosystem impacts.</p> <p>The condition is being reformulated to: <i>By the second annual surveillance the client shall present some evidence that the measures comprising the partial strategy for ecosystem management are being implemented successfully.</i></p> <p>Which is expected to be closed by the second annual surveillance</p>
3-1	3.2.2	Closed, 4 th surveillance Re-opened (re-assessment)	<p>The following condition was raised at the third surveillance audit: <i>By the fourth surveillance audit, the client should present evidence that the fishery management's decision-making process responds to serious and other important issues identified in relevant research, monitoring, evaluation and consultation in a transparent, timely and adaptive manner and takes some account of the wider implications of decisions. The decision-making process must also use the precautionary approach and should be based on the best available information. Information should be available and explanations provided for any actions or lack of action."</i></p> <p>The rationale behind the original condition placed at the third surveillance audit revolved around the perceived downward trend in catch and the need to demonstrate that such trend was not caused by the inability of the management system to respond <i>in a timely manner to a serious issue that has been identified by research and monitoring, nor do a precautionary set of measures appear to be applied to prevent serious harm to the stock and the ecosystem.</i> A significant element questioning the system's performance related to the reliability of the estimates of absolute abundance from acoustic surveys. At the fourth audit, these questions were addressed to the satisfaction of the team and the condition was closed.</p> <p>It should be noted that the SPFMP is in practice very young and some of its elements are still in the process of being properly understood and implemented. Because of this, at re-assessment it was realized that the fishery is missing critical parts of the implementation process for the HCR. First, the management requires procedures to assure that the fishery is able to stop operations as they approach the pre-established catch limit of the season. Secondly, the management system requires issuing additional regulatory documents derived from the guidelines in the SPFMP to make procedures such as the HCR binding. This caused re-opening the condition associated to PI 3.2.2.</p> <p>The condition is being reformulated to: <i>By the second surveillance the client shall present evidence that the decision-</i></p>

			<i>making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.</i>
3-2	3.2.3	Open, Behind On Target	<p>The following condition was raised at the third surveillance audit: <i>“By the fourth surveillance audit, the client should present evidence that the fishery’s management measures are enforced and complied with.”</i></p> <p>This condition has been addressed and discussed in past surveillance audits and remains open because of several considerations. The fishery has shown evidence of efforts to avoid catching undersized fish but controlling the outcome appears to be unpredictable. This non-compliance of the size regulation is subject to debate, amongst scientists in the fishery management agencies, as to whether it is relevant and should remain as a requirement. Also, we have been informed that a new approach to the allowed proportion of fish under the size limit has been introduced into the revision of the Norm in question. The assessment team received an official update to the process indicating that the revision was in its final steps. In consideration of the many other improvements and efforts made by the fishery we concluded that it was reasonable to wait for the revised Norm and re-evaluate the fishery performance on this issue. The assessment team concluded the progress to be ‘on-target’</p> <p>The condition is being reformulated to: <i>By the second annual surveillance the client shall provide evidence that there is no systematic non-compliance with current regulations.</i></p>

4.3 Assessment Methodologies

This assessment was conducted by SCS Global Services, an accredited MSC certification body. The fishery was assessed using the MSC Certification Requirements Version 1.3, January 14 2013 and the reporting template used in this report is also V1.3. The default assessment tree was used without adjustments, but with the appropriate considerations for key LTL stocks for Pacific sardines in Principle 1. The CAB has confirmed with MSC Fisheries Assessment Managers that the release of V2.0 FCR (April 1, 2015) and V2.1 GCR (Sept 1, 2015) are not binding for this fishery until during full assessment. The fishery will be subject to these updated process requirements (FCR 2.0 and GCR 2.1 or more up to date versions thereof) at the time of any next surveillance. The fishery will remain Part C of V1.3 of the Certification Requirements for all performance requirements (PISGs) for the five year duration of the certificate cycle, should the fishery be found capable of scoring at a level that confers certification.

4.4 Evaluation Processes and Techniques

4.4.1 Site Visits

The assessment team selected the visit site and attendees based on information needed to assess management operations of the unit of assessment. The client group and other relevant stakeholders helped identify and contact fisheries management, research, compliance, and habitat protection personnel and agency representatives. Before the site visit and meetings were conducted, an audit plan was provided to the client and relevant stakeholders. Participants to the onsite-meeting prepared materials to present to the assessment team, presenters then responded to questions from the assessment team and stakeholders present at the meeting. Time was also set aside for dialogue

facilitated by the team leader. The on-site meetings took place in Guaymas, Sonora, Mexico, between 20 and 21 of July 2016 in the offices of CANAINPES.

Table 25. Audit Plan: Key Topics covered during the site meeting. All meetings were conducted at the CANAINPES office in Guaymas, Sonora Mexico

	Meeting Date	Topic
1	20 July, 2016	Updates in fishery operations and landings presented by research staff from INAPESCA (Dr. Manuel Nevárez and Ángeles Martínez)
2	20 July	Findings from research on effects of environmental factors on Pacific sardine abundance and impacts of fishery on ecosystem function presented by Dr. Pablo del Monte Luna from CICIMAR)
3	20 July	Presentation on impacts of fishery on indirect and direct seabird mortality and trajectories in nesting populations of seabirds in the GOC presented by Dr. Enriqueta Velarde from Universidad Veracruzana
4	20 July	Open dialogue to examine the designation of Pacific sardine as key LTL with overview of MSC requirements, available data and management implications.
5	20 July	Updates in hydroacoustic estimations, Pacific sardine stock assessment presented by research staff from INAPESCA (Dr. Manuel Nevárez and Violeta González)
6	20 July	Evaluation of available harvest control rule, reference points and implications for designation of key LTL stock presented by Dr. Enrique Morales from CIBNOR
7	21 July, 2016	Findings from on-board observer program, evaluations of <i>bocona</i> sardine and chub mackerel presented by Dr. Manuel Nevárez, INAPESCA
8	21 July	Preliminary results on spatial and temporal variations in ETP interactions from the onboard observer program presented by Dr. Enrique Morales from CIBNOR
9	21 July	Review of information from on-board observer program, impacts on sea birds and mitigation strategies, presented by Francisco Fernández from COBI.
10	21 July	Open dialogue to examine difference in seabird mortality estimates
11	21 July	Findings from latest stock assessment for thread herring presented by Manuel Nevárez, INAPESCA
12	21 July	Findings from model of climate change and Pacific sardine distribution in Baja California presented by Dr. Pablo del Monte Luna from CICIMAR
13	21 July	Closing remarks and discussion of incorporation of predictive models to inform harvest control rule, review of status of NOM modification and function of Management Plan in relation to the NOM.

Table 26. Attendees and Organizations

Name	Role	Affiliation
Leon Tissot	Vice President	CANAINPES
Dr. Manuel Nevárez Martínez (MN)		INAPESCA
M.C. María de los Ángeles Martínez Zavala	Researcher	INAPESCA
Alejandro Alvarez	Researcher	INP/ CRIP-Guaymas
Eduardo Alvarez		INP/ CRIP-Guaymas
Juan Pablo Santos		INP/ CRIP-Guaymas

Violeta González	Researcher	INP/ CRIP-Guaymas
Dr. Enrique Morales-Bojórquez	Researcher	CIBNOR, SC
Dr. Pablo del Monte Luna	Researcher	CICIMAR
Francisco Fernández	Coordinator	COBI
Jesus Padilla Serrato	Researcher	COBI
M.C. María José Espinosa Romero (MJE)	Director of Conservation and Fisheries	COBI
Javier Alverde		Nova del Mar, CANAINPES
David Angulo	Direction	Pacifico Industrial, CANAINPES
Elias Ortega Silva	Coordinator Fishing Operation	Pesquera Costa Poca, CANAINPES
Esdras Delgado	Vessel Owner	Sardison, CANAINPES
Enrique Flores		Selecta de Guaymas, CANAINPES
Marco Ross		Subsecretaria de Pesca
Silvia Carreno Gala		Subsecretaria de Pesca
Dra. María Enriqueta Velarde González	Researcher	UNIVERSIDAD VERACRUZANA
Dr. Carlos Alvarez	Assessment Team Leader	SCS
Gabriela Anhalzer	Technical Support	SCS
Sandra Andracka	Assessment Team Member	SCS

4.4.2 Consultations

SCS identified relevant stakeholders for this fishery through professional networks of SCS and the audit team and know-how of the organizations working in the area. A list of over 50 individuals from 27 different organizations was compiled including representatives from the government, private sector and non-profit sectors working at regional and national levels (Table 27). The main form of communication to stakeholders has been via email to personal or organizational email addresses. Stakeholders on the list received ongoing notifications of progress at the following milestones, as detailed in CR 27.15.3.1:

- Announcement of Re-Assessment and proposed team– June 2016
- Onsite-meeting scheduled – July 2016
- Proposed peer reviewers– February 2017

Stakeholder written comments were received prior to the onsite-meeting from: Universidad Veracruzana

Dirección General de Investigaciones Instituto de Ciencias Marinas y Pesquerías and the Consejo Asesor del Conjunto de Áreas Naturales Protegidas Federales. A summary of stakeholder comments and the team's feedback can be found in Appendix 3).

Stakeholder consultation also occurred at the onsite-meeting, where stakeholders were contacted prior to the onsite-meeting and were invited to present. For more details on information stakeholders that attended the onsite-meeting see the previous section. Stakeholder input was also key for the

designation of Pacific sardines as key LTL stock (See section in Background Low Trophic Level Species (LTL))

Additional key stakeholders were identified as the process unfolded, these are marked in the table below with an asterisk (*). Artisanal fishing representatives were welcomed to the overall meeting by the Client.

Table 27. List of stakeholder organizations contacted for the MSC Assessment

Organization	Type
Prescott College Bahia Kino in Sonora	Academic Institution/Research
SCRIPPS Institution of Oceanography (SIO) University of California San Diego	Academic Institution/Research
UC Davis	Academic Institution/Research
Unam-Instituto De Ciencias Del Mar Y Limnología	Academic Institution/Research
Universidad Veracruzana	Academic Institution/Research
CONAPESCA	Government Institution
CONANP*	Government Institution
Secretaría de Pesca BC	Government Institution
INAPESCA	Government Institution/Research
Instituto Nacional de Pesca(INP)	Government Institution/Research
FEDECOOP	Industry (Client)
American Bird Conservancy*	NGO
Causa Natura*	NGO
COBI	NGO
Conservación de Islas	NGO
EDF Mexico	NGO
Fundación Carlos Slim, A.C.	NGO
Niparajá	NGO
Pew	NGO
Pronatura Noroeste	NGO
Rare	NGO
Sumar, AC	NGO
The Nature Conservancy	NGO
WWF	NGO
Centro de Investigaciones Biológicas del Noroeste S.C. (CIBNOR)	Research Institute
Centro Interdisciplinario de Ciencias Marinas (CICIMAR)	Research Institute

4.4.3 Evaluation Techniques

Media Announcements

No media announcements were made.

The assessment team confirmed that the website for a variety of aspects related to the fishery is fully functional at <http://sardinagolfodecalifornia.org/>. The site has links to most technical documents used towards certification, minutes of post-certification workshops, technical meetings, the management plan and other relevant documents. It was noted in one of the documents that during the last regular meeting of the technical committee stakeholders attended the meeting.

Documentation and Information Gathering

One of the most critical aspects of the MSC certification process is ensuring that the assessment team gets a complete and thorough grounding in all aspects of the fishery under evaluation. In even the smallest fishery, the assessment team typically needs documentation in all areas of the fishery from the status of stocks, to ecosystem impacts, through management processes and procedures.

Under the MSC program, it is the responsibility of the applying organizations or individuals to provide the information required proving the fishery or fisheries comply with the MSC standards. It is also the responsibility of the applicants to ensure that the assessment team has access to any and all scientists, managers, and fishers that the assessment team identifies as necessary to interview in its effort to properly understand the functions associated with the management of the fishery. Last, it is the responsibility of the assessment team to make contact with stakeholders that are known to be interested, or actively engaged in issues associated with fisheries in the same geographic location.

Information for the assessed was gathered from stakeholder comments prior to the onsite-meeting (and after), and via phone conversations. The assessment team lead conducted extensive phone conversations and email exchanges with a group of fisheries scientists in the process of determining Pacific sardine as key LTL stock. A summary of the analysis made by the review team is found in Appendix 13.2 *Summary Results for Determination of Pacific Sardines as Key LTL* (p. 315).

Scoring and Report Development Process

1. **Onsite-Meeting:** Scoring was initiated during the 3 day site visit and completed iteratively through phone calls, emails and skype teleconferences between July 2016 and February 2017.
2. **Additional Document Submission:** Following the onsite-meeting, the team compiled a list of requested documents for the client for submission within two weeks. The gathering of ecological data of Pacific sardine, in order to allow the designation of key LTL was crucial to the assessment of Principle 1 for this species. As described in the previous sections, this process had input from a number of stakeholders.

3. **Client Draft:** Rationales and associated background was developed by respectively assigned assessment team members, and then cross read by team members and SCS staff for production of the client draft report. Scoring was completed by consensus through this review process and team meetings by phone and email. The fishery received a total of 14 scoring-issue level conditions within 14 performance indicators. The team finalized scoring and submitted the Client Draft on 7 of February 2016.
4. **Peer Review:** The assessment team revised some sections of the Preliminary Draft report based on comments from the peer reviewers. No changes were made to scoring, but additional context and errors of fact were revised. For more details on the edits please see Appendix 2 Peer Review Reports.
5. **Stakeholder Comment on PCDR:**

Scoring Methodology

The assessment team followed guidelines in MSC FCR v2.0 Section 7.10 “Scoring the fishery”. Scoring in the MSC system occurs via an Analytical Hierarchy Process and uses decision rules and weighted averages to produce Principle Level scores. There are 28 Performance Indicators (PIs), each with one or more Scoring Issues (SIs). Each of the scoring issues are considered at the 60, 80, and 100 scoring guidepost levels. The decision rule described in Table 28 determines the Performance Indicator score, which must always be in an increment of 5. If there are multiple ‘elements³’ under consideration (e.g. multiple main primary species), each element is scored individually for each relevant PI, then a single PI score is generated using the same set of decision rules described in Table 28.

³ MSC FCRV2.0 7.10.7: In Principle 1 or 2, the team shall score PIs comprised of differing scoring elements (species or habitats) that comprise part of a component affected by the UoA.

Table 28. Decision Rule for Calculating Performance Indicator Scores based on Scoring Issues, and for Calculating Performance Indicator Scores in Cases of Multiple Scoring Elements. (Adapted from MSC FCRV2.0 Table 4)

Score	Combination of individual SIs at the PI level, and/or combining multiple element PI scores into a single PI score.
<60	Any scoring element/SI within a PI which fails to reach SG60 shall not be assigned a score as this is a pre-condition to certification.
60	All elements (as scored at the PI level) or SIs meet SG60 and only SG60.
65	All elements/SIs meet SG60; a few achieve higher performance, at or exceeding SG80, but most do not meet SG80.
70	All elements/SIs meet SG60; half* achieve higher performance, at or exceeding SG80, but some do not meet SG80 and require intervention action to make sure they get there.
75	All elements/SIs meet SG60; most achieve higher performance, at or exceeding SG80; only a few fail to achieve SG80 and require intervention action.
80	All elements/SIs meet SG80, and only SG80.
85	All elements/SIs meet SG80; a few achieve higher performance, but most do not meet SG100.
90	All elements/SIs meet SG80; half achieve higher performance at SG100, but some do not.
95	All elements/SIs meet SG80; most achieve higher performance at SG100, and only a few fail to achieve SG100.
100	All elements/SIs meet SG100.

**MSC FCRV2.0 uses the word 'some' instead of half. SCS considers 'half' a clearer description of the methodology utilized.*

When calculating the Principal Indicator scores based on the results of the Scoring Issues (SI), SCS interprets the terms in the Table 2 as following:

- **Few:** Less than half. Ex: if there are a total of three SIs, one SI out of 3 is considered few.
- **Some:** Equal to half. Ex: if there are a total of four SIs, two SIs out of 4 is considered some.
- **Most:** More than half. Ex: if there are a total of three SIs, two SIs out of 3 is considered most.

The MSC provides a mandatory Excel template that facilitates the calculation of Principle level scores. Within the Excel template (and provided in Section 6.2) PIs are organized into components, where each PI within a component is weighted equally (**PI weight**), where the sum of PI weights per component equals 1. Multiple components make up each Principle, and components are likewise weighted (evenly, except in Principle 1) (**Component weight**), where the sum of component weights per Principle equals 1. The PI weight within the component multiplied by the component weight within the Principle provides a weight for each PI within the Principle (**PI weight * Component weight= PI Principle weight**). Each PI score is then multiplied by its weight within the Principle (**PI Principle weight**), and all weighted PI values are summed to generate a Principle level score, reported to the nearest one decimal place in accordance with MSC FCRV2.0 (7.10.3)

The decision rule for MSC certification is based on the resulting Principle level scores and is as follows:

- No PIs score below 60
- The aggregate score for each Principle, rounded to the nearest whole number, is 80 or above

Elements evaluated in the scoring of the fishery are as follows:

Table 29. Scoring elements

Scoring Element	Common name	Scientific name	MSC Classification	Reason for classification
Retained (PI 2.1.X)				
Bigmouth sardine	Bigmouth sardine	<i>Cetengraulis mysticetus</i>	Main retained	>5% catch of UoA
Chub mackerel	Chub mackerel	<i>Scomber japonicas</i>	Main retained	>5% catch of UoA
Other small pelagics and fish species	See list in Appendix 13.1	See list in Appendix 13.1	Minor retained	<5% catch of UoA
Bycatch (PI 2.2.X)				
Sea Birds (Not ETP)	Western Grebe Black-headed Gull Magnificent Frigatebird Ring-billed Gull Least Storm-Petrel Double-crested Cormorant Brandt's Cormorant Black-necked Grebe Brown Booby	<i>Aechmophorus occidentalis</i> <i>Chroicocephalus ridibundus</i> <i>Fregata magnificens</i> <i>Larus delawarensis</i> <i>Oceanodroma microsoma</i> <i>Phalacrocorax auritus</i> <i>Phalacrocorax penicillatus</i> <i>Podiceps nigricollis</i> <i>Sula leucogaster</i> <i>Thalasseus maximus</i>	Minor bycatch	<5% catch of UoA
ETP (PI 2.3.X)				
Blue footed boobies	Blue footed boobies	<i>Sula nebouxii</i>	ETP	National legislation: NOM 096
Brown pelicans	Brown pelicans	<i>Pelecanus occidentalis</i>	ETP	National legislation: NOM 096
Other Sea birds	Pink-footed shearwater Black-vented shearwater Heermann's gull Yellow-footed gull Elegant Tern	<i>Puffinus creatopus</i> , <i>Puffinus ophistomelas</i> , <i>Larus heermanni</i> <i>Larus livens</i> <i>Thalasseus elegans</i>	ETP	National legislation: NOM 096
Marine mammals	Short-beaked common dolphin Spotted dolphin Bottlenose dolphin Californian Sea Lion	<i>Delphinus capensis</i> , <i>Stenella attenuate</i> , <i>Tursiops truncatus</i> , <i>Zalophus californianus</i> ,	ETP	National legislation: NOM 096
Sea turtles	Olive ridley turtle Black turtle	<i>Lepidochelys olivacea</i> , <i>Chelonia agassizii</i>	ETP	National legislation: NOM 096
Fish and shark Species	Giant seahorse Cortez angelfish Striped marlin Sailfish Totoaba White shark Smoothtail mobula Whale shark	<i>Hippocampus ingens</i> <i>Pomacanthus zonipectus</i> <i>Kajikia audax</i> <i>Istiophorus platypterus</i> <i>Totoaba macdonaldi</i> <i>Carcharodon carcharias</i> <i>Mobula munkiana</i> <i>Rhincodon typus</i>	ETP	National legislation: NOM 096 NOM 017 NOM 029

5. Traceability

5.1 Eligibility Date

Fish products originating from the UoC are processed into three main product types: (1) canned (2) fishmeal and (3) fish oil. SCS has concluded that currently only canned products are eligible to be sold as MSC-certified or carry the ecolabel. The eligibility date for canned products is determined to be at the certification of the fishery, projected for July 2017. The other two product types, fish meal and fish oil, are not eligible to be sold as MSC-certified or carry the ecolabel. This negative determination was a result of the lack of verifiable evidence demonstrating effectiveness of separation of certified and non-certified catch for these product types. The subsequent sections in this report provide further details on the traceability systems and potential risks identified. Accordingly, SCS has not nominated a date from which fishmeal and fish oil from the certified fishery is eligible to be sold as MSC certified or bear the MSC ecolabel. This determination may be changed if at a subsequent assessment (i.e. surveillance or CoC audit) traceability systems are deemed sufficient. The Actual Eligibility date will be determined in this subsequent assessment.

The fishery does not hold a currently valid MSC certificate (due to certificate expiration) and does not use the blue MSC ecolabel on product.

5.2 Traceability within the Fishery

The following traceability evaluation is for the UoC/UoA covering the CANAINPES fleet fishing with purse seine gear and targeting Pacific sardine and thread herring in the northern and central area of the Gulf of California, off the coast of the states of Sonora and Yavaros, Mexico.

Below we've listed the main stages of the fishery operation within the UoC fishery and the relevant tracking, tracing and segregation systems at each step.

Capture of product: The fishery targets exclusively small pelagics, the three principal commercial species captured are Pacific sardine (*Sardinops sagax*), thread herring (*Opisthonema spp.*)⁴, and bocona (*Cetengrulus mysticetus*). Other small pelagic species caught by the UoC include: Chub Mackerel (*Scomber japonicas*), Red-eye round herring (*Etrumeus teres*), California Anchovy (*Engraulis mordax*) and Leather-jackets (*Oligoplites Spp*). Only Pacific sardine and thread herring are the target species evaluated under Principle 1. According to the client group and the INAPESCA, small pelagics in the northern-central Gulf of California, occur in single-species schools⁵. When the vessel targets a specific species of small pelagics, the haul is presumed to belong to that single species. Vessels in the CANAINPES fleet each have four to six wells in their holds, the number of wells varies depending on vessel size. The availability of multiple wells enables vessels to set on species-specific schools and maintain the small pelagic segregated by species in separate wells. The client explained to the assessment team that protein and oil content vary across the different small pelagic species, thus

⁴ There are three species of thread herring in the Gulf of California, only the most commonly captured species (*Opisthonema libertate*) is included in the UoA. The two other species of thread herring (*O. libertate* and *O. bulleri*) are practicably visually indistinguishable and thus considered as 'Inseparable or Practicably Inseparable' (IPI) catches (See Section 5.4).

⁵ *Opisthonema spp.* are considered to occur in sub-species mixed schools

there is an operational and economic incentive for the fishery to maintain the different species segregated in order to control the level of protein of the processed products. According to the client, information on volumes and species are recorded under the “General Observations” section in the “Vessel logbook” (*Diario de Maquina*) by the onboard motor engineer. When different small pelagic species are mixed in the same well (this could occur when there is surplus volume from larger sets), these wells are labeled as ‘mixed’.

Aside from small pelagic species, the fleet is reported to capture over 100 fish species and invertebrate species. The majority of these non-target fish and invertebrates are small and due to the operational challenges of separating these species they are mostly retained and mixed with the target catch, thus these species are also considered IPI (See Section 5.4). Other non-target species include Endangered Threatened Protected (ETP) fish and elasmobranch species. Observer records and anecdotal evidence from the fishery representatives indicates that ETP and vulnerable elasmobranch organisms are manually separated on-board from the target catch and either returned to the sea or if kept these are stored separately from the rest of the catch.

Based on the anecdotal evidence provided by the client, the assessment team found the on-board traceability and control systems described above to be generally reasonable. However, the client did not provide traceability records that enabled the assessment team to adequately verify the well-segregation of small pelagic species, leading to some concern regarding the risk of mixing between certified and non-certified catch during storage on-board. Similarly, the assessment team believes the risk of mixing of ETP fish species and vulnerable elasmobranch organisms, with the rest of the catch, to be negligible as the total volume of these groups is extremely low and these are mostly larger individuals that may be manually separated during operations. However, this information was primarily anecdotal and could not be verified by the assessment team, and thus considered a potential risk.

Transshipment: When there is a surplus of catch, transshipment occurs exclusively between vessels within the CANAINPES fleet, all of which are within the UoC. Transshipment events are also documented under the “General Observations” section in the “Vessel logbook” (*Diario de Maquina*), as required by the Navy.

On-board processing: There is no processing at sea.

Product unloading: Most of the companies that are members of CANAINPES are vertically integrated, and directly own their respective processing plants and vessels, unloading takes place at their respective private docks. Only vessels within the UoC are permitted to unload at the private docks of the processing plants that are part of the UoC. At landing each vessel is assigned a lot number which documents the vessel’s name, date of landing, time of unloading, date and volume per species in a ‘Receiving Report’ (*Reporte de Rendimiento*). At unloading the catch continues to be separated by different small pelagic species. While operating or at landing, the vessel’s crew will also complete a self-reported (electronic or manual) fish/landing ticket (*Aviso de Arribo*) to be submitted to CONAPESCA. The official landing ticket includes date of landing, name of vessel, fishing area, fishing permit and volume for the different species.

The fishery certificate covers the activities up to the point of landing, the traceability systems used up to this point were assessed and documented by the assessment team. The activities in the subsequent stages of the supply chain are not covered under the fishery certificate, a description is provided below, but the assessment team did not completely verify the traceability systems at these stages:

Product transport, processing and storage: The product continues to be traced by the lot number assigned in the 'Receiving Report' through the transport, processing and storage stages. According to anecdotal evidence lots are separated by species, as the plants have a financial incentive to maintain species separation as protein content varies among the small pelagic species, resulting in varying quality and value of fishmeal. This is one of the areas where the assessment team identified risk of mixing between certified and non-certified catch. For product processed in cans, there is no risk as individual fish for the same species are selected to be canned. However, for fishmeal and fish oil, there is a risk that other species of non-certified small pelagics are mixed. For fishmeal the processing plants use anecdotal and qualitative means to ensure the composition of each lot is almost entirely the certified product. The anecdotal component comes from the assumption that vessels are effective in sorting sets into species-specific wells and the qualitative component from levels of protein content in the fishmeal and fish oil. Pacific sardines have a higher protein count than other species, thus species composition for the lot is assigned according to the protein count of the fishmeal once it's been processed. One of the problems with this approach is that combined proportion of catches from the other non-certified small pelagic species (*bocona*, chub mackerel, red-eye round, California anchovy and leather-jackets) exceed 15% of the catches of the UoA, and thus cannot be considered as IPI. Consequently, the current system in place is not appropriate, and the chain of custody needs to demonstrate separation of certified and non-certified catch. The first point of ownership change is after processing: when product is sold from the processing plant to a variety of clients in Mexico, Chile, the US, China, Indonesia, Europe and Canada.

Table 30. Traceability Factors within the Fishery:

Traceability Factor	Description of risk factor if present. Where applicable, a description of relevant mitigation measures or traceability systems (this can include the role of existing regulatory or fishery management controls)
Potential for non-certified gear/s to be used within the fishery	There is no risk that non-certified gear be used within the fishery, as only purse-seine nets are allowed in the UoA area to capture small pelagics.
Potential for vessels from the UoC to fish outside the UoC or in different geographical areas (on the same trips or different trips)	There is some risk that vessels from the UoC fish in other areas of the Gulf of California, but this is mitigated by use of VMS and recommendations in the Small Pelagics Management Plan against vessels travelling from Baja California to the Gulf of California and vice versa.
Potential for vessels outside of the UoC or client group fishing the same stock to land product as if from within the UoC	It is highly unlikely that vessels that are not members of CANAINPES would attempt to land product as it was from one of the vessels within the UoC. Every vessel is clearly identified and traceability risk is mitigated by privately managed and vertically integrated supply chains. The fishing companies that are part of CANAINPES unload at the Guaymas port to directly send their product to their respective processing plants.

	There is some risk that vessels outside the UoC may fish on the same stock. Traceability risk is mitigated by the privately managed and vertically integrated supply chains. The fishing companies that are part of CANAINPES unload at their respective private docks. Only vessels within the UoC are permitted to unload at the private docks of the processing plants that are part of the UoC.
Risk of mixing between certified and non-certified catch during storage, transport, or handling activities (including transport at sea and on land, points of landing, and sales at auction)	There is relevant risk of mixing between small pelagic species that are not certified (i.e. <i>bocona</i> sardine, chub mackerel, etc.) and the certified species (Pacific sardine, thread herring), with the exception of identified IPI species. This risk is described as mitigated by storing sets into species-specific wells and recording wells and contents in the fishing logbook. However, the assessment team was unable to verify the effectiveness of these measures. Additionally, the separation of other non-target catch aside from small pelagic species also needs to be more carefully verified. The ability of the fishery to segregate MSC-eligible and non-MSC eligible product requires further verification.
Risks of mixing between certified and non-certified catch during processing activities (at-sea and/or before subsequent Chain of Custody)	There is no processing activities at sea. See above for risk of mixing during processing, which is most likely to arise if the mitigation measures to sort sets into species-specific wells are not effective and MSC-eligible and non-eligible product enters processing in a mixed state from mixing in vessel wells.
Risks of mixing between certified and non-certified catch during transshipment	Transshipment is very rare, and if it does occur it only takes place between vessels within the UoC and it is recorded in the fishing logbook. CoC auditors should validate this self-reporting process.
Any other risks of substitution between fish from the UoC (certified catch) and fish from outside this unit (non-certified catch) before subsequent Chain of Custody is required	No other risk of substitution was identified.

5.3 Eligibility to Enter Further Chains of Custody

SCS has concluded that only certain fish products (canned fish) originating from the UoA are eligible to be sold as MSC-certified or carry the ecolabel. The other remaining fish products (fishmeal and fish oil) are not eligible to be sold as MSC-certified or carry the ecolabel. The traceability and segregation systems that are required to ensure the separation of any certified product from non-certified product have been described to the assessment team as already in place for the client fleet. Currently the fishery has in place a system that generally separates small pelagic species-based sets into different wells in the holds of vessels. However, this information was primarily anecdotal and the assessment team was unable to verify the capacity of the traceability and control systems in place to adequately mitigate the risk of mixing between certified and non-certified catch. As of early 2017 the client has started to implement additional systems (observer program and on-board cameras), which are expected to provide verification for current traceability systems. These additional systems or controls

will need to be verified by either CoC auditors or assessment team members in order to provide a positive determination for eligibility to enter further chains of custody.

Most of the vessels in the UoC are under the ownership of a company that also has a processing plant, and in these vertically integrated chains the change of ownership starts after the product is processed and sold from the processing plant to outside clients. The fishery certificate covers the activities up to the point of landing, the traceability systems used at this point are assessed and documented in this report under 'Product unloading' in section 5.2 *Traceability within the fishery*. The activities in the subsequent stages of the supply chain, were not completely assessed by the team, and thus are not covered under the fishery certificate. The assessment team has determined that Chain of Custody should start prior to the first sale, at the point of unloading.

A list of vessels whose product will be eligible to use the fishery certificate and sell product as MSC certified with the blue eco-label, pending a positive determination is provided in Annex 13.1.

5.4 Eligibility of Inseparable or Practicably Inseparable (IPI) stock(s) to Enter Further Chains of Custody

The fishery targets seven different species of small pelagics: Pacific sardine, thread herring, *bocona* sardine, chub mackerel, red-eye round, California anchovy and leather-jackets. Only Pacific sardine and thread herring are assessed as P1 target species. Aside from small pelagic species, the fleet is reported to incidentally capture approximately 104 fish species, and 29 invertebrates (See Appendix 13.3 *List of Non-Target Species*). In this section these species are referred to as "Non-small pelagic species 'minor' retained species".

SCS identified the following catches of target and non- target stock(s) that are considered to be inseparable or practicably inseparable (IPI) from target (P1) stock(s):

Thread herring (*O. bulleri* and *O. medirastre*): The thread herring is the common name for the genus *Opisthonema* that groups five different species. In the Gulf of California three species of *Opisthonema* are found: *O. libertate*, *O. bulleri* and *O. medirastre*. The target species assessed is in the thread herring UoA is *O. libertate*. The two other species of thread herring (*O. bulleri* and *O. medirastre*) account only for a marginal proportion of the catch of the UoA. A review conducted by INAPESCA (Martinez-Zavala 2013) sampled species composition from five fishing seasons from 2007/08 to 2011/12 and found that 96% of thread herring catch was *O. libertate* and 3.6% *O. bulleri*. Although the review recognized that species composition changes from season to season, it was concluded that *O. libertate* is the dominant species in this region of the Gulf of California. *O. libertate* is distinguishable from the other two *Opisthonema spp.* only by the number of gill rakers, making these two practicably visually indistinguishable during normal fishing operations. For the 2013-14 season⁶ estimated landings of thread herring amounted to 235,266 mt (Nevárez-Martínez et al, 2016) out of which ~4% (9,410 mt) is estimated to be *O. bulleri* and *O. medirastre*, representing 1.2% of catch of the UoAs for Pacific sardine and thread herring. Both *O. bulleri* and *O. medirastre* are widespread species with high fecundity and low vulnerability. The volume caught by the fishery (~5,000 mt) is not considered to be large enough to pose a risk to the health of their stocks.

⁶ This season was selected because it is the only season with complete observer data for catch composition.

Non-small pelagic species ‘minor’ retained species: Aside from the seven small pelagic targeted species, the fleet is reported to incidentally capture approximately > 100 fish species and invertebrates (not including ETP species and vulnerable elasmobranch species) categorized as ‘minor retained’. During the onsite-meeting, staff responsible for the observer program explained that due to the operational challenges of separating these ‘non-target’ species from the rest of the catch of small pelagics, they are mostly retained. Though these species are physically distinguishable from thread herring and Pacific sardine, it is not commercially feasible to separate them during the harvesting and processing operations and thus are considered IPI stocks. The observer program recorded an estimated 412 mt of ‘Non-small pelagic species minor retained’ species, representing ~ 0.14% of the total catches of the UoA in the most recent year. From this group the dominant species in terms of weight are bronze-stripped grunt (*Orthopristis reddingi*), finescale triggerfish (*Balistes polylepis*) and Pacific Sierra (*Scomberomorus sierra*). There is currently no population information available for these species. The IUCN lists them as ‘Least Concern’, with a wide distribution along the Mexican coast and no major threats. Though there are no known species-specific conservation measures for these species in Mexico, the volumes captured by the fishery are considered too low to pose a risk to the stocks of these species.

None of the species identified above as IPI are designated as ETP. The assessment team did identify eight ETP fish species and additionally the observer program recorded the catch of thirteen elasmobranch species that were not classified as ETP, but as minor retained (See Section 3.4.3 Retained Species). Some of the ‘minor retained’ species are categorized by the IUCN as endangered: scalloped hammerhead (*Sphyrna lewini*), and others as vulnerable: dusky shark (*Carcharhinus obscurus*), shortfin mako (*Isurus oxyrinchus*) and ocellated electric ray (*Diplobatis ommata*). Furthermore, despite their vulnerable status, relative catch volumes the thirteen shark and ray species are < 0.01% of the catch of the UoA, and are not considered to be significant enough to affect their respective populations. However, the same issues flagged in earlier sections, regarding the eligibility of certain products (fishmeal and fish oil) originating from the UoC to enter further chains of custody is applicable to these IPI stocks, as described in section 5.2:

Based on the anecdotal evidence provided by the client, the assessment team found the on-board traceability and control systems to be generally reasonable [...] the assessment team believes the risk of mixing of ETP fish species and vulnerable elasmobranch organisms, with the rest of the catch, to be negligible as the total volume of these groups is extremely low and these are mostly larger individuals that may be separated during operations. However, this information was primarily anecdotal and could not be verified by the assessment team, and is thus also considered a potential risk.

Once the ability of the fishery to segregate MSC-eligible and non-MSC eligible product is verified, the negative determination would be overturned and the IPI species would be eligible to enter further certified chains of custody.

The combined proportion of catches from the IPI stocks identified above are estimated to be equal to less than 2% of the catch of the fishery in the 2013-14 fishing season, which is the most recent fishing season with available observer data. Following clause 27.4.10 (MSC CR v1.3) SCS submitted on March 13th, 2017 a variation request to the requirements 27.4 to the MSC to allow an exemption to requirements for IPI stocks on grounds that the proportion of IPI stocks are less than 2% and the total catch of IPI stocks plus targeted landings by the fishery under assessment and do not create a significant impact on the IPI stocks as a whole. Based on MSC’s request for clarity the variation request was edited and resubmitted on April 24th 2017.

6. Evaluation Results

6.1 Principle Level Scores

Table 31. Final Principle Scores

Final Principle Scores		
Principle	Pacific Sardines	Thread Herring
Principle 1 – Target Species	82.5	81.9
Principle 2 – Ecosystem	80.7	
Principle 3 – Management System	85.3	

6.3 Summary of PI Level Scores

Table 32. Summary of Performance Indicator Scores and Associated Weights Used to Calculate Principle Scores for Pacific Sardines and Thread Herring.

Principle	Wt (L1)	Component	Wt (L2)	PI No.	Performance Indicator (PI)	Wt (L3)	Weight in Principle	Pacific Sardines Score	Thread Herring Score
One	1	Outcome	0.5	1.1.1	Stock status	0.5	0.25	100	90
				1.1.2	Reference points	0.5	0.25	75	90
				1.1.3	Stock rebuilding				
		Management	0.5	1.2.1	Harvest strategy	0.25	0.125	70	70
				1.2.2	Harvest control rules & tools	0.25	0.125	75	75
				1.2.3	Information & monitoring	0.25	0.125	80	75
				1.2.4	Assessment of stock status	0.25	0.125	85	75
Two	1	Retained species	0.2	2.1.1	Outcome	0.333	0.0667	80	
				2.1.2	Management	0.333	0.0667	75	
				2.1.3	Information	0.333	0.0667	80	
		Bycatch species	0.2	2.2.1	Outcome	0.333	0.0667	80	
				2.2.2	Management	0.333	0.0667	80	
				2.2.3	Information	0.333	0.0667	80	
		ETP species	0.2	2.3.1	Outcome	0.333	0.0667	85	
				2.3.2	Management	0.333	0.0667	75	
				2.3.3	Information	0.333	0.0667	65	
		Habitats	0.2	2.4.1	Outcome	0.333	0.0667	100	
				2.4.2	Management	0.333	0.0667	95	
				2.4.3	Information	0.333	0.0667	80	
		Ecosystem	0.2	2.5.1	Outcome	0.333	0.0667	80	
				2.5.2	Management	0.333	0.0667	75	
				2.5.3	Information	0.333	0.0667	80	
Three	1	Governance and policy	0.5	3.1.1	Legal & customary framework	0.25	0.125	95	
				3.1.2	Consultation, roles & responsibilities	0.25	0.125	95	
				3.1.3	Long term objectives	0.25	0.125	100	
				3.1.4	Incentives for sustainable fishing	0.25	0.125	80	
		Fishery specific management system	0.5	3.2.1	Fishery specific objectives	0.2	0.1	80	
				3.2.2	Decision making processes	0.2	0.1	75	
				3.2.3	Compliance & enforcement	0.2	0.1	75	
				3.2.4	Research plan	0.2	0.1	90	
				3.2.5	Management performance evaluation	0.2	0.1	70	

6.4 Summary of Conditions

Table 33. Summary of Conditions

Condition number	Condition	Performance Indicator	Related to previously raised condition? (Y/N/NA)
1-1	1-1. By the fourth annual surveillance audit, the client shall provide evidence that the target reference point for Pacific sardines takes into account the ecological role of the stock.	1.1.2	No
1-2	1-2. By the fourth annual surveillance audit, the fishery shall provide evidence that the harvest strategy for Pacific sardines is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	1.2.1	No
1-3	1-3 By the fourth annual surveillance audit, the fishery shall present evidence that for Pacific sardines defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	1.2.2	No
1-4	1-5. By the fourth annual surveillance audit, the fishery shall provide evidence that the harvest strategy for thread herring is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	1.2.1	No.
1-5	1-5. By the fourth annual surveillance audit, the fishery shall present evidence that defined thread herring harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	1.2.2	NA
1-6	1-6. By the third surveillance the fishery shall provide evidence that the stock abundance of thread herring is be regularly monitored at a level of accuracy and coverage consistent with the harvest control rule.	1.2.3	NA
1-7	By the third surveillance the assessment of stock status of thread herring has been subject to peer review.	1.2.4	NA
2-1	2-1. By the third annual surveillance the client shall present some evidence that the partial strategy is being implemented successfully.	2.1.2	Yes
2-2	2-2 By the second annual surveillance the client shall present some evidence that the partial strategy for managing brown pelicans and blue-footed boobies is being implemented successfully.	2.3.2	No
2-3	2-3. By the third annual surveillance the client shall provide evidence that there is sufficient information available to: 1) quantitatively estimate all fishery related mortality and the impact of the fishery for ETP seabird species and 2) measure trends and assess	2.3.3	No.

Condition number	Condition	Performance Indicator	Related to previously raised condition? (Y/N/NA)
	effectiveness the strategy to manage impacts on ETP species.		
2-4	2-4 By the second annual surveillance the client shall present some evidence that the measures comprising the partial strategy for ecosystem management are being implemented successfully.	2.5.2	Yes
3-1	3-1. By the second surveillance the client shall present evidence that the decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	3.2.2	Yes
3-2	3-2. By the second annual surveillance the client shall provide evidence that there is no systematic non-compliance with current regulations.	3.2.3	Yes
3-3	3-3. By the third annual surveillance the client shall provide evidence that the fishery-specific management system is subject to regular internal and occasional external review.	3.2.5	No

6.5 Recommendations

6.6 Determination, Formal Conclusion and Agreement

(REQUIRED FOR FR AND PCR)

The report shall include a formal statement as to the certification determination recommendation reached by the Assessment Team about whether or not the fishery should be certified.

(Reference: FCR 7.16)

Click here to enter text.

(REQUIRED FOR PCR)

The report shall include a formal statement as to the certification action taken by the CAB's official decision-makers in response to the Determination recommendation.

Click here to enter text.

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8. Appendices

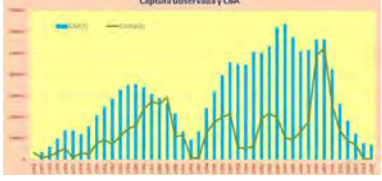

Appendix 1. Scoring and Rationales

Principle 1 – Pacific Sardine

Evaluation Table for PI 1.1.1 – Stock status

PI 1.1.1		The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue		SG 60	SG 80	SG 100
a	Guided post	It is likely that the stock is above the point where recruitment would be impaired.	It is highly likely that the stock is above the point where recruitment would be impaired.	There is a high degree of certainty that the stock is above the point where recruitment would be impaired.
	Met?	(Y)	(Y)	(Y)
	Justification	<p>The Pacific sardine stock in the central and northern Gulf of California (GoC) is considered to be above the point where recruitment would be impaired with a high degree of certainty.</p> <p>A useful approach to determine stock status relative to the point where recruitment would be impaired (PRI), is to conservatively assume the critical PRI is at the spawning stock biomass (SSB) that would cause a decline of 50% in the pre-exploitation recruitment (R_0). Maunder and Deriso (2014) suggested that although such reduction in recruitment is highly unlikely to cause recruitment failure, it can be used as a threshold before an undesirable state of the stock is reached. Additionally, a value of 0.8 for the steepness parameter in the Beverton-Holt stock-recruitment model is adopted for clupeids as suggested by Hill et al. (2014). Under these assumptions, and using the equation of Maunder and Deriso (2014), the level of stock depletion (the size of the SSB relative to SSB_0) that would reduce recruitment to 50% of R_0 is close to 6%. Assuming that the maximum estimated abundance is a proxy for SSB_0, estimated to be 2.5 million metric tons (mt) in 2003 (Nevarez-Martinez et al., 2016), a precautionary level of recruitment failure (6%) would be about 150,000 mt. This conservative reference point for PRI is slightly above the minimum critical biomass of 120,000 mt for 2015, estimated by INAPESCA staff (2016 pers. written comm.) using the Allee effect approach of Morales-Bojorquez and Nevarez-Martinez (2005). PRI values, obtained from the two approaches described above, between 120,000 to 150,000, can be considered cautious levels to compare current abundance. Pacific sardine SSB for 2013/14 and 2014/15 is estimated at 500,000 mt (Nevarez-Martinez et al. 2016), over three times the estimated critical value of 150,000 mt, over four times the critical value of 120,000 and at 20% of the maximum recorded biomass in 2003. With this evidence the assessment team concluded that the SSB is above the PRI with high degree of certainty meeting SG100.</p> <p>As described in the background section <i>Environmental considerations and the potential effect of El Niño on current sardine availability</i>, a non-linear regression analysis found that nearly 80% of the observed abundance variance could be explained exclusively by changes in sea surface temperature and upwelling (Nevarez-Martinez et al. 2001), leaving a small proportion of the variability to be explained by other factors including the fishery. As Holmgren-Urba and Baumgartner (1993) clearly expressed:</p> <p>“It is difficult to ignore the parallels between the recent collapse of the sardine population in the Gulf of California and the collapse in the California Current during the late 1940s and 1950s. Both populations declined under heavy fishing pressure [...] superimposed on broad, natural, decadal-to-centennial-scale biomass fluctuations”. “[...] we see that the alternation or replacement of populations may occur in the gulf without fishing pressure. This has apparently happened repeatedly in the California Current through the past 1700 years over time scales of 50 to 100 years.</p>		

		<p>Under the scenario presented by historical data, it is difficult to determine at what point of low abundance sardine recruitment could be compromised. Abundance trajectories for Pacific sardine indicate that after multiple events when abundance of Pacific sardine considerably declined, it recovered to be dominant again in the Gulf ecosystem. This indicates that even at the multiple times when abundance and availability has been low, the recruitment potential of the stock has not been compromised.</p> <p>The assessment team concludes that the evidence at hand is indicative of a high degree of certainty that the stock is above the point where recruitment would be impaired meeting the standard at SG100.</p>		
b	Guided post		The stock is at or fluctuating around its target reference point.	There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.
	Met?		(Y)	(Y)
	Justification	<p>The stock of Pacific sardine in the central/northern Gulf of California has been fluctuating around or has been above its target reference point over recent years. According to the MSC CR v1.3 (CB2.3.1), target reference points should be set at a level “consistent with <i>BMSY</i>”, meaning “close to or at <i>BMSY</i> or some other measure or surrogate with similar intent or outcome, which maintains a high productivity of the stock and is a level well above the point at which recruitment might be impaired”. In principle, <i>BMSY</i> is expressed as a fraction of <i>Bo</i>, but CR v1.3 (GCB2.3.18) indicates that “in the absence of robust estimates for <i>Bo</i>, target fishing mortality rates that would achieve the appropriate target biomass levels can be adopted”.</p> <p>In the Gulf of California, catch of Pacific sardine has shown wide variations that are assumed to mimic biomass variability associated with environmental fluctuation. Under such circumstances, determination of stock status relative to <i>Bo</i> may be impractical. This problem is clearly reflected in the estimated biomass trajectory which start low at the beginning of the fishery and show a considerable increase as the series progresses (Figure 11). According to these estimates, the original biomass is lower than biomass after many years of fishing pressure (Nevarez-Martinez et al 2016). This scenario suggests that the approach to management is better based on default reference points based on fishing mortality as suggested by the MSC CR.</p> <p>Additionally, the sardine fishery has not produced an explicit definition for a target reference point. According to CR v1.3, GCB 2.3.3. “[...] an explicit use of only a target reference point should include some implicit consideration of a limit reference point, and likewise a management system that uses only a limit reference point will have some implicit acknowledgement of targets”. In this fishery there are explicit limit reference points, and implicit target reference points.</p> <p>The peer reviewed stock assessment conducted by Nevarez-Martinez et al. (2016) estimated that the trend in fishing mortality rate has always been under the estimated $F_{msy} = 0.29$. After the decline in the early 90s, <i>F</i> has oscillated with peaks slightly above 0.1 and lows about 0.02. In years 2008 to 2010 a spike in <i>F</i> reached about 0.21 to decline afterwards to near zero in 2014 and 2015. In other words, in the last ten years, fishing mortality rates have been half or less the estimated <i>F_{msy}</i> with only two years (2009 & 2010) above 0.15 but never reaching the <i>F_{msy}</i> estimate.</p> <p>The trend in harvest rate has also remained for the most part below half the threshold of 0.36, which was proposed as a preliminary estimate limit reference point based on ecosystem needs (Arreguin-Sanchez et al. 2016a; 2016b), suggesting that the stock has been harvested at or below a potential target based on ecosystem needs, as required for key LTL</p>		

		stocks
		The team considers that these two forms of evidence indicate that there is a high degree of certainty that for long periods of time the stock has been exploited at a level well below the fishing mortality rate producing <i>MSY</i> which meets the standard at SG100.
References	Maunder and Deriso (2014); Hill et al. (2014); Nevarez-Martinez et al. (2016); Morales-Bojorquez and Nevarez-Martinez (2005); Arreguin-Sanchez et al. (2016a; 2016b); Holmgren-Urba and Baumgartner (1993).	
Stock Status relative to Reference Points		
	Type of reference point	Value of reference point
Target reference point	Optimum Yield: A fraction of the Biologically Acceptable Catch	Not determined yet
		 <p>Blue bars represent the yearly values of BAC computed using the control rule as specified in the FMP. If the target should be a fraction of the BAC, even if undetermined, the history indicates that recorded catch has effectively been a fraction of BAC preventing the stock to reach the LRP.</p>
Limit reference point	F_{MSY} And Biologically Acceptable Catch	$F_{MSY} = 0.29$ BAC (2014) = 134,900 - 145,500 mt
		 <p>The blue line in this figure represents the estimated trend of the fishing mortality rate. The upper bound of the yellow area is at $F = 0.3$. The current estimate of $F_{MSY} = 0.29$. The fishing mortality rate has been historically well under the LRP.</p>
OVERALL PERFORMANCE INDICATOR SCORE:		100
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 1.1.2 – Limit and Target Reference Points

PI 1.1.2		Limit and target reference points are appropriate for the stock		
Scoring Issue		SG 60	SG 80	SG 100
a	Guided post	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated.	
	Met?	(Y)	(Y)	
	Justification	<p>The management system of the Pacific sardine fishery in the central-north portion of the Gulf of California has defined in its fisheries management plan reference points that are recognized as limit and target and are based on justifiable and reasonable practice for the species category.</p> <p>The Pacific sardine in this region of the Gulf of California has been designated as a key low trophic level (LTL) stock. Requirements for reference points to maintain stocks at levels that are sufficient to protect dependent parts of the ecosystem are reviewed in SI d of this PI.</p> <p>The Reference Points can be Estimated:</p> <p>The Small Pelagics Fisheries Management Plan (SPFMP) operates on the concept of single-species stock assessments. Actively managed species, such Pacific sardine, are subject to a control rule to reduce catch when biomass declines or cease fishing when a minimum threshold is reached. The language in the SPFMP does not explicitly identify target or limit reference points, but defines that overfishing “[...] occurs when fishing takes place at a rate that is high enough to risk the stock’s ability to continuously produce MSY on the long term”. Within this management strategy the Biologically Acceptable Catch (BAC) is a “prudent level of catch”, that can vary between 5 and 25% of the estimated spawning biomass that is over a pre-established biomass cutoff point (BMIN). Operationally, overfishing occurs if the catch exceeds BAC, this condition is approached when predictive models project that over the next two years the fishing mortality or the harvest rate will exceed BAC. Exceeding BAC (overfishing) is considered an undesirable state of the system. Accordingly, BAC is consistent with MSY, and the <i>F</i> producing BAC, is interpreted as the Limit Reference Point (LRP). In the SPFMP, optimum yield (OY) is a “catch level that is equal or less than the BAC, but that in practice, it must be smaller than the BAC as much as needed to avoid overfishing.” Such language is interpreted as a desirable state of the system and by definition would represent a target reference point. The SPFMP does not detail how much smaller (than the BAC) the OY needs to be, however, as it is known to be smaller than BAC, the team considers this sufficient to estimate that it will be consistent with the LRP/BAC.</p> <p>The Reference Points are Appropriate for the Stock</p> <p>The Guidance to the MSC CR in GCB2.3.3 considers that a management strategy based solely around a limit reference point shall imply that there is a target reference point close to or at BMSY (or some other measure or surrogate that maintains the stock at high productivity), and at a level that is well above the limit reference point. Additionally, there may be situations where the limit reference point is set higher than the point at which there is an appreciable risk that recruitment is impaired. Where this results in more precautionary</p>		

		<p>management, the SG100 statement about “following consideration of relevant precautionary issues” would apply. Finally, in GCB2.3.7 the Guidance indicates that:</p> <p>Although it may generally be the case that limit reference points are set at the point that reproductive capacity starts to be appreciably impaired, for some fisheries, especially those for small pelagic species and annual species where the stock recruit relationship is very steep, management may choose to set a limit reference point above this level. Such action should attract scores between 80 and 100 with the intent that the overall score reflects the very low likelihood of reproductive capacity ever being impaired if such a limit reference point was used.</p> <p>The MSY based BAC as the implicit LRP in the SPFMP is set to assure that biomass remains higher than the estimated level of recruitment failure (BMIN) which would result in a score of SG80 in a single species context.</p> <p>In terms of appropriateness, the assessment team considered the following aspects:</p> <ol style="list-style-type: none"> 1. The MSC Guidance states that an implicit TRP should be close to or at Bmsy and well above the LRP to meet the requirements of the standard 2. However, if the LRP is set higher than PRI, more specifically at Bmsy, then high scores can be applied even if the target is not too far above the LRP since the target will be above Bmsy. 3. The small pelagics fishery Management Plan has set a LRP that is consistent with Bmsy, and is higher than the PRI. 4. If the fishery is estimated to have operated at harvest rates that are less than half the estimated ecosystem limit, then it can be concluded that even if not explicitly designed to account for ecosystem needs, the strategy has worked to meet this requirement even at the times of historic highest catch rates. <p>At the SG 80, the key reference point as defined in the SPFMP (BAC/LRP), can be estimated via the control rule, and the current system is appropriate because it is structured to maintain high productivity of the stock by being set to assure the stock remains above MSY. The fishery meets SG80.</p>		
b	Guidepost		The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of precautionary issues.
	Met?		(Y)	(Y)
	Justification	<p>The limit reference point in the small pelagics fishery in the Gulf of California is set above the level at which there is an appreciable risk of impairing reproductive capacity with consideration of precautionary issues. As mentioned in the rationale of Sla, the Guidance indicates in GCB2.3.7 that:</p> <p>Although it may generally be the case that limit reference points are set at the point that reproductive capacity starts to be appreciably impaired, for some fisheries, especially those for small pelagic species and annual species where there the stock recruit relationship is very steep, management may choose to set a limit reference point above this level. Such action should attract scores between 80 and 100 with the intent that the overall score reflects the very low likelihood of reproductive capacity ever being impaired if such a limit reference point was used.</p> <p>The Small Pelagics Fisheries Management Plan indicates that overfishing occurs if the catch is larger than a Biologically Acceptable Catch (BAC) and an Optimum Yield (OY) is a catch smaller than the BAC to avoid overfishing. This approach by definition links the BAC to a state of the fishery that has to be avoided, a LRP. The OY relates to the state of the stock that is desirable, a TRP. Regardless of whether the stock is passively or actively managed, the control rule computes a BAC (a LRP) that is consistent with the MSY.</p>		

		The definitions in the SPFMP are therefore considered to meet the criteria in GCB2.3.7 because the limit reference point is set at a level consistent with MSY, which is well above the level at which there is an appreciable risk of impairing reproductive capacity. Therefore, the LRP=BAC is precautionary and meets the standard at SG100.		
c	Guidepost		The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty.
	Met?		(Y)	(N)
	Justification	In the rationales of Sla and Slb, we have discussed that in the small pelagics fishery in the Gulf of California, the TRP has not been sufficiently defined beyond being a catch smaller than the BAC, as much as needed to avoid overfishing. However, because the LRP is based on MSY and in consideration of the criteria in GCB2.3.7, the assessment team agreed that the target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, and therefore the fishery meets the standard at SG80. However, because the fraction of the BAC that would determine the value of OY has not been defined yet and considerations about the ecosystem capacity to sustain a fishery without irreversible disruption are not yet hardwired into the management system, the fishery cannot meet the standard at SG100.		
d	Guidepost		For key low trophic level stocks, the target reference point takes into account the ecological role of the stock.	
	Met?		(N)	
	Justification	<p>Pacific sardine in this region of the Gulf of California was determined to be a key low trophic level (LTL) stock, for which reference points are expected to be (in terms of biomass) higher than those determined in a single species context. Reference points therefore are expected to be (in terms of biomass) higher than those determined in a single species context.</p> <p>An analysis of the GoC ecosystem structure and function, presented at the onsite-meeting, estimated that if all removals are attributable to the fishery, a harvest rate greater than 0.36 would be needed to cause irreversible damage to the ecosystem and was proposed as an undesirable state of the fishery or a viable limit reference point based on an ecosystem approach (Arreguin-Sanchez et al. 2016a; 2016b). The participants agreed that this reference point could be coded into the management system and considered in future updates of the Management Plan. If this approach is followed, it will be consistent with the content in GCB2.3.17 indicating that the estimated harvest rate would keep the abundance of this key LTL species at a level sufficient to protect the ecosystem. The estimated ecosystem limit reference point is about 30% higher than the F_{msy} based limit reference point estimated in the latest stock assessment (Nevarez-Martinez et al 2016a). Therefore, under the current management scheme, although based on a single species approach, the limit reference point is already accounting for ecosystem safety. The OY, although undefined, would take some value smaller than the BAC to avoid the SPFMP definition of “overfishing”.</p> <p>Under the ecosystem approach there is no possible definition of an “optimum” catch level although it may be possible to determine a safety margin to prevent fishing pressure approaching the limit reference point. The estimated harvest rate as defined in Nevarez-</p>		

		<p>Martinez et al. (2016a) has historically been under 0.1 for most of the trajectory, with the notable exceptions of spikes in the late 80s and late 2000s, but even then, the harvest rates were under 0.2 (Figure 16). These HR values compare with the estimated 0.36 threshold reported by Arreguin-Sanchez et al. (2016a; 2016b), therefore the fishery has always operated at exploitation rates that are well under the estimated critical ecosystem limit.</p> <p>If the fishery is estimated to have operated under harvest rates that are less than half the estimated ecosystem limit, then it can be concluded that even if not explicitly designed to account for ecosystem needs, the strategy has worked to meet this requirement even at the times of historically highest catch rates.</p> <p>However, the target reference point for Pacific sardine in the central/north Gulf of California is not formally accounting for the ecological role of the stock. Currently there's no explicit definition of a TRP in the SPFMP, and even if the LRP is consistent with Bmsy and the control rule has a minimum biomass threshold that would stop fishing if crossed, this lower biomass bound is explicitly defined to protect the fish stock, not ecosystem function. Research is available that has already produced an estimate of the harvest rate threshold, that if exceeded, would cause an irreversible disruption of current ecosystem function. However, this concept and quantity needs to be further developed to define a formal target reference point to account for the ecological role of the stock: therefore it does not meet the standard at SG80.</p>
References		
OVERALL PERFORMANCE INDICATOR SCORE:		75
CONDITION NUMBER (if relevant):		
1-1. By the third annual surveillance audit, the client shall provide evidence that the target reference point for Pacific sardines takes into account the ecological role of the stock.		

Evaluation Table for PI 1.2.1 – Harvest Strategy

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidpost	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points.
	Met?	(Y)	(N)	(N)
	Justification	<p>The Guidance to the CR lists in GCB2.5 three key elements of a harvest strategy: 1) The control rule and tools being in place; 2) the information base and monitoring; and 3) the assessment method. At SG80, the harvest strategy must be responsive to the state of the stock and the elements of the strategy have to work together towards achieving the management objectives.</p> <p>The harvest strategy for the fishery of small pelagics in Mexico is outlined in the SPFMP and is expected to achieve stock management objectives reflected in the target and limit reference points. Specific mechanisms in the SPFMP operate such that its definition of “sustainable levels” is consistent with MSY. The main reference point (BAC, a LRP) is established and expected to keep biomass above the level producing MSY. This works</p>		

		<p>through use of a control rule applied to species that are subject to <i>active management</i>. The control rule is also built with the intent to keep a minimum amount of biomass unfished to protect the stock. If the minimum biomass is reached; the fleet is expected to stop fishing.</p> <p>Nevertheless, given low availability during the fishing seasons 2013/14 and 2014/15, the industry voluntarily avoided fishing on Pacific sardines. The rule was computed to evaluate past catches and it was concluded the fishery has not exceeded the threshold level determined by the yearly computed BAC in almost all years.</p> <p>The fishery has a sampling program to collect data that includes the size of fish prior to the opening of the fishing season and the size/composition of landings. Acoustic surveys are conducted regularly to estimate absolute biomass abundance (see section on Abundance and Stock Assessment in the background).</p> <p>Stock assessments have been conducted for many years and have evolved to the current use of a statistical catch at age model, fit to several indices of abundance. The stock assessment has been peer reviewed and is considered to be appropriate for the control rule and the harvest strategy.</p> <p>The strategy appears to be working in its purpose to achieve the goal of sustainability with a fishery that has worked for many years and persevered in the face of intense environmental variability. However, because the harvest control rule is missing the formal mechanism to stop the fishery as it approaches the BAC every year, it is considered that the strategy is not required to be responsive to the state of the stock as established by the stock assessment and SPFMP, therefore the key elements of the strategy are not assured to work together to achieve key objectives. Nevertheless, there is evidence of cooperation between the government research agency and the fishery to define management actions such as pre-season surveys to avoid the catch of immature fish or to reduce or avoid the catch of species low in abundance such as the Pacific sardine in the 2013/14 and 2014/15 seasons, as well as fishery independent surveys. It is concluded that the fishery meets the standard at SG60 but not at SG80.</p>		
b	Guided post	The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met?	(Y)	(Y)	(N)
	Justification	The harvest strategy has not been fully tested but there is evidence that it is achieving its objectives. As determined by both the single species and the ecosystem reference point, the evidence discussed in PI 1.1.1 indicates that the fishery has operated with harvest rates that are consistent with either the Bmsy or the ecosystem needs. The stock assessment has estimated that the annual fishing mortality has been kept far under the estimated Fmsy (Figure 16). This is considered sufficient evidence that the current harvest strategy is meeting its objectives and therefore meets the standard at SG80. The SPFMP has been in effect only for a little over two years and the management system is still learning to operate under the requirements of the plan; the harvest strategy has not been fully tested, and some of its elements are not completely defined (e.g. <i>HR</i> based on F_{MSY} or ecosystem based; computation of the OY), therefore the team considered the fishery to meet the standard at SG 80 but not at SG100 until the strategy is fully tested.		
c	Guided post	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	(Y)		

	Justification	The fishery has a sampling program to collect data that includes the size of fish prior to the start of the fishing season and landings. Acoustic surveys are conducted regularly to estimate absolute biomass abundance. Data is processed in stock assessments that estimate the stock status relative to reference points. It is therefore concluded that monitoring is in place that is expected to determine whether the harvest strategy is working and the fishery meets the standard at SG60.		
d	Guided post			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			(N)
	Justification	The harvest strategy was only recently put together as a formal management plan published in 2012. The SPFMP explicitly considers that it should be reviewed every year. The team has not received evidence to demonstrate that formal review has occurred, therefore the fishery cannot meet the standard at SG100 yet. The team however witnessed a formal discussion to revise reference points and the control rule as it could be applied to Pacific sardines and other species that could be considered key elements of the ecosystem. INAPESCA staff showed a positive approach to revise the necessary elements of the Plan. If the review process continues along the same line, with periodic review, it will be feasible to meet the standard at SG100 in the near future.		
e	Guided post	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?	(Not relevant)	(Not relevant)	(Not relevant)
	Justification	Sharks are not a target in this fishery: n/a		
References				
OVERALL PERFORMANCE INDICATOR SCORE:				70
CONDITION NUMBER (if relevant):				
1-2. By the fourth annual surveillance audit, the fishery shall provide evidence that the harvest strategy for Pacific sardines is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.				

Evaluation Table for PI 1.2.2 – Harvest control rules and tools

PI 1.2.2		There are well defined and effective harvest control rules in place		
Scoring Issue		SG 60	SG 80	SG 100
a	Guided post	Generally understood harvest rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	

Met?	(Y)	(N)	
Justification	<p>The small pelagics Fisheries Management Plan as published in the Official Gazette, is one of the main management instruments defined under the General Fisheries Law of Mexico. It gives an explicit, written harvest control rule (HCR) that is used for actively managed species, such as Pacific sardine.</p> <p>Therefore, at present, there are not only generally understood, but also well-defined harvest control rules in place that reduce the exploitation rate as the point of recruitment impairment is approached. The control rule is defined by the following equation: $C = (B - B_{min}) * FRACTION$, where the output C, is the Biological Acceptable Catch (BAC). The HCR is an MSY-based control rule that is defined in the SPFMP where the value <i>FRACTION</i> (currently <i>Fmsy</i> is used, but this would be better defined as a harvest rate, see more below) limits the intensity of the harvest rate to a maximum of 0.25 of the biomass of individuals age 1+. The HCR also includes a pre-established minimum biomass cut-off (<i>Bmin</i>) such that if reached, the fishery would stop operating. This <i>Bmin</i> value is set at a point designed to assure that sufficient spawning biomass is left in the system to assure rebuilding. The HCR therefore operates by requiring catch reductions prior to biomass approaching the estimated level of recruitment impairment. Current definitions in the SPFMP do not explicitly consider the ecological role of any species in the ecosystem. However, research has been already been conducted to determine the maximum harvest pressure that the fishery can impose to the ecosystem before causing irreversible disruption of structure and function. It should be noted that: 1) the upper bound for the harvest rate specified in the SPFMP is 0.25, 2) the estimated harvest rate that can lead to irreversible disruption of ecosystem structure (an ecosystem based limit reference point) is 0.36 (Arreguin-Sanchez et al. 2016a; 2016b); and 3) the value for <i>Bmin</i> that has been computed for Pacific sardines, representing the threshold that can lead to Allee effects, was 10% of the current biomass estimated with acoustic methods. This information indicates that even if the current definition of the control rule is based on single species management, the sardine population is most likely capable of providing ecosystem services and the fishery managed using the control rule, is unlikely to cause serious or irreversible damage to ecosystem structure.</p> <p>While well-defined in terms of being explicit, the assessment team observed that two elements of the harvest control rule are problematic. First the variable <i>FRACTION</i> is currently using a fishing mortality rate, versus being specified as a true harvest rate. Second, there is also the concern that the current <i>Bmin</i> is a quantity that only prevents recruitment impairment, but does not explicitly provides service to the ecosystem; neither is <i>FRACTION</i> a value that (alternatively to <i>Bmin</i>) confers a desirable level of harvest to prevent damage to the ecosystem.</p> <p>Evidence was presented by INAPESCA that the HCR is in place in the FMP and has been computed, and that catches for the most recent season did not exceed BAC. However, the team has not been presented with evidence indicating that the control rule is computed prior to the fishing season or that the harvest control rule is connected via a functional system for monitoring catch in real time, with the ability reduce or stop fishing operations as the allowable catch of the year is reached. In order to meet SG80, the control rule needs to be applied every year and removals should be monitored relative to BAC in-season, with tools to reduce removals as BAC is approached. In addition, the 2012 Small Pelagics Fishery Management Plan has a well-defined control rule, however, under Mexican legislation, management plans serve to inform procedures or regulatory instruments that contain the enforceable actions for the fishery. No such instrument has been produced after the publication of the fishery management plan. In conclusion, the assessment team agreed that the current evidence indicates that the HCR is incidentally, but not proactively in place, meeting the standard at SG60 but not at SG80.</p> <p>Accessory tools to the control rule relate to minimum allowable size of fish and restrictions on effort. These tools are consistent with the harvest strategy as they aim to support the objective of sustainability by keeping production under MSY.</p>		

b	Guided post		The selection of the harvest control rules takes into account the main uncertainties.	The design of the harvest control rules takes into account a wide range of uncertainties.
	Met?		(Y)	(N)
	Justification	<p>The selection of the control rule takes into account the main uncertainties. The definition of the BAC is such that it works as a LRP because the SPFMP establishes the computation of an Optimum Yield (OY) as a fraction of the BAC, as needed with the explicit purpose of avoiding overfishing. By doing this, any estimate of stock status that is optimistically biased because of regular uncertainties such as current abundance or productivity will have a safety margin that will help to keep the stock at biomass levels that avoid impairing recruitment and most likely, to disrupt ecosystem structure. The MSC CR establishes that the TRP must be consistent with MSY, but in cases such as the small pelagic fishery in Mexico, where the LRP (as opposed to the TRP) is consistent with MSY, CB2.3.7 indicates that:</p> <p style="padding-left: 40px;">The team should award scores between 80 and 100 to the second scoring issue in PI 1.2.2 if management chooses to set a limit reference point above the point that reproductive capacity starts to be appreciably impaired.</p> <p>The Guidance to the same section of the CR further adds:</p> <p style="padding-left: 40px;">Although it may generally be the case that limit reference points are set at the point that reproductive capacity starts to be appreciably impaired, for some fisheries, especially those for small pelagic species and annual species where there the stock recruit relationship is very steep, management may choose to set a limit reference point above this level. Such action should attract scores between 80 and 100 with the intent that the overall score reflects the very low likelihood of reproductive capacity ever being impaired if such a limit reference point was used.</p> <p>By setting the LRP at a level slightly lower than MSY, the SPFMP accounts for the main uncertainties that may make recruitment fluctuate in unpredicted ways, therefore, the overall approach is precautionary and meets the SG 80.</p> <p>There are a wide range of other relevant uncertainties in parameterization, model performance, observation and process errors, which either have not been accounted for in the stock assessments or where the margin of safety of the HCR has not been fully investigated. Uncertainties related to the stock assessment are further discussed in PI 1.2.4. Therefore, the HCR does not meet the SG100.</p>		
c	Guided post	There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
	Met?	(Y)	(Y)	(N)
	Justification	<p>Scoring Issue c is focused on "harvest control rules evaluation". Here we have considered "evaluation" equivalent to the definition of testing (CR V1.3, p.69):</p> <p style="padding-left: 40px;">(the involvement of some sort of structured logical argument and analysis that supports the choice of strategy in the context of fisheries, it can include the use of experience from analogous fisheries, empirical testing (for e.g. practical experience of performance or evidence of past performance) simulation test (for instance using computer intensive modeling such as MSE)</p> <p>In this system there are tools (defined as "mechanisms for implementing strategies under Principles 1 or 2. For example, TACs, mesh regulations, closed areas, etc. could be used to implement HCRs" (CR V1.3, p.69)) that can be used to control effort in a manner that is "effective in achieving the exploitation levels required under the HCR".</p> <p>"Tools", or active management measures are included in legal instruments such as the NOM or the CNP. Some of the main provisions are catch monitoring, spatial and temporal closures, size limits and effort restrictions. Effort is restricted by prohibiting new vessels to enter the</p>		

		<p>fishery and by size restriction on the catch. The number of vessels has remained approximately stable at around 50. Effort in number of trips showed a clear average tendency to increase starting in season 1992/93. However this average stabilized after season 2006/07 and was below the average in seasons 2013/14 and 2014/15. There is evidence that size restrictions are not met to the standard set in the NOM. If the revised NOM allows for more dynamic definition of size limits, these need to be enforced more consistently to reach legal management goals.</p> <p>Harvest rate based strategies are known to be safer compared to constant catch policies to determine allowable seasonal catches because they are adjusted to the perceived biomass abundance. The harvest control rules however, need to be connected to a system or procedure that monitors in real time the cumulative catch during a fishing season so that the vessels can be informed when to stop fishing operations as the allowable catch of the year is being reached. Control rules also need to be applied every year before the beginning of the season.</p> <p>The fact that landings have not exceeded the recently calculated BAC indicates that the tools that are currently in use (some, like effort limits and size limits, imperfectly implemented) remain appropriate and effective in achieving the exploitation levels required under the harvest control rules and could also be used to further limit effort based on the status of the stock & the HCR, if needed.</p> <p>Deeper analyses need to be conducted to test the response of the HCR and other tools to respond effectively to unfavorable conditions. This is imperative in the light of environmental changes that can lead to situations in which effort levels (that presently are not affecting recruitment capacity) become crucial to the persistence of the stock. The team concluded that because the stock has remained below it's already conservatively set LRP, the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rule, but that more evidence is necessary to clearly show the effectiveness of the HCR to meet the goals stated in the SPFMP. In particular, the evidence needs to show more explicitly how each tool is operating to achieve exploitation levels required under the harvest control rules. This meets the requirements at SG80 but not SG100.</p>
References		
OVERALL PERFORMANCE INDICATOR SCORE:		75
CONDITION NUMBER (if relevant):		
1-3 By the fourth annual surveillance audit, the fishery shall present evidence that for Pacific sardines defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.		

Evaluation Table for PI 1.2.3 – Information and monitoring

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidpost	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly related to the

				current harvest strategy, is available.
	Met?	(Y)	(Y)	(N)
	Justification	<p>The INAPESCA small pelagics scientific program is regularly collecting useful information on stock productivity, size structure, biological data (egg and larval surveys), required by the analysis of the stock assessment to support the harvest strategy. There is detailed information about the number and characteristics of the ships that constitute the fishing fleet. Effort can be modelled and analyzed and catch is recorded with a reasonable level of accuracy. Pre-season surveys determine the age and size composition of the schools in the fishing grounds to prevent harvesting young fish. Acoustic surveys are being conducted to obtain estimates of abundance independent of the fishery. Harvest rate is computed at the end of the fishing season. An observer program that had been already implemented stopped operating will need to be re-opened (scored in P2) to complement data from fishery operations.</p> <p>Overall, it is concluded that sufficient information is available to support the harvest strategy to meet the requirements at SG80, but more is still needed to understand better the population dynamics, stock variability and the influence of environmental factors. In particular, current ecosystem models have already started to provide insights about the role of the stock and other elements including the fishery, however, the data already at hand and new data needs to be incorporated to improve the confidence in model predictions in the face of alternative scenarios. Therefore the fishery does not meet the requirements at SG100.</p>		
b	Guided post	Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	(Y)	(Y)	(N)
	Justification	<p>Stock abundance and fishery removals are regularly monitored in the Pacific sardine fishery in the Gulf of California.</p> <p>Abundance: Acoustic surveys are conducted to obtain estimates of absolute abundance independent of the fishery. Early reports indicated that <i>due to similar acoustic reflectivity of these species, work is needed to be done in order to refine the allocation of acoustic energy to species</i> (Villalobos et al 2013). A telephone interview with the first author conducted in June 4th 2015, indicated that the consequence of this problem represented a negative bias in the final estimate of absolute biomass given <i>coverage, sampling of adults, and maybe other factors</i>, but that nevertheless, the bias was constant in time and therefore, the <i>trend will not change after resolving methodological problems in the acoustic signal</i>. The acoustic indices are considered appropriate to support the control rule because the reliability in the trend and because it is inserted into a fisheries and population model in conjunction with other indices that have provided consistent results in the stock assessment.</p> <p>In addition to the acoustic surveys, research surveys are also conducted with different purposes. An important goal of these surveys is the observation of catch per unit of effort in prospective research fishing sets. This activity has produced a time series of CPUE that is used in the stock assessment as an index of abundance that is independent of the commercial operation (Nevarez-Martinez et al. 2016a).</p>		

		<p>Other types of indices that represent available information on relative abundance but are not systematically obtained, include an index based on the number of eggs and larvae that appeared in ictioplankton surveys and the proportion of sardine in the diet of seabirds (Nevarez-Martinez et al. 2016a).</p> <p>Removals: Catch records are a critical piece of information in any fishery harvest strategy. As required by the LGPAS to all fisheries in Mexico, in the small pelagics fishery in the Gulf of California, vessels are required to record technical aspects of the operation in a logbook and it is considered an infraction to the Law if the use of the logbook is ignored, or if the information recorded is false or modified. Additionally, catches are reported at the port of landing in official documents called “<i>avisos de arribo</i>” (landing notifications) that are provided by CONAPESCA. There is no hard evidence of a system to verify the accuracy or reliability of the landing records. Anecdotal evidence from INAPESCA and CONAPESCA staff indicates that inspectors and technicians participate in sampling programs and inspection activities at port. In reality, once the catch has been landed and stored, verification to determine if the report in the landing notification corresponds to the actual catch is very difficult. The staff at INAPESCA has historically operated under the assumption that the catch record is reliable enough to feed their management models and the harvest strategy in general.</p> <p>Size composition: Size composition of schools in the fishing grounds is observed before the beginning of the season as well as the season progresses to ostensibly avoid excessive catch of juvenile fish. As the surveys are conducted in a stratified manner, designed to cover all fishing grounds.</p> <p>Overall, the current data collection program is appropriate to conduct stock assessments, support the control rule and apply management procedures as required by the harvest strategy meeting the requirements of SIb at SG80. As the stock is assumed to be a key LTL, even if at present times available data is deemed sufficient to conduct ecosystem research to support the control rule, the monitoring program needs to be paired with the emerging research on the dynamics of the fishery in the ecosystem context and the stock so that alternative scenarios can be evaluated and for now it is not considered to meet SG100.</p>		
c	Guidepost		There is good information on all other fishery removals from the stock.	
	Met?		(Y)	
	Justification	The team was provided with information about some fishing effort by vessels originating from the port of Ensenada on the Pacific side of the Baja California Peninsula, fishing inside the GoC and landing in Sonora (Nevarez-Martinez et al. 2016c). All removals by vessels operating in the Gulf are documented in ports located inside the Gulf and the catches are included in the Gulf statistics and the stock assessment. Therefore there is good information about all removals of fish from this stock that are taken by boats or fishers that don't belong to the UoC and meets SG 80.		
References				
OVERALL PERFORMANCE INDICATOR SCORE:				80
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 1.2.4 – Assessment of stock status

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost		The assessment is appropriate for the stock and for the harvest control rule.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.
	Met?		(Y)	(N)
	Justification	<p>The assessment is appropriate for the stock and the control rule. An evaluation of stock status using the ASAP model of Legault and Restrepo (1999) was conducted by Nevarez-Martinez et al (2015) and updated the following year (Nevarez-Martinez et al 2016a). The analysis used catch and biological data from the fishery. Fishery independent data included the following indices of relative abundance: a) number of fish caught per squared km in tows, during prospective and acoustic surveys from 1990 to 2014; b) indices of biomass obtained by means of acoustic detection of fish from 2008 to 2014; c) abundance of eggs and larvae (number/10 m²) from 1971 to 1988; d) an environmentally based index specifying the spawning probability from 1979 to 1996; and d) an index based on the proportion of sardine in the diet of sea birds.</p> <p>The assessment obtained a time series of estimated abundance for different components of the sardine stock reconstructing the trajectory from 1972 to 2014. The analysis also computed a list of parameters of management and reference points, including the fishing mortality producing the MSY. A Beverton-Holt stock recruitment model was also fit to a plot of the estimated number of fish of age 0 against the total number of spawners.</p> <p>The review of Hill (2015) concluded that the stock assessment as reported by Nevarez-Martinez et al (2015) is “<i>satisfactory to provide management advice for the Pacific sardine stock in the Gulf of California</i>”. The assessment team concurs and considers as well that the stock assessment is appropriate for the stock and the control rule as currently defined in the Management Plan. However, the SPFMP was developed to manage fisheries of small pelagic fish without consideration of the role any particular species could play in the ecosystem. Reference points relative to the ecosystem capacity to support sardine harvesting have only been recently computed for the Pacific sardine in the Gulf of California and these recent developments are yet to be integrated into a single assessment procedure consistent with an updated harvest strategy. This allows the fishery to meet the standard at SG80 but not SG100.</p>		
b	Guidepost	The assessment estimates stock status relative to reference points.		
	Met?	(Y)		
	Justification	<p>The stock assessment is conducted with the specific purpose to evaluate the status of the stock relative to the reference points defined in the Management Plan as seen in Figure 10. Shortfalls to evaluate stock status in a probabilistic way and to integrate recent developments in ecosystem based management are included in the evaluation of SIs (a) and (c). The fishery meets the standard at SG60.</p>		

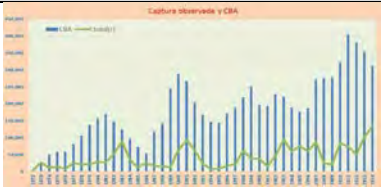
c	Guidepost	The assessment identifies major sources of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.
	Met?	(Y)	(Y)	(N)
	Justification	<p>The purpose of this SI is to recognize the scope of accounting for the intrinsic uncertainties found in fishery stock assessments. At SG60 the major sources of uncertainty should be identified, whereas at SG80 uncertainties need to be taken into account, and at SG100, quantification and recognition of uncertainty should allow to evaluate stock status in a probabilistic way or evaluating the effects of parameter sensitivity to alternative scenarios.</p> <p>Historically the fishery for Pacific sardine in the Gulf of California has evolved assessing stock status using a VPA approach under a set of assumptions that were not sufficiently discussed, leading to questions about the confidence in the assessment results. Since then, there is a documented search for more reliable approaches that is well seen as a way to handle the critical model related uncertainty. Presently, the assessment is conducted using the ASAP statistical catch at age model in a likelihood framework. This approach allows for accounting of observation error from the different data sources and the exploration of a variety of sensitivities and the influence of several sources of error.</p> <p>The report of Nevarez-Martinez et al. (2016) is addressing some of the main uncertainties associated to this fishery. Some of them, such as the CV associated to the indices independent of the fishery or the temporal variability in growth, were dealt with as a result of the review by Hill (2015). There are however several other important uncertainties that were also pointed out in the Hill (2015) review that have not been fully addressed. Among these uncertainties, some of the most important include the assumption about a single, age and time independent, natural mortality; the form of the stock recruitment function and time related changes in age structure. It is particularly important to observe that current treatment of uncertainty in the estimates of parameters, population abundance and management quantities (particularly stock status relative to reference points), is not reported. If measures of uncertainty come from the asymptotic estimates produced by AD Model Builder (the programming platform to implement ASAP), they can be better expressed as Hill (2015) suggests, in probabilistic way using AD Model Builder capacity to run Monte Carlo Markov Chain Bayesian estimation. If these estimates cannot be produced, likelihood profile based confidence intervals are satisfactory.</p> <p>The assessment team recognizes the complexities in handling uncertainty associated to this fishery and concludes that the stock assessment meets the standard at SG80 and although it does not meet the standard at SG100 is on the right path to do so in the near future.</p>		
d	Guidepost			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			(N)
	Justification	<p>The stock assessment in its present form is of recent development has not been able to be tested to the extent to show that is robust to the main uncertainties and no alternative hypotheses have been explored. This process also needs to be updated to include aspects related to the role of the stock in the ecosystem. The fishery cannot presently meet the standard at SG100.</p>		

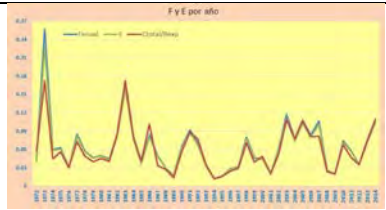
e	Guided post		The assessment of stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
	Met?		(Y)	(Y)
	Justification	Evidence has been provided that the stock assessment has been internally and externally peer reviewed. Evidence was provided that the stock assessment was reviewed by a group of mostly INAPESCA experts before it was submitted to external review. The external review report (Hill 2015) concluded that the results in the stock assessment <i>are "satisfactory to provide management advice for the Pacific sardine stock in the Gulf of California"</i> . Comments by the external review are being addressed and progress has been reported by the INAPESCA staff (Nevarez-Martinez et al 2016). The assessment team concluded that the fishery meets the standard at SG100, however, in the fourth surveillance audit a recommendation was presented so that two additional external reviewers are added to the peer review process. The team will be requesting progress on this recommendation during the following surveillance audits.		
References				
OVERALL PERFORMANCE INDICATOR SCORE:				85
CONDITION NUMBER (if relevant):				

Principle 1 – Thread Herring

Evaluation Table for PI 1.1.1 – Stock status (TH)

PI 1.1.1		The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing		
Scoring Issue		SG 60	SG 80	SG 100
a	Guided post	It is likely that the stock is above the point where recruitment would be impaired.	It is highly likely that the stock is above the point where recruitment would be impaired.	There is a high degree of certainty that the stock is above the point where recruitment would be impaired.
	Met?	(Y)	(Y)	(Y)
	Justification	<p>Two different criteria indicate that there is a high degree of certainty that the stock is above the point where recruitment would be impaired, the historic trend in biomass and the status of the stock in terms to biomass and fishing mortality rate relative to the levels producing MSY.</p> <p>Even if the absolute abundance values differ and the detailed trajectory are also different among trends, Figure 17, Figure 18 and Figure 19 in the background section show biomass trends along the entire history of the fishery that are increasing. This is indicative of a stock capable of producing surplus and therefore well above the point where recruitment would be impaired.</p> <p>If a stock is estimated to be exploited at or below F_{msy}, it is said that overfishing is not occurring. If this condition holds for a period of time, it follows that the stock is likely to be fluctuating at B_{msy} or at a higher level, and consequently, it should be well above the point where recruitment is compromised. The latest stock assessment (Nevarez-Martinez <i>et al.</i> 2016) indicates that for most of the history of the fishery, the thread herring has been harvested F and harvest rates lower than 0.15 (Figure 19 right). These levels of fishing mortality are lower than the default limit reference point of 0.25 established for all species in the Fisheries Management Plan for Small Pelagics. The allowable catch can however oscillate between 5 to 25% of the estimated biomass. This LRP value was proposed after Nevarez-Martinez <i>et al.</i> (1999) estimated that $F = 0.25$ was a slightly lower value of F_{msy} ($0.9F_{msy}$) that “would not only produce higher economic returns, and be safer biologically, but will reduce intrinsic population oscillations, which for management purposes is a desirable characteristic of an exploitable resource”. The assessment of Nevarez-Martinez <i>et al.</i> (2016) computed F_{msy} species specific for thread herring at $F_{msy} = 0.312$, which means the stock can sustain harvest rates higher than the one specified in the management plan. Current F is then much lower than the estimated F_{msy}.</p> <p>The results of a biomass dynamics model approach to estimate stock status and fishing mortality produced a Kobe plot (Figure 8) where the estimated relative fishing mortality rate was far below the level producing MSY which is consistent with previous results. The Kobe plot also shows biomass far above the level producing MSY.</p> <p>Although the results of different approaches are not entirely consistent, they indicate that biomass has increased along the history of the fishery and that fishing mortality has been lower than the level producing MSY. Combined with sustained biomass above the level of MSY for more than 20 years is taken as evidence that there is a high degree of certainty of certainty that the stock is above the point where recruitment would be impaired and meets the standard at SG100.</p>		
b	Guided post		The stock is at or fluctuating around its target reference point.	There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.

	Met?		(Y)	(N)
	Justification	<p>The stock of thread herring in the central/northern Gulf of California has been fluctuating around or has been above its target reference point over recent years. According to CB2.3.1, Target Reference Points should be set at a level “consistent with BMSY”, meaning “close to or at BMSY or some other measure or surrogate with similar intent or outcome, which maintains a high productivity of the stock and is a level well above the point at which recruitment might be impaired”. In principle, BMSY is expressed as a fraction of B_0, but GCB2.3.18 indicates that “in the absence of robust estimates for B_0, target fishing mortality rates that would achieve the appropriate target biomass levels can be adopted”.</p> <p>In the Gulf of California, catch of thread herring has shown wide variations that may follow biomass variability associated to environmental fluctuation. This assumption is not so straight forward as with Pacific sardine because the fishery shifts from one to the other depending on the availability of sardines. Nevertheless, because biomass at the beginning of the fishery was lower than at the present times, and because oceanographic conditions drive the availability of all small pelagics, considering that under such circumstances, determination of stock status relative to B_0 may be impractical still holds as. Additionally, the sardine fishery has not produced an explicit definition of what the target reference point is. This scenario suggests that the approach to management is better based on default reference points based on fishing mortality as suggested by the CR.</p> <p>The peer reviewed stock assessment conducted by Nevarez-Martinez et al (2016) estimated that the trend in fishing mortality rate has always been under the estimated $F_{msy} = 0.312$ and in the last ten years, fishing mortality rates have been half or less the estimated F_{msy}.</p> <p>As discussed in Scoring Issue a, the stock of thread herring has been harvested for more than 20 years with fishing mortalities much lower than both the MSY related limit reference point in the management plan and the species specific reference point estimated in the latest stock assessment. It can therefore be considered that the stock is above the biomass producing MSY which represents the LRP, so much that even if the target is not explicitly defined in the management plan, it is possible to consider that the stock has been exploited at a level well below the fishing mortality rate producing MSY which meets the standard at SG80. Inconsistencies in the different approaches to the stock assessment create a level of uncertainty that prevents from concluding that there is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years. The standard is not met at SG100.</p>		
References				
Stock Status relative to Reference Points				
	Type of reference point	Value of reference point	Current stock status relative to reference point	
Target reference point	Optimum Yield: A fraction of the Biologically Acceptable Catch	Not determined yet	 <p>Blue bars represent the yearly values of BAC computed using the control rule as specified in the FMP. If the target should be a fraction of the BAC, even if undetermined, the history indicates that recorded catch has effectively been a fraction of BAC</p>	

			preventing the stock to reach the LRP.
Limit reference point	F_{MSY}	$F_{MSY} = 0.312$	 <p>The blue line in this figure represents the estimated trend of fishing mortality rate. The upper bound of the yellow area is at $F = 0.27$. The current estimate of $F_{MSY} = 0.312$. The fishing mortality rate has been historically well under the LRP.</p>
OVERALL PERFORMANCE INDICATOR SCORE:			90
CONDITION NUMBER (if relevant):			

Evaluation Table for PI 1.1.2 – Limit and Target Reference Points (TH)

PI 1.1.2		Limit and target reference points are appropriate for the stock		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidpost	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated.	
	Met?	(Y)	(Y)	
	Justification	<p>The management system of the thread herring fishery in the central-north portion of the Gulf of California has defined in its fisheries management plan reference points that are recognized as limit and target and are based on justifiable and reasonable practice for the species category. The stock of thread herring in the central Gulf of California is not assumed to be key LTL.</p> <p>The Reference Points can be Estimated</p> <p>The Small Pelagics Fisheries Management Plan (SPFMP) operates on the concept of single-species stock assessments. Actively managed species, such Pacific sardine, are subject to a control rule to reduce catch when biomass declines or cease fishing when a minimum threshold is reached. The language in the SPFMP does not explicitly identify target or limit reference points, but defines that overfishing “[...] occurs when fishing takes place at a rate that is high enough to risk the stock’s ability to continuously produce MSY on the long term”. Within this management strategy the Biologically Acceptable Catch (BAC) is a “prudent level of catch”, that can vary between 5 and 25% of the estimated spawning biomass that is over a pre-established biomass cutoff point (BMIN). Operationally, overfishing occurs if the catch exceeds BAC, this condition is approached when predictive models project that over the next two years the fishing mortality or the harvest rate will exceed BAC. Exceeding BAC (overfishing) is considered an undesirable state of the system. Accordingly, BAC is consistent with MSY, and the <i>F</i> producing BAC, is interpreted as the Limit Reference Point (LRP). In the SPFMP, optimum yield (OY) is a “catch level that is equal or less than the BAC, but that in practice, it must be smaller than the BAC as much as needed to avoid overfishing.” Such language is interpreted as a desirable state of the system and by definition would represent a target reference point. The SPFMP does not detail how much smaller (than the BAC) the OY needs to be, however, as it is known to be smaller than BAC, the team considers this sufficient to estimate that it will be consistent with the LRP/BAC.</p> <p>The Reference Points are Appropriate for the Stock</p> <p>The Guidance to the MSC CR in GCB2.3.3 considers that a management strategy based solely around a limit reference point shall imply that there is a target reference point close to or at BMSY (or some other measure or surrogate that maintains the stock at high productivity), and at a level that is well above the limit reference point. Additionally, there may be situations where the limit reference point is set higher than the point at which there is an appreciable risk that recruitment is impaired. Where this results in more precautionary management, the SG100 statement about “following consideration of relevant precautionary issues” would apply. Finally, in GCB2.3.7 the Guidance indicates that:</p> <p style="padding-left: 40px;">Although it may generally be the case that limit reference points are set at the point that reproductive capacity starts to be appreciably impaired, for some fisheries, especially those for small pelagic species and annual species where the stock recruit relationship is very steep, management may choose to set a limit reference point above this level. Such action should attract scores between 80 and</p>		

		<p>100 with the intent that the overall score reflects the very low likelihood of reproductive capacity ever being impaired if such a limit reference point was used.</p> <p>The MSY based BAC as the implicit LRP in the Management Plan is set to assure that biomass remains higher than the estimated level of recruitment failure (BMIN) which would result in a score of SG80 in a single species context.</p> <p>Even when perceived fluctuations in thread herring abundance are not as dramatic as in the Pacific sardine biomass, potential variability consistent with a LTL species and an initial abundance much lower than the current estimated biomass, leads to a similar conclusion that it is not only difficult but impractical to attempt determination of what Bo could be to assess relative stock status. Under such conditions, GCB2.3.19 indicates that:</p> <p style="padding-left: 40px;">[...] in the absence of robust estimates for B0, target fishing mortality rates that would achieve the appropriate target biomass levels can be adopted. In these cases the likely relationship between fishing mortality rates and stock biomass levels should be considered in scoring PI 1.1.2.</p> <p>The definitions in the management plan are thus acceptable as surrogate reference points that are expected to achieve productivity and biomass at MSY.</p> <p>We interpret that the intent of this PI is to maintain stocks at high productivity and in terms of appropriateness, the assessment team considered the following aspects:</p> <ol style="list-style-type: none"> 1. The MSC Guidance states that an implicit TRP should be close to or at Bmsy and well above the LRP to meet the requirements of the standard 2. However, if the LRP is set higher than PRI, more specifically at Bmsy, then high scores can be applied even if the target is not too far above the LRP since the target will be above Bmsy. 3. The small pelagics fishery Management Plan has set a LRP that is consistent with Bmsy, and is higher than the PRI. 4. If the fishery is estimated to have operated at harvest rates that are less than half the estimated ecosystem limit, then it can be concluded that even if not explicitly designed to account for ecosystem needs, the strategy has worked to meet this requirement even at the times of historic highest catch rates. <p>At the SG 80, the key reference point as defined in the SPFMP (BAC/LRP), can be estimated via the control rule, and the current system is appropriate because it is structured to maintain high productivity of the stock by being set to assure the stock remains above MSY. The fishery meets SG80.</p>		
b	Guided post		The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of precautionary issues.
	Met?		(Y)	(Y)
	Justification	<p>The limit reference point in the small pelagics fishery in the Gulf of California is set above the level at which there is an appreciable risk of impairing reproductive capacity with consideration of precautionary issues. As mentioned in the rationale of Sla, the Guidance indicates in GCB2.3.7 that:</p> <p style="padding-left: 40px;">Although it may generally be the case that limit reference points are set at the point that reproductive capacity starts to be appreciably impaired, for some fisheries, especially those for small pelagic species and annual species where there the stock recruit relationship is very steep, management may choose to set a limit reference point above this level. Such action should attract scores between 80 and 100 with the intent that the overall score reflects the very low likelihood of reproductive capacity ever being impaired if such a limit reference point was used.</p>		

		<p>The Small Pelagics Fisheries Management Plan indicates that overfishing occurs if the catch is larger than a Biologically Acceptable Catch (BAC) and an Optimum Yield (OY) is a catch smaller than the BAC to avoid overfishing. This approach by definition links the BAC to a state of the fishery that has to be avoided, a LRP. The OY relates to the state of the stock that is desirable, a TRP. Regardless of whether the stock is passively or actively managed, the control rule always computes a BAC (a LRP) that is consistent with the MSY.</p> <p>The definitions in the Management Plan are therefore considered to meet the criteria in GCB2.3.7 because the limit reference point is set at a level consistent with MSY, which is well above the level at which there is an appreciable risk of impairing reproductive capacity. Therefore, the LRP=BAC is precautionary and meets the standard at SG100.</p>		
c	Guided post		The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty.
	Met?		(Y)	(N)
	Justification	<p>In the rationales of Sla and Slb, we have discussed that in the small pelagics fishery in the Gulf of California, the TRP has not been sufficiently defined beyond being a catch smaller than the BAC. However, because the LRP is based on MSY and in consideration of the criteria in GCB2.3.7, the assessment team agreed that the target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, and therefore the fishery meets the standard at SG80. However, because the fraction of the BAC that would determine the value of OY has not been defined yet and considerations about the ecosystem capacity to sustain a fishery without irreversible disruption are not yet hardwired into the management system, the fishery cannot meet the standard at SG100.</p>		
d	Guided post		For key low trophic level stocks, the target reference point takes into account the ecological role of the stock.	
	Met?		(NA)	
	Justification	The thread herring in the central/northern Gulf of California is not considered to be a key LTL stock therefore SI (d) is Not Applicable		
References				
OVERALL PERFORMANCE INDICATOR SCORE:				90
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 1.2.1 – Harvest Strategy

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points.
	Met?	(Y)	(N)	(N)
	Justification	<p>The Guidance to the CR lists in GCB2.5 three key elements of a harvest strategy: 1) The control rule and tools in place; 2) The information base and monitoring; and 3) The assessment method. At SG80, the harvest strategy must be responsive to the state of the stock and the elements of the strategy have to work together towards achieving the management objectives.</p> <p>The harvest strategy for the fishery of small pelagics in Mexico is outlined in the Management Plan and is expected to achieve stock management objectives reflected in the target and limit reference points. Specific mechanisms in the Plan operate such that its definition of “sustainable levels” is consistent with MSY. The main reference point (a LRP) is established and expected to keep biomass above the level producing MSY. This works through use of a control rule applied to species that are subject to <i>active management</i>. The control rule is also built with the intent to keep a minimum amount of biomass unfished to protect the stock. If the minimum biomass is reached; the fleet is expected to stop fishing.</p> <p>The fishery has a sampling program to collect data that includes the size of fish prior to the opening of the fishing season and the size/composition of landings. Acoustic surveys are conducted regularly to estimate absolute biomass abundance (see section on Abundance and Stock Assessment in the background).</p> <p>Stock assessments have been conducted for many years and have evolved to the current use of a statistical catch at age model fit to several indices of abundance. The stock assessment has not been peer reviewed but is considered to be appropriate for the control rule and the harvest strategy.</p> <p>The strategy appears to be working in its purpose to achieve the goals of sustainability with a fishery that has worked for many years and persevered in the face of intense environmental variability. However, because the harvest control rule is missing the formal mechanism to stop the fishery as it approaches the BAC every year, the strategy is not required to be responsive to the state of the stock as established by the stock assessment and the SPFMP, consequently, the key elements of the strategy are not assured to work together to achieve key objectives. Nevertheless, there is evidence of cooperation between the government research agency and the fishery to define management actions such as pre-season surveys to avoid the catch of immature fish or to reduce or avoid the catch of species low in abundance such as the Pacific sardine in the 2013/14 and 2014/15 seasons, as well as fishery independent surveys. It is concluded that the fishery meets the standard at SG60 but not at SG80.</p>		
b	Guidepost	The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including

				being clearly able to maintain stocks at target levels.
	Met?	(Y)	(Y)	(N)
	Justification	The harvest strategy has not been fully tested but there is evidence that it is achieving its objectives as determined by estimated status in the stock assessment. The evidence discussed in PI 1.1.1 indicates that the fishery has operated with harvest rates that are consistent with B_{msy} . The stock assessment has estimated that the annual fishing mortality has been kept far under the estimated F_{msy} (Figure 19). This is considered sufficient evidence that the current harvest strategy is meeting its objectives and therefore meets the standard at SG80. The SPFMP has been in effect only for a little over two years and the management system is still learning to operate under the requirements of the plan; the harvest strategy has not been fully tested, and some of its elements are not completely defined (e.g. HR based on F_{MSY} ; computation of the OY), therefore the team considered the fishery meets the standard at SG 80 but not at SG100 until the strategy is fully tested.		
c	Guided post	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	(Y)		
	Justification	The fishery has a sampling program to collect data that includes the size of fish prior to the start of the fishing season and landings. Acoustic surveys are conducted regularly to estimate absolute biomass abundance. Data is processed in stock assessments that estimate the stock status relative to reference points. It is therefore concluded that monitoring is in place that is expected to determine whether the harvest strategy is working and the fishery meets the standard at SG60.		
d	Guided post			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			(N)
	Justification	The harvest strategy was only recently put together as a formal management plan published in 2012. The SPFMP explicitly considers that it should be reviewed every year. The team has not received evidence to demonstrate that formal review has occurred, therefore the fishery cannot meet the standard at SG100 yet. The team however witnessed a formal discussion to revise reference points and the control rule as it could be applied to Pacific sardines and other species that could be considered key elements of the ecosystem. INAPESCA staff showed a positive approach to revise the necessary elements of the Plan. If the review process continues along the same line, with periodic review, it will be feasible to meet the standard at SG100 in the near future.		
e	Guided post	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?	(NA)	(NA)	(NA)

	Justification	Sharks are not a target in this fishery.
References		
OVERALL PERFORMANCE INDICATOR SCORE:		70
CONDITION NUMBER (if relevant):		
1-4. By the fourth annual surveillance audit, the fishery shall provide evidence that the harvest strategy for thread herring is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.		

Evaluation Table for PI 1.2.2 – Harvest control rules and tools

PI 1.2.2		There are well defined and effective harvest control rules in place		
Scoring Issue		SG 60	SG 80	SG 100
a	Guided post	Generally understood harvest rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	
	Met?	(Y)	(N)	
	Justification	<p>The small pelagics Fisheries Management Plan as published in the Official Gazette, is one of the main management instruments defined under the General Fisheries Law of Mexico. It gives an explicit, written harvest control rule (HCR) that is used for actively managed species, such as the Pacific sardine.</p> <p>Therefore, at present, there are not only generally understood, but also well-defined harvest control rules in place that reduce the exploitation rate as the point of recruitment impairment is approached. The control rule is defined by the following equation: $C = (B - B_{min}) * FRACTION$, where the output C, is the Biological Acceptable Catch (BAC). The HCR is an MSY-based control rule that is defined in the SPFMP where the value <i>FRACTION</i> (currently <i>Fmsy</i> is used, but this would be better defined as a harvest rate, see more below) limits the intensity of the harvest rate to a maximum of 0.25 of the biomass of individuals age 1+. The HCR also includes a pre-established minimum biomass cut-off (<i>Bmin</i>) such that if reached, the fishery would stop operating. This <i>Bmin</i> value is set at a point designed to assure that sufficient spawning biomass is left in the system to assure rebuilding. The HCR therefore operates by requiring catch reductions prior to biomass approaching the estimated level of recruitment impairment.</p> <p>While well-defined in terms of being explicit, the assessment team observed that for the purpose of setting the BAC an element of the harvest control rule is still problematic, the variable <i>FRACTION</i> is currently using a fishing mortality rate, versus being specified as a true harvest rate.</p> <p>Evidence was presented by INAPESCA that the HCR is in place in the FMP and has been computed, and that catches for the most recent season did not exceed BAC. However, the</p>		

		<p>team has not been presented with evidence indicating that the control rule is computed prior to the fishing season or that the harvest control rule is connected via a functional system for monitoring catch in real time, with the ability reduce or stop fishing operations as the allowable catch of the year is reached. In order to meet SG80, the control rule needs to be applied every year and removals should be monitored relative to BAC in-season, with tools to reduce removals as BAC is approached. In addition, the 2012 Small Pelagics Fishery Management Plan has a well-defined control rule, however, under Mexican legislation, management plans serve to inform procedures or regulatory instruments that contain the enforceable actions for the fishery. No such instrument has been produced after the publication of the fishery management plan. In conclusion, the assessment team agreed that the current evidence indicates that the HCR is incidentally, but not proactively in place meeting the standard at SG60 but not at SG80.</p> <p>Accessory tools to the control rule relate to minimum allowable size of fish and restrictions on effort. These tools are consistent with the harvest strategy as they aim to support the objective of sustainability by keeping production under MSY.</p>		
b	Guidepost		The selection of the harvest control rules takes into account the main uncertainties.	The design of the harvest control rules takes into account a wide range of uncertainties.
	Met?		(Y)	(N)
	Justification	<p>The selection of the control rule takes into account the main uncertainties. The definition of the BAC is such that it works as a LRP because the SPFMP establishes the computation of an Optimum Yield (OY) as a fraction of the BAC, as needed with the explicit purpose of avoiding overfishing. By doing this, any estimate of stock status that is optimistically biased because of regular uncertainties such as current abundance or productivity will have a safety margin that will help to keep the stock at biomass levels that avoid impairing recruitment and most likely to disrupt ecosystem structure. The MSC CR establishes that the TRP must be consistent with MSY, but in cases such as the small pelagic fishery in Mexico, where the LRP (as opposed to the TRP) is consistent with MSY, CB2.3.7 indicates that:</p> <p style="padding-left: 40px;">The team should award scores between 80 and 100 to the second scoring issue in PI 1.2.2 if management chooses to set a limit reference point above the point that reproductive capacity starts to be appreciably impaired.</p> <p>The Guidance to the same section of the CR further adds:</p> <p style="padding-left: 40px;">Although it may generally be the case that limit reference points are set at the point that reproductive capacity starts to be appreciably impaired, for some fisheries, especially those for small pelagic species and annual species where there the stock recruit relationship is very steep, management may choose to set a limit reference point above this level. Such action should attract scores between 80 and 100 with the intent that the overall score reflects the very low likelihood of reproductive capacity ever being impaired if such a limit reference point was used.</p> <p>By setting the LRP at a level slightly lower than MSY, the SPFMP accounts for the main uncertainties that may make recruitment fluctuate in unpredicted ways, therefore, the overall approach is precautionary and meets the SG80.</p> <p>There are a wide range of other uncertainties in parameterization, model performance, observation and process errors that either have not been accounted for in the stock assessments or where the margin of safety of the HCR has not been fully investigated. Uncertainties related to the stock assessment are further discussed in PI 1.2.4. Therefore, the HCR does not meet the SG100.</p>		
c	Guidepost	There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.

Met?	(Y)	(Y)	(N)
Justification	<p>Scoring Issue c is focused on “harvest control rules evaluation”. Here we have considered “evaluation” equivalent to the definition of testing(CR V1.3, p.69):</p> <p style="padding-left: 40px;">[...] the involvement of some sort of structured logical argument and analysis that supports the choice of strategy in the context of fisheries, it can include the use of experience from analogous fisheries, empirical testing (for e.g. practical experience of performance or evidence of past performance) simulation test (for instance using computer intensive modeling such as MSE)</p> <p>In this system there are tools (defined as ‘[...] mechanisms for implementing strategies under Principles 1 or 2. For example, TACs, mesh regulations, closed areas, etc. could be used to implement HCRs” (CR V1.3, p.69) that can be used to control effort in a manner that is “effective in achieving the exploitation levels required under the HCR”.</p> <p>“Tools”, or active management measures are included in legal instruments such as the NOM or the CNP. Some of the main provisions are catch monitoring, spatial and temporal closures, size limits and effort restrictions. Effort is restricted by prohibiting new vessels to enter the fishery and by size restriction on the catch. The number of vessels has remained approximately stable at around 50. Effort in number of trips showed a clear average tendency to increase starting in season 1992/93. However this average stabilized after season 2006/07.</p> <p>Harvest rate based strategies are known to be safer compared to constant catch policies to determine allowable seasonal catches because they are adjusted to the perceived biomass abundance. The harvest control rules however, need to be connected to a system or procedure that monitors in real time the cumulative catch during a fishing season so that the vessels can be informed when to stop fishing operations as the allowable catch of the year is being reached. Control rules also need to be applied every year before the beginning of the season.</p> <p>The fact that landings have not exceeded the recently calculated BAC indicates that the tools that are currently in use (some, like effort limits and size limits, imperfectly implemented) remain appropriate and effective in achieving the exploitation levels required under the harvest control rules and could also be used to further limit effort based on the status of the stock & the HCR, if needed.</p> <p>Deeper analyses need to be conducted to test the response of the HCR and other tools to respond effectively to unfavorable conditions. This is imperative in the light of environmental changes that can lead to situations in which effort levels (that presently are not affecting recruitment capacity), become crucial to the persistence of the stock. The team concluded that because the stock has remained below its LRP the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules but that more evidence is necessary to clearly show the effectiveness of the HCR to meet the goals stated in the SPFMP. In particular, the evidence needs to show more explicitly how each tool is operating to achieve exploitation levels required under the harvest control rules. This meets the requirements at SG80 but not SG100.</p>		
References			
OVERALL PERFORMANCE INDICATOR SCORE:			75
CONDITION NUMBER (if relevant): 1-5. By the fourth annual surveillance audit, the fishery shall present evidence that defined thread herring harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.			

Evaluation Table for PI 1.2.3 – Information and monitoring

PI 1.2.3		Relevant information is collected to support the harvest strategy		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	(Y)	(Y)	(N)
	Justification	<p>The INAPESCA small pelagics scientific program is regularly collecting useful information on stock productivity, size structure, biological data (egg and larvae surveys), required by the analysis of the stock assessment to support the harvest strategy. There is detailed information about the number and characteristics of the ships that constitute the fishing fleet. Effort can be modelled and analyzed and catch is recorded with a reasonable level of accuracy. Pre-season surveys determine the age and size composition of the schools in the fishing grounds to prevent harvesting young fish. Acoustic surveys are being conducted to obtain estimates of abundance independent of the fishery. Harvest rate is computed at the end of the fishing season. An observer program that had been already implemented stopped operating will need to be re-opened (scored in P2) to complement data from fishery operations.</p> <p>Overall, it is concluded that sufficient information is available to support the harvest strategy to meet the requirements at SG80, but more is still needed to understand better the population dynamics, stock variability and the influence of environmental factors. In particular, current ecosystem models have already started to provide insights about the role of the stock and other elements including the fishery, however, the data already at hand and new data needs to be incorporated to improve the confidence in model predictions in the face of alternative scenarios. Therefore the fishery does not meet the requirements at SG100.</p>		
b	Guidepost	Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	(Y)	(N)	(N)

	Justification	<p>Stock abundance and fishery removals are regularly monitored in the small pelagic fishery, including the thread herring in the Gulf of California.</p> <p>Abundance: Acoustic surveys are conducted to obtain estimates of absolute abundance independent of the fishery. However, such estimates need to be improved because the sampling design emphasis was on Pacific sardines, whereas the thread herring schools are more accessible in more coastal areas and at the early hours of the day. These conditions may have led to underestimate thread herring abundance in the acoustic surveys.</p> <p>CPUE from research surveys and egg and larvae data complement relative abundance information independent from the fishery, however, the amount of data for thread herring is not as abundant as data for Pacific sardines, which combined with the lack of a reliable estimate of absolute abundance, make the accuracy of this data set not fully useful yet to have a high degree of confidence in the results of the stock assessment to support the HCR.</p> <p>Removals: Catch records are a critical piece of information in any fishery harvest strategy. As required by the LGPAS to all fisheries in Mexico, in the small pelagics fishery in the Gulf of California, vessels are required to record technical aspects of the operation in a logbook and it is considered an infraction to the Law if the use of the logbook is ignored, or if the information recorded is false or modified. Additionally, catches are reported at the port of landing in official documents called “avisos de arribo” (landing notifications) that are provided by CONAPESCA. There is no hard evidence of a system to verify the accuracy or reliability of the landing records. Anecdotal evidence from INAPESCA and CONAPESCA staff indicates that inspectors and technicians participate in sampling programs and inspection activities at port. In reality, once the catch has been landed and stored, verification to determine if the report in the landing notification corresponds to the actual catch is very difficult. The staff at INAPESCA has historically operated under the assumption that the catch record is reliable enough to feed their management models and the harvest strategy in general.</p> <p>Size composition: Size composition of schools in the fishing grounds is observed before the beginning of the season as well as the season progresses to avoid excessive catch of juvenile fish.</p> <p>Overall the current data collection program is appropriate to conduct stock assessments, support the control rule and apply management procedures as required by the harvest strategy, but the accuracy of the abundance data still needs to be improved. Therefore, the fishery does not meet the requirements of SIb at SG80.</p>		
c	Guidepost		There is good information on all other fishery removals from the stock.	
	Met?		(Y)	
	Justification	The team was provided with information about some fishing effort by vessels originating from the port of Ensenada on the Pacific side of the Baja California Peninsula, fishing inside the GoC and landing in Sonora (Nevarez-Martinez et al 2016c). All removals by vessels operating in the Gulf are documented in ports located inside the Gulf and the catches are included in the Gulf statistics and the stock assessment. Therefore there is good information about all removals of fish from this stock that are taken by boats or fishers that don't belong to the UoC and meets SG 80.		
References				
OVERALL PERFORMANCE INDICATOR SCORE:				75
CONDITION NUMBER (if relevant):				

1-6. By the third surveillance the fishery shall provide evidence that the stock abundance of thread herring is be regularly monitored at a level of accuracy and coverage consistent with the harvest control rule.	
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Evaluation Table for PI 1.2.4 – Assessment of stock status

PI 1.2.4		There is an adequate assessment of the stock status		
Scoring Issue		SG 60	SG 80	SG 100
a	Guideline		The assessment is appropriate for the stock and for the harvest control rule.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.
	Met?		(Y)	(N)
	Justification	<p>The assessment is appropriate for the stock and the control rule. An evaluation of stock status was made (Nevarez-Martinez et al 2016b) using the ASAP model of Legault and Restrepo (1999). The analysis used commercial catch data and independent indices of abundance. One CPUE index of number of fish caught per hour of tow in set made during prospective cruises from 1990 to 2014. An index of eggs and larvae was produced from samples obtained during ictioplankton cruises from 1984 to 1987.</p> <p>The assessment obtained a time series of estimated abundance for different components of the sardine stock reconstructing the trajectory from 1972 to 2014. The analysis also computed a list of parameters of management and reference points, including the fishing mortality producing the MSY. A Beverton-Holt stock recruitment model was also fit to a plot of the estimated number of fish of age 0 against the total number of spawners.</p> <p>An alternative evaluation was made using a biomass dynamics model aggregated with the bocona sardine. This approach besides reconstructing the biomass trajectory and estimating basic population parameters, allows for the production of Kobe plots that represent the status of the stock in terms of fishing mortality and biomass relative to their respective levels that produce the MSY. Although this analysis still needs further development is a useful and robust approach to represent stock status in a relative scale and is worth observing.</p> <p>The assessment team considers that the stock assessment is appropriate for the stock and the control rule as currently defined in the Management Plan. Although the ASAP approach allows for accounting for the major features relevant to the biology of the species and the nature of the fishery, it is the first time this model is applied to the thread herring and needs to be further developed to verify that the different aspects of the biology and the process are acting properly to make the model converging to the correct solutions. This allows the fishery to meet the standard at SG80 but not SG100.</p>		
b	Guideline	The assessment estimates stock status relative to reference points.		
	Met?	(Y)		

	Justification	The stock assessment is conducted with the specific purpose to evaluate the status of the stock relative to the reference points defined in the Management Plan as seen in Figure 10. Shortfalls to evaluate stock status in a probabilistic way are included in the evaluation of SIs a & c. The fishery meets the standard at SG60.		
c	Guided post	The assessment identifies major sources of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.
	Met?	(Y)	(Y)	(N)
	Justification	<p>The purpose of this SI is to recognize the scope of accounting for the intrinsic uncertainties found in fishery stock assessments. At SG60 the major sources of uncertainty should be identified, whereas at SG80 uncertainties need to be taken into account, and at SG100, quantification and recognition of uncertainty should allow to evaluate stock status in a probabilistic way or evaluating the effects of parameter sensitivity to alternative scenarios.</p> <p>Historically the fishery for thread herring in the Gulf of California has evolved assessing stock status using a VPA approach under a set of assumptions that were not sufficiently discussed, leading to questions about the confidence in the assessment results. Since then, there is a documented search for more reliable approaches that is well seen as a way to handle the critical model related uncertainty. Presently, the assessment is conducted using the ASAP statistical catch at age model in a likelihood framework. This approach allows for accounting of observation error from the different data sources and the exploration of a variety of sensitivities and the influence of several sources of error.</p> <p>The reports of Nevarez-Martinez et al. (2015) and Nevarez-Martinez et al. (2016a) address some of the main uncertainties associated to the fishery of small pelagics in the Gulf of California. Some of them, such as the CV associated to the indices independent of the fishery or the temporal variability in growth, were discussed in the Pacific sardine assessment as a result of the review by Hill (2015) and there are other important uncertainties that were also pointed out in the Hill (2015) review that have not been fully addressed. Among these uncertainties, some of the most important include the assumption about a single, age and time independent, natural mortality; the form of the stock recruitment function and time related changes in age structure. These uncertainties need to be discussed and addressed explicitly in the thread herring assessment. It is particularly important to observe that current treatment of uncertainty in the estimates of parameters, population abundance and management quantities (particularly stock status relative to reference points), is not reported. If measures of uncertainty come from the asymptotic estimates produced by AD Model Builder (the programming platform to implement ASAP), they can be better expressed as Hill (2015) suggests, in probabilistic way using AD Model Builder capacity to run Monte Carlo Markov Chain Bayesian estimation. If these estimates cannot be produced, likelihood profile based confidence intervals are satisfactory.</p> <p>The assessment team recognizes the complexities in handling uncertainty associated to this fishery and concludes that the stock assessment meets the standard at SG80 and although it does not meet the standard at SG100 is on the right path to do so in the near future.</p>		
d	Guided post			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			(N)
	Justification	The stock assessment in its present form is of recent development and has not been able to be tested to the extent to show that is robust to the main uncertainties and no alternative hypotheses have been explored. The fishery cannot presently meet the standard at SG100.		

e	Guidpost		The assessment of stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
	Met?		(N)	(N)
	Justification	The team received no evidence that the thread herring stock assessment has been internally nor externally reviewed, therefore the fishery cannot meet the requirement at SG60.		
References				
OVERALL PERFORMANCE INDICATOR SCORE:				75
CONDITION NUMBER (if relevant):				
1-7 The assessment of stock status of thread herring has been subject to peer review.				

Principle 2

Evaluation Table for PI 2.1.1 – Retained species outcome

PI 2.1.1		The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	Main retained species are likely to be within biologically based limits (if not, go to scoring issue c below).	Main retained species are highly likely to be within biologically based limits (if not, go to scoring issue c below).	There is a high degree of certainty that retained species are within biologically based limits and fluctuating around their target reference points.
	Met?	Y	Y	N
	Justification	<p><i>Bocona sardines</i> (<i>Cetengraulis mysticetus</i>) and chub mackerel (<i>Scomber japonicus</i>) are designated as main species for this fishery as their recorded landings, in the last 25 years, frequently account for >5% of catch for the UoA.</p> <p>Life history information suggests that <i>bocona</i> sardine has robust life history traits, with the highest natural mortality rate of all retained species, a short lifespan and early maturity. Assessments for <i>bocona</i> sardine based on biomass dynamics models (Nevárez-Martínez et al. 2016d) conclude that recorded catches for <i>bocona</i> are below the estimated MSY (185,485 mt) for most of its trajectory, except in fishing season 2011-12 when <i>bocona</i> catch (197,354 mt) surpasses B_{MSY}. During the history of the fishery estimated biomass for <i>bocona</i> is also predicted to have remained above B_{MSY}. Annual fishing mortality rates for <i>bocona</i> from 1972 through 2012 have stayed under the level producing MSY.</p> <p>For chub mackerel estimates based on biomass dynamics models for indicate that estimated biomass is above B_{MSY}, recorded catches for chub mackerel remain below B_{MSY} and average fishing mortality rate remains below F_{MSY}.</p> <p>The assessment team recognized limitations in the interpretations of biomass trends for both <i>bocona</i> sardine and chub mackerel due to poor model fit. Hydroacoustic surveys are not available for the shallow inshore waters that <i>bocona</i> inhabits, nor have these been estimated for chub mackerel. Furthermore, samples for catch size distribution for <i>bocona</i> sardine collected in 2015 suggest that catch may be composed entirely, or in a high proportion, of juveniles.</p> <p>Based on available biomass estimates and life history characteristics the assessment team concludes that both <i>bocona</i> sardine and chub mackerel are highly likely to be within biological based limits, meeting SG80. However, due to lack of fisheries independent estimates of biomass, high proportion of juveniles in the catch for <i>bocona</i>, and uncertainties regarding the biomass dynamic model there is no a high degree of certainty, Additionally, explicit reference points as outlined in the Small Pelagics Management Plan have not been estimated for either species thus SG100 is not met.</p> <p><i>Bocona</i> sardines meets SG80 for SI(a) Chub mackerel meets SG80 for SI(a)</p>		
b	Guidepost			Target reference points are defined for retained species.
	Met?			N

PI 2.1.1		The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species		
	Justification	<p>The assessment team interprets Optimum Yield to equal TRP (See PI 1.1.2 of this report) though OY is generally understood to be less than BAC (Biological Acceptable Catch), a value for OY has not been defined for <i>bocona</i> sardine and chub mackerel. Limitations with successful implementation of management measures are discussed in PI 1.2.1 SIc.</p> <p>Additionally, there are no reference points for available for the other minor retained species.</p> <p><i>Bocona</i> sardines do not meet SG100 for SI(b)</p> <p>Chub mackerel do not meet SG100 for SI(b)</p> <p>Scoring element of minor retained species do not meet SG100 for SI(b)</p>		
c	Guidepost	If main retained species are outside the limits there are measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding of the depleted species.	If main retained species are outside the limits there is a partial strategy of demonstrably effective management measures in place such that the fishery does not hinder recovery and rebuilding.	
	Met?	N/A	N/A	
	Justification	The two main retained species, <i>bocona</i> sardine and chub mackerel, are not considered to be outside the biological base limits, thus there is no need for the implementation of measures or a strategy and SI(c) is considered Not Applicable.		
d	Guidepost	If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the retained species to be outside biologically based limits or hindering recovery.		
	Met?	Y		
	Justification	<p>The status of both <i>bocona</i> sardine and chub mackerel are not considered to be poorly known. Moreover, these two species are part of the small pelagic fishery which is regulated by NOM 003-PESC-1993, Small Pelagics Fisheries Management Plan and the National Fisheries Charter. Measure in place include seasonal closures, landing monitoring and effort limits. The practices in place (low exploitation rates relative to overall abundance for species with broadly distributed biological populations) are expected to result in the fishery not causing <i>bocona</i> sardine and chub mackerel to be outside biologically based limits. Limitations with successful implementation of management measures are discussed in PI 1.2.1 SIc.</p> <p>The status of the majority of minor retained species is poorly known, however, the fishery's low catch levels for these species coupled with the anticipated continuation of monitoring by the observer program are expected to result in the fishery not causing the minor retained species to be outside biologically based limits.</p> <p><i>Bocona</i> sardines meets SG60 for SI(d)</p> <p>Chub mackerel meets SG60 for SI(d)</p> <p>Scoring element of minor retained species meets SG60 for SI(d)</p>		

PI 2.1.1	The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species		
References	Nevárez-Martínez et al 2015; 2016;		
OVERALL PERFORMANCE INDICATOR SCORE:			80
CONDITION NUMBER (if relevant):			

Evaluation Table for PI 2.1.2 – Retained species management strategy

PI 2.1.2		There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species		
Scoring Issue		SG 60	SG 80	SG 100
a	Guided post	There are measures in place, if necessary, that are expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary, that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing retained species.
	Met?	Y	Y	N
	Justification	<p>As part of the small pelagics fishery in the Gulf of California <i>bocona</i> sardine and chub mackerel are managed by NOM-003 and the Small Pelagics Fisheries Management Plan (SPFMP). Under this management framework there is in place a sampling program to collect landing data and surveys to gather size data and stock assessments have been conducted for both species. Chub mackerel has been included in acoustic surveys, but these results have not been included in stock assessments for this species. Under the SPFMP chub mackerel is classified as an “active” management species, and <i>bocona</i> sardine as a “passive” management species. There are two MSY-based control rules in the SPFMP, for passively managed species, the control rule determines that the Biological Acceptable Catch (BAC) is 25% of the most recent estimate of the SSB. This represents the use of a fixed harvest rate (0.25) for all ‘passively’ managed species at all times. For species that are actively managed the control rule uses a harvest rate that can vary among species at different times but is constrained between 5 and 25% of the estimated SSB, over a cutoff of minimum biomass. There are also limits to fleet capacity and gear regulations in place.</p> <p>The existing measures have been designed specifically to manage the status of the small pelagic species under NOM-003, expected to work cohesively ensure the stock of these species remain at levels which are highly likely to be within biologically based limits, meeting SG80. However, as discussed in PI 1.2.1 SIa, there is no evidence of a cohesive arrangement in which management actions are responsive to the status of small pelagic species, thus SG100 is not met.</p> <p>The type of gear used in this fishery (purse-seine nets) results in relatively low catch levels of the species designated as ‘minor’ retained, and thus its considered a measure expected to ensure the fishery does not hinder their recovery and rebuilding of any of these species. The observer program serves to support information on catch levels and is considered a supporting measure. These measures are not explicitly designed to manage species designated as ‘minor’ retained, thus are not considered a complete strategy and SG100 is not met.</p>		

		<i>Bocona</i> sardines does not meets SG80 for SI(a) Chub mackerel does not meets SG80 for SI(a) Minor retained species don't meet SG100 for SI (a)		
b	Guidepost	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Y	Y	N
	Justification	Several of the management measures for the small pelagic fishery are already in place. Systematic monitoring of landing has been conducted since the 1970s, and several evaluations of biological reference points for both <i>bocona</i> sardine and chub mackerel have been conducted. The assessment team considers this information collected for the UoA provides and objective basis for confidence that the partial strategy will work, meeting SG80. There is also systematic monitoring in place (landing monitoring, dynamic models, size sampling), which provide a high degree of confidence that the partial strategy will work once limitations identified in SIa and c for this PI are solved, thus SG100 is met for <i>bocona</i> sardines and chub mackerel. Information collected from the observer program provides some objective basis for confidence of the likelihood that the current operations of the fleet will work to manage impacts of the fishery on minor retained species, meeting SG80. There is no systematic monitoring thus SG100 is not met. <i>Bocona</i> sardines meets SG100 for SI(b) Chub mackerel meets SG100 for SI(b) Minor retained species meet SG80 for SI (b)		
c	Guidepost		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		N	N
	Justification	There is some evidence that measures in the partial strategy are implemented (landing monitoring, dynamic models, size sampling), however, at present the harvest control rule for small pelagics is not considered to be 'in place' (See PI 1.2.1 and corresponding condition). The absence of evidence of monitoring and enforcement to implement the harvest strategy and stop the fishery operation as BAC is approached, preclude the partial strategy from being considered as 'successfully' implemented, thus SG80 is not met. <i>Bocona</i> sardines does not meet SG80 for SI(c) Chub mackerel does not meet SG80 for SI(c) Minor retained does not meet SG100 for SI(c)		
d	Guidepost			There is some evidence that the strategy is achieving its overall objective.
	Met?			N

	Justification	<p>There is no evidence that management measures for <i>bocona</i> sardine, chub mackerel or minor retained species are responsive to the state of the stocks of these species, thus SG100 is not met.</p> <p><i>Bocona</i> sardines does not meet SG100 for SI(d)</p> <p>Chub mackerel does not meet SG100 for SI(d)</p> <p>Minor retained does not meet SG100 for SI(d)</p>		
e	Guided post	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?	Y	Y	N
	Justification	<p>The assessment team identified five shark species that were designated as 'minor retained', catch volumes for these species are very low <0.01% of the catch of the UoA. Information from the observer data indicates that these species are retained for consumption by the crew or are stored in the holds along with the small pelagics catch. There is no indication that shark fins are cut on board. Mexican regulations under NOM 029 require the landing of all sharks with fins and prohibits the use of fins. The assessment team concluded that since sharks are retained numbers are very low it is likely that shark finning is not taking place, meeting SG80. Due to lack of good external validation that document the destination of all shark bodies there is no high degree of certainty that shark finning is not taking place.</p>		
References		Nevárez-Martínez, et al. 2015; 2016; NOM-003-PESC-1993; Carta Nacional Pesquera (CNP)		
OVERALL PERFORMANCE INDICATOR SCORE:				75
CONDITION NUMBER (if relevant):				
<p>2-1. By the third annual surveillance the client shall present some evidence that the partial strategy for management of <i>bocona</i> sardine and chub mackerel is being implemented successfully</p>				

Evaluation Table for PI 2.1.3 – Retained species information

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	Qualitative information is available on the amount of main retained species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.	Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations.
	Met?	Y	Y	N
	Justification	<p>Commercial fisheries landings and effort is monitored for all small pelagic species, providing some quantitative information on the amount taken of <i>bocona</i> sardine and chub mackerel by the fishery and meeting SG80.</p> <p>From January 2013 to August 2014 the observer program collected data on volume for non-small pelagic species, providing some quantitative information on the amount taken of retained 'minor' species by the fishery, meeting SG80.</p> <p>For both the main retained species (<i>bocona</i> sardine and chub mackerel) and for the minor retained species there is no information available on the precision of the catch estimates, nor an indication that this data has been verified. It is unclear whether discard data for <i>bocona</i> and chub mackerel are monitored. Furthermore, for minor retained species there is an absence of continuity in the data as the observer program only operates for less than two fishing seasons. For these reasons the assessment team concludes that the information is not accurate and verifiable and SG100 is not met.</p> <p><i>Bocona</i> sardines meets SG80 for SI(a)</p> <p>Chub mackerel meets SG80 for SI(a)</p> <p>Minor retained species do not meet SG100 for SI(a)</p>		
b	Guidepost	Information is adequate to qualitatively assess outcome status with respect to biologically based limits.	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.
	Met?	Y	Y	N
	Justification	<p>The assessment team concluded that information available for <i>bocona</i> sardines and chub mackerel (landings data and catch sampling) is sufficient to generate dynamic models that estimate outcome status with respect to biologically based limits, meeting SG80.</p> <p>However, because of the importance of these species in terms of volume, the assessment team determined that more comprehensive and precise information is required to 'estimate outcome status with a high degree of certainty' and meet SG100. Currently, for these two species, information on fisheries independent data, estimates for natural mortality, age or length data or discard estimates are either not available or have not been included in the assessments of the stock status. There are also limitations in the precision of the dynamic models presented.</p> <p>For chub mackerel INAPESCA has outlined a work plan for future evaluations, including: processing of biological data (growth parameters, mortality indices), processing of size distribution, application of independent abundance indices, processing of information from the acoustic data and application of age based methods to the stock status. The achievement of these goals would attract a higher score for chub mackerel in this SI in future evaluations. No such plan was made available for <i>bocona</i> sardine.</p> <p>The data collected from the observer program and other available data is not sufficient to estimate outcome in respect of biological based limits for all (> 100) minor retained species. However, because the impact of the UoA on these species is minor, on account of small</p>		

		<p>catch volumes, the assessment team concludes the available information is adequate, attracting a score of SG80.</p> <p><i>Bocona</i> sardines meets SG80 for SI(b)</p> <p>Chub mackerel meets SG80 for SI(b)</p> <p>Minor retained species meet SG80 for SI(b)</p>		
c	Guidepost	Information is adequate to support measures to manage main retained species.	Information is adequate to support a partial strategy to manage main retained species.	Information is adequate to support a strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
	Met?	Y	Y	N
	Justification	<p>Information available for <i>bocona</i> sardines and chub mackerel (catch and effort data, and biological reference points from the dynamic models) are considered adequate to support the partial strategy to manage these species, meeting SG80.</p> <p>Problems with the adequacy and precision of this data, reviewed in SI (b) and the lack of a responsive management strategy preclude reaching SG100.</p> <p>Problems with continuity of information available for minor retained species preclude this element from reaching SG100.</p> <p><i>Bocona</i> sardines meets SG80 for SI(c)</p> <p>Chub mackerel meets SG80 for SI(c)</p> <p>Minor retained species do not meet SG100 for SI(c)</p>		
d	Guidepost		Sufficient data continue to be collected to detect any increase in risk level to main retained species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy)	Monitoring of retained species is conducted in sufficient detail to assess ongoing mortalities to all retained species.
	Met?		Y	Y
	Justification	<p>Monitoring of catch data and effort, and size distributions, are considered sufficient to detect an increase in risk level to <i>bocona</i> sardine and chub mackerel, meeting SG80. There is not clear information on discard volume of <i>bocona</i> sardine and chub mackerel, thus SG100 is not met.</p> <p>For minor retained species there are issues with the continuity of the data, as the observer program only operated in 2013 and part of 2014, thus SG100 can't be met.</p> <p><i>Bocona</i> sardines meets SG80 for SI(d)</p> <p>Chub mackerel meets SG80 for SI(d)</p> <p>Minor retained species do not meet SG100 for SI(d)</p>		
References				
OVERALL PERFORMANCE INDICATOR SCORE:				80
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.2.1 – Bycatch species outcome

PI 2.2.1		The fishery does not pose a risk of serious or irreversible harm to the bycatch species or species groups and does not hinder recovery of depleted bycatch species or species groups		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	Main bycatch species are likely to be within biologically based limits (if not, go to scoring issue b below).	Main bycatch species are highly likely to be within biologically based limits (if not, go to scoring issue b below).	There is a high degree of certainty that bycatch species are within biologically based limits.
	Met?	NA	NA	N
	Justification	<p>There are no species designated as 'main' bycatch in this fishery, thus SG60 and SG80 are considered to be Not Applicable.</p> <p>Ten seabird species that are not classified as ETP were designated as 'minor' bycatch species: western grebe, black-headed gull, magnificent frigatebird, ring-billed gull, storm-petrel, double-crested Cormorant, Brandt's cormorant, black-necked grebe, brown booby and royal tern.</p> <p>All of these seabirds species are listed Least Concern by IUNC. Although most of these species display a large distribution range, some of these are distributed into sub-populations and several of the seabird species in the Gulf of California may be part of local or regional sub-populations. The assessment team was unable to find recent populations estimates in the Gulf of California for <i>all</i> of these species, therefore the assessment team concluded that there is not a high degree of certainty that the populations in the GOC for all of these seabird species are within biological based limit, thus SG100 was not met.</p> <p>Minor bycatch species (seabirds) do not meet SG100</p>		
b	Guidepost	If main bycatch species are outside biologically based limits there are mitigation measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding.	If main bycatch species are outside biologically based limits there is a partial strategy of demonstrably effective mitigation measures in place such that the fishery does not hinder recovery and rebuilding.	
	Met?	N/A	N/A	
	Justification	Main species are not identified in this fishery, consequently SI (b) is Not Applicable.		
c	Guidepost	If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the bycatch species to be outside biologically based limits or hindering recovery.		
	Met?	(Y)		

	Justification	<p>The status of the GOC population of several of the seabird species is not well known, however, there are several measures and practices in place expected to mitigate the potential effects of the fishery.</p> <p>There are several protected areas in the GOC, intended to help the conservation of several nesting colonies of seabird species. Furthermore the current practices of the fishery result in very low mortality levels for most of the seabird species designated as 'bycatch'. There are only two seabird species that are affected by the fishery in larger numbers: brown booby (<i>Sula leucogaster</i>) and double-crested cormorant (<i>Phalacrocorax auritus</i>). For brown boobies direct recorded mortality is considered relatively low ~100 individuals recorded during January 2013-August 2014 (10% observer coverage). There are also concerns that exposure of seabirds to fish oil during the fishing operation affects their ability to thermoregulate, feed, and maintain buoyancy (See Background: Seabird Mortality due to Oiling p. 30). Number of 'affected' sea birds by fish oil are 100 for brown boobies and 75 for double-crested cormorants.</p> <p>The assessment team concluded that for brown boobies and double-crested cormorant the number of affected birds suggest it is unlikely that the fishery hinders populations of these species. The low numbers of individuals affected and the continuing of monitoring of bycatch numbers by the observer program are expected to result in the fishery not causing the seabird species to be outside biologically based limits or hindering their recovery, thus the SG60 is not met.</p> <p>Minor bycatch species (seabirds) meet SG60</p>
References		
OVERALL PERFORMANCE INDICATOR SCORE:		80
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 2.2.2 – Bycatch species management strategy

PI 2.2.2		There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	There are measures in place, if necessary, that are expected to maintain the main bycatch species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary, that is expected to maintain the main bycatch species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing and minimizing bycatch.
	Met?	NA	NA	(N)
	Justification	<p>There are no species designated as 'main' bycatch in this fishery, thus SG60 and SG80 are considered to be Not Applicable.</p> <p>During two fishing seasons (2012-13 and 13-14) an observer program operated to develop a strategy for managing and minimizing bycatch. The client and INAPESCA presented a letter with commitment to continue data collection by observer during the next fishing season.</p> <p>Other measures that are not specifically designed to manage bycatch but contribute to minimize bycatch are in place such as effort and catch limits, protected areas management plans and zoning, among others. A mitigation strategy has been proposed by INAPESCA and discuss in workshops with captains and boat owners. Awareness workshops have been held to disseminate this strategy focused mainly on seabird impact mitigation but also in other species such as sea turtles, sharks and marine mammals. However, there is not a full strategy in place, thus SG100 is not met.</p>		
b	Guidepost	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.
	Met?	NA	NA	N
	Justification	<p>There are no species designated as 'main' bycatch in this fishery, thus SG60 and SG80 are considered to be Not Applicable.</p> <p>There is not a strategy in place thus the SG100 is not met.</p>		
c	Guidepost		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		Y	N

PI 2.2.2		There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations		
	Justification	Records, reports and analysis of the observer program serve as evidence that the partial strategy is being implemented successfully and workshops held to disseminate the mitigation strategy. There is not clear evidence of successful implementation since the observer program stopped and mitigation measures such as a water curtain to avoid interactions with seabird has not been widely adopted. Evidence of implementation of other measures (closures, effort and catch limits, zoning in protected areas and workshops to disseminate the agreements to avoid fishing in some areas of protected areas) a part of a partial strategy are presented in annual reports of the fishery and protected areas reports. SG80 is met but SG100 is not reached.		
d	Guidepost			There is some evidence that the strategy is achieving its overall objective.
	Met?			(N)
	Justification	There is no strategy in place so SG100 is not reached.		
References				
OVERALL PERFORMANCE INDICATOR SCORE:				80
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.2.3 – Bycatch species information

PI 2.2.3		Information on the nature and the amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	Qualitative information is available on the amount of main bycatch species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main bycatch species taken by the fishery.	Accurate and verifiable information is available on the catch of all bycatch species and the consequences for the status of affected populations.
	Met?	NA	NA	N
	Justification	<p>There are no species designated as 'main' bycatch in this fishery, thus SG60 and SG80 are considered to be Not Applicable.</p> <p>The assessment team identified accuracy issues in regards to interpretation of mortality numbers of seabirds from the observer program. Additionally, there is no external verification of information gathered by the observer program, thus SG100 is not met for minor bycatch species.</p>		
b	Guidepost	Information is adequate to broadly understand outcome status with respect to biologically based limits	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with respect to biologically based limits with a high degree of certainty.
	Met?	Y	Y	N
	Justification	<p>There are no species designated as 'main' bycatch in this fishery.</p> <p>The data collected from the observer program and other available data (IUCN status, population census) is considered sufficient to generally estimate outcome in respect of biological based limits for seabird species designated as minor bycatch species, attracting a score of SG80. However, there is limited up-to-date information on the status of the sub-populations or nesting colonies in the Gulf of California for <i>all</i> of the seabird species designates as 'minor' bycatch. Consequently outcome status with respect to biologically based limits cannot be estimated with a high degree of certainty, thus SG100 is not met.</p>		
c	Guidepost	Information is adequate to support measures to manage bycatch.	Information is adequate to support a partial strategy to manage main bycatch species.	Information is adequate to support a strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
	Met?	NA	NA	N
	Justification	<p>There are no species designated as 'main' bycatch in this fishery, thus SG60 and SG80 are considered to be Not Applicable.</p> <p>The observer program collects data on impact of the UoA on seabirds. The team identified several shortcoming with the information collected for bycatch. First there is absence of continuity in data since the observer program only operate for less than two fishing seasons. Secondly there are issues with data interpretation mortality from oiling leading to and uncertainty when determining the impact of the fishery on seabirds. Lastly, there is no evidence that the data collected by the observer program has been externally verified. For these reasons the assessment team concluded that the available information is not adequate to determine whether the measures implemented (i.e. water curtains) are effective thus SG100 is not met.</p>		

PI 2.2.3		Information on the nature and the amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch		
d	Guidepost		Sufficient data continue to be collected to detect any increase in risk to main bycatch species (e.g., due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).	Monitoring of bycatch data is conducted in sufficient detail to assess ongoing mortalities to all bycatch species.
	Met?		NA	N
	Justification	<p>There are no species designated as 'main' bycatch in this fishery, thus SG80 is considered Not Applicable.</p> <p>There has been progress on developing monitoring and reporting system for bycatch species. The observer program started to generate quantitative and qualitative information from January 2013 until August 2014. The analysis of data gathered during this time was published in INAPESCA and COBI on-board observer report, including a list and number of individual/volume of bycatch species. According to the data, catch volume are very low therefore no species is considered as main. No data were presented on potential unobserved mortality of returned individuals, this information would be required to accurately assess the consequences of the fishery on the populations of bycaught species. Furthermore, a long-term program is required to provide sufficient information to detect any significant changes of the impact of the fishery on bycatch species. For these reasons the assessment team concludes that monitoring of bycatch data is not conducted in sufficient detail to assess ongoing mortalities to all bycatch species, therefore SG100 is not met.</p>		
References		Padilla-Serrato (2015); Garcia-Gastellum (2015); Arizmendi et al (2016);		
OVERALL PERFORMANCE INDICATOR SCORE:				80
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.3.1 – ETP species outcome

PI 2.3.1		<p>The fishery meets national and international requirements for the protection of ETP species</p> <p>The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species</p>		
Scoring Issue		SG 60	SG 80	SG 100
a	Guided post	Known effects of the fishery are likely to be within limits of national and international requirements for protection of ETP species.	The effects of the fishery are known and are highly likely to be within limits of national and international requirements for protection of ETP species.	There is a high degree of certainty that the effects of the fishery are within limits of national and international requirements for protection of ETP species.
	Met?	NA	NA	NA
	Justification	According to FCR v2.0, 'limits' in scoring issue (a) is only scored when there are quantitative mortality limits for that species. None of the 21 ETP species evaluated in this fishery have quantitative limits in national or international legislation. ETP species are scored in scoring issues (b) and (c).		
b	Guided post	Known direct effects are unlikely to create unacceptable impacts to ETP species.	Direct effects are highly unlikely to create unacceptable impacts to ETP species.	There is a high degree of confidence that there are no significant detrimental direct effects of the fishery on ETP species.
	Met?	Y	Y	N
	Justification	<p>Brown pelicans and Blue-footed boobies</p> <p>The California subspecies (<i>P.o. californicus</i>) is proposed to be a metapopulation, consisting of breeding colonies (Stinson, 2014). The largest breeding aggregation is found in the GOC, there is a limited understanding on the degree of connectivity of the GOC population with other nesting colonies. The most recent population assessment of this aggregation was published in 2006, estimating ~43 000 breeding pairs (Anderson et al. 2013). This estimate may no longer be accurate, as brown pelicans in the GOC experience important fluctuations in the size of nesting colonies linked to environmental changes and food availability (Godínez-Reyes et al. 2006; Velarde, 2014 unpublished data; Stinson, 2014; Ainley et al. 1988 in Anderson et al. 2013).</p> <p>From January 2013 to August 2014, the observer program for the Sonora fleet recorded a range of 83-2,050 dead and injured pelicans and ~2,000 pelicans exposed to fish oil during the fishing operation. The observer program reported only the results from the observer samples. In absence of an estimate of total bycatch/ETP interaction the assessment team extrapolated the ETP observer samples over the rest of the fishery for the two fishing seasons. The observer samples may not be properly stratified to be representative of the whole fishery, introducing bias and thus these estimates should be treated only as an exploratory effort at best (Uncertainty in observer program deficiencies are addressed in PI 2.3.3).</p> <p>Extrapolations to the whole fishery, for two fishing seasons, estimates ranges from 830 to 1,025 dead and injured individuals, and ~20,000 pelicans exposed to fish oil. Without recent estimates of the current population size of the brown pelican colony in the GOC, of the relevant colonies in the metapopulation, or of accurate estimates of mortality caused by the fleet, it is challenging to quantify the relative importance of direct mortality caused by the fishery on the brown pelican population. However, estimates from observed mortality and injury for two years, appear to be relatively small when compared to the last known population estimate of 80,000 breeding individuals in the GOC colony.</p> <p>The number of pelicans exposed to fish oil during the fishing operation are significantly higher than those with observed direct mortality. Hypothesis speculate exposure to fish oil,</p>		

	<p>may affect seabirds' ability to thermo-regulate, feed, and maintain buoyancy, and affect survivorship and reproductive capacity (See Background: Seabird Mortality due to Oiling p. 30). No field data supporting this hypothesis has been presented, and preliminary evaluations of the small pelagic fleet in Sinaloa indicate that fishing maneuvers have no significant effect on the concentration of fish oil in the water (Jacob-Cervantes et al. 2016b).</p> <p>Blue-footed boobies (<i>Sula nebouxii</i>) are widely distributed, however, Mexico colonies are believed to be essentially isolated from colonies to the south (Taylor et al., 2011). Surveys in the early 1990s from the San Pedro Martir Island, the largest breeding colony of this species in the Gulf of California, estimated a population of 110,000 breeding pairs of blue-footed boobies (Tershy and Breese 1997). Sporadic data suggest a reduction in reduction in number of nests from 2009 to 2015 in the GOC (Velarde, nd). Events such as decline in breeding, as evidenced in the population of blue-footed boobies in the Galapagos (Achundia et al, 2014), has been linked to has been linked to ENSO's influence in prey availability (Anconca et al, 2011).</p> <p>From January 2013 to August 2014, the observer program for the Sonora fleet recorded a range of 101-112 dead and injured blue-footed boobies and 232 individuals exposed to fish oil during the fishing operation. The assessment team also extrapolated the observer samples over the rest of the fishery for the two fishing season to estimate total bycatch/ETP interactions for blue-footed boobies. As noted above, these crude total estimates do not account for potentially important bias. Extrapolations for the whole fishery during two fishing seasons, estimate ~1,000 dead and injured individuals, and ~2,000 individuals exposed to fish oil. Without recent estimates of the current population size of the blue-footed booby colony in the GOC, and accurate estimates of mortality caused by the fleet, it is challenging to quantify the relative importance of direct mortality caused by the fishery on the population. However, estimates from observed mortality and injury for the two fishing seasons, appear to be relatively small when compared to the last known population estimate of 220,000 breeding individuals (Tershy and Breese 1997). Number of blue-footed boobies recorded as exposed to fish oil during the fishing operation are double than those with observed direct mortality. As noted previously, no field data has been presented to verify inferences of the impact of fish oil exposure on seabirds.</p> <p>Based on the following: (1) the apparently low numbers of observed mortality relative to the size of the brown pelican and blue-footed booby populations, (2) the accepted population fluctuations in the GOC linked to environmental changes and food availability, (3) the limited available evidence supporting the hypothesis of seabird mortality impacts from exposure to fish oil and (4) the relatively large distribution area of these species, the assessment team concluded that direct effects of the fishery are highly unlikely to create unacceptable impacts to the California brown pelican and blue-footed boobies meeting SG80.</p> <p>The assessment team recognizes there are significant uncertainties in the assessment of the fishery's direct impact on this species. A conditions has been placed on the sufficiency of the information available to determine the outcome status of brown pelicans under PI 2.3.3 "ETP Species Information". For this reason SG100 is not met.</p> <p>Other ETP species</p> <p>The number of other ETP species affected by the fishery including marine mammals, sea turtles, fish and sharks, and other sea bird species, are very low and the status of population of most ETP species as qualified via listing in NOM 029 are considered to be of 'Least Concern' by the IUCN. The team concluded that direct effects are highly unlikely to create unacceptable impacts to other ETP species, meeting SG80. For those ETP species with extremely low numbers of interactions and no observed mortality (sea turtles) there is a high degree of confidence that there are no significant detrimental direct effects of the fishery on all other ETP species, meeting SG100.</p> <p>Blue footed boobies meet SG80 Brown pelicans meet SG80</p>
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		Other Sea birds meet SG80 Marine mammals meet SG80 Sea turtles meet SG100 Fish and shark species meet SG80		
c	Guided post		Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts.	There is a high degree of confidence that there are no significant detrimental indirect effects of the fishery on ETP species.
	Met?		Y	N
	Justification	<p>Brown pelicans, blue-footed boobies and other sea bird species</p> <p>The diet of the ETP seabirds identified in this fishery depends mostly on small pelagic species. Both brown pelicans and blue-footed boobies forage on adults of Pacific sardine, Californian anchovy and chub mackerel. Elegant terns and Heermann's gulls feed on pre-recruits of small pelagic species and thread herring is an important part of the blue-footed booby diet. Diet composition of seabirds fluctuates seasonally as a response to fluctuation of abundance of different small pelagic species. In the GOC a shift has been identified where as abundance of Pacific sardine decreases the diet of seabird species shifts towards California anchovy, and vice versa. Fluctuations of seabird breeding pairs are linked to food availability, and the effect of the ENSO oscillation on abundance of small pelagics. Population fluctuations of small pelagics have not been explained by direct effects of fisheries, however, concerns have been raised about the potential competition of between fisheries and seabirds for small pelagics. Changes in birds foraging behavior have been linked to localized impacts of fisheries targeting low trophic level species.</p> <p>A global meta-analysis quantifying effects of food abundance fluctuation on seabird breeding success has proposed a threshold of approximately one-third of the maximum prey biomass observed as the minimum fish biomass required to sustain seabird productivity. Additionally, ecosystem evaluations by Arreguin-Sanchez et al. (2016a; 2016b) for Pacific sardine estimated threshold harvest rate of 36% as a limit to cause serious or irreversible harm to the ecosystem. Trends of exploitation rates for Pacific sardine and thread herring indicate that the fishery has never exceeded a 25% threshold. Considering the low harvest relative to those thresholds estimated for ecosystem functioning and seabird breeding success, the assessment team concluded that it is unlikely that the fishery results in unacceptable impacts to seabirds, attracting meriting a score of SG80.</p> <p>There is a limited understanding of the ecosystem role of other small pelagic species retained by the fishery and which are known to be part of the diet of seabirds. There is also a limited understanding of the precise ranges of interaction between foraging seabirds and the fishery, and if whether seabirds foraging strategies might have been affected by the fishery. Furthermore, ecosystem-based management and evaluation consideration have not been incorporated into formal management. For these reasons the team concludes there is not a high degree of confidence that fishery will not cause significant detrimental indirect effects to ETP seabird species, thus the SG100 is not met.</p> <p>Other ETP species</p> <p>The other ETP species affected by the fishery include marine mammals, sea turtles, and fish and sharks species. The assessment team did not identify small pelagic species as the dominant diet of any of these species, thus indirect effects are thought to be unlikely to create unacceptable impacts for all other ETP species, meeting SG80. Information on relationships between ETP species and the small pelagic species captured by the fishery, is still limited thus there is not a high degree of confidence and SG100 can't be met.</p> <p>Blue footed boobies meet SG80 Brown pelicans meet SG80</p>		

		Other Sea birds meet SG80 Marine mammals meet SG80 Sea turtles meet SG80 Fish and shark species meet SG80
References		Padilla-Serrato (2015) García-Gastellum et al (2015) Morales-Bojórquez (in press) Jacob-Cervantes, M.L., Rendón-Martínez, R. 2016b COBI 2015 COBI y CANAINPES 2015 Morandin and O'Hara 2014 Arreguin-Sanchez et al. 2016a; 2016b (Arreguín-Sánchez & Calderón-Aguilera, 2002; Arreguín-Sánchez & Martínez-Aguilar, 2004; Rosas-Ruiz et al., 2008; Lercari, 2006, Morales-Zarate et al. 2004 Cury, P. M., Boyd, I. L., Bonhommeau, S., Anker-Nilssen, T., Crawford, R. J., Furness, R. W., ... & Piatt, J. F. (2011). Global seabird response to forage fish depletion—one-third for the birds. Science, 334(6063), 1703-1706.
OVERALL PERFORMANCE INDICATOR SCORE:		85
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 2.3.2 – ETP species management strategy

PI 2.3.2A		There is a strategy in place for managing ETP species that is designed to ensure the fishery does not hinder the recovery of ETP species.		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	There are measures in place that are expected to ensure the fishery does not hinder the recovery of ETP species.	There is a partial strategy in place that is expected to ensure the fishery does not hinder the recovery of ETP species.	There is a strategy in place for managing ETP species, to ensure the fishery does not hinder the recovery of ETP species.
	Met?	Y	Y	N
	Justification	<p>There are a number of measures that indirectly contribute to the managing the impacts of the small pelagics fishery on ETP species: input controls including limited entry, gear restrictions and regulations for the permitted fishing gear, fleet and fishing capacity limitations, restriction on fishing effort, temporary spatial closures, biologically acceptable catch, and monitoring of landings.</p> <p>The assessment team notes that Art. 66 in the National Fisheries Law states that “Bycatch shall be limited and may not exceed the volume determined by The Secretariat, for each fishery, according to zones, seasons and fishing gears [...]”. At the moment there are no limits determined for this fishery.</p> <p>Additionally, there are measures designed to explicitly manage the impacts of the fishery on ETP species: observer program, mitigation measures (water curtains for seabirds, avoid setting on turtles, shark and dolphin aggregations or herds.), workshops and training material for captains on mitigation measures, protected areas that control fishing activities and federal regulations that prohibit retention of protected species.</p> <p>These practices and measures are expected to ensure the fishery does not hinder the recovery of ETP species, meeting SG80. The assessment team identified issues with the success of implementation of some of these measures, resulting in a condition in SI c of this PI.</p> <p>Blue footed boobies meet SG80 Brown pelicans meet SG80 Other Sea birds meet SG80 Marine mammals meet SG80 Sea turtles meet SG80 Fish and shark species meet SG80</p>		
b	Guidepost	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.	The strategy is mainly based on information directly about the fishery and/or species involved, and testing supports high confidence that the strategy will work.
	Met?	Y	Y	N

PI 2.3.2A		There is a strategy in place for managing ETP species that is designed to ensure the fishery does not hinder the recovery of ETP species.		
	Justification	<p>In response to conditions raised in previous assessment the client created an observer program and supported workshops for mitigation strategies, and testing of mitigation measures (i.e.) water curtain. During the present audit, CANAINPES and INP presented a letter with the commitment to continue the implementation of the observer program during the next fishing season. The fishery has recruited bycatch experts to support the workshops (Dr. Martin Hall, from the IATTC bycatch program) and seabird experts to comment on the observer program design (Dr. Enriqueta Velarde). The trajectory of the fishery and the use of expert knowledge provides some objective basis for confidence that the partial strategy for ETP species will work.</p> <p>Information about the seabirds and the impact of the fishery is incomplete to support a high degree of confidence, thus SG100 is not met.</p> <p>Blue footed boobies meet SG80</p> <p>Brown pelicans meet SG80</p> <p>Other Sea birds meet SG80</p> <p>Marine mammals meet SG80</p> <p>Sea turtles meet SG80</p> <p>Fish and shark species meet SG80</p>		
c	Guidepost		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully, and intended changes are occurring.
	Met?		N	N

PI 2.3.2A	There is a strategy in place for managing ETP species that is designed to ensure the fishery does not hinder the recovery of ETP species.	
	Justification	<p>There is some evidence that some measures of a partial strategy are being implemented as demonstrated by the data collected by the observer program for two fishing season, the workshops conducted and the development of mitigation measures such as water curtains. However, the assessment team identified implementation problems with several of these measures, precluding them from being considered 'successful' and from attaining a score of SG80:</p> <ul style="list-style-type: none"> -Water curtain to avoid seabirds from entering into the net has been preliminary tested, but it's not widely adopted by the fleet. -There has been a discontinuation during the 2014-2015 and 2015-2016 fishing seasons of the observer program: thus, there is neither an understanding on effectiveness of mitigation measures nor a mechanism to inform management of the need to change measures should they cease to be effective -Recorded catches of juvenile Pacific sardine and thread herring account for more than 30% of the permitted volume. Stakeholders have expressed concern that the majority of catches of juveniles may be occurring in Marine Protected Areas, which are of importance to seabird colonies. -Instances where protected species (i.e. white sharks and mobulas) appear to be retained, presumably for consumption by the crew, against regulation prohibiting retention of these protected species. These appear to be isolated events with only a couple individuals retained. <p>Blue footed boobies meet SG60 Brown pelicans meet SG60 Other Sea birds meet SG80 Marine mammals meet SG80 Sea turtles meet SG80 Fish and shark species meet SG80</p>
References	<p>Padilla-Serrato (2015) García-Gastellum et al (2015) COBI and CANAINPES, workshop report. 2015 COBI 2015</p>	
OVERALL PERFORMANCE INDICATOR SCORE:		75
<p>CONDITION NUMBER (if relevant):</p> <p>2-2 By the second annual surveillance the client shall present some evidence that the partial strategy for managing brown pelicans and blue-footed boobies is being implemented successfully.</p>		

Evaluation Table for PI 2.3.3 – ETP species information

PI 2.3.3		Relevant information is collected to support the management of fishery impacts on ETP species, including: <ul style="list-style-type: none"> • Information for the development of the management strategy; • Information to assess the effectiveness of the management strategy; and • Information to determine the outcome status of ETP species. 		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	Information is sufficient to qualitatively estimate the fishery related mortality of ETP species.	Sufficient information is available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species.	Information is sufficient to quantitatively estimate outcome status of ETP species with a high degree of certainty.
	Met?	Y	Y/N	N
	Justification	<p>Brown pelicans and blue-footed boobies</p> <p>The data collected from the observer program and other available data (population census) is considered sufficient to generally estimate outcome in respect of biological based limits for seabird species designated as ETP species, attracting a score of SG60. However, there is limited up-to-date information on the status of the sub-populations or nesting colonies in the Gulf of California for brown pelicans and blue footed boobies. The assessment team received only data for samples obtained from the observer program, and not for the impact of the whole fleet. The assessment team also identified accuracy issues with the interpretation of mortality numbers of seabirds from the observer program and on the exposure of seabirds to fish oil. There is also a limited understanding of the interaction between foraging seabirds and the fishery, and if seabirds foraging and reproductive strategies might have been affected by the fishery. Consequently the assessment team concluded that there is not sufficient information available to allow to quantitatively estimate all related mortality of brown pelicans and blue footed- boobies and the impact of fishing resulting from UoA fishing activities for brown pelicans and blue footed- boobies, thus SG80 is not met.</p> <p>Other ETP species</p> <p>The other ETP species affected by the fishery include marine mammals, sea turtles, other seabird species and fish and sharks species. The impact of the UoA on these species is minor. Given the importance the assessment team concludes the available information is sufficient attracting a score of SG80</p> <p>Blue footed boobies meet SG60</p> <p>Brown pelicans meet SG60</p> <p>Other Sea birds meet SG80</p> <p>Marine mammals meet SG80</p> <p>Sea turtles meet SG80</p> <p>Fish and shark species meet SG80</p>		
b	Guidepost	Information is adequate to broadly understand the impact of the fishery on ETP species.	Information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species.	Accurate and verifiable information is available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species.
	Met?	Y	Y/N	N

PI 2.3.3		Relevant information is collected to support the management of fishery impacts on ETP species, including: <ul style="list-style-type: none">• Information for the development of the management strategy;• Information to assess the effectiveness of the management strategy; and• Information to determine the outcome status of ETP species.		
	Justification	<p>Brown pelicans and blue-footed boobies</p> <p>The data collected from the observer program on direct and potential mortalities due to oiling, the population assessment for these species, the results for the models for ecosystem needs and the monitoring of effort of the fishery are considered Information is adequate to broadly understand the impact of the fishery on ETP species. As mentioned in SI (a) there are issues related to challenges in quantifying mortality, there is not up-to-date population assessment for the GOC subpopulations and there is also a limited understanding of potential localized indirect impacts of the fishery on foraging strategies of seabirds. Without reliable quantitative estimates of the impact of the fishery on brown pelicans and blue-footed boobies, the assessment team concludes the information is not sufficient to determine whether the fishery is a threat to the protection and recovery of these species. The SG80 is not met.</p> <p>Other ETP species</p> <p>The other ETP species affected by the fishery include marine mammals, sea turtles, other seabird species and fish and sharks species. The data collected from the observer program on direct mortalities is considered sufficient to determine whether the fishery may be a threat, attracting a score of SG80. There is limited information on potential indirect impacts on other ETP species, thus SG100 is not met.</p> <p>Blue footed boobies meet SG60 Brown pelicans so not meet SG60 Other Sea birds meet SG80 Marine mammals meet SG80 Sea turtles meet SG80 Fish and shark species meet SG80</p>		
c	Guidepost	Information is adequate to support measures to manage the impacts on ETP species.	Information is sufficient to measure trends and support a full strategy to manage impacts on ETP species.	Information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives.
	Met?	Y	N	N
	Justification	<p>All ETP species</p> <p>The coverage of the observer program (10%) and distribution in fishing grounds and throughout the fishing season is sufficient to measure trends if the program continues to be implemented, and it will contribute to fully tested and adapted mitigation measures such as assembling a hose structure to improve the area span of the water curtain to prevent seabird from entering the net. However, without ongoing observer coverage it is not possible to detect increases in risk to main bycatch species, or to evaluate the efficacy of mitigation measures, thus SG80 is not met.</p> <p>Blue footed boobies meet SG60 Brown pelicans so not meet SG60 Other Sea birds meet SG60 Marine mammals meet SG60 Sea turtles meet SG60 Fish and shark species meet SG60</p>		

PI 2.3.3	Relevant information is collected to support the management of fishery impacts on ETP species, including: <ul style="list-style-type: none">• Information for the development of the management strategy;• Information to assess the effectiveness of the management strategy; and• Information to determine the outcome status of ETP species.	
References	Padilla-Serrato (2015) García-Gastellum et al (2015) COBI and CANAINPES, workshop report. 2015 COBI 2015	
OVERALL PERFORMANCE INDICATOR SCORE:		65
CONDITION NUMBER (if relevant): 2-3. By the third annual surveillance the client shall provide evidence that there is sufficient information available to: 1) quantitatively estimate <i>all</i> fishery related mortality and the impact of the fishery for ETP seabird species and 2) measure trends and assess effectiveness the strategy to manage impacts on ETP species.		

Evaluation Table for PI 2.4.1 – Habitats outcome

PI 2.4.1	The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function		
Scoring Issue	SG 60	SG 80	SG 100
a	Guidepost	The fishery is unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	The fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.
	Met?	Y	Y
	Justification	<p>Small pelagics in the Gulf of California are fished with purse seine nets. Purse seine vessels fishing in midwater are considered to have minimal impacts, causing little or no damage to biogenic habitats. Data from the on-board observer program indicates that nets are set in shallow areas, close to the coast. In the observed vessel 48% of sets occurred in areas at a of less than 10 fathoms (18.52 m) and benthic species were recorded as bycatch, indicating that the nets are interacting with the bottom substrate. Nevertheless, evidence was provided that most sets are on sandy substrates. Jacob-Cervantes et al (2015) conclude that bottom substrates with soft or soft textures such as sand present little or no damage due to having a high rate of recovery of the effects of the disturbance of purse-seine small pelagic fisheries.</p> <p>The substrate conditions were found to be consistent with those from studies conducted to evaluate the impact of the shrimp trawl fishery in the Gulf of California. Research on the impact of shrimp trawls concludes that shrimp trawls affect the grains size and organic content of sediments, however, because these systems are characterized by high energy processes with infaunal communities that are adapted to regular disturbance events, there are no significant impacts on the productivity of these habitats. Considering that purse seine nets have a minor magnitude of contact with the bottom substrate than bottom trawlers, it can be inferred that it is highly unlikely that the gear type used in this fishery can reduce habitat structure and function to a point where there would be serious or irreversible harm. The available information on the interactions of the small pelagics fleet, in association with research on the impacts of the shrimp bottom trawl fleet, are considered to have a level of detail appropriate to the scale and intensity of this fishery.</p> <p>The SG100 is met</p>	

PI 2.4.1	The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function		
References	López-Martínez, et al. 2012 Jacob Cervantes et al., 2015.		
OVERALL PERFORMANCE INDICATOR SCORE:			100
CONDITION NUMBER (if relevant):			

Evaluation Table for PI 2.4.2 – Habitats management strategy

PI 2.4.2		There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	There are measures in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a partial strategy in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a strategy in place for managing the impact of the fishery on habitat types.
	Met?	Y	Y	N
	Justification	<p>The small pelagics fishery operating in the waters of central Gulf of California has not been considered to pose a risk of serious or irreversible harm to habitat types, especially when compared to other fisheries such as shrimp trawling, meeting SG100 for PI 2.4.1 (Habitat outcome status). The team considered that there practices in place (mainly the use of purse-seine gear) which achieved a performance above the 80 level for Habitat Outcome, thus meeting SG80 for this SI.</p> <p>There are also several MPAs established in the Gulf of California which contribute to minimize the fishery impact. The influence of the UoA operating in MPAs is considered to impact ecosystems rather than habitat, thus this topic is addressed in PI 2.5.2</p> <p>There is no cohesive arrangement of measures designed to manage the impact of the fishery on habitat thus SG100 is not met.</p>		
b	Guidepost	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/habitats).	There is some objective basis for confidence that the partial strategy will work, based on information directly about the fishery and/or habitats involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or habitats involved.
	Met?	Y	Y	Y
	Justification	Chuenpagdee et al. (2003) assessed the collateral impact (bycatch and impact on habitat) of a variety of fishing gear by integrating the knowledge of a wide range of fisheries stakeholder. They concluded that purse seine showed relatively low impact compared to other gear types like bottom trawl and bottom gillnet. There is some objective basis for confidence that the partial strategy will work based on the normal fishing operation method of the fishery in question, but also on the effectiveness of closed areas and MPAs of restoring benthic habitats.		
c	Guidepost		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.

PI 2.4.2		There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types		
	Met?		Y	Y
	Justification	VMS data show that the fishery not only does not change considerably its fishing grounds, but also that the close areas and seasons and MAPs are being respected and that only purse-seine nets are being used by the fishery. This scoring issue meets SG100.		
d	Guidepost			There is some evidence that the strategy is achieving its objective.
	Met?			Y
	Justification	There is no strategy for managing habitat impact, however, the assessment team considers there is evidence that the measures in place (use of purse-seine nets) are achieving a level of performance above 80 for Habitat Outcome (See PI 2.4.1), thus meeting SG100.		
References				
OVERALL PERFORMANCE INDICATOR SCORE:				95
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.4.3 – Habitats information

PI 2.4.3		Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	There is basic understanding of the types and distribution of main habitats in the area of the fishery.	The nature, distribution and vulnerability of all main habitat types in the fishery are known at a level of detail relevant to the scale and intensity of the fishery.	The distribution of habitat types is known over their range, with particular attention to the occurrence of vulnerable habitat types.
	Met?	Y	Y	N
	Justification	There is adequate information of the general distribution of benthic habitat substrate types, the location of protected areas, areas of primary productivity and areas of biological importance for small pelagic, marine mammals, seabirds, among other species, in the Gulf of California. Several eco-regional planning has taken place in this area and vulnerable habitats have been identified. Protected areas have further studies on the habitats encompassed. The bathymetry of the area is well known and habitat distribution could be inferred from it. However, there is no detailed information on the distribution of habitat types, thus the SG100 is not met. The SG80 is met.		

PI 2.4.3		Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types		
b	Guidepost	Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.	Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear.	The physical impacts of the gear on the habitat types have been quantified fully.
	Met?	Y	Y	N
	Justification	<p>Data of the observer program carried out for two fishing season show the depth of sets on the different fishing areas. There is reliable information on the spatial distribution of fishing effort and its distance relative to shore/depth to broadly understand the impacts of gear as a function of contact with substrata. The data from the VMS program also provides information on the distribution of the fleet and the timing and location of use of the fishing gear.</p> <p>Maps with set location and bathymetry was presented as evidence. Purse-seine are considered to have low impact on the habitat due to the own fishing operation that avoid rocky substrate to prevent the damage of the net. Additionally, most set on shallow water are done on sandy bottoms.</p> <p>The physical impacts of purse seines on soft bottom substrates are currently inferred from studies from the shrimp trawl fishery, and the impact of the fishery has not been fully quantified. Therefore SG 100 is not met.</p> <p>This scoring issue meets SG80</p>		
c	Guidepost		Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Changes in habitat distributions over time are measured.
	Met?		Y	N
	Justification	<p>CANAINPES and INAPESCA provided written evidence that the observer program will continue for the next fishing season. Data on the areas and depths of sets continues to be collected through this program. Information on changes in habitat distributions over time should be presented to meet SG 100.</p> <p>This element meets scoring at SG80.</p>		
References				
OVERALL PERFORMANCE INDICATOR SCORE:				80
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.5.1 – Ecosystem outcome

PI 2.5.1		The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	The fishery is unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	The fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	There is evidence that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
	Met?	Y	Y	N
	Justification	<p>Arreguin-Sanchez et al. (2016a; 2016b) estimated for the Upper Gulf of California a limit of biomass loss generated by biomass extraction that would prevent ecosystem deterioration. A maximum allowable harvest rate was identified for each functional group or species according to their trophic level. For Pacific sardines and thread herring, the maximum allowable harvest rate was estimated to be 36%. Trends of exploitation rates for Pacific sardine and thread herring indicate that the fishery has never exceeded a 25% harvest rate threshold. Considering the harvest rates for Pacific sardine and thread herring have consistently remained below the estimated threshold necessary for ecosystem functioning, the assessment team concluded that it is highly unlikely that the fishery disrupts key elements of the ecosystem structure and function to a point where there would be a serious or irreversible harm, attracting a score of SG80</p> <p>The research presented for ecosystem based fisheries management in the Gulf of California is promising, however, a more in-depth understanding of uncertainties surrounding the estimated harvest rates, are necessary in order to meet SG100.</p>		
References		<p>Arreguin-Sanchez et al. 2016a; 2016b</p> <p>Del Monte et al (2016)</p> <p>Hernández-Padilla et al (2015)</p>		
OVERALL PERFORMANCE INDICATOR SCORE:				80
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 2.5.2 – Ecosystem management strategy

PI 2.5.2		There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	There are measures in place, if necessary.	There is a partial strategy in place, if necessary.	There is a strategy that consists of a plan, in place.
	Met?	Y	Y	N
	Justification	<p>Due to the ecological importance of Pacific sardines and thread herring as forage species, special attention is given to the need for measures that control the harvest of these species in order to maintain ecosystem function. Though not designed to manage the impact of the fishery in response to ecosystem needs, the arrangements in place for the harvest strategy of the fishery, outlined in Principle 1 (landings monitoring, independent surveys, stock assessments, effort limits, reference points, seasonal closures, minimum size and protected areas) work cohesively to control effort and implicitly manage the impact of the fishery on ecosystem functions. The SPFMP also identifies the need to take into account the protection of the ecosystem when defining reference points (DOF, 8th November 2012, Clause 6.2). The evidence presented in PI 2.5.1 indicates that the fishery has remained below the estimated maximum allowable harvest rate to prevent ecosystem deterioration, suggesting that the available measures have indirectly ensured that the fishery has not posed a risk of serious or irreversible harm to ecosystem structure and function, thus meeting SG80. The team identified limitations in the performance of the partial strategy, which are addressed in SI d of this PI.</p> <p>The measures mentioned above are not designed explicitly to limit fishing effort based on minimum biomass needs for ecosystem functioning, nor are there any mechanisms for the modification of fishing practices should the fishery surpass the estimated maximum allowable harvest rate and create unacceptable impacts on the ecosystem, thus SG100 is not met.</p>		
b	Guidepost	The measures take into account potential impacts of the fishery on key elements of the ecosystem.	The partial strategy takes into account available information and is expected to restrain impacts of the fishery on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	<p>The strategy, which consists of a plan, contains measures to address all main impacts of the fishery on the ecosystem, and at least some of these measures are in place. The plan and measures are based on well-understood functional relationships between the fishery and the Components and elements of the ecosystem.</p> <p>This plan provides for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm.</p>
	Met?	Y	Y	N

PI 2.5.2		There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function		
	Justification	The partial strategy takes into account available information from monitoring of landings, independent surveys, and stock assessments. As discussed at length, in PIs 1.2.1 and 1.2.2, the harvest strategy and harvest control rule, require further developments, however, the measures and practices currently in place are expected to continue to achieve the Ecosystem Outcome 80 level of performance.		
c	Guidepost	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ecosystems).	The partial strategy is considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ecosystems).	The measures are considered likely to work based on prior experience, plausible argument or information directly from the fishery/ecosystems involved.
	Met?	Y	Y	N
	Justification	Based on evidence that the fishery has remained below the estimated maximum allowable harvest rate to prevent ecosystem deterioration, the partial strategy is considered likely to work, meeting SG80. There is no systematic monitoring and research of the ecosystem component to provide an objective basis for confidence to meet SG100.		
d	Guidepost		There is some evidence that the measures comprising the partial strategy are being implemented successfully.	There is evidence that the measures are being implemented successfully.
	Met?		N	N
	Justification	There is some evidence that some measures comprising the partial strategy are being implemented (e.g. monitoring of landings, observer program, effort limits, ecosystem and stock modeling, and regulation within protected areas). However, the assessment team identified deficiencies in the implementation of the harvest strategy and harvest control rule, which are as discussed at length in PIs 1.2.1 and 1.2.2 and resulted in corresponding conditions under Principle 1. Furthermore, the SFMP identifies the need for reference points to take into account the protection of the marine ecosystem, however, there is no evidence that current reference points take into account biomass requirements required to maintain ecosystem structure and function. This deficiency was previously identified when evaluating Pacific sardines as key low trophic level (LTL) stock, and a condition was placed for PI 1.2.1 SI d. Thread herring was not designated as key LTL stock, however, it is a forage species, thus the team concluded that ecosystem considerations are also required for this species under this PI. The SG80 is not met.		
References		Garcia-Gastellum (2015); Padilla-Serrato (2015); FMP; NOM 003.		
OVERALL PERFORMANCE INDICATOR SCORE:				75
CONDITION NUMBER (if relevant):				
2-4 By the third annual surveillance the client shall present some evidence that the measures comprising the partial strategy for ecosystem management are being implemented successfully.				

Evaluation Table for PI 2.5.3 – Ecosystem information

PI 2.5.3		There is adequate knowledge of the impacts of the fishery on the ecosystem		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	Information is adequate to identify the key elements of the ecosystem (e.g., trophic structure and function, community composition, productivity pattern and biodiversity).	Information is adequate to broadly understand the key elements of the ecosystem.	
	Met?	Y	Y	
	Justification	It is considered that there is adequate information to broadly understand the key elements of the ecosystem. This includes information from landings, stock structure and abundance, bycatch and ETP interactions data of the onboard observer program, trophic relationships, ecosystem model, hydroacoustic surveys, fishing location and depth of fishery operation among others. SG80 is met.		
b	Guidepost	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, and have not been investigated in detail.	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information and some have been investigated in detail.	Main interactions between the fishery and these ecosystem elements can be inferred from existing information, and have been investigated.
	Met?	Y	Y	N
	Justification	Some main impacts of the fishery are being investigated in detail through the observer program; researches conducted by INAPESCA and COBI; thesis; trophic studies; ecosystem models, among others. The FMP (2012) includes a Research Plan and INAPESCA elaborated an annual operative plan (POA) containing proper and formal consideration of the role of the resource on the maintenance of the ecosystem. A stock assessment of the fishery is conducted every year. Better understanding of interactions with seabirds and impact of the fishery is needed and finalizing ecosystem models is needed in order to get SG100.		
c	Guidepost		The main functions of the Components (i.e., target, Bycatch, Retained and ETP species and Habitats) in the ecosystem are known.	The impacts of the fishery on target, Bycatch, Retained and ETP species are identified and the main functions of these Components in the ecosystem are understood.
	Met?		Y	N

PI 2.5.3		There is adequate knowledge of the impacts of the fishery on the ecosystem		
	Justification	The observer program conducted has provided information on the interaction of bycatch and ETP species with the fishery but it operated during two fishing seasons. Species accumulation curves for recorded species from the onboard observer program shows a curve that has not yet reached an asymptote. Regular monitoring of the fishery is carried out in order to obtain stock abundance, ecology information of small pelagics, fishing location, together with hydroacoustic surveys, attracting a score of SG80. Ecosystem models have provided further information but are still being adjusted to incorporate additionally variables. More precise information on the food habits, population sizes and mortality rates of these component is required for the function of these components in the ecosystems to be understood, therefore SG100 is not met yet.		
d	Guidepost		Sufficient information is available on the impacts of the fishery on these Components to allow some of the main consequences for the ecosystem to be inferred.	Sufficient information is available on the impacts of the fishery on the Components and elements to allow the main consequences for the ecosystem to be inferred.
	Met?		Y	Y
	Justification	During the last years there have been efforts to document impacts associated with all fishing activity including the observer program, individual researches and ecosystem models, in addition to the regular monitoring of the fishery. These efforts provide sufficient information to allow some of the main consequence of the impacts of the fishery to be inferred, meeting SG80.		
e	Guidepost		Sufficient data continue to be collected to detect any increase in risk level (e.g., due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Information is sufficient to support the development of strategies to manage ecosystem impacts.
	Met?		Y	N
	Justification	Data continues to be collected through landing catches to provide information that allows detecting potential risks on the fishery. A written commitment of INAPESCA and CANAINPES to continue the observer program was presented as evidence during the onsite-meeting. There is sufficient data to detect any increase in risk level but further development of the ecosystem models and collection of data from the observer and mitigation implementation are needed to support the development of strategies to manage ecosystem impacts. SG100 is not met.		
References				
OVERALL PERFORMANCE INDICATOR SCORE:				80
CONDITION NUMBER (if relevant):				

Principle 3

Evaluation Table for PI 3.1.1 – Legal and/or customary framework

PI 3.1.1		<p>The management system exists within an appropriate legal and/or customary framework which ensures that it:</p> <ul style="list-style-type: none"> • Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; and • Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and • Incorporates an appropriate dispute resolution framework. 		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	There is an effective national legal system and a framework for <u>cooperation</u> with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2	There is an effective national legal system and <u>organised and effective cooperation</u> with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2.	There is an effective national legal system and <u>binding procedures governing cooperation with other parties</u> which delivers management outcomes consistent with MSC Principles 1 and 2.
	Met?	(Y)	(Y)	(Y)
	Justification	<p>At the national level, Mexico's legal framework allows for cooperation among parties to deliver outcomes consistent with Principles 1 and 2. The framework is based on the Constitution which in its Article 27, establishes that "The Nation has full ownership over all natural resources of the continental shelf and the seabed and subsoil of the submarine areas of the islands." In order to accomplish this responsibility, the specific instrument for Mexican fisheries legislation is the General Law for Sustainable Fisheries and Aquaculture (Ley General de Pesca y Acuicultura Sustentable, LGPAS) providing guidelines for the regulation of fisheries (DOF, 2007). Linked to this Law are fisheries regulations and NOMs that define fishery specific management measures.</p> <p>Article 1.II of the LGPAS notes that one objective is to establish and define the principles to manage, promote and regulate fisheries and aquaculture to ensure the sustainable use of the resources, taking into consideration social, technological, productive, biological and environmental considerations. Article 1.IX of LGPAS specifically deals with the need to consider other elements of the ecosystem, e.g.: (i) ecosystem protection as defined in the <i>Ley General del Equilibrio Ecológico y la Protección al Ambiente</i> (LGEEPA), and; (ii) the protection of turtles, marine mammals and other aquatic resources that require specific protection.</p> <p>Although Mexico is not a party to the UNFSA, Mexico's policies and regulations are consistent with the primary objectives of that agreement and actively participates in the meetings of the Parties including the Review Conference mandated by Article 36, held in 2010 (OECD 2013).</p> <p>The provisions of Mexican fisheries legislation are consistent with MSC Principles 1 and 2 and are considered binding meeting SG100 requirements.</p>		

PI 3.1.1	<p>The management system exists within an appropriate legal and/or customary framework which ensures that it:</p> <ul style="list-style-type: none"> • Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; and • Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and • Incorporates an appropriate dispute resolution framework. 			
b	Guidepost	The management system incorporates or is subject by law to a mechanism for the resolution of legal disputes arising within the system.	The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes which is considered to be effective in dealing with most issues and that is appropriate to the context of the fishery.	The management system incorporates or subject by law to a transparent mechanism for the resolution of legal disputes that is appropriate to the context of the fishery and has been tested and proven to be effective.
		Met?	(Y)	(N)
	Justification	<p>There is a national system of transparent and effective mechanisms for the resolution of legal disputes within the context of the fishery. The LGPAS outlines appeal mechanisms for administrative proceedings that are issued with the application of corresponding infractions and legal sanctions for the violations of regulations in the LGPAS which include action at Federal, State and Municipal level to deal with a broad range of fishery issues.</p> <p>Sanctions related to fisheries violations are recorded by fisheries field officers and submitted to the Public Ministry which is an independent body of the Judiciary and Executive Branches of the government, and is responsible for investigating the offenses based on evidence. If a ruling is not accepted, the legal system allows for the Ministry to be subject to legal challenges and provides transparent mechanisms (DOF, 8th November 2012).</p> <p>The resolution of legal disputes and appeals are subject to the Federal Law on Administrative Procedure (<i>Ley Federal de Procedimientos Administrativos</i>, LFPA), which describes the path and nature of the administrative actions the federal government would have to follow, and how these actions can be review and nullified when there is a legal dispute (DOF 1994).</p> <p>Section V of the General Law for the Ecological Equilibrium and Environmental Protection (<i>Ley General del Equilibrio Ecológico y la Protección al Ambiente</i>, LGEEPA), describes specifications for Environment Impact Assessments that are put in place when fishing activities threaten the preservation of one or more aquatic species. Chapters IV, V and VI describe the corresponding legal procedures for administrative sanctions, resolutions reviews, and federal order offenses (DOF 1988).</p> <p>Overall, there is evidence that a transparent mechanism for the resolution of legal disputes exists. The current legal framework is considered to be effective in dealing with most issues and it is also deemed appropriate in the context of the fishery. Therefore the fishery meets the standard at SG80, but there is no evidence that the system has been tested, nor that its effectiveness has been evaluated, SG 100 is not met.</p>		

PI 3.1.1		The management system exists within an appropriate legal and/or customary framework which ensures that it: <ul style="list-style-type: none"> • Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; and • Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and • Incorporates an appropriate dispute resolution framework. 		
d	Guidepost	The management system has a mechanism to generally respect the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to observe the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to formally commit to the legal rights created explicitly or established by custom of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.
	Met?	(Y)	(Y)	(Y)
	Justification	Article 72 of the LGPAS allows subsistence fishing without a permit by people living along the coastline and prohibits selling the catch for profit. Article 2 Section V of the LGPAS secures that within the scope of this Law, the access, use and preferential benefit of aquatic and fishery resources is given to indigenous communities and people. Examples of actual consideration of rights for indigenous peoples to fish for food or cultural rituals include the case of the Cucapa people that live at the Colorado Delta in the states of Baja California and Sonora, and the Seri people that live in the state of Sonora (OECD 2013). This evidence indicates that the fisheries management system in Mexico has mechanisms to formally commit to the legal rights of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2 meeting SG100.		
References		DOF. 1988. Ley General de Equilibrio Ecológico y la Protección del Ambiente. Diario Oficial de la Federación. 28 de enero de 1988. DOF. 1994. Ley Federal de Procedimientos Administrativos. Diario Oficial de la Federación. 4 de agosto de 1994. DOF. 2007. Ley General de Pesca y Acuicultura. Diario Oficial de la Federación. Diario Oficial de la Federación. 24 de Julio de 2007.		
OVERALL PERFORMANCE INDICATOR SCORE:				95
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 3.1.2 – Consultation, roles and responsibilities

PI 3.1.2		<p>The management system has effective consultation processes that are open to interested and affected parties.</p> <p>The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties</p>		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are generally understood.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for key areas of responsibility and interaction.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction.
	Met?	(Y)	(Y)	(Y)
	Justification	<p>Individuals responsible for fisheries management in Mexico are clearly identified in the LGPAS. Functions, roles and responsibilities are explicitly described in the Law and are well understood. Articles 6 to 10 in Chapter I “Distribution of Responsibilities” of the Second Title of the LGPAS, describes the roles and responsibilities of the different agencies in the fisheries management system. In particular, Article 7 establishes that coordination with other Federal Secretaries have to follow specifications in the Organic Law of the Federal Public Administration. Articles 9 and 10 define coordination with SEMARNAT and SEMAR (<i>Secretaría de Marina</i>, Navy Secretary) to support the fisheries legal system. Articles 11 and 12 in Chapter II, “Of Coordination”, specify the mechanism for coordination between the Federal, State and Municipal governments. Articles 13 to 16 in Chapter III of the LGPAS, “Of the Concurrence”, establish the responsibilities at Federal, State and Municipal level.</p> <p>In addition, the Advisory Committee for the Normalization of Agricultural Food Production (<i>Consejo Consultivo para la Normalización Agroalimentaria</i>) is an advisor committee for SAGARPA, which objective is to propose, compile, review, approve, modified, cancel, publish and broadcast Mexican official norms related with the food production based on agriculture, livestock, aquaculture and fisheries. In the case of regulations for aquaculture and fisheries, the Sub-committee of Responsible Fishing is in charge of this sector (DOF, 8th November 2012).</p> <p>The assessment team was able to identify agencies involved in management processes, roles and responsibilities are explicitly defined and well understood for all main areas of responsibility. The fishery is considered to meet SG100.</p>		
b	Guidepost	The management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used.
	Met?	(Y)	(Y)	(N)

PI 3.1.2	<p>The management system has effective consultation processes that are open to interested and affected parties.</p> <p>The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties</p>			
	Justification	<p>The fisheries management framework in Mexico includes a consultation process that gathers information from a broad range of stakeholders and the process is clear about how the information is used to inform the management system.</p> <p>At the upper level, the Federal Law on Metrology and Standardization (LFMN) establishes that an Official Mexican Norm (NOM) (such as those relative to fisheries), is developed by the corresponding <i>Comite Consultivo Nacional de Normalizacion</i> (CCNN) which for fisheries is a subcommittee on Responsible Fishing. Among the responsibilities of this Committee, Article 47 of the LFMN indicates that a proposal for a new or update to a NOM will be subject to open consultation and that the CCNN will receive comments for analysis and determination of pertinence.</p> <p>Article 22 of the LGPAS (DOF 2007) also assigns to the National Fisheries and Aquaculture Council (CNPA) the task to call every year all parties interested in the sector to submit proposals or participate in consultation processes aimed to support, promote productivity, and improve regulations and the control of fishing activities as well as to increase the sector's competitiveness. The CNPA is an inter-sectorial forum, includes representatives from the Federal regulatory organizations, social organizations, and fisheries and aquaculture producers groups. The CEPA is a council similar to the CNPA, described in Article 23 of the LGPAS, operating at a state level. The CNPA and the CEPA define the management objectives of Fisheries Management Plans (DOF 2007).</p> <p>While evidence of consultations are vast for the definition of new regulations and their updates, there isn't a clear explanation about how the information is used or not used to inform the management system. The fishery therefore meets the standard at SG80 but not SG100.</p>		
c	Guidepost		The consultation process provides opportunity for all interested and affected parties to be involved.	The consultation process provides opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement.
	Met?		(Y)	(Y)
	Justification	<p>As described in the rationale for SIb, there are several layers in the fisheries management system of Mexico providing opportunities and encouragement for participation of all interested sectors in consultation processes. The NOMs are the main binding regulatory documents after the LGPAS and determines that part of the process to produce a new or updated NOM is a public consultation process. There is vast evidence in the public internet portal of the CONAPESCA with reports published in the Official Gazette where SAGARPA responds to comments and proposals put forward during the consultation indicating effective participation of interested parties. The fishery meets the standard at SG100</p>		
References		[List any references here]		
OVERALL PERFORMANCE INDICATOR SCORE:				95
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 3.1.3 – Long term objectives

PI 3.1.3		The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria, and incorporates the precautionary approach		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	Long-term objectives to guide decision-making, consistent with the MSC Principles and Criteria and the precautionary approach, are implicit within management policy	Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach are explicit within management policy.	Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within and required by management policy.
	Met?	(Y)	(Y)	(Y)
	Justification	At the national level, the LGPAS incorporates clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach. The LGPAS defines one of its main objectives as: Establishing the basis for the ordination, conservation, protection, repopulation and sustainable utilization of fisheries and aquaculture resources, as well as the protection and rehabilitation of the supporting ecosystems. Mexico's implementation of actions against objectives in relation to this fishery are guided principally by the Mexican management plan for small pelagics (DOF, 8th November 2012). The Management Plan presents the guidelines that are the basis for specific management actions that can be inserted in a specific NOM or use with the necessary frequency through regulatory agreements. Management goals in the small pelagic fisheries management plan are consistent with the goals in the LGPAS and therefore consistent with MSC Principles and Criteria and the precautionary approach. The basis of the legal power of the plan is the LPGAS which includes the management plan as one of three legal management tools. SG100 requirements are met.		
References		[List any references here]		
OVERALL PERFORMANCE INDICATOR SCORE:				100
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 3.1.4 – Economic and Social Incentives

PI 3.1.4		The management system provides economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and seeks to ensure that perverse incentives do not arise.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and explicitly considers incentives in a regular review of management policy or procedures to ensure they do not contribute to unsustainable fishing practices.
	Met?	(Y)	(Y)	(N)
	Justification	<p>At the national level, the management system provides for incentives to support the performance of the fishery in achieving outcomes that are consistent with Principles 1 and 2 at the same time that discourages incentives that contribute to unsustainable fishing practices. The approach to long term vessel licensing with concessions reduces the discretionary powers of the authorities while offering fishing companies greater stability and security for investment. No individual catch rights are established, either at a company or vessel level by the Mexican authorities.</p> <p>The Mexican Government through SAGARPA developed a Program to promote fishery and aquaculture productivity with the inclusion of components that support the development of innovation of fishery technology, regulating fishing and aquaculture, and capitalization of fishery related activities. This program provides funding for improving gear, research development and improvements in regulations (SAGARPA 2016).</p> <p>CONAPESCA has indicated that there are no subsidies other than the widespread subsidy that reduces the cost of fuel for primary producers, i.e. agriculture and fisheries. The audit team saw no evidence of additional subsidies given to the small pelagic fishery.</p> <p>SG80 requirements are met, but there is no evidence that there is explicit consideration of incentives in a regular review of management policy as required by SG100.</p>		
References		[List any references here]		
OVERALL PERFORMANCE INDICATOR SCORE:				80
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 3.2.1 – Fishery-specific objectives

PI 3.2.1		The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	Objectives, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are implicit within the fishery's management system	Short and long-term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery's management system.	Well defined and measurable short and long-term objectives, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery's management system.
	Met?	(Y)	(Y)	(N)
	Justification	<p>Performance Indicator 3.2.1 requires that short and long term objectives can be identified implicitly or explicitly and are consistent with achieving the outcomes in Principles 1 and 2. The Small Pelagics Fisheries Management Plan (DOF, 8th November 2012) does not identify goals as short or long term but as general and specific. These goals however, are explicit and can be identified as short or long term by the type of activity or definition of the goal. The broadest goal recognized as a long term goal is, to conduct reliable diagnostics of the fishery to determine, with multisector participation, policies based on research, management procedures, regulations, use of resources and any other action toward the responsible management of the fishery.</p> <p>More specific but still broad goals detail shorter term objectives aimed to meet the intention of the main goal:</p> <ol style="list-style-type: none"> 1) To conserve stocks at sustainable levels, control effort and the process of issuing fishing permits, based on optimal estimated carrying capacity. <ol style="list-style-type: none"> a. Determine total potential capacity of the fishery and optimize the number of fishing permits. b. Follow the development of the fishery with enough detail to make decisions based on knowledge and reference points and adjust the management strategy. c. Protect spawning and nursery areas in coastal and estuarine areas. 2) Optimize yield and economic benefit. <ol style="list-style-type: none"> a. Restrict juvenile catch regulating refuge zones. b. Determine optimal size of catch establishing minimum size regulations. c. Foster management measures that are economically viable and efficient. d. Produce forecasts to allow efficient planning by the industry and authorities. 3) Minimize ecosystem impact. <ol style="list-style-type: none"> a. Foster responsible fishing. 4) Foster socio-economic benefits increasing employment and income. 5) Promote good practices in catch, handling and processing to increase aggregated value. <p>The team considered that these statements are sufficient to satisfy the requirements at SG80. There are however, no timeframes to properly measure whether a particular goal has been achieved, therefore SG100 is not met.</p>		
References		DOF, 8th November 2012		
OVERALL PERFORMANCE INDICATOR SCORE:				80

PI 3.2.1	The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2	
CONDITION NUMBER (if relevant):		

Evaluation Table for PI 3.2.2 – Decision-making processes

PI 3.2.2		The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery under assessment.		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	There are some decision-making processes in place that result in measures and strategies to achieve the fishery-specific objectives.	There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	
	Met?	(Y)	(Y)	
	Justification	<p>This SI requires the existence of decision-making processes resulting in measures and strategies to achieve the fishery-specific objectives.</p> <p>There are established and understood processes and roles for decision-making. The process of the development of NOMs and management plans is described in SIb of PI 3.1.2. Participation of the Sub-Committee on Responsible Fishing, the National Council of Fishing and Aquaculture and the State Council of Fishing and Aquaculture have specific procedures defined by the Federal Law on Metrology and Standardization (LFMN) and the LGPAS. Management decisions are attributed to CONAPESCA with technical advice from INAPESCA. Fishing violations are penalized under the terms of the LGPAS and are enforced in coordination between CONAPESCA and the Federal Attorney for Environmental Protection (PROFEPA). At this level there are established decision-making processes resulting in the development and update of fishery regulations supporting the achievement of the fishery-specific objectives meeting SG80.</p>		
b	Guidepost	Decision-making processes respond to serious issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	Decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	Decision-making processes respond to all issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
	Met?	(Y)	(N)	(N)

PI 3.2.2		The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery under assessment.		
	Justification	<p>The decision-making process of the small pelagics fishery in the Gulf of California respond to serious issues identified in relevant research, monitoring, evaluation and consultation in a transparent, timely and adaptive manner (through the implementation of a web site) accounting for some of the wider implications of the decisions taken. Evidence of this decision-making process was provided to the assessment team showing how the INAPESCA conducts research cruises before the start of the fishing season and reports the results with recommendations that are adopted by the industry, including to delay the beginning of the season or to cancel fishing for Pacific sardines given the low biomass availability. The purpose of these decisions is clearly aligned with the management objectives to conserve biomass and protect recruitment.</p> <p>The fishery meets the standard at SG60. There are however other management mechanisms, in particular, the utilization of the control rule that are not fully implemented because after computing the applicable biologically acceptable catch of the year, there is no procedure to decide when and how the fishery must stop operations as the cumulative catch approaches the limit of the year. This problem makes the harvest strategy not fully responsible to the state of the stock as required by PI 1.2.1. SG80 cannot be met.</p>		
c	Guidepost		Decision-making processes use the precautionary approach and are based on best available information.	
	Met?		(Y)	
	Justification	The small pelagics management plan is consistent with the concept of the precautionary approach (DOF, 8th November 2012, page 12), with agreement with the FAO Code of Conduct for the Responsible Fisheries which Mexico promoted and signed.		
d	Guidepost	Some information on fishery performance and management action is generally available on request to stakeholders.	Information on fishery performance and management action is available on request, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	Formal reporting to all interested stakeholders provides comprehensive information on fishery performance and management actions and describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
	Met?	(Y)	(Y)	(N)

PI 3.2.2	The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery under assessment.			
	Justification	The assessment team was provided with evidence indicating that information on fishery performance and management action is available on request, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity. The evidence includes the minutes of technical meetings with fishers, government researchers and representatives of the academic community and NGOs attending. Reports of catch and effort, stock assessments and general fishery performance are periodically produced and a quarterly report on how the fishing season is progressing is produced and is available to the general public. The fishery meets the standard at SG80 but not at SG100 because the reports are not fully comprehensive and on occasion information may be difficult to be released. The assessment team acknowledges that issues on data accessibility have improved considerably but it is considered that there is still room for improvement on the requirements of this SI.		
e	Guidepost	Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery.	The management system or fishery is attempting to comply in a timely fashion with judicial decisions arising from any legal challenges.	The management system or fishery acts proactively to avoid legal disputes or rapidly implements judicial decisions arising from legal challenges.
	Met?	(Y)	(Y)	(N)
	Justification	<p>The management system or fishery provided evidence that is attempting to comply in a timely fashion with judicial decisions arising from any legal challenges.</p> <p>Specifications about infractions, administrative sanctions, responsibilities and review processes are described and specified in Chapters I, II, III and IV of Fourteenth Title of the LGPAS (DOF 2007). The fishery does not have an extensive record of sanctions but provided official CONAPESCA records of inspection where infractions were found and resulted in temporary retention of the vessel and catch.</p> <p>The assessment team was provided with a document with the minutes of a meeting between the fishery representatives and the Secretary of SAGARPA, the Commissioner of CONAPESCA and the Director of the INAPESCA. In this meeting, the Director of Inspection and Surveillance informed that if no infraction was found in any particular inspection, no report is produced. The industry representatives requested that a report is always produced so that there is a clear record of the behavior of the fishery that, the industry informed, would let them determine areas of improvement.</p>		
References		[List any references here]		
OVERALL PERFORMANCE INDICATOR SCORE:				75
CONDITION NUMBER (if relevant): 3-1. By the second surveillance the client shall present evidence that the decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.				

Evaluation Table for PI 3.2.3 – Compliance and enforcement

PI 3.2.3		Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidpost	Monitoring, control and surveillance mechanisms exist, are implemented in the fishery under assessment and there is a reasonable expectation that they are effective.	A monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.	A comprehensive monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.
	Met?	(Y)	(Y)	(N)
	Justification	<p>CONAPESCA and INAPESCA conduct monitoring, control and surveillance of the fishery to ensure the compliance with current regulations. In the case of small pelagic fish catch, landings are monitored and sampled. Regular inspections take place at ports of landing/processing plants and on fishing vessels.</p> <p>An observer program covered approximately 20% of all sets by the fleet from January 2013 through August 2014, but the observer program stopped operations afterwards due to lack of funding. By 2016 the industry committed support for 5 observers that would complement the INAPESCA observers. The fishing season had not started at the time of the onsite-meeting, but the team received the formal INAPESCA observer program for 2016 and a copy of the commitment letter from the industry to the Director of the Small Pelagics Program Protocol of INAPESCA.</p> <p>The assessment team has witnessed that fishing operations are tracked by a VMS system to monitor the location of vessels at all times and to determine unauthorized activities, particularly inside protected areas.</p> <p>Evidence of inspection records by CONAPESCA (<i>Actas de Inspección.pdf</i>) exist where the officials found infractions at port and at sea and temporarily secured the catch and vessels. This evidence shows that the surveillance system has been implemented and enforced.</p> <p>The results of the port sampling and their analysis are used for the assessment of the stock and for the recommendation for the management published in the CNP (DOF 2012). Also, these results were parts of the rationale of the SPFMP to create the objectives of the plan.</p> <p>The increment trend in the number of vessels in the fleet inside the Gulf of California appears to have leveled off and declined in the last two years. Whether this is a result of enforcing limitations in the access to the Gulf fishing grounds by vessels from other regions is uncertain. The team decided to remove the observation leading to condition for this evaluation but to keep monitoring the trend in number of fishing trips in the following years.</p> <p>Overall, there is sufficient evidence of the existence of a MCS implemented in the fishery under assessment and there is a reasonable expectation that it is effective meeting the SG60 is met.</p> <p>However, the fishery has a history of catch proportions under the size limit exceeding the maximum allowed. The team is also aware that the revision of the NOM may include a different approach to the catch of undersized fish. This revision has been in development for some time but at the time of the onsite-meeting, the deadline for a final version was still uncertain. A letter from the Director of Normativity at CONAPESCA dated July 2016 indicated that the period of public consultation had ended and that the comments were being reviewed to be sent for approval to the <i>Subcomité de Pesca Responsable</i> and the <i>Comité Consultivo Nacional de Normalización Agroalimentaria</i>, this would represent the final step before publication of the revised NOM in the official gazette. Added the complexity of this</p>		

		issue, during the last two fishing seasons the catch of Pacific sardines has been very low and have produced limited and unusual size distributions so the current situation of the catch is uncertain. At the time of the 4 th surveillance, this condition was decided to remain open pending the implementation of new regulations in the revised NOM. Considering that the fishery has several regulatory mechanisms that are being monitored, and only the particular problem of the size distribution in the catch has remained unresolved, the team concluded that the fishery meets the SG80 because it has demonstrated an ability to enforce relevant management measures, strategies and/or rules. That the fishery fails in one aspect is interpreted in terms that it has not implemented a comprehensive monitoring, control and surveillance system and therefore cannot meet SG100.		
b	Guidepost	Sanctions to deal with non-compliance exist and there is some evidence that they are applied.	Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence.	Sanctions to deal with non-compliance exist, are consistently applied and demonstrably provide effective deterrence.
	Met?	(Y)	(Y)	(N)
	Justification	The fishery presented inspection reports that led to sanctions and indicated that in recent years there have been very few infractions. The fishery proved that although inspections take place regularly, no report is produced as stated by the Director of CONAPESCA's Inspection and Surveillance Office in meeting minutes dated June 2016. Therefore the team concludes that sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence meeting SG80. At the SG100 the fishery would still have to provide further evidence that most inspections lead to no sanctions.		
c	Guidepost	Fishers are generally thought to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.	Some evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.	There is a high degree of confidence that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery.
	Met?	(Y)	(Y)	(N)
	Justification	As indicated in Sla and Slb, there is some evidence that demonstrates that fishers comply with the management system and fishers provide information of importance to the effective management of the fishery meeting SG80. The requirement at SG100 is not considered met given the pending issue regarding the history of exceeding the allowable proportion of undersized fish in the catch.		
d	Guidepost		There is no evidence of systematic non-compliance.	
	Met?		(N)	
	Justification	The fishery generally complies with most regulatory mechanisms defined in the Law, the NOM, the CNP and the Management Plan. The team however emphasizes the need to resolve the problem of the fishery systematically exceeding the allowable proportion of undersized fish in the catch. The team was informed that this problem is complex and is being addressed in the proposal to modify the current NOM. The process of consultation has taken longer than expected but we received official notification from CONAPESCA that the final review of public input was almost finished and after that, the draft is to be sent		

		for final approval before published in the official gazette. Until there is a satisfactory resolution of this problem, the fishery cannot meet the standard of this SI at SG80.
References	[List any references here]	
OVERALL PERFORMANCE INDICATOR SCORE:		75
CONDITION NUMBER (if relevant):		
3-2. By the second annual surveillance the client shall provide evidence that there is no systematic non-compliance with current regulations.		

Evaluation Table for PI 3.2.4 – Research Plan

PI 3.2.4		The fishery has a research plan that addresses the information needs of management		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	Research is undertaken, as required, to achieve the objectives consistent with MSC's Principles 1 and 2.	A research plan provides the management system with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.	A comprehensive research plan provides the management system with a coherent and strategic approach to research across P1, P2 and P3, and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.
	Met?	(Y)	(Y)	(N)
	Justification	<p>This Scoring Issue requires that research is conducted to achieve objectives that are consistent with MSC Principles 1 and 2. Under CB 4.3.10, a research plan is: <i>a written document that includes a specific research plan for the fishery under assessment, relevant to the scale and intensity and the issues requiring research.</i></p> <p>Research by INAPESCA is conducted as required to achieve objectives that are consistent with MSC's Principles 1 and 2. This research is usually organized in Annual Operative Plans (POA) and is determined by the current needs of the fishery. The current POA was constructed on the basis of evidence indicating not only the fishery but also environmental factors play a significant role in stock variability. This creates the need to conduct research about the fishery, biological and environmental factors, including technological and economic factors to produce reliable forecasts to optimally use and manage the stocks of small pelagic fish (e.g. INAPESCA 2016). Activities described in the POA are consistent with the goals included in the research section of the management plan and present the opportunity to provide the management system with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC Principles 1 and 2. The research program is pro-active, anticipatory and driven by management needs. This meets the standard at SG80.</p> <p>At SG100 the CR require that the program must be <i>coherent</i> to mean including all aspects of the system and <i>comprehensive</i> to include research that goes beyond the immediate short-term needs of the management system. The small pelagic fishery research program include many relevant aspects of the management system, but does not include all aspects and is bounded to the immediate needs of the fishery. For example, there is little research if any on the ecological role of the Pacific sardine and how the fishery may impact the</p>		

		abundance and variability of the stock. The already started observed program has not functioned during 2015/16 and it is required to better determine the interactions with other species. The fishery therefore cannot meet SG100.		
b	Guidepost	Research results are available to interested parties.	Research results are disseminated to all interested parties in a timely fashion.	Research plan and results are disseminated to all interested parties in a timely fashion and are widely and publicly available.
	Met?	(Y)	(Y)	(Y)
	Justification	Research results are found in internal reports of different scope prepared by INAPESCA as well as in peer reviewed scientific publications. Monitoring results and their analyses are shared with interested parties during yearly meetings of the Technical Committee on Small Pelagics, where the fishing industry, stakeholders, managers and academia participate, and the Abstract Proceedings of the meetings are open to the public. The dissemination of these reports is widely and publicly available in an open web site created for this purpose. Therefore a score of 100 is achieved.		
References		[List any references here]		
OVERALL PERFORMANCE INDICATOR SCORE:				90
CONDITION NUMBER (if relevant):				

Evaluation Table for PI 3.2.5 – Monitoring and Evaluation

PI 3.2.5		There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives		
		There is effective and timely review of the fishery-specific management system		
Scoring Issue		SG 60	SG 80	SG 100
a	Guidepost	The fishery has in place mechanisms to evaluate some parts of the management system.	The fishery has in place mechanisms to evaluate key parts of the management system	The fishery has in place mechanisms to evaluate all parts of the management system.
	Met?	(Y)	(Y)	(N)
	Justification	<p>This SI requires that the management system has mechanisms to evaluate some or all parts that constitute the system.</p> <p>Fishery specific regulations in Mexico are included in NOMs, the CNP and regulatory Agreements published in the Official Gazette. The small pelagics fishery in addition has guidelines included in the fishery management plan.</p> <p>INAPESCA regularly produces updates of the CNP every two or three years, with the most recent update published in 2012 (DOF 2012). The management plan has to be reviewed and updated every year (DOF, 8th November 2012) but to the present no review of the Plan has been produced.</p> <p>It can be said that the fishery has mechanisms in place at the SG80 to evaluate key parts of the management system including landings relative to reference points, catch composition and non-target interactions. However, a number of aspects of the fishery-specific management system are not considered for systematic review. Furthermore, there is evidence of systematic non-compliances against basic aspects of the CNP and NOMs but these documents do not have mechanisms to address and/or rectify deficiencies in the management system. The fishery does not meet the requirements at SG100.</p>		

b	Guided post	The fishery-specific management system is subject to occasional internal review.	The fishery-specific management system is subject to regular internal and occasional external review.	The fishery-specific management system is subject to regular internal and external review.
	Met?	(Y)	(N)	(N)
	Justification	<p>Scoring Issue b requires that the fishery management system is subject to internal and external reviews.</p> <p>Although not explicitly defined to operate as part of any review process, during the annual meetings of the Technical Committee on Small Pelagics, monitoring and assessment procedures and results are necessarily subject to critique and review as discussions develop among members of the Committee. The Committee includes members of the industry and the academic community to expand the scope of the discussions, and is recognized in the management plan as an element that will provide support to the management system.</p> <p>The assessment team sought evidence that the system is reviewed as described in GCB4.11.1 by either: another department within an agency; another agency or organization within the country; through a government audit that is external to the fisheries management agency; by a peer organization nationally or internationally; by external expert reviewers. As the participation of external parties in reviewing the management system has not been documented beyond members of the academic community that are regularly involved in the research applied to the fishery management, the condition for external also expressed in CB4.11.1 as “external to the fisheries specific management system” was not met. The fishery is considered to meet SG60, but not SG80.</p>		
References				
OVERALL PERFORMANCE INDICATOR SCORE:				70
CONDITION NUMBER (if relevant):				
3-3. By the third annual surveillance the client shall provide evidence that the fishery-specific management system is subject to regular internal and occasional external review.				

Appendix 1.3 Conditions

A total of 13 conditions were raised in the re-assessment on 13 PIs (For a Summary of all Conditions see Table 33. Summary of Conditions). Some of the conditions raised in Principle 2 and 3 in this re-assessment are related to conditions raised in the previous assessment and surveillance audits.

Table 34. Summary of overlapping conditions from previous assessment and re-assessment. Related conditions opened during this re-assessment are marked in orange.

Performance indicator (PI)	Year Opened	Status	Condition original score	PI revised score 2015	PI re-scored 2016
1.1.1	2014, 3 rd surveillance	Closed, 4 th surveillance	75	80	100
1.2.4	2012, Full Assess.	Closed, 4 th surveillance	75	80	85
2.1.1	2012, Full Assess.	Closed, 4 th surveillance	75	80	80
2.1.2	2012, Full Assess.	Closed, 4 th surveillance Re-opened Re-assessment	70	80	75
2.2.2	2012, Full Assess.	Closed, 4 th surveillance	70	80	80
2.2.3	2012, Full Assess.	Closed, 3 rd surveillance	70	80	80
2.3.1	2012, Full Assess.	Closed, 4 th surveillance	75	80	85
2.5.1	2014, 3 rd surveillance	Closed, Re-Assessment	60	60	80
2.5.2	2012, Full Assess.	Open, On Target	75	75	75
3.2.1	2012, Full Assess.	Closed, 3 rd surveillance,	75	80	80
3.2.2	2013, 2 surveillance	Closed, 4 th surveillance Re-opened re-assessment	85	80	75
3.2.3	2014, 3 rd surveillance	Open, Behind Target	70	70	75
3.2.4	2012, Full Assess.	Closed 3 rd surveillance Re-opened re-assessment	70	90	90

For an explanation on conditions raised in the re-assessment that are related to conditions raised in the previous assessment or surveillance audits, and for progress on conditions carried over from the previous assessment please see Table 24. Summary of Previous Assessment Conditions.

Client Action Plan

The client has consulted local investigators and management agencies to ensure that the proposed actions in response to the condition are reasonable and can be achieved within the established time frame. The commitment of the relevant agencies to the action plan has been confirmed (See Appendix 13.4 Client Action Plan Support Letters).

Condition 1-1 (Pacific Sardine)

Performance Indicator 1.1.2 Limit and target reference points are appropriate for the stock.	
SI d SG80: For key low trophic level stocks, the target reference point takes into account the ecological role of the stock.	
Rationale	See Justification for SI d in PI 1.1.2 (Evaluation Table for PI 1.1.2 – Limit and Target Reference Points)
Score	75
Condition	By the fourth annual surveillance audit, the client shall provide evidence that the target reference point for Pacific sardines takes into account the ecological role of the stock.
Client Action Plan	<p>The client will present evidence that the target reference point for Pacific sardine takes into account the ecological role of the stock.</p> <p>The client will actively collaborate with INAPESCA and other technical groups in the necessary investigations to determine the target reference point for this species. This reference point will be included in the Small Pelagics Management Plan (and other regulatory mechanisms) which will be formally published in the Official Gazette of the Federation (DOF).</p> <p>The activities and results will be reflected in working minutes and in Technical Reports, and will be made public via a technical meeting to the fishing industry and CONAPESCA (Administrative Body) for its systematic and effective application.</p>
Milestone Surveillance 1: By this stage, the fishery shall have demonstrated some progress toward the closure of this condition. No improvements expected.	
Expected Outcome	<p>The client, together with INAPESCA and other technical groups (for example, CICIMAR), will initiate meetings with the purpose of proposing the most appropriate mechanisms to define a formal target reference point that considers the ecological role of Pacific sardine.</p> <p>At least one meeting's minutes agreements reached and signed by the participant will be presented.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 2: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed three years.	
Expected Outcome	<p>The client will provide a technical report showing the progress in determining the target reference point that considers the ecological role of the Pacific sardine; also a summary of the agreements reached and the revisions made in the meetings.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 3: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	<p>The target reference point (TRP) for Pacific sardine will be determined. The client, in coordination with INAPESCA, will have a meeting with academics and CONAPESCA to discuss the incorporation of the TRP in the normative documents, including the Management Plan, before being published in the Official Federal Gazette (DOF). The client will provide a technical</p>

	<p>report showing the progress in determining the TRP; Also a summary of the agreements reached and the revisions made at the meetings.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 4: Condition expected to be fully met	
Expected Outcome	<p>The client will provide a final report on the Target Reference Point that considers the ecological role of Pacific sardine; This Target Reference Point will be included in the Management Plan (and other regulatory mechanisms) which will be formally published in the Official Gazette of the Federation (DOF).</p> <p>Resulting score: 80</p>
Responsible Party	The Client in coordination with INAPESCA and with the support of CICIMAR

Condition 1-2 (Pacific Sardine)

Performance Indicator 1.2.1_ There is a robust and precautionary harvest strategy in place	
Sla SG80: The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	
Rationale	See Justification for SI a in PI 1.2.1 for Pacific Sardine: (Evaluation Table for PI 1.2.1 – Harvest Strategy)
Score	70
Condition	By the fourth annual surveillance audit, the fishery shall provide evidence that the harvest strategy for <u>Pacific sardines</u> is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.
Client Action Plan	<p>The client will actively collaborate with INAPESCA and the Small Pelagics Technical Committee to review and implement the necessary changes in the Fisheries Management Plan that will allow the formal mechanisms to stop fishing activities, when close to the Biological Allowable Catch (BAC), So that they work together to achieve the management objectives.</p> <p>The activities and results will be reflected in working minutes and at least one Technical Report, and will be made known through technical meetings to the fishing industry and to CONAPESCA (Administrative Body) for its systematic and effective implementation. These changes to the Management Plan, will be documented with its publication in the Official Gazette of the Federation (DOF).</p>
Milestone Surveillance 1: By this stage, the fishery shall have demonstrated some progress toward the closure of this condition. No improvements expected.	
Expected Outcome	<p>The client, in coordination with INAPESCA and the Small Pelagics Technical Committee, will initiate meetings to propose and discuss the formal mechanisms for stopping fishing activities, when approaching BAC.</p> <p>At least one minute of the meetings signed by the participants will be presented with all the agreements reached.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 2: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	

Expected Outcome	<p>The client will provide a technical report showing progress in determining the formal mechanisms for stopping fishing activities when close to the BAC; Also a summary of the agreements reached and the revisions made at the meetings.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 3: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	<p>The formal mechanisms for stopping fishing activities will be determined when approaching BAC. The client, in coordination with INAPESCA and the Small Pelagics Technical Committee, will have a meeting with CONAPESCA to discuss these mechanisms, as well as their incorporation in the normative documents, including the Management Plan, before their publication in the Official Gazette of the Federation (DOF). The client will provide a technical report showing progress in determining formal mechanisms; Also a summary of the agreements reached and the revisions made at the meetings.</p> <p>The report will also include evidence that the proposed mechanisms have been “tested” to meet the requirements for the 80 level in SI1.2.1b to indicate that there is some logical argument and analysis that supports the choice of strategy.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 4: Condition expected to be fully met	
Expected Outcome	<p>The client will provide a final report on the formal mechanisms for stopping fishing activities, when close to the BAC; These formal mechanisms will be included in the Management Plan (and other regulatory mechanisms) which will be formally published in the Official Gazette of the Federation (DOF).</p> <p>Resulting score: 80 or above.</p>
Responsible Party	The Client in coordination with INAPESCA

Condition 1-3 (Pacific Sardine)

Performance Indicator 1.2.2_ There are well defined and effective harvest control rules in place	
Sla SG80: Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	
Rationale	See Justification for SI a in PI 1.2.2 (a) Evaluation Table for PI 1.2.2 – Harvest control rules and tools
Score	75
Condition	By the fourth annual surveillance audit, the fishery shall present evidence that for Pacific sardines defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.
Client Action Plan	<p>Explicit mechanisms to limit, reduce or cease fishing as it approaches the annual BAC, will be defined in the Management Plan, which must be published in the Official Federal Gazette (DOF) (as noted in Condition 1-2).</p> <p>The client will actively collaborate with INAPESCA and the Small Pelagics Committee to update the Management Plan, as well as to implement a systematic monitoring of catch levels to determine when the annual BAC is being reached. INAPESCA will announce, until the Small Pelagics Management Plan is published in the DOF, these results through technical reports that will be the basis for management decision making (limit, reduce or cease fishing as it</p>

	<p>approaches the annual BAC), ensuring that the fishery does not represent a risk for the Pacific sardine population. These mechanisms will be defined in the Management Plan.</p> <p>For the formal implementation of these mechanisms, the technical reports will be disseminated through technical meetings between industry, INAPESCA and CONAPESCA for their implementation, after the effective publication of the Management Plan in the Official Federal Official Gazette (DOF)</p>
Milestone Surveillance 1: By this stage, the fishery shall have demonstrated some progress toward the closure of this condition. No improvements expected.	
Expected Outcome	<p>The client, in coordination with INAPESCA and the Small Pelagics Technical Committee, will initiate meetings in order to propose the most appropriate mechanisms to limit, reduce or stop fishing when approaching BAC.</p> <p>The minutes of the meetings signed by the participants will be presented with all the agreements reached, as well as the main agreed mechanisms.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 2: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	<p>Proposed mechanisms to limit, reduce or cease fishing will be announced when the permissible biological catch (BAC) for that year is reached. A meeting will be held where INAPESCA and the client will discuss how to initiate, in a preliminary way, the tests to evaluate the mechanisms of limitation, reduction and cessation. Some test analyzes of the chosen mechanisms will be carried out to determine their feasibility when the BAC is approaching.</p> <p>The minutes of the meeting (or meetings), signed by the participants, will be provided with the agreements reached; A report of the selected mechanism will be submitted; And a progress report will be provided after testing the mechanisms.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 3: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	<p>At this stage, the client, INAPESCA and CONAPESCA will review and discuss the mechanisms proposed and the results of the tests carried out to evaluate them and propose the official document to be published, which in principle is the Management Plan, but could also be the National Fisheries Charter (CNP), or normative agreement, etc.</p> <p>The minutes of the meeting, signed by the participants, will be provided for discussion and review of the mechanisms.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 4: Condition expected to be fully met	
Expected Outcome	<p>The mechanisms will be established, the Management Plan updated and published in the Official Journal of the Federation (DOF).</p> <p>The mechanisms to limit, reduce or cease fishing when approaching the permissible biological catch of the year will be explicitly, systematically and effectively implemented. In addition, these mechanisms will be included in the Management Plan or other regulatory document and published in the Official Gazette of the Federation (DOF).</p> <p>Resulting score: 80</p>
Responsible Party	The Client in coordination with INAPESCA

Condition 1-4 (Thread Herring)

Performance Indicator 1.2.1_ There is a robust and precautionary harvest strategy in place	
Sla SG80: The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	
Rationale	See Justification for SI a in PI 1.2.1 for thread herring:
Score	70
Condition	By the fourth annual surveillance audit, the fishery shall provide evidence that the harvest strategy for <u>thread herring</u> is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.
Client Action Plan	<p>The client will actively collaborate with INAPESCA and the Pelagic Minor Technical Committee to review and implement the necessary changes in the Fisheries Management Plan that will allow the formal mechanisms to stop fishing activities, when close to the BAC, So that they work together to achieve the management objectives.</p> <p>The activities and results will be reflected in working minutes and at least one Technical Report, and will be made known through technical meetings to the fishing industry and to CONAPESCA (Administrative Body) for its systematic and effective implementation. These changes to the Management Plan, will be documented with the publication of this in the Official Gazette of the Federation (DOF).</p>
Milestone Surveillance 1: By this stage, the fishery shall have demonstrated some progress toward the closure of this condition. No improvements expected.	
Expected Outcome	<p>The client, in coordination with INAPESCA and the Small Pelagics Technical Committee, will initiate meetings to propose and discuss the formal mechanisms for stopping fishing activities, when close to the BAC.</p> <p>At least one minute of the meetings signed by the participants will be presented with all the agreements reached.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 2: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	<p>The client will provide a technical report showing progress in determining the formal mechanisms for stopping fishing activities when close to the BAC; Also a summary of the agreements reached and the revisions made at the meetings.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 3: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	<p>The formal mechanisms for stopping fishing activities will be determined when approaching BAC. The client, in coordination with INAPESCA and the Small Pelagics Technical Committee, will have a meeting with CONAPESCA to discuss these mechanisms, as well as their incorporation in the normative documents, including the Management Plan, before their publication in the Official Gazette of the Federation (DOF). The client will provide a technical report showing progress in determining formal mechanisms; Also a summary of the agreements reached and the revisions made at the meetings.</p> <p>The report will also include evidence that the proposed mechanisms have been “tested” to meet the requirements for the 80 level in SI1.2.1b to indicate that there is some logical argument and analysis that supports the choice of Strategy.</p>

	Resulting score: No changes to score anticipated at this stage.
Milestone Surveillance 4: Condition expected to be fully met	
Expected Outcome	<p>The client will provide a final report on the formal mechanisms for stopping fishing activities, when close to the BAC; These formal mechanisms will be included in the Management Plan (and other regulatory mechanisms) which will be formally published in the Official Gazette of the Federation (DOF).</p> <p>Resulting score: 80 or above.</p>
Responsible Party	The Client in coordination with INAPESCA

Condition 1-5 (Thread Herring)

Performance Indicator 1.2.2_ There are well defined and effective harvest control rules in place	
Sla SG80: Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	
Rationale	See Justification for SI a in PI 1.2.2 (a) for thread herring
Score	75
Condition	By the fourth annual surveillance audit, the fishery shall present evidence that for <u>thread herring</u> defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.
Client Action Plan	<p>Explicit mechanisms to limit, reduce or cease fishing as it approaches the annual BAC, will be defined in the Management Plan, which must be published in the Official Federal Gazette (DOF) (as noted in Condition 1-2).</p> <p>The client will actively collaborate with INAPESCA and the Small Pelagics Committee to update the Management Plan, as well as to implement a systematic monitoring of catch levels to determine when the annual BAC is being reached. INAPESCA will announce, until the Small Pelagics Management Plan is published in the DOF, these results through technical reports that will be the basis for management decision making (limit, reduce or cease fishing as it approaches the annual BAC), ensuring that the fishery does not represent a risk for the Pacific sardine population. These mechanisms will be defined in the Management Plan.</p> <p>For the formal implementation of these mechanisms, the technical reports will be disseminated through technical meetings between industry, INAPESCA and CONAPESCA for their implementation, after the effective publication of the Management Plan in the Official Federal Official Gazette (DOF)</p>
Milestone Surveillance 1: By this stage, the fishery shall have demonstrated some progress toward the closure of this condition. No improvements expected.	
Expected Outcome	<p>The client, in coordination with INAPESCA and the Small Pelagics Technical Committee, will initiate meetings in order to propose the most appropriate mechanisms to limit, reduce or stop fishing when approaching BAC.</p> <p>The minutes of the meetings signed by the participants will be presented with all the agreements reached, as well as the main agreed mechanisms.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>

Milestone Surveillance 2: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	<p>Proposed mechanisms to limit, reduce or cease fishing will be announced when the permissible biological catch (BAC) for that year is reached. A meeting will be held where INAPESCA and the client will discuss how to initiate, in a preliminary way, the tests to evaluate the mechanisms of limitation, reduction and cessation. Some test analyzes of the chosen mechanisms will be carried out to determine their feasibility when the BAC is approaching.</p> <p>The minutes of the meeting (or meetings), signed by the participants, will be provided with the agreements reached; A report of the selected mechanism will be submitted; And a progress report will be provided after testing the mechanisms.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 3: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	<p>At this stage, the client, INAPESCA and CONAPESCA will review and discuss the mechanisms proposed and the results of the tests carried out to evaluate them and propose the official document to be published, which in principle is the Management Plan, but could also be the National Fisheries Charter (CNP), or normative agreement, etc.</p> <p>The minutes of the meeting, signed by the participants, will be provided for discussion and review of the mechanisms.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 4: Condition expected to be fully met	
Expected Outcome	<p>The mechanisms will be established, the Management Plan updated and published in the Official Journal of the Federation (DOF).</p> <p>The mechanisms to limit, reduce or cease fishing when approaching the permissible biological catch of the year will be explicitly, systematically and effectively implemented. In addition, these mechanisms will be included in the Management Plan or other regulatory document and published in the Official Gazette of the Federation (DOF).</p> <p>Resulting score: 80</p>
Responsible Party	The Client in coordination with INAPESCA

Condition 1-6 (Thread Herring)

Performance Indicator 1.2.3_ Relevant information is collected to support the harvest strategy	
Sib SG80: Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	
Rationale	See Justification for SI a in PI 1.2.3 (b) for thread herring
Score	75
Condition	By the third surveillance the fishery shall provide evidence that the stock abundance of <u>thread herring</u> is be regularly monitored at a level of accuracy and coverage consistent with the harvest control rule.
Client Action Plan	<p>The client will actively collaborate with INAPESCA to conduct research aimed at evaluating biomass through acoustic methods. This research will be regular and focused on the analysis and consolidation of these methods so that the parameters of "target strength" used can be applied more reliably to thread herring.</p> <p>This will allow systematic and reliable indices of abundance independent of the fishery to be included in the catch strategy. The results obtained in this research will be announced through a technical meeting to the interested parties for its effective and systematic application in the Control Rule.</p>
Milestone Surveillance 1: By this stage, the fishery shall have demonstrated some progress toward the closure of this condition. No improvements expected.	
Expected Outcome	<p>The client, together with INAPESCA, will start meetings with the aim of advancing the determination of thread herring sardine biomass by hydroacoustic methods.</p> <p>The client will present at least a record of the meetings signed by the participants with all the agreements reached.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 2: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	<p>The analysis is continued for the evaluation of thread herring sardine by hydroacoustic methods. In addition, work will be carried out to determine the target strength of thread herring so that it can be applied more strongly in t. herring evaluations. The results will be documented through reports that will be presented at the technical meetings that will be attended by interested parties.</p> <p>The client will present technical progress reports with the main results of the specific evaluation of the thread herring.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 3: Condition expected to be fully met	
Expected Outcome	<p>Systematic acoustic investigations and the specific evaluation of the thread herring stock will continue. Also, a technical meeting will be held between the interested parties for the analysis and discussion of the results obtained. The client will provide the minutes of the meetings signed by all the participants, which will include the discussion, analysis and agreements related to systematic acoustic research and the specific evaluation of the thread herring stock under the control rule. Also, a final technical report will be provided with the results of the evaluation of thread herring, which will include estimates of biomass with hydroacoustics.</p> <p>Resulting score: 80</p>
Responsible Party	The Client in coordination with INAPESCA

Condition 1-7 (Thread Herring)

Performance Indicator 1.2.4_ There is an adequate assessment of the stock status	
SIb SG80: The assessment of stock status is subject to peer review.	
Rationale	See Justification for SI e in PI 1.2.4 for thread herring
Score	75
Condition	By the third surveillance the assessment of stock status of thread herring has been subject to peer review.
Client Action Plan	The client will collaborate with INAPESCA for that the assessments be subject to peer review. The condition and milestones will be assessed as outlined and addressed within the stated timeframe.
Milestone Surveillance 1: By this stage, the fishery shall have demonstrated some progress toward the closure of this condition. No improvements expected.	
Expected Outcome	Progress can be measured in terms of the assessment presentation at the Workshop of Small Pelagic Forum. The Workshop of Small Pelagic proceedings will be providing. Resulting score: No changes to score anticipated at this stage.
Milestone Surveillance 2: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed three years.	
Expected Outcome	Progress can be measured in terms of the assessment presentation at the Workshop of Small Pelagic Forum. The Workshop of Small Pelagic proceedings will be providing. The client will present a technical report of the fishery internal review issued by Technical Committee of Small Pelagic. Resulting score: No changes to score anticipated at this stage.
Milestone Surveillance 3: Condition expected to be fully met	
Expected Outcome	At this stage, the progress may be measured by a manuscript submitted to a scientific journal for a peer reviewing. Resulting score: 80
Responsible Party	The Client in coordination with INAPESCA

Condition 2-1 (Pacific Sardine & Thread Herring)

Performance Indicator 2.1.1_ There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species.	
SIc. SG80: There is some evidence that the partial strategy is being implemented successfully.	
Rationale	See Justification for SI c in Evaluation Table for PI 2.1.2 – Retained species management strategy
Score	75
Condition	By the fourth annual surveillance the client shall present some evidence that the partial strategy for management of <i>bocona</i> sardine and chub mackerel is being implemented successfully

Client Action Plan	<p>Explicit mechanisms to limit, reduce or cease fishing (<i>bocona</i> and chub mackerel) as it approaches the allowable biological catch (BAC) of the year, will be defined in the Management Plan, which must be published in the Official Gazette of the Federation (DOF) (As noted in condition 1-2).</p> <p>The client will actively collaborate with INAPESCA and the Small Pelagic Technical Committee to update the Management Plan, as well as to implement a systematic monitoring of catch levels to determine when the BAC of the year is being reached. INAPESCA will announce, until the Small Pelagics Management Plan is published in the DOF, these results through technical reports that will be the basis for management decision making (limit, reduce or cease fishing as it approaches the BAC of the year), ensuring that the fishery does not pose a risk to the population of sardine bocona and mackerel. These mechanisms will be defined in the Management Plan.</p> <p>For the formal implementation of these mechanisms, the technical reports will be disseminated through technical meetings between industry, INAPESCA and CONAPESCA for their implementation, after the effective publication of the Management Plan in the Official Federal Official Gazette (DOF).</p>
Milestone Surveillance 1: By this stage, the fishery shall have demonstrated some progress toward the closure of this condition. No improvements expected.	
Expected Outcome	<p>The client, in coordination with INAPESCA and the Small Pelagics Technical Committee, will initiate meetings with the purpose of proposing the most adequate mechanisms to limit, reduce or cease fishing (<i>bocona</i> and chub mackerel) when approaching BAC.</p> <p>The minutes of the meetings signed by the participants will be presented with all the agreements reached, as well as the main agreed mechanisms.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 2: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	<p>Proposed mechanisms to limit, reduce or cease fishing (<i>bocona</i> and chub mackerel) will be announced when the permissible biological catch (BAC) of the year is achieved. A meeting will be held where INAPESCA and the client will discuss how to initiate, in a preliminary way, the tests to evaluate the mechanisms of limitation, reduction and cessation. Some test analyzes of the chosen mechanisms will be carried out to determine their feasibility when the BAC is approaching.</p> <p>The minutes of the meeting (or meetings), signed by the participants, will be provided with the agreements reached; A report of the selected mechanism will be submitted; And a progress report will be provided after testing the mechanisms.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 3: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	<p>At this stage, the client, INAPESCA and CONAPESCA will review and discuss the mechanisms proposed and the results of the examinations carried out to evaluate them and start the procedures aimed at the publication of the Small Pelagics Management Plan in the Official Federal Official Gazette (DOF). Monitoring of catches will continue to determine when the BAC of the year is being reached.</p> <p>The minutes of the meeting, signed by the participants, will be provided with the agreements reached; A report will be provided of the systematic monitoring of catch levels aimed at determining when the BAC of the corresponding year is being reached; And a Small Pelagics Management Plan, document that is in the process of publication in the DOF will be presented.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>

Milestone Surveillance 4: Condition expected to be fully met	
Expected Outcome	<p>The mechanisms will be established, the Management Plan updated and published in the Official Federal Official Gazette (DOF).</p> <p>The mechanisms to limit, reduce or cease fishing (<i>bocona</i> and chub mackerel) will be applied explicitly, systematically and effectively when approaching the permissible biological catch of the year. On the other hand, and in case the Small Pelagics Management Plan is not yet published by this date, INAPESCA will notify CONAPESCA and the Client, in case the BAC of the corresponding year has been reached, through a Technical Opinion that Management actions should be taken to limit, reduce or cease fishing for <i>bocona</i> and/or chub mackerel, thus ensuring that the fishery does not pose a risk to the population of these two species.</p> <p>Resulting score: 80</p>
Responsible Party	The Client in coordination with INAPESCA

Condition 2-2 (Pacific Sardine & Thread Herring)

Performance Indicator 2.3.2 _ There is a strategy in place for managing ETP species that is designed to ensure the fishery does not hinder the recovery of ETP species.	
Slc. SG80: There is some evidence that the partial strategy is being implemented successfully.	
Rationale	See Justification for SI c in Evaluation Table for PI 2.3.2 – ETP species management strategy
Score	70
Condition	By the second annual surveillance the client shall present some evidence that the partial strategy for managing brown pelicans and blue-footed boobies is being implemented successfully.
Client Action Plan	<p>The client, in coordination with INAPESCA, will collect information (within the framework of a program of observers on board the purse seine fleet) on the different species of birds associated with the fishing work, as well as evidence of the implementation of the mitigation measure (water curtains to avoid seabirds from entering into the net).</p> <p>The results of these actions, i.e. the implementation and monitoring of the mitigation measure, will be disseminated through technical meetings between the industry, INAPESCA and CONAPESCA, as well as technical reports; These evidences will be delivered to the certification body.</p>
Milestone Surveillance 1: By this stage, the fishery shall have demonstrated some progress toward the closure of this condition. No improvements expected.	
Expected Outcome	<p>There will be evidence of the continuity of the observer program on board the purse-seine fleet of the Gulf of California, from which information and evidence of the implementation of the mitigation measures will be generated (water curtains to avoid seabirds from entering the net), which will contribute to reduce potential impacts (if any) of the fishery on brown pelicans and blue footed boobies.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 2: Condition expected to be fully met	
Expected Outcome	An analysis of the information generated from the observer program on board the purse-seine fleet of the Gulf of California will be carried out, from which a report will be generated, in which it will be documented the successful implementation of the mitigation measure for managing the impacts on seabirds (brown pelican and blue footed boobies) associated with the small pelagics fishing activities with purse seiners in the Gulf of California.

	Resulting score: 80
Responsible Party	The Client in coordination with INAPESCA

Condition 2-3 (Pacific Sardine & Thread Herring)

Performance Indicator 2.3.3 _ Relevant information is collected to support the management of fishery impacts on ETP species, including: <ul style="list-style-type: none"> • Information for the development of the management strategy; • Information to assess the effectiveness of the management strategy; and • Information to determine the outcome status of ETP species. 	
Rationale	See Justification for Evaluation Table for PI 2.3.3 – ETP species information
Score	65
Condition	By the third annual surveillance the client shall provide evidence that there is sufficient information available to: 1) quantitatively estimate all fishery related mortality and the impact of the fishery for ETP seabird species and 2) measure trends and assess effectiveness the strategy to manage impacts on ETP species.
Client Action Plan	<p>The client, together with INAPESCA and CONAPESCA, will maintain the on-board observer program, as well as training the fishing fleet crew on how to carry out the proposed mitigation measure (water curtains to avoid seabirds from entering into the net).</p> <p>The client will provide evidence that the on-board observer program of the small pelagics fleet remains in effect; That information will be collected on the species of birds (brown pelican and blue footed booby) interacting during the fishing season and evidence of the application and operation of the mitigation measure, including training, will be collected. In addition, a technical report will be presented, based on information obtained from the observer program, on the impact of the entire fleet on the mortality of brown pelican and blue footed boobies.</p>
Milestone Surveillance 1: By this stage, the fishery shall have demonstrated some progress toward the closure of this condition. No improvements expected.	
Expected Outcome	<p>The client, in coordination with INAPESCA and CONAPESCA, will support the activities of the observer program on board the small pelagics fleet (coverage of 10%). To ensure relevant information is collected to: (a) assess the effectiveness of the management strategy and (b) provide quantitative estimates of mortality and impacts of the fishery on seabird species for the entire fleet.</p> <p>It will also maintain training for fishing fleet personnel.</p> <p>The client will present evidence of the information collected, in the form of technical reports and minutes (and other evidence) of the training courses, and will also provide a description of the coverage, duration, objectives, and data collection protocols of observer programs, demonstrating that the data collected by the observer program is representative of the activity of the fishery.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 2: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed years.	
Expected Outcome	The client will continue to support the activities of the observer program on board the purse-seine fleet;

	<p>The client will also show evidence (minutes and other evidence) that the fleet staff training program is maintained.</p> <p>A preliminary analysis of the work associated with the mitigation measure and its operation will be carried out;</p> <p>The client will provide a preliminary technical report on:</p> <ul style="list-style-type: none"> (a) operations of the mitigation measure on bird species (brown pelican and blue footed boobies) associated with the small pelagics fishery (b) quantitative estimates of mortality and impacts of the fishery on seabird species for the entire fleet, including considerations for potential unobserved mortality <p>Additionally, the client will continue the Support research in ecosystem models detailed in condition 2-4, to continue to assess potential indirect impacts of the fishery on sea birds.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 3: Condition expected to be fully met	
Expected Outcome	<p>The client will report on bird species (brown pelican and blue footed boobies) associated to small pelagics fishery in the Gulf of California, implementation of mitigation measures and evaluation of how these measures contributed to minimize the potential mortality of birds. A report on the results of the observer program on board the smaller pelagic fleet will also be presented, which will include an analysis on mortality and impacts of the entire fleet on brown pelican and blue footed boobies.</p> <p>Resulting score: 80</p>
Responsible Party	The Client in coordination with INAPESCA

Condition 2-4 (Pacific Sardine & Thread Herring)

Performance Indicator 2.5.2 _ There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function	
SI d SG80: There is some evidence that the measures comprising the partial strategy are being implemented successfully.	
Rationale	See Justification for SI d for Evaluation Table for PI 2.5.2 – Ecosystem management strategy Evaluation Table for PI 2.3.3 – ETP species information
Score	75
Condition	By the fourth annual surveillance the client shall present some evidence that the measures comprising the partial strategy for ecosystem management are being implemented successfully.
Client Action Plan	<p>The client will show evidence that small pelagics fishery in the Gulf of California does not affect the structure and function of the ecosystem, this management aspect will be defined according to what is stated in Condition 1-1 (Pacific sardine) and Condition 1-4 (Thread herring).</p> <p>The client, in coordination with INAPESCA, will continue working on models with an ecosystem management approach, aspects that will be discussed within the framework of the meetings noted in condition 1-1 and 1-4. Finally, this will be reflected in the revised Fisheries Management Plan, which should be formally published in the DOF.</p>
Milestone Surveillance 1: By this stage, the fishery shall have demonstrated some progress toward the closure of this condition. No improvements expected.	

Expected Outcome	<p>The client together with INAPESCA and other technical groups (for example, CICIMAR), will continue to support data collection programs and ecosystem modelling that consider the impact of removal of the target stocks on ecosystem functioning.</p> <p>Also see “Milestone Surveillance 1” for Condition 1-1 and 1-4.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 2: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	<p>The client will continue to support the activities of the observer program on board the sardine fleet and provide a preliminary report of the different taxonomic groups that interact during the sardine fishing activities in the Gulf of California.</p> <p>The client together with INAPESCA and other technical groups (for example, CICIMAR), will continue to support data collection programs and ecosystem modelling that consider the impact of removal of the target stocks on ecosystem functioning.</p> <p>Also see “Milestone Surveillance 2” for Condition 21-1 and 1-4.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 3: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	<p>See “Milestone Surveillance 2” for Condition 21-1 and 1-4.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 4: Condition expected to be fully met	
Expected Outcome	<p>The client will provide a final report on the Target Reference Point that considers the ecological role of Pacific sardine; This Target Reference Point will be included in the Management Plan (and other regulatory mechanisms) which will be formally published in the Official Gazette of the Federation (DOF). Also provide evidence that the harvest strategy for the thread herring is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.</p> <p>The client will provide a report on the different taxonomic groups and / or associated species during the sardine fishery in the Gulf of California. The client will also present advances on ecosystem modelling that show the management measure is successfully implemented, and that fishing activities do not alter or modify the ecosystem in which this activity is carried out.</p> <p>Resulting score: 80</p>
Responsible Party	The Client in coordination with INAPESCA and with the support of CICIMAR

Condition 3-1 (Pacific Sardine & Thread Herring)

Performance Indicator 3.2.2 _ The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery under assessment.

SI b SG80: Decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.

Rationale	See Justification for SIb for Evaluation Table for PI 3.2.2 – Decision-making processes Evaluation Table for PI 2.3.3 – ETP species information
Score	75
Condition	By the fourth surveillance the client shall present evidence that the decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
Client Action Plan	The client will actively collaborate with INAPESCA and the Small Pelagics Technical Committee to review and implement the necessary changes in the Fisheries Management Plan that will allow the formal mechanisms to stop fishing activities, when close to the BAC, So that they work together to achieve the management objectives. The activities and results will be reflected in working minutes and at least one Technical Report, and will be made known through technical meetings to the fishing industry and to CONAPESCA (Administrative Body) for its systematic and effective implementation. These changes to the Management Plan, will be documented with the publication of this in the Official Gazette of the Federation (DOF).
Milestone Surveillance 1: By this stage, the fishery shall have demonstrated some progress toward the closure of this condition. No improvements expected.	
Expected Outcome	The client, in coordination with INAPESCA and the Small Pelagics Technical Committee, will initiate meetings to propose and discuss the formal mechanisms for stopping fishing activities, when close to the BAC. At least one minute of the meetings signed by the participants will be presented with all the agreements reached. Resulting score: No changes to score anticipated at this stage.
Milestone Surveillance 2: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	The client will provide a technical report showing progress in determining the formal mechanisms for stopping fishing activities when close to the BAC; Also a summary of the agreements reached and the revisions made at the meetings. Resulting score: No changes to score anticipated at this stage.
Milestone Surveillance 3: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	The formal mechanisms for stopping fishing activities will be determined when close to the BAC. The client, in coordination with INAPESCA and the Small Pelagics Technical Committee, will have a meeting with CONAPESCA to discuss these mechanisms, as well as their incorporation in the normative documents, including the Management Plan, before their publication in the Official Gazette of the Federation (DOF). The client will provide a technical report showing progress in determining formal mechanisms; Also a summary of the agreements reached and the revisions made at the meetings. Resulting score: No changes to score anticipated at this stage.
Milestone Surveillance 4: Condition expected to be fully met	
Expected Outcome	The client will provide a final report on the formal mechanisms for stopping fishing activities, when close to the BAC; These formal mechanisms will be included in the Management Plan (and other regulatory mechanisms) which will be formally published in the Official Gazette of the Federation (DOF). Resulting score: 80

Responsible Party	The Client in coordination with INAPESCA
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Condition 3-2 (Pacific Sardine & Thread Herring)

Performance Indicator 3.2.3 _ Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with	
SI d SG80: There is no evidence of systematic non-compliance.	
Rationale	See Justification for Sid for Evaluation Table for PI 3.2.3 – Compliance and enforcement Evaluation Table for PI 2.3.3 – ETP species information
Score	75
Condition	By the fourth annual surveillance the client shall provide evidence that there is no systematic non-compliance with current regulations.
Client Action Plan	See "Client Action Plan" for Condition 3-1. The review of necessary changes in the Fishery Management Plan and NOM-003 discussed under Condition 3-1, will include revisions of the minimum size regulations. In addition, the client will actively collaborate with CONAPESCA and INAPESCA, so that the NOM-003 will be published in the shortest possible time in the DOF and that its implementation will be effective. The fishery will abide by the regulations showing that there is no evidence of systematic non-compliance, for which it will present the minutes of the meetings in which it shows its participation and the inspection reports of the fishery will be presented.
Milestone Surveillance 1: By this stage, the fishery shall have demonstrated some progress toward the closure of this condition. No improvements expected.	
Expected Outcome	See "Client Action Plan" for Condition 3-1. Resulting score: No changes to score anticipated at this stage.
Milestone Surveillance 2: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	See "Client Action Plan" for Condition 3-1. Resulting score: No changes to score anticipated at this stage.
Milestone Surveillance 3: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed four years.	
Expected Outcome	See "Client Action Plan" for Condition 3-1. Resulting score: No changes to score anticipated at this stage.
Milestone Surveillance 4: Condition expected to be fully met	
Expected Outcome	See "Client Action Plan" for Condition 3-1. Resulting score: 80
Responsible Party	The Client in coordination with INAPESCA

Condition 3-3 (Pacific Sardine & Thread Herring)

Performance Indicator 3.2.5 _ There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives	
There is effective and timely review of the fishery-specific management system	
SI b SG80: The fishery-specific management system is subject to regular internal and occasional external review.	

Rationale	See Justification for Sid for Evaluation Table for PI 2.5.2 – Ecosystem management strategy Evaluation Table for PI 2.3.3 – ETP species information
Score	70
Condition	By the third annual surveillance the client shall provide evidence that the fishery-specific management system is subject to regular internal and occasional external review.
Client Action Plan	The client will actively support the systematic internal reviews of the monitoring, evaluation and overall management proposals of the small pelagics fishery conducted by INAPESCA. Will present the minutes or reports of the meetings held for this purpose; In addition, it will also actively solicit and support external review by Technical Committee of Small Pelagic for the results made by INAPESCA; Present the minutes or reports of the meetings held for this purpose.
Milestone Surveillance 1: By this stage, the fishery shall have demonstrated some progress toward the closure of this condition. No improvements expected.	
Expected Outcome	<p>The client will collaborate actively with INAPESCA for the annual monitoring and evaluation of the small pelagics fishery performance in meeting the objectives laid out in the Fisheries Management Plan and corresponding Nom(s). The results of INAPESCA's annual evaluation of the performance of the fishery will be reviewed by the Technical Committee of Small Pelagic. The client will present a technical report of the fishery internal review issued by Technical Committee of Small Pelagic.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 2: By this stage, the fishery shall have demonstrated further progress toward the closure of the condition, consistent with the achievement of the condition within the allowed three years.	
Expected Outcome	<p>INAPESCA will continue to conduct an annual monitoring and evaluation of the small pelagics fishery performance in meeting the objectives laid out in the Fisheries Management Plan and corresponding Nom(s). The results of INAPESCA's annual evaluation of the performance of the fishery will be reviewed by the Technical Committee of Small Pelagic. The client will present a technical report of the fishery internal review issued by Technical Committee of Small Pelagic.</p> <p>Resulting score: No changes to score anticipated at this stage.</p>
Milestone Surveillance 3: Condition expected to be fully met	
Expected Outcome	<p>The Client will actively solicit and support the external reviews of the results made by INAPESCA; Present the minutes or reports of the meetings held for this purpose.</p> <p>Resulting score: 80</p>
Responsible Party	The Client in coordination with INAPESCA

9. Appendix 2 Peer Review Reports

9.1 Peer Reviewer 1

Overall Opinion

<p><i>Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?</i></p>	<p>No</p>	<p>Conformity Assessment Body Response</p>
<p><u>Justification:</u> <u>See General Comments Below</u></p> <p>I generally agree with the Assessment Team for the Pacific sardine.</p> <p>I believe that several of the scores for thread herring should have been lower. The absence of a control rule, the low current hydroacoustic estimate of stock size and the very wide variation in biomass levels with the several recent assessments are the principal problems.</p> <p>In my opinion the MSC Assessment should include the three species that have had significant landings rather than relegating them to 'retained species'. Of course, this may have been outside of the responsibility of the Team. with that the regulation of annual catch of the various</p> <p>I also disagree with the exclusion of the California anchovy from the main retained species classification.</p> <p>I have included where I would have scored PIs differently on the PI Review Form.</p>		<p>Thread Herring: The reviewer points to the following as the "principal problems" that could justify lower scores for TH:</p> <ul style="list-style-type: none"> - <i>Absence of a control rule.</i> Reply: the Small Pelagics Fishery Management Plan (SPFM) includes well defined control rules. The rule for actively managed species applies to thread herring. See section 3.3.2 of the background for details. The assessment team did observe in PI 1.2.2 Sla that for thread herring the "HCR is incidentally, but not proactively in place meeting the standard at SG60 but not at SG80", In response to this shortcoming a condition was placed requiring that "By the fourth annual surveillance audit, the fishery shall present evidence that for thread herring defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached" _ - <i>Low current hydroacoustic estimate of stock size and very wide variation in biomass levels with several recent assessments.</i> Reply: the team agrees there is an inconsistency in the estimates of abundance obtained with different approaches and such inconsistency has been pointed out. One such inconsistency is that the only estimate of abundance from acoustic surveys is lower than those from stock assessments. Nevertheless, the trends in abundance of thread herring do not lead to infer that current status is low in the present relative to the past caused by excessive fishing mortality. <p>The team therefore does not have grounds for scores to be lower than have been assigned based on the analysis of the evidence as required by specific Performance Indicators.</p> <p>In response to the comment regarding the inclusion of 'retained species' as target species, the assessment team notes that "[...] the client nominates the fish species on which they seek to put the MSC ecolabel" (FCR v2.0 G7.4.10)</p> <p>When considering retained small pelagic species for designation as 'main'; following MSC FCR GSA3.4.2 the assessment team took into</p>

account the variability of the catch composition over 25 years. The abundance of California anchovy under the cycle evaluated was not considered to qualify as 'main' for most of the fishing seasons, this species was classified as 'minor' retained. For more details on the justification see in this report Section 2.6.2 **Overview of Non-Target Catch** (p. 63). In particular, GSA3.4.2 indicates that teams should account for "the variability of the catch composition over the last five years or fishing seasons and recognizing that some species might be 'main' some years but not in others. Depending on data availability, teams may choose a different length of the time series, but a rationale should be provided in all cases of the method chosen. The overall intent when designating 'main' species, is that there should be a good understanding of the long-term average catch composition of P2 species". With this in mind, the team recognized that from season 10-11 to season 13-14, the California anchovy represented more than 10% of the total catch of small pelagics and that this could be reasonable cause to classify the stock as main retained. However, the team also noted that by season 14-15 the proportion was down to 2% and noted that low contribution of this stock to total catch is a more regular situation in the long term trend of the fishery (see **Table 5** and **Figure 23**). We therefore concluded that under MSC criteria, the California anchovy is better classified as minor retained.

<i>Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe?</i>	No	Conformity Assessment Body Response
<p><u>Justification:</u></p> <p>The conditions raised by the Team for Pacific sardine are well designed and reflect the fact that the fishery has high quality stock assessments but is lacking in the implementation of harvest control rule and a mechanism to close the fishery when the harvest exceeds the rule.</p> <p>The conditions for the thread herring clearly address the major limitations in the management of this species. The management limitations are well addressed but the wide variation in stock assessments is not.</p> <p>I have considerable differences with the retained species section and feel that bocona sardine, Pacific mackerel and California anchovy should become target, rather than retained species in the next MSC Assessment. I agree with the Team concerning what needs to be done to implement management strategies for the bocona sardine and Pacific mackerel but believe that similar work should be carried out for California anchovy. I do not agree with the Team's exclusion of California anchovy from the main retained classification. As noted in my review the California anchovy had recent landings as high as 118,807 t and within two years this fell to 3,888 t. suggesting that there may be a problem with this species.</p> <p>With the exception of California anchovy, I agree with the major thrust of the Team's conditions regarding the major importance of developing reference points and enacting management regulations for the major retained species.</p> <p>I also agree with the Team's conditions for ETP and ecosystem monitoring and analyses.</p>		<p>We have already clarified that under MSC requirements, designation of any particular stock as a target of the fishery is a decision made by the fishery and not the assessment team. We have also explained our rationale to classify the California anchovy as a minor retained stock. We however would like to add that we disagree with the view that there may be a problem with this stock after the high catches between seasons 10-11 and 13-14. As we have described throughout different sections in this report (e.g. section a iii in the background of Pacific sardines as key LTL species and Background section on Environmental considerations and the potential effect of El Niño on current sardine availability), populations of small pelagic fish undergo wide variations in their contribution to the total catch that are associated to their availability due to environmental fluctuations. Figure 23 clearly shows that the California anchovy is not a regular or frequent component of the catch and that the period between seasons 2010/11 to 2013/14 presented the highest catch in 20 or 25 years. As expected, by season 2014/15 the catch of anchovy declined and if the pattern continues, we do not expect to see it again any time soon. Therefore, the assessment team did not consider that the decline of California anchovy represents a problem for the stock or that such problem could be attributed to the fishery but that it is part of the natural fluctuations of these stocks in the GoC. Under such considerations, the team cannot justify lower scores than the ones assigned to include a condition related to California anchovy.</p>

If included:

<i>Do you think the client action plan is sufficient to close the conditions raised?</i>	No	Conformity Assessment Body Response
<p><u>Justification:</u></p> <p>The action plan for Pacific sardine appears to cover the limitations in the present management of this species. I would suggest that simulation modeling, similar to that used in the management of the northern stock of Pacific sardine, be carried out to help establish an optimum harvest control rule.</p>		<p>In addition to responses already provided, regardless of whether we agree or disagree with the approach suggested by the reviewer, the reviewer should know that the MSC standard requires that the conditions placed must "[...] follow the narrative or metric form of the PISGs used in the final tree." (CR v2.0 clause 7.11.1.2). Additionally, MSC requires that "CABs should not be prescriptive about the means of meeting conditions. The fishery client may develop</p>

<p>The action plan for thread herring needs to address the present uncertainty in the biomass assessments. I suggest that external review of current models be carried out to determine the best model for this stock. I agree with the Team's conditions on the development and enactment of management mechanisms. I also agree with their emphasis on the continuing development of the hydroacoustic surveys.</p> <p>The action plan for retained species does not even mention California anchovy, which has obviously recently become a target species for the fishery. The very sharp decline in landings from 118,833 t to 3,888 t suggest that it is possible that this species was overfished. The action plan should include the development of better information on the status of this stock, perhaps through the hydroacoustic surveys, and a pragmatic TAC should be enacted to protect the stock until estimates of its population size are available.</p> <p>I agree with the Team's recommendations regarding ETP species.</p> <p>Ecosystem models for small pelagic fishes are rapidly being developed in a number of countries. I agree with the Team's conditions regarding the continuation of ecosystem analyses and the development of target reference points that include ecosystem services.</p>	<p>their own corrective actions and deal with a condition in their own way." (CR v2.0 clause G7.11.2)</p> <p>The purpose of such limitations is to prevent the assessment team to prescribe solutions that suit the particular points of view of the team when alternative approaches are equally valid to satisfy the MSC requirements.</p> <p><i>Suggestion for external review of threat herring stock assessment model.</i> Response: for thread herring a condition was placed on PI 1.2.4 Sid requiring that "By the third surveillance the assessment of stock status of thread herring has been subject to peer review." This condition was missing from the Client Action Plan, and has now been included (See Condition 1-7).</p>
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General Comments on the Assessment Report (optional)

The assessment team was faced with an unusual situation, the Pacific sardine stock and it's fishery in the Gulf of California essentially collapsed during the interval since the last assessment. The fact that this collapse was primarily environmentally-dependent and associated with large scale climatic fluctuation is largely proven by the simultaneous reproductive failure and collapse of the completely separate, northern stock of Pacific sardine that occurs on the Pacific Coast between Northern Baja California and Canada.

The Sonoran fishery has gone from a dominance of Pacific sardine to a situation where the fishery is dependent upon five other genera (thread herring, bocona sardine, California anchovy, round herring and chub mackerel). The thread herring had significant, but secondary, landings until the 2012-13 season. The total landings since the 2010/11 season have been more than 50% from species not considered target species in the Management Plan. Each of the two anchovy genera (California anchovy and bocona sardine, have had annual landing exceeding 100,000 t.

The Mexican scientists doing the stock assessments also are faced with completely different situation than that expected in the last MSC assessment.

In my opinion, based on the above, the MSC Assessment should have included four genera (Pacific sardine, thread herring, bocona, and chub mackerel. It is clear from the landings since the last MSC Assessment that the Sonora purse-seine fishery for small pelagics is likely to be a much more dynamic and multi-species fishery than assumed in the last assessment.

The recent very rapid change in species composition makes it very difficult for the scientists doing the monitoring, analysis and modeling of the fishery to respond to the changes. In addition, the principal emphasis on ecosystem management of the sardine fishery that was recommended in the last assessment should now be expanded to focus on ecosystem management of a variable complex of small pelagics.

It is clear that biomass estimates of three 'secondary' genera are tentative and heavily dependent upon preliminary estimates of natural mortality and stock-recruitment relationships. There is not assessment of the California anchovy and it would be unrealistic to have expected one given the very recent expansion in landings.

The very flat, near B_0 , time series of biomass for these genera imply that the density-dependence which determines the sustainable and/or optimum exploitation rate cannot possibly be assessed until the biomass of these genera falls below 50% of B_0 . Presently, in my opinion, the estimates of the productivity (i.e. E_{msy}) of the genera are tentative and probably overly optimistic.

There appears to be considerable confusion with the Harvest Control Rule used in similar fisheries:

$$\text{Allowable Catch} = (\text{Current Biomass} - \text{Minimum Biomass}) * \text{Fraction}$$

As noted by the MSC Assessment Team the confusion centers around the Fraction term. As used elsewhere the Fraction is usually equal to or less than the exploitation rate that produces the maximum long-term yield (E_{msy}). Where the exploitation rate is simply the catch divided by the biomass. Unfortunately it appears that those working on the Sonoran Fishery have used the instantaneous fishing mortality at MSY (F_{msy}) in place of the Fraction. This will result in overfishing the stock as F_{msy} is larger than E_{msy} .

For example; natural mortality rates for Pacific sardine of $M=0.6$ and $M=0.77$ are mentioned in the MSC Assessment. With a target exploitation rate of 0.25, it would require an $F=0.395$ with $M=0.6$ and an $F=0.429$ with $M=0.77$ to achieve the 0.25 target.

The Team obviously realized this but the text of their report is quite confusing with regards to the control rule. The authors should point out the very large differences that will occur if F_{msy} is used at Fraction; as shown above with no minimum biomass the allowable catch would be 25% of the biomass with E_{msy} but about 40% of the biomass if F_{msy} is used. However, it is unclear if the figure they use to show that the exploitation rate for sardine has not exceeded the biologically acceptable catch (BAC) as it is not clear if it used F_{msy} or E_{msy} to calculate the BAC (i.e. Figure 10). In fact it is impossible to tell how the BAC from Nevarez-Martinez et al (2016) was calculated.

The Biomass Dynamics Models (BDM) used for thread herring, bocona sardine and chub mackerel show very stable biomass from the mid-1970s to the present. The low initial biomass and rapid increase to a stable higher biomass occurs in the ADM models for thread herring (Figure 21), bocona sardine (Figure 24) and chub mackerel (Figure 26). This common pattern with three different BDM models suggests that the low initial biomass in these models is a modeling artifact, rather than a large increase in the carrying capacity for small pelagics in the mid-1970s.

I note that these BDMs are critical to the evaluation of the fishery as they are the most recent studies. It is also important that all of these models have very little variation in biomass after the mid-1970s. The implication from this is that the fishery for these species has had very little effect on their population sizes. Apparently these models have not been subject to external review so there is some doubt as to their accuracy.

I have particular concerns with the use of 'retained species' due to the now dominance of these species in the landings. Clearly the mackerel and anchovy stocks are presently targeted species. I have particular concerns with the exclusion of California anchovy from the main retained species classification. Landings from the 2010-11 to 2012-13 seasons totaled 268,806 t. The fishery then landed 33,772 t in the 2013-14 season and then declined too only 3,888 t in the 2014/15 season. If this extreme decline in landings occurred during a period that the Pacific sardine landings were increasing I would be less concerned because it might mean that the fishery ceased targeting

the anchovy. However, the sharp decline in the landings of California occurred during a period when both Pacific sardine and total landings had major declines.

Without stock assessments or hydroacoustic estimates of the biomass of California anchovy the possibility that the very large recent fishery has greatly reduced the population size cannot be ignored. The obvious solution is to establish a pragmatic and conservative annual catch limit; for example, the mean catch since the 1999-2000 season.

PI	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
Pacific Sardine					
1.1.1	Yes	Yes	No	<ol style="list-style-type: none"> 1. The Sonoran fishery for Pacific sardine has collapsed in association with an extended period of unfavorable environmental conditions. Under these conditions It is very likely that the productivity of the stock is well below that which would support an exploitation rate of 0.25. 2. Reference points for Pacific sardine (Table 8) do not include MSY, Fmsy, Bmsy or unfished biomass (Bo). The estimate of Bmin is given as a range (22,000- 126,000 t) rather than a single number which can be used to regulate the fishery. If used in a Harvest Rule there will be considerable differences between the exploitation rates recommended at low biomass levels. 3. There are two reasonably consistent estimates of fishing mortality (F=0.189 and F= 0.218 and associated exploitation rates 0.161 and 0.183) and one very much lower estimate F=0.08. It is not clear from the wording in the table if these are average rates, current rates or perhaps even average msy rates. 4. Stock-recruitment relationships are critical to modeling the sardine; however, there is zero material presented concerning 	<p>Since the score of this PI is above 80 there is no condition associated to it.</p> <ol style="list-style-type: none"> 1. The stock is not considered collapsed. The argument made is that environmental conditions caused a reduction in stock availability by a combination of reduced abundance and relocation. 2. The concept of the BAC in the control rule and the default harvest rate (or F) in the management plan are based on MSY (see background section on the SPFMP). 3. These values in Table 8 have been revised and corrected 4. There is some consideration of S-R relationship. Not sure in what context the reviewer expected to see a discussion.

				<p>these relationships.</p> <p>5. The recent period of unfavorable environmental conditions for Pacific sardine may, or may not continue. If the two year-classes that were not present in the 2014-15 season (i.e. 2015 and 2016), have poor recruitment the estimates of Fmsy, BAC and OY are clearly too large and the stock will continue to decline, therefore it is critical that a minimum biomass level should be established and a mechanism established to stop the fishery for Pacific sardine if it reaches this level.</p> <p>6. Currently the stock biomass is well below the average since 1972. The fact that at the start of the fishery the 1972 biomass was about one tenth of the peak in 2002-08 (Figure 11) suggests that even without a fishery the biomass can vary by a factor of 10. Note that the 2015 biomass in Figure 11 is about twice that in the reference points (Table 8).</p> <p>7. As mentioned, a non-linear regression analysis found that nearly 80% of the observed abundance variance could be explained exclusively by changes in sea surface temperature and upwelling (Nevarez-Martinez et al. 2001. I note that a mild El Nino is forecast.</p> <p>8. I do not agree with the conclusion that the sardine fishery in the southern gulf can be considered to be a separate fishery stock. The stock assessments should include the entire Gulf of California Pacific sardine population rather than drawing a line between two areas due to a political boundary.</p> <p>9. In my opinion the population dynamics utilized in this fishery are viewed from a possibly dangerous perspective. Ecological theory suggest that populations are regulated by density-dependent factors and the productivity rate increases as the population size decreases. This resiliency allows populations to recover from periods of adverse environmental conditions and disease outbreaks. The fact that the productivity rate is</p>	<p>5. The assessment team disagrees with the notion that, regardless of stock status, a fishing mortality producing or leading to MSY or below and the corresponding BAC is “too large and the stock will continue to decline”. Exploitation rates (function of fishing mortality) operate in a way that if abundance is low, then the allowable catch is also low. Nevertheless, the control rule includes a safety biomass limit that stops the fishery if reached. In addition, there was discussion at the onsite meeting about strategies to anticipate periods of low abundance where it would be prudent to stop targeting such species.</p> <p>6. No comment.</p> <p>7. No comment.</p> <p>8. There is no southern GoC stock of Pacific sardine. The reviewer may be making reference of TH but in the wrong section. As for TH, we only use the evidence given to us. We didn’t receive evidence indicating that TH in the GoC is found in a single stock.</p> <p>9. No comment.</p> <p>10. And 11. The team disagrees. There is no consideration throughout the</p>
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				<p>higher at low biomass levels does not mean that the population's annual production is higher. In fisheries the average maximum annual production of biomass occurs at intermediate levels (often near 40% of the average unharvested biomass level). The whole concept of MSY was based on this.</p> <p>10. Somehow in this fishery the concept that the productivity rate increases as the biomass decreases has been used to assume that the 'best' harvest rate is the rate that would help to maintain the population at its current level.</p> <p>11. The Gulf of California sardine biomass is at a low level, obviously far below the steady state OY level, although OY is not given in the reference points. At this low biomass level the exploitation rate should clearly be reduced, but there does not appear to be a mechanism for this. Instead the authors suggest a current Fmsy of 0.29 which is larger than any observed in the fishery. In fact the 'best' way to maintain the current low biomass level is to use the current Fmsy value of 0.29.</p> <p>12. I disagree with the 100 score for Pacific sardine but agree with a score of 90.</p>	<p>documentation that such is the assumption guiding the management of this fishery. The team also disagrees with the statement that "In fact the 'best' way to maintain the current low biomass level is to use the current Fmsy value of 0.29". The team agrees that a fishing mortality rate lower than Fmsy would speed up the recovery of a depleted stock, but if F is at about Fmsy, unless the depletion has reached the point where recruitment is compromised, even a depleted stock should recover to Bmsy, it won't stay at current biomass, unless it is already at Bmsy.</p> <p>12. No rationale about which SI merits a lower score and why so to make the overall PI lower than 100. Therefore no comment is provided.</p>
1.1.2	Yes	No	No	<p>Reference points for Pacific sardine (Table 8) do not include MSY, Fmsy, Bmsy, unfished biomass (Bo) or target reference point. One estimate of Bmin gives a range (22,000- 126,000 t) rather than a single number which can be used to regulate the fishery. The other is clearly wrong unless the units are kg. If the units are kg the range would be 269,000 – 1,569,000 t and the middle of this estimate is above the current biomass estimate of the hydroacoustic survey. If ranges are used in a Harvest Rule there will be considerable differences between the exploitation rate recommended at low biomass levels. The primary reference points needed to determine how manage a fishery. There are four reasonably consistent estimates of the exploitation rate (i.e.</p>	<p>In answering this comment, it should be kept in mind that the reviewer does not disagree with the score. He/She only considers that the available information and/or the rationale does not support the score.</p> <p>Justification for the reviewer disagreement is based on the actual use or estimates of reference points as provided by the INAPESCA staff.</p> <p>The assessment team however points to the four</p>

				<p>varying from 0.161 to 0.218); however, it is not clear if these rates are average rates, current rates or Emsy rates.</p> <p>A specific harvest control rule does not appear to be part of the present management system for sardine so the only way that the exploitation rate can be controlled appears to be by voluntary action by the fishermen.</p> <p>Given that the biomass estimates are reasonably robust (I have not seen the stock assessments), I agree that the fishery has probably not overfished the stock. However as pointed out by the authors the reference points for sardine are not available.</p> <p>Therefore I agree with their score of 75.</p>	<p>main elements that are used in the rationale: 1) appropriateness of the reference points; 2) limit reference points “set above the level at which there is an appreciable risk of impairing reproductive capacity”; 3) target reference points that contribute to maintain biomass at a level “consistent with BMSY or some measure or surrogate with similar intent or outcome”; and 4) for “key low trophic level species, the target reference point takes into account the ecological role of the stock”. There is a careful and thorough discussion about these issues in the rationale of PI 1.1.2. The team considered that the actual definition of the reference points in the management plan, although incomplete, are in close agreement with the requirements, enough to grant a 75 score.</p> <p>One particular point we would like to clarify is that the discussion in the rationale of PI 1.1.2 discusses that the limit reference point is defined to keep the stock above a level consistent with Bmsy and that although not completely specified, the target should be necessarily above that level. Still, because the Pacific sardine is assumed to be a key LTL stock in the GoC, the reference point needs to account for the ecological role of the stock which is not happening and therefore the lower score.</p> <p>Finally, although HCR considerations do not belong here, it should be clear that the management plan does have a clearly specified control rule. The problem with the HCR is that it is not in place because it lacks a mechanism to enforce the predeterminied BAC. This was observed by the assessment team and used in</p>
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					scoring PI 1.2.2
1.1.3				NA	
1.2.1	Yes	No	No	<p>The current harvest strategy appears to primarily rely on a good limited entry program, a closed season to limit fishing effort and the fishermen voluntarily avoiding fishing sardine during periods of low availability. The basic fishery-dependent (stock assessments) and fishery-independent (hydroacoustic surveys) appear to be well established so the information necessary to develop a harvest control rule exist. Harvest rates based on current, or average, Fmsy are not appropriate for species such as Pacific sardine because of their extreme environment-dependent variaton recruitment. A harvest control rule with a minimum biomass designed to help prevent the biomass from going to really low levels and a Fraction equal to or less than Emsy would be required to achieve a score of 100.</p> <p>I agree with both the PI score of 70 and perhaps a stronger wording of condition 1-2.</p>	<p>Noting again that there is no disagreement in scores, the team observes that the concerns in this comment have already been adressed above. We would only add that even if we agreed with the opinion that stronger wording would be convenient, we stick to the guideline to present conditions strictly in terms of what is needed based on the language of the specific scoring guidepost that was not met.</p>
1.2.2	Yes	No	No	<p>I agree with the authors that the use of Fmsy as the Fraction in a control rule will result in overharvesting the stock due to the fact that F is the instantaneous fishing mortality not the annual exploitation rate (i.e. Emsy).</p> <p>I do not agree that the way to define the Bmin value is to take 10% of the current hydroacoustic estimate of biomass. Note that 10% of the hydroacoustic estimate is about 50,000 t which is about 1% of the biomass at it's recent peak. If a quick and dirty estimate is required I suggest using either an estimate of unfished biomass or Bmsy to establish a conservative value.</p> <p>The value of a harvest control rule (HRC) has two principal components. First stopping the fishery when it gets to some minimum biomass (Bmin) and second reducing the exploitation</p>	<p>We are unaware of any procedure based on application of a 10% fraction of a biomass estimate to compute Bmin. It may appear that the critical value in the Morales-Bojorquez and Nevarez-Martinez (2005) resembles a percentage of the maximum estimated biomass, but in reality it is a parameter estimated from a variant in the Ricker S-R model fit to data. This parameter is considered by the authors as "a good indicator of the minimum stock size necessary to maintain the fishery" which is considered equivalent to the MSC concept of recruitment impairment. The assessment team didn't dispute the validity of this approach but</p>

				<p>rate as the population gets lower. The reduction in the exploitation rate is achieved by applying the Fraction to the portion of the biomass above Bmin. When Bmin is equal to 1% of the peak biomass the reduction in the exploitation rate component of the control rule is virtually useless as the annual exploitation rate does not decline significantly until the biomass is near 1%. The reason that Emsy is used for the Fraction is to allow close to the full Emsy when the biomass is large. From an ecosystem services perspective a control rule with Bmin below about 10% of the peak biomass provides very little ecosystem protection. Note that the 2016 biomass estimate of 420,000 t would be below a cutoff of 10% of the peak biomass estimate of about 5,200,000 t (Figure 11).</p> <p>Based on the assessment teams comments it appears that a formal control rule has not been implemented and the team did not provide the values tentatively accepted by the management agencies.</p> <p>So in my opinion the, as yet to be enacted, harvest control rule is not adequate to protect either the fishery or ecosystem services and without the voluntary action of the fishermen to reduce the exploitation rate in the recent fishery I would score this PI =60. However, due to the fishermen's apparent concern for the fishery and their actions in reducing the exploitation rate I believe that a score of 70 is warranted for this PI.</p> <p>Clearly simulation modeling to establish OY exploitation rates and minimum biomass should be a priority for future work.</p>	<p>the concept that computation of Bmin in this way is designed to protect the stock when the Pacific sardine requires a Bmin that is designed to protect the ecosystem.</p> <p>The control rule does not reduce the exploitation rate as biomass declines, it remains constant, the HCR reduces the allowable catch. If catch is considered, we disagree that it "does not decline significantly until the biomass is near 1%". Since the BAC is computed as biomass times FRACTION, which is acting as a harvest rate, and FRACTION is constant and set as a minimum of 0.25, then whatever the biomass is above Bmin, only 25% of the difference $B_t - B_{min}$ can be removed. The lower the biomass, the closer it is to Bmin, making the biomass available to harvest smaller and smaller and reducing the BAC until it is zero if Bmin is reached. Note that the rule as constructed, computes the BAC based on the difference, therefore, the biomass available for exploitation gets reduced as it approaches Bmin.</p> <p>The ultimate concern about this issue, considering that the Pacific sardine in the GoC is assumed to be a key LTL stock is that this approach is not useful to protect the ecosystem, which we agree with. The current status of the threshold for ecosystem management of the sardine fishery is about 0.36 which is higher than the 0.25 in the management plan based on the sardine population only.</p> <p>Finally, the structure of the criteria in PI 1.2.2 was carefully considered to determine whether the control rule meets the standard. We agree that the HCR is not fully implemented because it</p>
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					lacks a mechanism to assure that the fishery stops operations as the cumulative catch of the season approaches the pre-defined BAC of the year. However that shortfall was accounted for by not granting SG80 in Sla. Following CR rules, when a PI has three SIs, all meeting SG60 and only one of them fails to meet SG80, the only possible score is 75.
1.2.3	Yes	Yes	No	<p>The basic monitoring, analysis and stock assessments and fishery independent surveys of Pacific sardine appears to be of quite high quality and can be very useful for supporting a harvest strategy. The information presented by the assessment team does not appear to capture many of the valueable features of this work. For example, the reference points do not have an estimate of the average unfished biomass which would be important for ecosystem modeling. Apparently Bmin was based on a value of 10% of the biomass estimate from a recent hydroacoustic survey; however, this is not included in their reference points (Table 8) which has Bmin values ranging from 9,500 to 185,000 t. If estimates of average unfished biomass exist they would be very useful for simulations of differing harvest control rules. This type of analysis is highly desirable to determine a balance between fishery yields and ecosystem services which should be used in future ecosystem based harvests strategies.</p> <p>If the final assessment includes a reference points table that includes average unfished biomass, Bmsy and a better description of the present harvest control rule I would agree with the score of 80.</p>	<p>Figure 11 in the background section on stock assessment of the Pacific saradine shows the biomass trend from the beginning of the history of the fishery. The figure shows that despite to start at a close to “unfished” state, the abundance was much lower than in the present. This is actually suggests that it is not very useful to think about what was the “unfished” biomass even in average terms because the species is known to have been through cycles of high and low abundance, which is described in the rationale for PI 1.1.1 Sla. We agree though that this information is valuable for ecosystem modelling, but the assessment team observed that such information is well embedded in the analyses conducted by different research.</p> <p>As previously clarified, estimated values of Bmin were not obtained as a fixed fraction (10%) of the acoustic estimate of current abundance. It was computed using the approach of Morales-Bojorquez and Nevarez-Martinez (2005) using a variation of the Ricker S-R relationship. The concept of such approach is to compute a critical biomass threshold that could trigger an allee effect that would functionally explain recruitment failure. It should be noted that the conclusion from the analysis of evidence was</p>

					<p>that current abundance, despite of historic low catches, is far above the estimated Bmin and therefore above the point where recruitment could be compromised. It should also be noted that the reconstruction of the biomass trend includes another moment of low biomass in 1991-1992 slightly above 1 million tons. But most interestingly, the lowest biomass is at the very beginning of the fishery, barely above half of the current biomass. This hints that the point of recruitment failure is still well under half a million tons, which is consistent with the estimate from the S-R/Allee effect approach.</p> <p>In the end, the reviewer objection relates to stated conditions for the corresponding PI, but no conditions are associated because it reached SG80 on all SIs. The reviewer apparently would like to see some particular information (discussed in the previous paragraphs) to be in agreement with the final 80 score. The assessment team evaluated the specific requirements of PI 1.2.3 which are at SG80: Sla. <i>Sufficient relevant information</i> related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy. [Note that we make emphasis on <i>sufficient relevant information</i> at SG80 as opposed to a <i>comprehensive range of information</i> at SG100, which we did not recognized]; Slb. Stock abundance and fishery removals are <i>regularly monitored</i> at a level of accuracy and coverage <i>consistent</i> with the harvest control rule, and one or more indicators are available and monitored with <i>sufficient frequency</i> to support the harvest control rule. [Emphasis is</p>
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					<p>made on the key words of this SI at SG80 as opposed to wording such as <i>all information required by the harvest control rule is monitored</i> at SG100 which was not granted]</p> <p>Slc. There is good information on all other fishery removals from the stock.</p> <p>The assessment team received evidence that meets all these requirements at SG80, therefore, although we agree that there is more information that would make both the stock assessment and management more precise, the current information package meets the standard at SG80 on all SIs.</p>
1.2.4	Yes	No	No	<p>The stock assessments appear to be of high quality but the description of the parameters and output from the assessments was not well presented by the assessment team. For example, it appears that a Beverton and Holt spawner recruit relationship was included in the assessment but the values were not in the MSC Assessment Team's Draft. The team states that "a list of parameters of management and reference points, including the fishing mortality producing the MSY. A Beverton-Holt stock recruitment model was also fit to a plot of the estimated number of fish of age 0 against the total number of spawners". This material was largely omitted from the MSC Assessment Team's Draft.</p> <p>I agree with the Team's reduction in score based on the lack of "reference points relative to the ecosystem capacity to support sardine harvesting" and lack of simulation modeling to assess the expected yields and sardine biomass under a range of harvest control rules.</p> <p>Without the above information I am unable to score the PI above 75, given more complete information I would probably agree with the score of 85.</p>	<p>The reviewer considers that the information and/or rationale used to score this Indicator does not support the given score. The main argument is that the assessment team "largely omitted" material such as the results of fitting the Beverton-Holt S-R relationship after the ASAP analysis and a table with parameters resulting also from the ASAP analysis. Information such as Fmsy from the ASAP analysis is referred to in the stock assessment section of the background because it was critical to identify how the stock assessment is appropriate for the harvest strategy and the control rule. Without detriment of the value of other elements, the assessment team did not include them to the extent they were not deemed relevant to answer the following questions at the SG80 level:</p> <p>Sla. The assessment is appropriate for the stock and for the harvest control rule.</p> <p>Slc. The assessment takes uncertainty into</p>

					<p>account.</p> <p>Sle. The assessment of stock status is subject to peer review.</p>
Thread Herring					
1.1.1	Yes	Yes	No	<p>The MSC Assessment Team states “The stock of thread herring in the central/northern Gulf of California has been fluctuating around or has been above its target reference point over recent years.” However, there is no target biomass in the Reference Points (Table 9).</p> <p>The reference points for thread herring appear to be very tentative with estimates of Fmsy varying from 0.313 to 0.879, estimates of MSY varying from 101,484 mt to 290,257 mt. and there are no estimates for unfished biomass, Bmsy or target biomass (Table 9). One study has MSY estimated at 170,949 but gives a BAC of 258,000-213,000. Landings in 2013-14 and 2014-15 exceed the lower MSY estimate but this is not even mentioned by the MSC Assessment Team.</p> <p>The lack of reference biomass points makes it very difficult to establish the status of the population size in relation to reference biomass levels.</p> <p>There are several stock assessments made with different models and also biomass estimates from hydroacoustic surveys. The stock assessment estimates of biomass vary extremely widely with the 2011 estimates varying between 1,000,000 and 5,800,000 mt. The 2016 estimates from the hydroacoustic survey were 355,924 and 491,312 (Table 8)</p> <p>VPA 2011 1,400,000 Figure 17 ASAP 2011 5,000,000 Figure 18 ASAP 2011 5,800,000 Figure 19 BDM 2011 1,000,000 Figure 21</p>	<p>The assessment team acknowledges that the conclusion on the status of the TH relative to the target reference point is not straight forward. As the reviewer points out, there’s no clear specification of such reference point in the management plan, therefore we had to rely on the latitude provided by the CR as described in the rationale of PI 1.1.1. Given that the MSC basic definition of reference points is related to Bo, which in this case may not work as expected, then we followed GCB2.3.18 advising that “in the absence of robust estimates for Bo, target fishing mortality rates that would achieve the appropriate target biomass levels can be adopted”. We also considered GCB2.3.3 indicating that a management strategy based solely around a limit reference point shall imply that there is a target reference point close to or at BMSY (or some other measure or surrogate that maintains the stock at high productivity), and at a level that is well above the limit reference point. Additionally, the situation with the conceptual construction of the reference points in the management plan match the consideration in the same section of the Guidance, <i>there may be situations where the limit reference point is set higher than the point at which there is an appreciable risk that recruitment is impaired. Where this results in more precautionary management, the SG100</i></p>

				<p>Several of the biomass assessments show that the recent biomass is much higher than that which occurred in the 1970s when the fishery started (Figures 17, 18, and 19); however, the most recent model shows an extremely stable biomass of just over 1 MMT occurred from the mid-1970s to the present. The Team uses the most recent study and Kobe plots from this study to demonstrate that the biomass was extremely stable with biomass levels just under twice Bmsy (Figure 22). I assume that the Kobe plots come from the Nevarez-Martinez et al (2016) study, but this cannot be determined from the Figure title or text.</p> <p>Although the team uses the most recent study, which has a stable biomass of about 1MM, for much of their discussion they use another figure</p> <p>The MSC Assessment Team mentions the stock-recruitment relationships that are critical to modeling for sustainable yield; however, there is no material presented concerning these relationships.</p> <p>The most recent landings of thread herring (14/15 season) were 120,919 t. The most recent stock assessments were about 800,000 t with the BDM model (Figure 21) and 355,926-491,312 t with two different TS parameters with the hydroacoustic survey (Table 10). Assuming landings equal to the 14/15 season the exploitation rate for the BDM model would be about 0.15 with the BDM numbers and 0.29 with the hydroacoustic numbers.</p> <p>The Team does not even mention the hydroacoustic biomass estimates in their discussion of this PI. The biomass estimates from the hydroacoustic survey clearly suggest that since about 2012 the thread herring has had an exploitation rate above the 0.25 recommended by CNP and well above the target exploitation rates (0.143 and 0.183) given in the reference points (Table 9).</p> <p>The Team does not mention that an exploitation rate derived from the BDM assessment (0.15) is between the two Emsy values given</p>	<p><i>statement about “following consideration of relevant precautionary issues” would apply. We thus concluded that the conditions in both the CR and its associated Guidance were met and SG80 was granted to the extent that indirectly, it can be concluded that the stock is at or fluctuating around its target reference point. We however could not accept that this was asserted with a <i>high degree of certainty</i> as required at SG100.</i></p> <p>The assessment team acknowledges that there is work to do to obtain consistent results with the different approaches and that is reflected in the score that cannot be at the SG100 level. Nevertheless, despite scale differences among the different modeling approaches, neither one of them leads to conclusions different than the stock is either at a historic high or has been stable along the history of the fishery. For the purposes of the intent in PI 1.1.1, this was considered enough grounds to conclude that the fishery meets the standard of SIa at SG80 but not SG100.</p> <p>We revised the order of figures and added the missing references.</p>
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				<p>in the reference points (Table 9)</p> <p>I have not seen the several stock assessments and must rely on the Teams evaluation of the accuracy of the assessments. Unfortunately the Team does not really say which biomass estimate they believe is the most accurate; if the 4 to 5 MMT biomass estimates from the ASAP assessment is the most accurate the conclusion would have to be that the current biomass is well above the Bmsy level.</p> <p>In my opinion the Team's description in this PI is seriously in need of clarification and I am unable to agree with their SG 90 score.</p>	
1.1.2	Yes	No	No	<p>As mentioned in 1.1.1, reference points for thread herring appear to be very tentative with estimates of Fmsy varying from 0.313 to 0.879, estimates of MSY varying from 101,484 mt to 290,257 mt. and there are no estimates for unfished biomass or target biomass (Table 9). One study has MSY estimated at 170,949 but gives a BAC of 258,000-213,000. Landings in 2013-14 and 2014-15 exceed the MSY of one of the estimates.</p> <p>Two of the most important reference points Bun (unfished Age 1+biomass and spawning biomass) are not given. Bmsy is given but it is impossible to determine the depletion level at Bmsy.</p> <p>The Team discusses a pre-established Bmin and states that Reference points can be estimated but does not provide an estimate of Bmin either in the PI evaluation table or Table 9 of the report. In fact the entire 1.1.2 Section does not have a single numerical value mentioned for any reference point.</p> <p>The Team has not described which stock assessment it is using to determine the relationship between current catches and current biomass. In section 1.1.1 they appear to favor the most recent BDM assessment. But in the PI evaluation they mention "an initial abundance much lower than the current estimated</p>	See response for PI 1.1.1 above

				<p>biomass". The much lower initial biomass occurs in the VPA and ASAP assessments.</p> <p>The results from the BDM model show a very stable biomass from the mid-1970s to the present. The low initial biomass and rapid increase to a stable higher biomass occurs in the ADM models for thread herring (Figure 21), bocona sardine (Figure 24) and chub mackerel (Figure 26). This common pattern with three different BDM models suggests that the low initial biomass in these models is a modeling artifact, rather than a large increase in the carrying capacity for small pelagics in the mid-1970s.</p> <p>Due to the absence of estimates for unfished biomass, Bmsy and Bmin the management is forced to rely on estimates of Fmsy to manage the fishery. The reference points for Fmsy given are extremely variable. The ASAP assessments of Fmsy are 0.879 and 0.312; the BDM estimate is 0.5195.</p> <p>The Team primarily discusses goal and objectives in the PI text and they do not describe any specific target reference point that could be used to manage the fishery and they do not describe the target reference point that is currently used to manage the fishery.</p> <p>Given the above I agree with the 75 score given by the MSC Team.</p>	
1.1.3				NA	
1.2.1	Yes	No	No	<p>Based on my comments in the above sections and the material in the Assessment Report I feel that the current harvest strategy is essentially an informal process that has little to do with biological reference points. Instead it appears to be a fairly functional process that limits effort by good fleet limitations, closed seasons and discussions with the fishery participants to convince them to reduce effort on sardine when catches of sardine are low.</p>	See response for 1.2.1 for Pacific sardine section

				<p>This process may be fairly successful but it clearly does not meet the higher MSC standards.</p> <p>I agree with the score of 70.</p>	
1.2.2	Yes	No	No	<p>There appears to be considerable confusion with the Harvest Control Rule (see the general comments section).</p> <p>The Team states that there is an “explicit, written harvest control rule (HCR) that is used for actively managed species, such as the Pacific sardine.” and it shows that the Fraction component of the rule is set at 0.25. This value appears to be a general rule for many fisheries in Mexico and it is not known if any of the species in this fishery actually have an Emsy value of 0.25. The Team mentions that the current practice is to use the Fmsy as the Fraction. As shown in the general comment section, and pointed out by the Team, using fishing mortality (F) is not valid.</p> <p>There is also presently no assessment of the minimum biomass level used in the control rule so agree with the Team that the SG 80 is not met for 1.2.2 a</p> <p>Since no numerical control rule presently exists I disagree with the Team’s yes on SG 80 for 1.2.2 b and think the score should be yes for SG 60.</p> <p>I do not think that a framework presently exists to use biological control rules to achieve the exploitation levels required under control rules. So I would again disagree with the Team and score 1.2.2 c as SG 60. The possible exception to this would be that I agree that the thread herring catches to date are probably not greater than Emsy. So if the informal management discussed in the general comment section have prevented overfishing could be considered to override the wording of SG 80 c I would agree with a yes on SG 80 c.</p>	<p>Speaking strictly about small pelagics, the default value of 0.25 in the management plan, which is used as an upper bound for harvest rates and a baseline for passive management, originates from a peer reviewed publication for Pacific sardines (Nevarez-Martinez et al (1999) (see background section about management/limit reference point analogue). There is therefore a logic in the selection of that value for Pacific sardines, we however questioned the validity of that default when applied to other species.</p> <p>In the case of the species under active management, the harvest rate is to be computed and used as FRACTION. Because of the long history of use of Fmsy as FRACTION, we thoroughly discussed the inconvenience of such assumption even if at levels of 0.25 or lower the difference is not large. As we pointed out in the background to the stock assessment, this issue was evaluated by INAPESCA staff under the advice of Dr. Morales-Bojorquez and agreed to shift to a harvest rate form that may be more appropriate for use as FRACTION. The new assumption was already used in the 2016 assessment.</p> <p>As for actual computation of the control rule, the estimated Fmsy was used to compute a harvest rate and was used as fraction to compute BAC</p>

					values for 2014/15 and 2015/16. This was originally omitted in the background but has already been inserted as necessary information. The team considers this addresses the reviewer concern and supports maintaining SG80.
1.2.3	Yes	No	No	<p>The material in the MSC Assessment shows that there is considerable fishery-dependent monitoring and analyses as well as fishery-independent hydroacoustic surveys and egg and larvae surveys. The research and monitoring programs appear to be of high quality and analyses are being made to improve the knowledge base needed to manage the fishery.</p> <p>There does seem to be some delay in getting external review of stock assessments of thread herring and it is likely that population simulation models similar to those used for the Northern Stock of Pacific Sardine would allow a better estimate of reference points for minimum biomass, maximum long-term yield and Emsy.</p> <p>As mentioned by the Team fishery monitoring and surveys were designed for Pacific sardine and may need some revision to cover thread herring. The more near-shore habitat of thread herring (and bocona sardine) will probably result in underestimation of biomass with hydroacoustic surveys. I note that this is a continuing problem with hydroacoustic surveys for the northern stock of Pacific sardine and central stock of northern anchovy in the US fishery.</p> <p>I agree with the overall comments of the MSC Team and would score this PI with 75.</p>	Not clear what the intention of this comment is as the reviewer agrees with both score and rationale but says does not agree that the information or rationale support the score and that the condition would not improve the score.
1.2.4				<p>The latest biomass estimates given in Table 8 for the three stock assessments. are 3,000t (preliminary), 52,700 t and NA. An estimate from the hydroacoustic survey is lacking.</p> <p>Obviously these numbers are incorrect, as the recent landings have exceeded 100,000 t.</p>	This was due to editorial error but has been corrected. 3,000 and 52,700 mt were labeled as current biomass when they actually are Bmin estimates.

				I am unable to assess the Team's score on this PI due to lack of information.	
2.1.1	Yes	Yes	Yes	<p>The MSC Team did not consider the California anchovy, round herring and leatherjackets to be main retained species but do include chub mackerel and bocona sardine. The landings temporal pattern suggests that "retained species" is probably a poor description of the role of these species. They are better described as 'alternative species' because the landings clearly shows that the landings of these species increase when the biomass (and landings) of Pacific sardine decline.</p> <p>It is worth mentioning that in the peak fishing season (2008-9) only 14,640 t of non-target species were landed. Landings of non-target species in the last season in the report (2014-15) were 119,091 t and the peak of non-target species landings was 322,807 t in the 2011-12 season.</p> <p>I find it difficult to accept landings of 322,807 tons as retained species.</p> <p>I suggest that the California anchovy be added to the main retained species list as its landings reached 118,833 t in the 2012-13 season when it was the most important species in the fishery. Clearly this species has been a target species and the fact that its landings declined sharply to only 3,888 t in the 2014-15 season implies that it may have been overfished; of course it is also possible that there were economic or environmental reasons for the apparent decline in biomass. However, this sharp decline and possible reasons for it are not addressed in the report.</p> <p>I agree that the round herring and leatherjackets, which have landings exceeding 10,000 t in only one year, do not need to be included as main retained species.</p>	The reviewer concern regarding California anchovy has already been addressed in previous sections.

				<p>I agree with the Team's conclusion that there are limitations in the biomass assessments and hydroacoustic survey results for bocona sardine and chub mackerel (note my comments on possible model artifacts concerning Bo in the general comments section). Monitoring and modeling 'alternative species' is difficult due to the very wide variations in fishing effort directed towards these species. In particular, it is difficult to assess harvest rates, which are more affected by the biomass of Pacific sardine and thread herring than the biomass of the alternative species. The fact that there are three important 'alternative species' introduces additional problems for stock assessments (i.e. bocona sardine, chub mackerel and California sardine).</p> <p>In spite of the recognized difficulties I agree with the Teams score of SG 80 for bocona sardine and chub mackerel as there is no evidence that the biomass of these species has been seriously reduced. I do have some concern about the California anchovy biomass and feel that it should have been included as a main retained species.</p>	
2.1.2	Yes	No	No	<p>I agree with the Team's assessment that an operational management strategy does exist for the retained species. As shown below the available evidence shows that the exploitation rates of chub mackerel and bocona sardine have not exceeded the generalized rule that limits the exploitation rate to $E=0.25$. However, there does not appear to be a mechanism to prevent the exploitation rate from exceeding the 0.25 target.</p> <p>MSY and the associated mean biomass in the chub mackerel estimates presented in Table 13 are obviously wrong, as the mean biomass is lower than MSY. In addition, MSY values from Table 14 are greatly in excess of those in Table 13. The problem with instantaneous fishing mortality estimates are again seen in the chub mackerel reference points (Table 14) where E_{msy} is mis-identified as F_{msy} (i.e. $MSY/B_{msy} = E_{msy}$: $70,000/200,000 = 0.35$).</p>	<p>It should be considered that the biomass values in Table 13 for chub mackerel actually refer to "mean" biomass from a VPA which most likely refer to the mean biomass across all ages for some particular period of time. This biomass should not be taken as total, adult or vulnerable biomass. It's inclusion in the Nevarez-Martinez et al (2016e) and the background section was only as a reference that efforts have been made to obtain fishery management related parameters. Actual parameters used for stock assessment are in Table 14 where B_0, B_{msy} and MSY are more meaningful.</p> <p>We agree with the reviewer observation that the parameter referred to as "F_{msy}" is in reality</p>

				<p>According to the general management strategy of the Mexican Government the exploitation rate should not exceed $E=0.25$. This value is well below the E_{msy} values from the stock assessment ($E=0.35$). In addition, the maximum landings of chub mackerel (47,600 t in 20011-12) were taken from a biomass of about 380,000 t (Figure 26); an exploitation rate of $E=0.125$.</p> <p>The maximum exploitation rate of bocona sardine ($E=0.14$) also occurred in the 2011-12 season when 197,354 t were taken from a biomass of about 1,370,000 (Figure 26). The $E=0.262$ estimate is slightly above the general $E=0.25$ value and both are well above the maximum recorded value (note again that the F_{msy} in Table 12 is actually E_{msy}).</p> <p>I agree with the Team's reasoning for a score of 75.</p>	<p>H_{Rmsy}, which the INAPESCA staff needs to start correcting in all their assessments. Nevertheless, for the purposes of the assessment of stock status, considering they are using Kobe plots, what matters is that they are consistent in the use of F or E to compute their relative indices.</p> <p>Not sure why there are two "No" if the reviewer agrees with the score and the reasoning.</p>
2.1.3	Yes	Yes	No	<p>It is worrying that there is some question as to the precision of the basic catch for the retained species. The lack of the basic population dynamics parameters and the absence of age data for the catch and hydroacoustic surveys needs to be addressed.</p> <p>Based on the Team's assessment of this PI I feel that they were perhaps too generous and would have preferred to see a score of 75. However, this element is particularly hard for a reviewer to address as the specifics of the monitoring programs, which were discussed at the site meetings, are not available. Therefore I defer to the Team's assessment.</p>	<p>The assessment team agrees that given the importance of these species more precise information of these species to "quantitatively estimate outcome status with a high degree of certainty" for this reason a score of SG100 for SIb. In this PI was not granted. However, there is sufficient information to "estimate outcome status" meeting the SG 80. Issue with the monitoring program, were also recognized and addressed in PI 2.1.2 under SI c, for which a condition was placed due to the absence of evidence of monitoring.</p>
2.2.1	Yes	Yes	No	<p>Considerable effort has recently been placed on obtaining information on bycatch species and the information now available is quite extensive and it shows that the fishery has only minor impacts on the populations of bycatch species. These results are seen in most major fisheries for small pelagics as purse-seine</p>	<p>No response is necessary</p>

				<p>fisheries catch relatively few benthic fish species or non-fish species. The Team appears to have some concerns about birds becoming oiled by fish oils released during capture. The number of birds taken as bycatch appears to quite small with the exception of brown pelican.</p> <p>The probability of fish-oiling of brown pelicans leading to mortality and the mortality of blue-footed booby appears to have resulted in the Team giving a score of SG 80 to this PI. Given the apparent high quality of the observer programs and the information in the report I would have given a score above SG 80.</p>	
2.2.2	Yes	Yes	No	Based on the Team's comment "Awareness workshops have been held to disseminate this strategy focused mainly on seabird impact mitigation but also in other species such as sea turtles, sharks and marine mammals. However, there is not a full strategy in place, thus SG100 is not met." I agree with their score of SG 80	No response is necessary
2.2.3	Yes	Yes	No	I agree with the Team's Not Applicable comments.	No response is necessary
2.3.1	Yes	Yes	No	<p>The oiled brown pelicans appear to be the major issue for this PI. For the reasons listed in 2.2.1 I agree with the score of SG 85 (the same score I would have given 2.2.1.</p> <p>The ecosystem implications are discussed elsewhere.</p>	No response is necessary
2.3.2	Yes	No	No	<p>There does not appear to be a coordinated plan concerning the protection of ETP species from impacts of the fishery. In particular the fishing of juveniles in marine protected areas could be a problem for marine bird species that largely rely on the early life-history stages and juvenile pelagic fishes.</p> <p>The switch from a fishery dominated by Pacific sardine to one concentrating on species that are more abundant in near-shore waters is a potential problem and absence of an observer program makes it difficult to quantify the magnitude of changes that may</p>	The team agrees with the comments that more information is required to understand problems with oiled pelicans and implementation of the observer program. These issues are addressed in PI 2.3.3

				<p>have occurred. It is important that the possible problems with oiled pelicans be addressed.</p> <p>I agree with the low score SG-70.</p>	
2.3.3	Yes	No	No	<p>For the reasons listed above, I agree with the low scoring of ETP marine birds that are the Team's primary reason for the very low score for this PI. However, I would have scored this PI at 75 as I cannot agree with their scores of SG 60 for marine mammals, other sea birds or fish and shark species which do not occur in significant numbers in most purse-seine fisheries for small pelagics.</p> <p>If setting on porpoise schools becomes an issue this might be a more important issue.</p>	<p>The assessment team agrees with the reviewer's comment that the impact of the UoA on other sea birds, marine mammals, sea turtles and fish and shark species is minor. The ETP species were organized into six scoring elements (See Table 11).</p> <p>These ETP scoring elements (other sea birds, marine mammals, sea turtles and fish/shark species) scored SG80 on SI a and b of this PI. However, since the observer program operated for less than two full seasons, and was not in operation when the onsite was conducted, the team considered that there is no sufficient information to measure trends and detect any increase of risk for the ETP elements mentioned previously, for this reason a score of SG60 was given for SI c.</p> <p>Following the MSC CR V 2.0 Clause 7.10.7 the assessment team, where the scores were determined for each scoring element and then Table 4 was used to determine the overall score for the PI from the scores of the different scoring elements. See the "Scoring Methodology" section in this report (p. 123).</p> <p>The two other ETP scoring elements (Blue footed boobies and brown pelicans) scored SG60 on all three SIs in this PI. When the scores of all the six ETP scoring elements are combined, following the MSC CR, the overall score for this</p>

					<p>PI, even though the individual score for five of the ETP scoring element (other sea birds, marine mammals, sea turtles and fish/shark species) is 75.</p> <p>The overall score of the PI was 65 because the two other ETP elements received a score of SG60 on all Sis for this PI.</p>
2.4.1	Yes	Yes	Yes	I agree that this purse-seine fishery, like most others, have very little effect on the benthic habitat. I therefore agree with the Teams SG 100.	No response is necessary
2.4.2	Yes	Yes	No	<p>There appears to be very little need for a management strategy to protect the benthic habitat, which is the only habitat likely to be impacted by a purse-seine fishery. The exception to this is that setting purse-seines in water shallower than the depth of the net can impact the bottom substrate and take benthic organisms.</p> <p>The fact that the fishery is now utilizing species that have fishable concentrations in quite shallow water does make it possible that benthic habitats could be impacted. This may be more important in the Marine Protected Areas.</p> <p>Due to the fact that there is no strategy in effect prevents a score of SG 100 so I agree with the score of SG 95.</p>	No response is necessary
2.4.3	Yes	Yes	No	<p>The most important source of information for this PI is the observer program that can document the depths of capture and incidents of benthic organisms in the catch.</p> <p>According to the Team, CANAINPES and INAPESCA provided written evidence that the observer program will continue for the next fishing season. Therefore I agree with the Teams score of SG 80.</p>	No response is necessary
2.5.1	Yes	Yes	No	Based on the available stock assessments for Pacific sardine (Figure 11), thread herring (Figure 21), bocona sardine (Figure 24)	The assessment team agrees that evidence based on population assessments indicate that

				<p>and chub mackerel (Figure 26) the total biomass of these four species was at a peak at about 2008. The combined biomass at this time was about 7.8 MMT. The recent combined biomass was about 3.5 MMT, which is about the same as that occurring in the early 1970s.</p> <p>I note that if the ASAP stock assessment for thread herring is used (Figure 19) the results are quite different. The combined biomass in the early 1970s was about 3.2 MMT, at the peak it was 10.7 MMT and the recent biomass would be about 7.1 MMT. Note that there are no biomass estimates for the California sardine, round herring so these values are less than the total small pelagics biomass.</p> <p>Given the very different patterns in the assessments for thread herring predicting the ecosystem outcome is chancy.</p> <p>The exploitation rate of the combined four species at the peak of the fishery was about $E=0.07$ using the lower biomass value and $E=0.05$ using the higher biomass value. The combined exploitation rate in the 2014-15 season would have been about $E=0.06$ with the lower biomass value (3.2 MMT) and $E=0.03$ with the higher biomass value (7.1 MMT).</p> <p>Depending on which assessment is used for thread herring (Figure 21 or Figure 19) the fishery has a higher or lower exploitation rate at the peak of the fishery than in 2014/15. Note that this is slightly biased as the landings include California anchovy and a small biomass of other species whereas the biomass estimates do not include these species populations.</p> <p>The most important conclusion from the available fishery is that it has apparently never had an exploitation rate exceeding $E=0.7$. Note that this value includes the much smaller thread herring biomass estimates</p>	<p>the fishery is highly unlikely to disrupt the key elements of ecosystem structure/function. However, because quantitative information on all key ecosystem elements (trophic structure and function, community composition, productivity pattern) is not complete, and thus the team elected a more precautionary score.</p>
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				Given that the stock assessments are reasonably precise and that the principal disruption in the combined biomass was probably due to large scale environmental variation I would score this PI at 90	
2.5.2	Yes	No	No	<p>While agreeing that the fishery does not appear to be causing ecosystem changes it is clear that a viable ecosystem management strategy has not been developed. In fact it appears that even single species harvest control rules are not presently being used to manage annual landings.</p> <p>Therefor I agree with the low score given by the Team (SG 75)</p>	No response is necessary
2.5.3	Yes	No	No	<p>Ecosystem models are being developed and the initial models seem to provide some valuable ecosystem information; however, as repeatedly mentioned, there are quite large differences in the biomass time series from different stock assessment. Some even have very different trends. The possible spin-up problem with BDM models, which all have very different Bo values from the higher and very stable biomass values after about 1980, needs attention.</p> <p>The observer program needs to be continued.</p> <p>The ecosystem information for other faunal components will be required before reasonable precise ecosystem models can be developed. Good information on the food habits, population sizes and mortality rates of these components will be necessary before ecosystem analyses can be used for fishery management. This was not discussed in the report and it may not be the responsibility of the fishery to develop this information. However, the need for this information should be mentioned somewhere in the report.</p> <p>I agree with the reasoning of the Team and their score of SG</p>	The need for more information on the main funtions of the ecoystem components (i.e., target, Bycatch, Retained and ETP species and Habitat) has been included under SI c for this PI.

3.1.1	NA	NA	NA		The peer reviewer did not examine this PI
3.1.2	NA	NA	NA		The peer reviewer did not examine this PI
3.1.3	NA	NA	NA		The peer reviewer did not examine this PI
3.1.4	NA	NA	NA		The peer reviewer did not examine this PI
3.2.1	NA	NA	NA		The peer reviewer did not examine this PI
3.2.2	NA	NA	NA		The peer reviewer did not examine this PI
3.2.3	NA	NA	NA		The peer reviewer did not examine this PI
3.2.4	NA	NA	NA		The peer reviewer did not examine this PI
3.2.5	NA	NA	NA		The peer reviewer did not examine this PI

9.2 Peer Reviewer 2

PI	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification Please support your answers by referring to specific scoring issues and any relevant documentation where possible. Please attach additional pages if necessary.	Conformity Assessment Body Response
Pacific Sardine					
1.1.1	Yes	No	NA	<p>Given the quantitative and qualitative data from available references, the assessor's presented a good rationale for their assigned PI score of 100.</p> <p>However, the argument that is little to no risk of overfishing the stock seems to largely hinge on the assumption that there always remains a large unexploitable population of sardine in deeper waters of the northwest Gulf of California. The glaring issue with this hypothesis is that sardine would have to remain in deep water at all times to avoid capture by the fishery. To my knowledge, there is no existing evidence of such a change in behavior by a pelagic species (that feeds on plankton) in any region of the world.</p> <p>It is also not clear that this hypothesis and the evidence supporting it correlate well with observed catch trends. Around 2008, catch was around 500 thousand tons, so about 1/6th of total biomass (~3 million tons; Fig. 8, pg. 41). But at 500 thousand tons of total abundance (according to the survey estimate), only 4 thousand tons (1/100th) were</p>	<p>By no means the assessment team worked under the assumption that there is <i>always</i> a portion of the stock that works as a reservoir preventing the stock to be overfished. The team used evidence provided in reports in the public domain, some peer reviewed, discussing how the waters around the midriff islands work as a refuge under the adverse oceanographic conditions of El Niño (see background section on Environmental considerations and the potential effect of El Niño on current sardine availability.</p> <p>More importantly, assessing the key LTL stock of Pacific sardine in the GoC in terms of its status as "overfished" relative to a biomass at MSY reference point is not very useful given the wide fluctuations of a stock following the frequency and scope of environmental variability. Fishing rates are more useful, particularly if they can be associated to some type of ecosystem related indicator. This is the approach that is being developed by the fishery and</p>

				<p>captured? This seems highly doubtful and highlights the uncertainty (which the assessment team very clearly acknowledged) in existing information.</p> <p>Given the differences between estimated stock abundance and catch trends, in my opinion this PI might qualify for a score of 80, but not 100.</p>	<p>it was considered by experts as appropriate.</p> <p>As for the apparent inconsistency between recorded catches and estimated abundances, it should be noted that the catch of 4,000 tons was obtained by the fishery after effort was voluntarily redirected to other species. This process is clearly depicted in Figure 3 comparing catch of Pacific sardine to the other small pelagic species. Disaggregated catch of non-Pacific sardine small pelagics is shown in Figure 5.</p> <p>Finally, PI 1.1.1 evaluates stock status relative to the point where recruitment could be compromised and the status of the stock relative to a level that is consistent with Bmsy. As described in several sections, particularly in the rationale of the evaluation table for this particular PI, we used the MSC CR specifications to evaluate indirect approaches. Even in the event that a target reference point is not explicit, if the limit reference point is consistent with Bmsy and particularly if the LRP is specified under precautionary considerations (as in the management plan), then it can be accepted that a higher score is merited. To reach our conclusions we observed that the exploitation rate has been for the most part in the history of the fishery, well under the estimated rates producing MSY and more importantly, under the estimated ecosystem threshold.</p>
1.1.2	Yes	Yes	No	<p>Although this PI requires more actions, as indicated in the corresponding Condition, I agree with the assessment team's reasoning given the available information.</p> <p>While there is no existing explicit operational integration of ecosystem considerations for setting yearly TACs, the single</p>	<p>Even if the assessment team would agree with the reviewer suggestion, we are uncertain to what extent it is possible to suggest such level of action in the workplan. We may need to request guidance from MSC on this.</p>

				<p>species-based recommendations given available data in the meantime safeguard against possible ecosystem impacts. ADD SIZE UNCERTAINTY</p> <p>Regarding this PI's Condition, I would note that a full evaluation of the ecological role of the target species should fully consider linkages to fish species (i.e. not only primarily marine mammals and birds), throughout seasons and in different ecosystems within the study area. This certainly can fall within the Condition plans as currently specified, but has not been made explicit in these plans.</p>	
1.2.1	Yes	Yes	No	<p>While agree with the assessment team's evaluation of this PI, and their justification for a Condition, the client action plan as currently stated (Condition 1-2) is not sufficient to meet the PI criteria for SG80.</p> <p>Specifically, the client action plan as current stated only discusses arriving at a plan for a harvest mechanism. However, there is no mention of concurrent field-testing (and subsequent reporting) of this mechanism, as outlined in the PI and the Condition.</p> <p>This need for testing of the harvest strategy is indeed mentioned in the justification for GPb, so it should also appear explicitly in the client action plan, particularly in light of the four-year time horizon for this Condition, which is more than sufficient for adaptive policy design to take place. This plan can easily be paired with Condition 1-3 to co-achieve required criteria.</p>	<p>At PI 1.2.1 GI b the passign score of SG80 requires that the "The harvest strategy may not have been fully tested but evidence exists that it is achieving its objectives", further clauses associated with this scoring issues (CR v 1.3 CB2.5.1.2) indicate that " "Tested" at SG80 to mean the involvement of some sort of structured logical argument and analysis that supports the choice of strategy."</p> <p>The activities mentioned in the Client Action Plan associated with this conditions (Condition 1-2) indicate that the "[...] client will provide a technical report showing progress in determining the formal mechanisms for stopping fishing activities when close to the BAC; Also a summary of the agreements reached and the revisions made at the meetings." The assessment will verify in upcoming surveillances that the reports and evidence presented for this condition include a "[...] the involvement of some sort of structured logical argument and analysis that supports the choice of strategy."</p>

1.2.2	Yes	Yes	Yes	<p>The assessment team correctly highlighted a need for further sensitivity analyses in key parameters used in the stock assessment models.</p> <p>I would recommend going much further in the current Conditions in integrating uncertainty in all parameters used in these models, including by regarding catch statistics themselves as hypotheses.</p> <p>Our certainty in these data can be increased through the various Conditions currently proposed, but in the meantime such sensitivity analyses would present a more transparent outlook of possible ecological and fisheries research and management scenarios.</p>	No response necessary.
1.2.3	Yes	Yes	NA	<p>Aside from bycatch species, an observer or electronic monitoring program would be highly useful to complement the current monitoring and research plans. Given the relatively small number of vessels and relatively short vessel trips of the UoA, there are many potential strategies to address this, perhaps including digital camera equipment.</p>	No response necessary, but different approaches to improve monitoring and data gathering are already being considered by the industry under advice of INAPESCA staff and probably with assistance from COBI.
1.2.4	Yes	Yes	NA	<p>I agree with the assessment team's evaluation for this PI, and would further stress the need for full formal integration of uncertainty in data, parameters, and model structure.</p> <p>That being said, this weakness is well addressed here (e.g. GPc), and in related PI evaluations, Conditions, and corresponding justifications. In that sense, I am not concerned that a result of SG100 will be difficult to reach given current plans, but concur in that it has certainly not yet been reached.</p>	No response necessary.
Thread Herring					

1.1.1	Yes	Yes	NA		No response necessary.
1.1.2	Yes	Yes	NA		No response necessary.
1.2.1	Yes	Yes	No	<p>While agree with the assessment team's evaluation of this PI, and their justification for a Condition, the client action plan as currently stated (Condition 1-4) is not sufficient to meet the PI criteria for SG80.</p> <p>Specifically, the client action plan as current stated only discusses arriving at a plan for a harvest mechanism. However, there is no mention of concurrent field-testing of this mechanism, as outlined in the PI and the Condition. This need for testing of the harvest strategy is indeed mentioned in the justification for GPb, so it should also appear explicitly in the client action plan, particularly in light of the four-year time horizon for this Condition. This plan can easily be paired with Condition 1-5 to co-achieve required criteria.</p>	The need to present evidence that the proposed mechanism have been "tested" has now been included in the Action Plan for conditions 1-2 and 1-4
1.2.2	Yes	Yes	Yes		No response necessary.
1.2.3	Yes	Yes	Yes		No response necessary.
1.2.4	Yes	Yes	Yes		No response necessary.
2.1.1	Yes	Yes	NA		No response necessary.
2.1.2	Yes	Yes	Yes		No response necessary.
2.1.3	Yes	No	NA	The evaluation for GPd is inconsistent with the rationale for other scores. Data on retained species was deemed not to be adequate and verifiable (GPa), such that there is insufficient information to ascertain their status (GPb).	The assessment team agrees that there are limitations with the precision of the information provided for retained species, for this reason the fishery did not meet the 100 level for SI d, which

				Therefore, one cannot justify that monitoring of retained species is “conducted in sufficient detail to assess ongoing mortalities to all retained species” (GPd).	requires that “ <i>Monitoring of retained species is conducted in sufficient detail to assess ongoing mortalities to all retained species.</i> ”
2.2.1	Yes	Yes	NA		No response necessary.
2.2.2	Yes	Yes	NA		No response necessary.
2.2.3	Yes	Yes	NA		No response necessary.
2.3.1	Yes	No	NA	<p>See comment for PI 2.3.2 (below).</p> <p>While the team correctly noted that there are no specific limits to ETP bycatch, these limits should be determined by the UoA itself, in accordance with the Ley Federal de Pesca (Art. 66). Therefore, the current norm under revision must necessarily include such provisions for future evaluations, without which the norm would violate legal requirements.</p> <p>In addition, bycatch monitoring results (from observers or otherwise) must be transparently carried out and the data made publicly available.</p>	<p>Information regarding Art. 66 in the National Fisheries Law has been included in the justification of PI 2.3.2 related to management of ETP species.</p> <p>For response to comment regarding bycatch data see below.</p>
2.3.2	Yes	No	No	<p>I find the rationale and final evaluation for this PI inconsistent with previously provided evidence. For example, there is observer evidence of interaction with or capture of dolphins, sea turtles, whale sharks, (Critically Endangered) totoaba, sea lions, and other ETP species, but there is no mention of this fact in the justification for other relevant PIs (e.g. 2.1.1, 2.2.1).</p> <p>Given that existing information is highly limited, it is difficult to strongly argue that the bycatch impacts of the UoA on ETP species is minor (despite qualitative arguments). Furthermore,</p>	<p>Interactions with the ETP species mentioned (dolphins, sea turtles, whale sharks, totoaba, sea lions..) are mentioned in the justification only for those PIs that are relevant to ETP species (PI 2.3.1, 2.3.2, and 2.3.3).</p> <p>The assessment team agrees that information to determine the outcome status of ETP species needs improvement, for this reason a condition was placed under the relevant PI 2.3.3.</p>

				<p>even the rare capture of ETP species would obviously present significant legal (both through national laws, international regulations such as NOAAs, and international binding agreements such as CITES) and public perception issues for this fishery.</p> <p>Is there more information on such occurrences? Can this information be managed transparently? I note that past observer data is not public and the observer program is not currently operating. Are there mechanisms in place to transparently respond to occurrences of ETP bycatch by particular vessels?</p> <p>These issues should be addressed in the Client Action plan Conditions 2-2 and 2-3, which at the moment only address seabird mortality.</p>	<p>The assessment team did evaluate the regulations relevant to ETP species, at a national level, these are described in the background of this report (See Section ETP Regulations p.80). The assessment team notes that the regulations reviewed for the ETP species in this fishery mandated mostly against directed catch, retention and/or commercialization. The assessment team found only a few isolated instances of species protected under NOM-029-PESC-2006 were retained. Other measures in place for managing impact on ETP species included the observer program, water curtains, etc. Due to the implementation issues with several of these measures, the assessment team placed a condition on PI 2.3.2.</p> <p>The assessment team evaluated the available information from the reports of the observer program from 2013 to 2014. A summary of the information regarding the interactions of the fishery with ETP species is provided in the background of this report (See Section 2.7.3 Endangered, Threatened and Protected (ETP) Species). The reports of the observer data are not publically available, this is not required by MSC, however, the CAB will be able to provide the reports used on the assessment to interested stakeholder upon request.</p> <p>As for the existence of “mechanism in place to transparently respond to occurrence of ETP bycatch by particular vessels”, The observer program is expected to operate in a transparent manner, verified field observations. In the upcoming surveillances as the observer program is implemented again, the assessment team will ensure that the observer program and validation methods</p>
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					<p>are appropriate for the scale of the fishery.</p> <p>Condition 2-3 already address issues with non-seabird ETPs. Requesting that by the third annual surveillance the client shall provide evidence that there is sufficient information available to: measure trends and assess effectiveness the strategy to manage impacts on ETP species.</p>
2.3.3	Yes	No	No	See comment for PI 2.3.2 (above).	See response above
2.4.1	Yes	No	NA	<p>There is an inconsistency with the data provided and the resulting score and justification. If fully 48% of sets have contact with the sea bottom, it would seem benthic species and habitats (such as required by bivalves) may very well be affected, with potential negative effects to coastal fisheries.</p> <p>Aside from specific research into this issue, the particular matter of bycatch species monitoring could be readily addressed by expanding the requirements and scope of Conditions 2-2 and 2-3. In addition to quantitative evaluation of habitat (and associated bycatch) impacts from the UoA, these interactions could be cross-referenced through independent surveys of other fisheries stakeholders.</p>	<p>As noted in the SI a PI 2.4.1, thought there is a high number of sets in shallow areas, the information provided show that due to the substrate and oceanographic characteristic o, that the contact of the gear with the bottom substrate is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.</p> <p>There implementation of the observer program in response to condition 2-2, 2-3 and 2-4 is expected to provide more information regarding the catch composition of this fishery.</p>
2.4.2	Yes	Yes	NA		No response necessary.
2.4.3	Yes	Yes	NA		No response necessary.
2.5.1	Yes	Yes	NA		No response necessary.

2.5.2	Yes	Yes	No	<p>In GPb, there seems to only be one independent survey on bycatch and ecosystem impacts. The lack of independent reviews is acknowledged in other PIs (e.g. PI 3.2.5 GPb) score, but this is also relevant here.</p> <p>Within Condition 2-4, making monitoring and survey data freely and publicly available would give opportunity for independent surveys to emerge and be compared with existing assessments.</p>	
2.5.3	Yes	Yes	NA		No response necessary.
3.1.1	Yes	Yes	NA	<p>I agree with the assessment team's evaluation, but note that the recognition of preferential rights to resources for artisanal fleets and Indigenous peoples in particular has been continually challenged throughout the country.</p> <p>This is certainly not an issue specific to the UoA, nor does the UoA interact particularly strongly with artisanal and Indigenous fisheries (though this does occur when setting close to shore and catching non-target species important for coastal fisheries, as noted in this evaluation), but these interactions should be considered through qualitative surveys.</p> <p>The certification process may actually represent an opportunity for the UoA to more formally integrate a recognition of artisanal and Indigenous fisheries access to particular fishing areas, with little downside and potential benefits coming from improved relationships with these stakeholders.</p>	<p>This is actually an interesting comment and the assessment team would appreciate if evidence is provided showing that the rights of indigenous people are not being respected contradicting provisions in the Law. Such violation may not affect the score of this PI since this pertains to the existence of mechanisms so that the management system respects legal rights. But there may be other PI where the issue could be addressed.</p>
3.1.2	Yes	Yes	NA		No response necessary.

3.1.3	Yes	Yes	NA	<p>While I agree with the evaluation of this PI in the sense that objectives are indeed clearly <i>stated</i>, I'm not convinced that they are <i>clear</i> given the many competing objectives and no mention of associated (and unavoidable) trade-offs.</p> <p>The design of objectives within the various Conditions, and I suggest adding one to this PI, would highly benefit from following the SMART criteria. That is, a good objective must be Specific, Measurable, Achievable, Relevant, and Time-bound. This can help break down the necessarily complex goals of ecosystem-based management into more tractable objectives.</p>	The assessment team does not dispute the value of the criteria suggested by the reviewer. However, even if we were strongly in agreement, we are bound by the specific content and language in the MSC CR document. As described in the rationale, the management system at both the national level and within the management plan, include explicit objectives that are in agreement with MSC Principles and Criteria.
3.1.4	Yes	Yes	NA	<p>I agree there is no evidence that sardine receives subsidies aside from fuel, and that for this particular fishery there is no compelling evidence that the subsidy amounts contribute to unsustainable fishing.</p> <p>However, it is important to note that fuel subsidies are the best example of a capacity-enhancing subsidy. The use of such subsidies is strongly discouraged by international agreements, whatever their effects may be, and there are agreements in place to entirely eliminate such subsidies from fisheries (e.g. UN Sustainable Development Goal 14.6, and current WTO negotiation rounds).</p> <p>The effects of current subsidies (including non-fuel subsidies such as tax breaks that may not be readily apparent due to poor transparency in Mexican fishery subsidy application) should therefore be carefully weighed by the industry to plan potential subsidy reductions or pre-emptive foregoing of subsidies by the industry.</p>	The assessment team strongly appreciates this comment and we will certainly look further into the scope of lower level or embedded subsidies and the reach of the fuel subsidy.
3.2.1	Yes	Yes	NA		No response necessary.

3.2.2	Yes	Yes	Yes		No response necessary.
3.2.3	Yes	Yes	Yes		No response necessary.
3.2.4	Yes	Yes	NA		No response necessary.
3.2.5	Yes	Yes	No	While I agree with the requirements of Condition 3-3, the nature of anticipated “external reviews” must be made more clear. At the moment, if the Client is actively soliciting and supporting these reviews, there is high risk of conflicts of interest. A well-defined mechanism for truly independent external review must be explicitly outlined in this Condition.	We may not be able to request that the action plan includes specifics such as the one suggested by the reviewer, but we may consider the issue of potential Conflict of Interest at surveillance audits.

10. Appendix 3 Stakeholder Submissions

Table 35. Summary of Stakeholder Submissions

Organization	Representative	Date Received	Medium of submission (verbal/written)	Summary of verbal sub. /Section in report written sub.	Associated Quotes Numbers
Consejo Asesor del Conjunto de Áreas Naturales Protegidas Federales	Dr. Óscar Sosa Nishizaki	14 July, 2016	Written	<p>Fishery should abstain from operating in protected areas that are refuges for seabirds</p> <p>Strategy should be in place to minimize seabird bycatch and mortality</p>	1, 2
Universidad Veracruzana Dirección General de Investigaciones Instituto de Ciencias Marinas y Pesquerías	Enrique Velarde	18 June, 2016	Written	<p>There is no evidence of a robust and precautionary harvest strategy</p> <p>Issues with minimum size</p> <p>Need for strategy to mitigate bycatch of protected seabird species</p> <p>Need for an ecosystem approach for management of the fishery</p>	3-20

Table 36. Summary of Stakeholder Comments and Responses by Performance Indicator

No	Performance Indicator	Quote/Summary	Team Response (All comments by stakeholders were presented before or during the onsite-meeting, therefore they are part of the evaluation process and the resulting scores. No further change took place)
1	2.3.1 2.3.2 2.3.3	<p>“Elegant Cockerel (<i>Sterna elegans</i>) and Gaviota ploma (<i>Larus heermanni</i>), which are in the risk category Species Subject to Special Protection in accordance with NOM-059-SEMARNAT-2010 [...] have stopped nesting for three years; mainly in Isla Rasa, decreed since 1964 as a Natural Reserve and Bird Refuge Area [...] Whereas such lack of nesting in birds (<i>Sterna elegans</i> and <i>Larus heermanni</i>) is related to lack of food, which mainly includes juveniles of the sardine Monterrey (<i>Sardinops sagax</i>); and that the lack of presence of Monterey sardine juveniles in the areas where such bird species feed, is related to the sum of effects of large-scale oceanographic phenomena, such as El Niño, and fishing targeting this forage species</p> <p>[...]Therefore, this Advisory Council of the Joint Federal Protected Natural Areas previously mentioned, REQUESTS that in the assessment of the sardine fishery for re-certification, consideration is give as a potential condition the abstention of sardine fishing (especially of juvenile organisms) in waters included within the polygons of the Marine Biosphere Reserve Zone of Bahía de los Ángeles, Canales de Ballenas and Salsipuedes, and of the Marine Area of the National Park of the San Lorenzo Archipelago, to help the populations of these seabirds recover their nesting levels more quickly, by removing the pressure of this factor”</p>	<p>This comment relates to PI 2.3.1 Slc requiring at SG80 that: <i>Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts</i>. The assessment team examined potential competition of fisheries and seabirds for small pelagics under PI 2.3.1 Slc, but no changes were made to scoring. The assessment team agrees there is a correlation between trends in Pacific sardine biomass and predator abundance. What we considered has not been established beyond assumption, is that trends in predator abundance are the consequence of harvest intensity. On the contrary, the evidence presented at the onsite-meeting supports the alternative hypothesis that the environment is the main driver of Pacific sardine biomass variability and that all predators, including the fishing fleet, only follow the trend in fish abundance and hence the correlation. Furthermore, trends of exploitation rates for Pacific sardine and thread herring indicate that the fishery has never exceeded the threshold for ecosystem function estimated by Arreguin-Sanchez et al. (2016a; 2016b)</p> <p>Species such as the elegant tern are species that could be affected if juvenile fish were targeted by the fishery around the islands in the protected areas of interest by the Advisory Board. However, no evidence was provided to the assessment team to verify that the fleet is applying significant effort inside the protected areas, removing mostly juvenile fish to the extent that it could represent a risk to create unacceptable impacts. At a minimum, it would be useful to have evidence showing the total and relative catch of juvenile fish by blocks of area and time superimposed with the distribution of the birds emphasizing breeding areas. It should be expected that the variability in effort inside the protected areas removing juvenile fish should at least correspond to trends in bird survival or abundance along a sufficiently large span of time to</p>

			<p>determine that at least the correlation exists. On the contrary, the evidence indicates that effort in the protected areas is low and that juvenile fish are generally avoided. The assessment team examined available evidence and did not include a condition as requested because there was no SI under SG80 for PI 2.3.1.</p> <p>Nevertheless, a recommendation was included in PI 2.3.2 SIc to provide more details about the amount of juvenile fish removals by volume, time and location.</p>
2	2.3.1 2.3.2	<p>“Considering many birds of the species commonly known as brown pelican (<i>Pelecanus occidentalis californicus</i>), which are in the risk category Threatened Species NOM-059-SEMARNAT-2010, are caught incidentally and die during the fishing operations directed at the Monterrey Sardina, as indicated by the results of the Observers program on board such vessels (Morgan and Álvarez-Flores, 2015) [...] this advisory Council of the Joint National Protected Areas, REQUESTS also that within the assessment of the sardine fishery for re-certification, it is included, as a condition, the establishment of a strategy to eliminate or reduce to its minimal expression, by-catch of seabirds, mainly brown pelican (<i>Pelecanus Occidentalis californicus</i>)”</p>	<p>This comment pertains to PI 2.3.2 SIa requiring that “There is a partial strategy in place that is expected to ensure the fishery does not hinder the recovery of ETP species.”</p> <p>The assessment team reviewed the available evidence and concluded that there are measures in place expected to mitigate the impact of the fishery on brown pelicans (observer program and water curtains). However, the assessment team considered that despite progress, the strategy has not been fully established and therefore a condition was placed in PI 2.3.2 SIc requesting that, by the second annual surveillance, the client shall present some evidence that the partial strategy for managing brown pelicans and blue-footed boobies is being implemented successfully.</p>
3	1.1.3	<p>Since the record catch of Pacific Sardine of ca. 525,000 metric tons (MT), of the fishing season 2008/9, the catches started falling at a rate of about 50% per year, until 2013 [...] fishing effort continued for two more fishing seasons with no evidence from the industry to reduce fishing effort or any attempt for stock rebuilding, precipitating a collapse till catches reached less than 1% of the record catch 5 years before. The lack of effective, dynamic, management lead to drastic falls in catch volume repeatedly in the last decades (1992, 1998, 2003), the last of which was the above mentioned in 2008/9 fishing season.</p>	<p>All evidence at hand indicates that the referred drop in the catch is not related to depletion caused by overexploitation, therefore there is no requirement for a stock rebuilding strategy. For more details on stock status see PI 1.1.1.</p>

4	1.2.1	<p>The declines in catches never led to control measures in time.</p> <p>There is no evidence of a robust and precautionary harvest strategy. During the collapses of the fishery, and particularly this last collapse, fishing effort did not decrease, precipitating the collapse of the fishery.</p>	<p>During the onsite-meeting this issue was acknowledged by all participants. The fishery needs to learn from the history that has been quite consistent and respond earlier not only until the drop in Pacific sardine biomass is underway but before the maximum of the cycle is reached. Participants agreed that this is an area of improvement and that research will focus on a potential solution. Further, the finding was that although the majority of occasions the biologically acceptable catch was not exceeded by the actual catch, the system must work in a way that the Biological Acceptable Catch (BAC) is first determined and then, as the season progresses, the fishery must have a mechanism to stop operations as the BAC is approached. This process has not been fully implemented and therefore the fishery cannot be responsive to the state of the stock. This situation led to a condition to meet PI 1.2.1 Sla at SG80 that the harvest strategy is responsive to the state of the stock.</p>
5	1.2.1	<p>Furthermore, there is now a proposal of a modification of the Official Norm for forage fish fishery NOM 003, which includes, among other things, the elimination of the legal size for the various species that it takes. This point is in total disagreement with a precautionary approach to the harvest strategy.</p>	<p>Regardless of the debate that prevails among small pelagics experts on the need to have a minimum legal size restriction, it should be noted that the draft revision of the NOM does not consider eliminating the size restriction but to develop a dynamic strategy to determine the characteristics of the restriction. And yet, the MSC evaluation cannot make any type of judgment based on actions that have not taken place. The revised NOM is still in the final review stages and until it is published in the official gazette we cannot use its content to support rationales in any PI.</p> <p>The comment didn't influence the score.</p>
6	1.2.1	<p>Another point that goes against a precautionary harvest of the sardine is the fact that there is a requirement for a 30% tolerance of sublegal catch, which refers to the catch of the whole fishing season. This allows for the catch of 100% sublegal size in most of the catches of boats operating in areas and times of the year where small and young recruit sardines occur, namely the Midriff Island Region, a region that has been shown to be a "REFUGIA" zone to many marine species, particularly during periods of low marine productivity.</p>	<p>While we do not imply this is inaccurate, we recommend that before assumptions such as this are presented as facts, data are assembled demonstrating the total and relative (to the total catch) catch of undersized fish obtained in the area of interest.</p> <p>So far the evidence we have is that pre-season surveys take place to assure that most effort would be directed to legal size fish. The data also indicate that effort inside these protected areas is small relative to total effort. Evidence also shows that when small fish show up once the season has begun, the fishery stops operations.</p>

			<p>Finally, whether any particular percentage is considered appropriate or not is not for the SCS assessment team to decide. We only consider the fact of whether a formal regulatory action is required and followed. Compliance to such regulations is evaluated in Principle 3.</p> <p>The comment didn't influence the score</p>
7	1.2.1	<p>The impact to the population and ecosystem is particularly negative when fishing boats are operating in the recruitment area of the species, in the Midriff Island Area, during the Spring and Summer months of the year, when the juveniles are found in this northern area of their distribution. The recommendation would be to substantially reduce fishing effort in the recruitment areas (Midriff Island Region), at least during the Spring and Summer months, when recruitment is happening</p> <p>[...] a very close relationship has existed at least between the Pacific sardine and several of its predators in the Gulf of California and renders it, undoubtedly, as a Key Low Trophic Level species in the area.</p>	<p>These two comments are closely related because the second highlights the importance of sardines in the ecosystem as key LTL species while the first implicates that the sardine fishery in the GoC, conclusively has an adverse effect on the stock and the ecosystem.</p> <p>While we do not dispute the importance of sardines in the GoC and the stock was assumed to be key LTL, the evidence provided to the assessment team indicates that the correlation between trends in sardine and predator abundance cannot imply that removals of fish are directly responsible for any type of response in the predator abundance. The evidence presented at the onsite-meeting supports the alternative hypothesis that the environment is the main driver of sardine biomass variability and that all predators, including the fishing fleet, only follow the trend in fish abundance and hence the correlation.</p> <p>While the issue raised in this comments was introduced in a section related to PI 1.2.1 (Harvest strategy), the implications of the reply are pertinent to PI 2.3.1 (ETP Species Outcome), 2.5.1 (Ecosystem Outcome) and 2.5.2 (Ecosystem Management Strategy), as well. The comment didn't influence the scores for 1.2.1 but was thoroughly investigated and was relevant in the determination of the Pacific sardine as constantly be considered a key LTL species. Accordingly, under 1.1.2 Sia the assessment team concluded that the limit and target reference points do not explicitly account for ecosystem needs failing to meet the standard at SG80. Likewise the absence of an 'in-place' partial strategy for Ecosystem management under PI 2.5.2 Sia did not meet SG80.</p>
8	1.2.4	<p>Although in past years, several meetings in this relation have been held and several experts in the different fields have participated, there is no known and peer-reviewed actual assessment of the stock until now.</p>	<p>The stock assessment presented at the 4th surveillance audit was internally and externally peer-reviewed and the report of such review was presented to the assessment team. Most recommendations in the peer review report were addressed to</p>

			<p>some degree in the last stock assessment presented at the onsite-meeting.</p> <p>The comment didn't influence the score</p>
9	1.2.4	<p>[...] fishery independent data should be used to assess the population biomass. The data available are hydroacoustics, spawning biomass and seabird diet composition. Although fishery independent data have been provided and the information is available, we presently have no knowledge of an actual stock assessment.</p> <p>The results of several seabird researches have shown that the seabird diet composition is an accurate predictor of the commercial fleet total catch and catch per unit effort. This information can provide a threshold value under which the fishing effort could be reduced in order to prevent collapses [...] this valuable information has not been integrated into the management process.</p>	<p>Last year's stock assessment used the ASAP method which allows, through the use of a likelihood approach, the inclusion of multiple indices of abundance that are fit to the predicted biomass trajectory (adjusted by rescaling factors). The indices included the sea bird data provided by the author of this comment and other four different fishery independent sources. This was done in last year's stock assessment and in the update presented at the onsite-meeting. The reports have been openly available to stakeholders. This comment didn't influence the score.</p> <p>The assessment team cannot advocate for the use of any particular methodology no matter how good it is. The assessment methodology that has been used in the latest two stock assessments is considered appropriate for the stock, the control rule, estimates stock status relative to reference points, takes into account uncertainty and was peer reviewed which was sufficient to get a score above SG80 in PI 1.2.4.</p>
10	1.2.4	After 1989, catches did not increase in relation to effort, and even decreased with increasing effort, signaling an over-exploited stock	<p>Not necessarily, in the case of the Pacific sardine, it signaled a reduced availability of the stock. The stock assessment does not indicate that the stock is over-exploited.</p> <p>The comment didn't influence the score.</p>
11	1.2.4	We believe that if catch is stabilized to a certain level not much higher than the 200,000 metric tons signalled by this analysis, relatively stable catch level may be reached and a precautionary approach will undoubtedly be in use	<p>We cannot advocate any particular approach to management of a stock subject to exploitation. However, the need to identify an anticipated time where catch should be adjusted to a potential future decline was discussed as a necessary improvement in the harvest strategy under PI 1.2.2, where a condition was placed. Whether the proposition in the comment is the most appropriate or not is for the technical group to discuss and decide.</p> <p>This comment is unrelated to PI 1.2.4</p>
12	2.2.2	In this case, a very high by-catch of California Brown Pelican and Blue-footed Booby (<i>Pelecanus occidentalis californicus</i> and <i>Sula nebouxii</i> (Figs. 2 and 3) both species listed in the Mexican protected species list: NOM-059-	This concern was introduced as part of assumed evaluation under 2.2.2, however, by definition, if the two species are under some type of national or international regime of protection, the problem

		SEMARNAT-2010) has been demonstrated, through the analysis of 1.5 years worth of data collected by the on-board observers program recently implemented. This information has been analyzed by seabird specialists with decades of experience in the region, and the results show that the mortality of these two species during fishing operations triples the natural mortality.	has to be evaluated under Pls 2.3.X in relation to Endangered, Threatened and Protected species. The issue is discussed below in the corresponding section.
13	2.3.1	<p>Following the issue in the preceding box related to PI 2.2.2: In this case, a very high by-catch of California Brown Pelican and Blue-footed Booby [...] results show that the mortality of these two species during fishing operations triples the natural mortality.</p> <p>Our primary concerns specifically relate to the California Brown Pelican and the Bluefooted Boobie (<i>Pelecanus occidentalis californicus</i> and <i>Sula nebouxii</i>). These are the major species observed suffering the highest negative sardine by-catch effects. Natural adult seabird survival is generally high (for example, for Brown Pelicans from the Gulf of California, adult survival has been found to be high, ~95%/year once adulthood is reached at 3-5 years of age; D. W. Anderson, pers. comm.), while their breeding rate is normally very low, and highly variable. This makes them extremely susceptible to factors that may affect their adult survival, such as mortality or lethal affectation during fishing operations. [...]</p> <p>One of the highest effects with the sardine fishing operations is through the oiling of the seabirds. Fish oils have been shown to be even more detrimental than petroleum oils for the health and recovery of seabirds (Morandin & O'Hara, 2014, Science of the Total Environment 496: 257-263) [...]</p>	<p>The first aspect to consider in relation to the assumed impact on seabird populations is that, evidence on fishery related mortality from observer data, in particular, that of brown pelicans due to oiling, is contradictory and has not been established unequivocally.</p> <p>There is no MSC guidance regarding what type of evidence are considered valid, however, due to the magnitude of the assumed unobserved mortality, the assessment team observes that:</p> <p>A) Direct mortality unequivocally observed was expanded to the entire fishery by means of a simple direct linear extrapolation, which was deemed as inappropriate because strata in bird distribution and vulnerability were not considered. Therefore, total number of birds killed is in reality unknown and as of today.</p> <p>B) If oiled birds are assumed to die, the resulting number (16,000 for the entire fleet in one fishing season, noting that Anderson et al 2013 estimated for the midriff are in the GoC a population of 17,200 breeding pairs) presents an intrinsic inconsistency in the assumption because if used directly in a population model, either this number of birds killed, or an assumed tripled bycatch mortality are applied for 45 years of operation of this fishery, such high level of bycatch must have eradicated any bird species long ago.</p> <p>The team accounted for the documented effect of fish oil and the connection made by the submitting stakeholder with the assumed pelican mortality to decide whether there was enough merit in the concern to influence scoring. It should be noted that the requirement is that direct impacts are highly unlikely to cause unacceptable impacts, where the term <i>unacceptable impacts</i> means that <i>the fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species</i>. These definition implies that if there is an impact from the fishery, the impact is such that the fishery is directly responsible for driving the population down at a rate that extinction is imminent or is not</p>

			<p>allowing recovery to the extent that it will remain endangered risking extinction.</p> <p>The team further observed that while there is evidence that feather structure is affected when exposed to fish oil, under experimental conditions motivated to address concerns over impacts from oil discharges of fish processing (Morandin and O'Hara, 2014). There is no verifiable anecdotal evidence that fishing operations results in exposure of seabirds to oil concentrations as high as those caused by an oil discharge from a processing plants or vessels. Furthermore, a preliminary study of oil concentration in the small pelagic fishery in the southern Gulf of California, concluded that fishing operation/maneuver has no effect on oils concentration in water and that average values of oil are low and unlikely to pose a harm to birds (Cervantes-Jacob et al 2016b).</p> <p>Due to the lack of verifiable evidence, beyond anecdotal evidence, that exposure to fish oil during fishing operations affects survivorship of seabirds, the assessment team did not consider this as a certain source of mortality when scoring the ETP species outcome (PI 2.3.1). However, because seabirds are vulnerable to fishery activities, and there is an important overlap of breeding colonies in the fisheries operation area, the assessment team recognized that the available information is not sufficient to quantitatively estimate mortality of seabirds and to assess the threat level. Conditions addressing this issue were placed on PI 2.3.3</p> <p>As discussed before, if oiled birds in the sardine fishing operations in the GoC were killed to the extent that the population was seriously or irreversibly damaged, the population would be extinct by now. Nevertheless, assuming there is a different but still unknown level of impact, the team observed that pelicans in the GoC are part of a population that was recently delisted from the ESA in the US state of California because it was considered that the population had recovered. The stakeholder argued at the onsite-meeting that there is a metapopulation structure and that the unit from the GoC was not affected by such recovery which had to be taken as evidence of the impact caused by the fishery. The paper that the stakeholder refers to (Anderson et al 2013) is very clear</p>
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			<p>that the referred metapopulation is a <i>presumed structure</i> that <i>should be considered preliminary and subject to future testing</i>. However, two aspects can be mentioned, the paper by Anderson and co-workers considers that the putative unit in the GoC is the most abundant of all and that, coinciding with the stakeholder and all other available evidence, is sensible to the high variability of environmental conditions in the Gulf.</p> <p>Summarizing, with these elements the team concluded that:</p> <ol style="list-style-type: none"> 1. Seabird populations in the GoC fluctuate together with the availability of their prey following environmental conditions. 2. Information on the actual effect of oiling and the potential to cause unacceptable mortality levels is missing and the evidence at hand does not support the existence of critical mortality levels. <p>Although the issues raised by the stakeholder did not result in a score that reflects the concerns, the issues were thoroughly investigated and discussed.</p> <p>In the absence of detailed scientific information to allow fishery related mortality and the impact of fishing to be quantitatively estimated for brown pelicans and blue footed boobies the assessment team placed a condition in PI 2.3.3 for the fishery to provide better quantitative estimate <i>all</i> fishery related mortality and the impact of the fishery for ETP seabird species</p>
14	2.3.2 [2.2.2]	<p>There is, at present, no implemented strategy to correctly manage, evaluate and eliminate or, at least, greatly reduce, this high by-catch [of California Brown Pelican and Blue-footed Booby] and there are important factors about the biology of these species to take into consideration, in order to realize that it is of extreme urgency to implement methods in order to prevent the very high mortality that they are incurring through this fishery, which will result in severe decreases in these species populations in the short to mid-term.</p> <p>A prevention strategy must be in place, including methods to mitigate the bycatch and a continued on-board observers' program that evaluates the success of the actions and strategy [...]</p>	<p>It is our understanding that the stakeholder, together with other experts, including Dr. Martin Hall, bycatch expert from the IATTC, have worked together with other stakeholders towards this end. We have evidence that efforts are already underway to reduce whatever level of bycatch truly occur in the fishery. These efforts include reinstallation of the observer program and implementation of mitigation measures such as the water curtains suggested by the stakeholder. We agree that the development of the strategy must be closely monitored to evaluate its effectiveness and determine areas of improvement.</p> <p>The comment is in agreement with other considerations leading to a condition on PI 2.3.2 requiring the successful implementation of a</p>

			partial strategy that is expected to ensure the fishery does not hinder the recovery of ETP species.
15	2.2.3	It was also stipulated that “approximately 10% of the fishing fleet and about 10% of the fishing trips would be covered by observers”, and that “if the peer review shows that the design of the program is not adequate, a revised program will need to be implemented in an appropriate timeframe, so that scientific rigor can be shown as required by the condition”. At present, and although the data show a high by-catch of seabirds, the observers’ program has ceased and, no actions have been taken to eliminate bycatch. Therefore, the 10% coverage to which both the fisheries authorities and the industry committed during the first stage of this process is not being complied with.	As mentioned before, the assessment team received evidence that the observer program will resume in the fishing season following the onsite-meeting. The concern of the stakeholder is being addressed by the condition placed on PI 2.3.2
16	2.5.2	It has become apparent that management of small pelagic fishes, and especially that of the Pacific sardine, should follow a precautionary approach [...]The recommendation is that a dynamic management decision making is put in place, which integrates all possible stock evaluation methods at our disposal, most importantly those that are fishery independent, as well as one that takes into consideration both the effects of environmental fluctuations on the stock, and the needs of all the components of the ecosystem before allotting a proportion of the evaluated stock to the fishery. Only through this means will the fishery reach a sustainable condition.	Evidence presented at the onsite-meeting, based on ecosystem modeling indicates that harvest rates have been historically far below the level that would cause serious or irreversible damage to the ecosystem (Arreguin-Sanchez et al. 2016a; 2016b). The assessment team identified shortcomings in the implementation of the harvest strategy and harvest control rule under Principle 1 while the SFMP identifies the need for reference points to account for the protection of the marine ecosystem. Consequently conditions were placed in PIs 1.2.1 and 1.2.2, and a condition placed was on PI 2.5.2 Sla requesting some evidence that the measures comprising the partial strategy are being implemented successfully.
17	2.5.2	[...] management of small pelagic fishes, and especially that of the Pacific sardine, should follow a precautionary approach [...] This is a crucial step in the management of this most important forage fish species. Such management can not be done using Catch Per Unit Effort (CPUE) of the fishery as a reliable measure of its abundance [...] This seems to be the case for the Pacific sardine fishery in the Gulf of California, and strongly suggests that there should be a quota fixed for the sardine fishery, and other small-pelagic fishes, in order to prevent a future resource or ecosystem crisis.	<p>We don't have evidence that the sardine fishery in the GoC is assessed or managed using [commercial] CPUE as a reliable measure of abundance. The stock assessment used 5 different indices of abundant that are independent from the fishery. These indices include a CPUE from surveys independent of the fishery [i.e. they do not use commercial catch and effort data], and bird data provided by the stakeholder.</p> <p>With regard to the proposition that the fishery should be managed under the approach of a fixed quota, even if the assessment team would interpret that the stakeholder to mean <i>fixed limit</i> (fixed quotas are well known by fishery scientists to be inadequate), the approach is not considered appropriate for a stock that is highly variable. The current approach in the harvest strategy has a</p>

			<p>feedback mechanism that computes allowable catch depending on a fraction of the current estimated biomass. Shortcomings of the harvest strategy as currently operating have been discussed elsewhere and have led to conditions (e.g. in PI 1.2.1). The assessment team has also pointed the agreement that a more efficient system to anticipate stock biomass decline in their natural cycles is needed. We therefore consider that the issue has been properly addressed and noted. Scores are in alignment with the outlined criteria adopted by the assessment team and discussed extensively in these sections.</p>
18	2.5.3	<p>Not much information exists on this topic [impacts of the fishery on the ecosystem] for the Gulf of California. However, in the last decade, several studies have demonstrated that heavy mortality from fisheries increases stock fluctuations [...] And, in a recent paper regarding this specific resource, Velarde et al. (2004 op. cit.) show that this is exactly what has been happening with the Pacific sardine catches in the Gulf of California. Furthermore, they show that the sardine also drops in the diet of three seabird species breeding in the region, 2-3 years before the drop in commercial sardine catches, rendering this parameter an excellent indicator of future declines in sardine catches by the fishing fleet (Velarde et al. 2013[...]) Therefore, the recommendation would be to establish a stable catch level in accordance to a precautionary approach, based on an estimate of healthy fishery level, considering both the effects of environmental fluctuations on the sardine population size, and the needs of the ecosystem components, using sound scientific and peer reviewed methods</p>	<p>The stakeholder refers to a paper by Essington et al (2015) that was further reviewed by Szuwalski and Hilborn (2015). The results of this review suggested that fishing plays little role in the dynamics of forage fish productivity. In response to Szuwalski and Hilborn, Essington and co-workers point that “[...] <i>fishing rates inadvertently increase during declines in population biomass, and that fishing does not directly incite these recruitment declines</i>. They also clarify that their paper <i>show that when forage fish undergo natural population fluctuations (i.e., recruitment declines), fishing acts to amplify the extent of collapse. That is, fishing deepens the troughs of population cycles. We do not claim that fishing causes collapses or that it precipitates declines in productivity, only that fishing does affect the biomass of forage fish in the system, which can have repercussions throughout the food web.</i>” Finally, Essington and co-workers point that <i>studies have shown that predators are most sensitive to forage fish depletion at low forage fish biomass and that these effects are highly nonlinear. Therefore, <u>fishing strategies need to avoid, to whatever extent possible, depleting stocks below critical ecological thresholds.</u> Identifying these thresholds remains an important priority for forage fish fisheries management.</i></p> <p>As mentioned before, the assessment team does not deny the importance of managing the fishery under a strategy that is aimed to maintain structure and function as required by the MSC requirements. However, the evidence that was presented to us indicates that the Pacific sardine stock in the Gulf of California has</p>

			<p>been harvested to a rate that is well below the threshold that would cause irreversible ecosystem structure and function.</p> <p>The assessment team has already placed a condition on PI 1.1.2 SId requesting the client provide evidence that the target reference point for Pacific sardines takes into account the ecological role of the stock.</p>
19	2.5.3	<p>In addition, Velarde et al. (2014b) in a seabird case study have further shown that the decline in the availability of their food will lead to an added stress factor for the seabird population, affecting their long term breeding success, leading to a steady population decline, evident only after some years [...] This added stress could be the reduction in food availability, the increased adult mortality in fishing operations or, even worse, both factors simultaneously.</p>	<p>Once again, there are two correlated processes occurring simultaneously, seabird population variability and sardine fishery operations. However, there is no evidence that the action of fishery determines the trends in seabird populations, only that trends in seabird abundance and catch are correlated. Therefore, the only thing certain is that they closely follow each other but that cannot lead to the conclusion that one is caused by the other.</p> <p>On the contrary, the evidence that has been discussed so far indicates that fishing is highly likely to be unrelated to the trends in seabird populations.</p>
20	P3	<p>A final recommendation would be that the Technical Research Committee is incorporated to the review of the management plan for small pelagic fishes. At present, there is a total lack of ecosystem considerations in the existing plan and it is my belief this aspect needs to be considered and included in the reviewed version, just as the ecosystem perspective is integrated and used in the most recent and advanced management strategies around the world, if a sustainable use of a resource and the whole ecosystem is the goal.</p>	<p>Members of the Technical Research Committee have been present at surveillance audits and the onsite-meeting and have been a critical part of the discussions. Also, as previously mentioned, ecosystem management is not yet a formal part of the harvest strategy and the scores reflect this shortcoming. However, the evidence indicates that despite this problem, the fishery has harvested the sardine stock below the estimated level that would cause serious or irreversible damage to the ecosystem.</p>

Letter from the *Consejo Asesor del Conjunto de Áreas Naturales Protegidas Federales*



Bahía de los Ángeles, Ensenada, Baja California, a 14 de julio 2016

ASUNTO: Solicitud del Consejo Asesor de ANP

**DR. CARLOS ÁLVAREZ-FLORES Y
DRA. SANDRA ANDRAKA
GRUPO DE RE-CERTIFICACIÓN SCS
PRESENTES**

En referencia a la re-certificación de la pesquería de sardina Monterrey (*Sardinops sagax*) del Golfo de California dentro del programa del *Marine Stewardship Council* (MSC), como parte de la consulta a los interesados (stakeholders), y con fundamento en los artículos 17 y 18 fracciones I, IV, V, VI y IX del Reglamento de la Ley General del Equilibrio Ecológico y la Protección al Ambiente en Materia de Áreas Naturales Protegidas; el Consejo Asesor del Conjunto de Áreas Naturales Protegidas Federales, integradas por el Área de Protección de Flora y Fauna Islas del Golfo de California en Baja California, la Reserva de la Biosfera Zona Marina de Bahía de los Ángeles Canales de Ballenas y de Salsipuedes, y el Parque Nacional Zona Marina del Archipiélago de San Lorenzo, hacemos de su conocimiento las siguientes CONSIDERACIONES y SOLICITUDES:

PRIMERO.- Considerando que las aves marinas conocidas comúnmente como Gallito o Charrán elegante (*Sterna elegans*) y Gaviota ploma (*Larus heermanni*), que se encuentran en la categoría de riesgo *Especie Sujeta a Protección Especial* de conformidad con la NOM-059-SEMARNAT-2010, y consideradas especies indicadoras de la salud ecológica en las Áreas Naturales Protegidas marinas referidas, habían venido anidando en las islas pertenecientes al Área de Protección de Flora y Fauna Islas del Golfo de California en Baja California, bajo nuestra responsabilidad, han dejado de anidar desde hace tres años; principalmente en Isla Rasa, decretada desde 1964 como Zona de Reserva Natural y Refugio de Aves, para la protección de las colonias de dichas aves por concentrar más del 90% de su anidación mundial.

SEGUNDO.- Considerando que dicha falta de anidación en las aves (*Sterna elegans* y *Larus heermanni*) está relacionada con la falta de alimento, el cual incluye principalmente a juveniles de la Sardina Monterrey (*Sardinops sagax*); y que la falta de presencia de juveniles de sardina Monterrey en las áreas en donde se alimentan dichas especies de aves, está relacionada con la suma de los efectos de fenómenos oceanográficos de gran escala, como es El Niño, y por la pesca de esta especie de forraje.

TERCERO.- Considerando los resultados de la última auditoría de la pesquería de sardina (Morgan y Álvarez-Flores, 2015), y tomando en cuenta que dentro de los estándares del MSC se incluyen aspectos relacionados con la interacción de la pesquería con el ecosistema (Principio 2 del MSC).

CUARTO.- Por lo anterior, este Consejo Asesor del Conjunto de Áreas Naturales Protegidas Federales ya mencionadas, SOLICITA que dentro de la evaluación de la pesquería de sardina para su re-certificación, se considere como una posible condicionante la abstención de la pesca de sardina (sobre todo de organismos juveniles) en aguas comprendidas dentro de los polígonos de la Reserva de la Biosfera Zona Marina de Bahía de los Ángeles Canales de Ballenas y de Salsipuedes, y del Parque Nacional Zona Marina del Archipiélago de San Lorenzo, para coadyuvar a que las poblaciones de estas aves marinas recuperen



CONSEJO ASESOR DE LAS ÁREAS NATURALES PROTEGIDAS

APFF-Islas del Golfo de California-BC, RB-Bahía de los Ángeles canales de Ballenas y de Salsipuedes, PNZM-Archipiélago de San Lorenzo

los niveles de anidación de una manera más rápida, al quitar la presión de este factor. Esta medida que se solicita debe ser aplicada, en espera de que los procesos oceanográficos adversos dejen de tener su injerencia en el ecosistema, y por consiguiente se reanude la anidación del Gallito (*Sterna elegans*) y Gaviota pluma (*Larus heermanni*) en Isla Rasa (principalmente), por su importancia para el ecosistema marino de las ANP bajo nuestra responsabilidad.

QUINTO.- Considerando que muchas aves de la especie conocida comúnmente como pelicano pardo (*Pelecanus occidentalis californicus*), que se encuentran en la categoría de riesgo *Especie Amenazada* de conformidad con la NOM-059-SEMARNAT-2010, son capturadas incidentalmente y muertas durante las operaciones pesqueras de encierro dirigidas a la Sardina Monterrey, como lo señalan los resultados del programa de observadores a bordo de dichas embarcaciones (Morgan y Álvarez-Flores, 2015); y que dicha especie de ave es considerada como especie centinela para el ecosistema marino e insular, de conformidad con los Programas de Manejo de las ANP bajo la responsabilidad de este Consejo Asesor; asimismo tomando en cuenta que durante la última auditoría de la pesquería, se comentó sobre diversas estrategias de mitigación.

SEXTO.- Es por lo que, este Consejo Asesor del Conjunto de Áreas Naturales Protegidas Federales, SOLICITA también que dentro de la evaluación de la pesquería de sardina para su re-certificación, se incluya como una condición, el establecimiento de una estrategia que permita eliminar, o reducir a su mínima expresión, la captura incidental de aves marinas, principalmente pelicano pardo (*Pelecanus occidentalis californicus*).

Dicho lo anterior, quedando a sus órdenes para resolver cualquier duda relacionada a estas peticiones, y esperando que éstas sean atendidas durante el proceso de re-certificación de la pesquería, reciban ustedes un cordial saludo.

ATENTAMENTE

PRESIDENTE EJECUTIVO
DEL CONSEJO ASESOR

DR. ÓSCAR SOSA NISHIZAKI

SECRETARIO TÉCNICO
DEL CONSEJO ASESOR

MAIA. DOMINGO DE JESÚS ZATARAIN GONZÁLEZ

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Letter from the *Universidad Veracruzana Dirección General de Investigaciones Instituto de Ciencias Marinas y Pesquerías*



Universidad Veracruzana
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18 June, 2016

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Dear Carlos Álvarez:

Thank you so much for your invitation to participate in this meeting.

I would like to express my interest in participating in this meeting, because I have been following the evaluation and surveillance processes relating to the certification of the Pacific Sardine (*Sardinops sagax*) since 2007. I am a researcher at the Instituto de Ciencias Marinas y Pesquerías at Universidad Veracruzana and my contact information is included in the letterhead of this document. My e-mail address is: enriqueta_velarde@yahoo.com.mx. I am a seabird researcher and have been studying several seabird species mainly in the Midriff Island Region of the Gulf of California during the last 38 years and have focused mainly in their population dynamics, breeding and feeding ecology, distribution and genetics.

My research results show that seabirds are excellent indicators of the status of the population of the forage fish on which they feed, such as the Pacific sardine and Northern anchovy. We have also found that seabirds breeding success is a very good indicator of the effects of environmental conditions and fishing effort on the ecosystem, reflecting the factors that are most important in determining ecosystem dynamics. Also, some of my research has been devoted to analyse the effect of the condition of the sardine fishery in relation to the larger fish which are important in the artisanal fishery. Most recently, we have been able to show how the demographic histories of some forage fish in the Gulf of California, such as Pacific sardine and northern anchovy, are linked to the demographic history of some of its predators, such as some seabirds, demonstrating a close relationship that has lasted for almost 200,000 years, showing that some of these forage fish have undoubtedly been Key Low Trophic Level Species for hundreds of thousands of years.



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I truly believe that some progress has been made towards the objectives drawn in the agreement reached during the meeting between the industry and INAPESCA with the objection group in 28 June 2011. An initial observers program was under way for 1.5 years between 2013 and 2014 but, regrettably was not continued. Some meetings were held to determine a method to estimate the Pacific sardine stock of the region. COBI has been instrumental in this progress and all participants have been cooperating in this direction. Data have been provided by all the different research sectors (hydroacoustic, egg and larvae and seabird studies) which will provide fisheries-independent data for the stock estimate in the future. Some of the initial concerns are still valid though, and I believe they need to be considered for future work, in the view to continue in the path of common work towards achieving a sustainable fishery. In this sense, we want to express our concern regarding 'rational use' of this fish stock (see Holt and Talbot, *iNew Principles for the Conservation of Wild Living Resources*, J Wildl Manag 43, Supplement, 33 pp).

Here I follow the different points in accordance with the MSC evaluation tree, including adjustments relating to considerations for Key Low Trophic Level species. I will focus only on the main issues, in order to make the best use of my arguments and I will only be referring to the Pacific Sardine (*Sardinops sagax*), which I consider, due to its extremely relevant role in the Midriff Island Area and Guaymas Basin ecosystem:

Principle 1

PI 1.1.3 Where the stock is depleted there is evidence of stock rebuilding.

Since the record catch of Pacific Sardine of ca. 525,000 metric tons (MT), of the fishing season 2008/9, the catches started falling at a rate of about 50% per year, until 2013, when they reached slightly over 3,000 MT, and have stayed between 3,000 and 4,000 MT until the last season. Even after the catch reached 83,600 MT, close to half the historic average of the fishery, fishing effort continued for two more fishing seasons with no evidence from the industry to reduce fishing effort or any attempt for stock rebuilding, precipitating a collapse till catches reached less than 1% of the record catch 5 years before.

The lack of effective, dynamic, management lead to drastic falls in catch volume repeatedly in the last decades (1992, 1998, 2003), the last of which was the above mentioned in 2008/9 fishing season. As mentioned before, in any of these instances, the declines in catches never lead to control measures in due time, well before this collapse occurred. On the contrary, the fleet continued to operate until sardines were no more available to the fleet, and had long since disappeared from the diet of sentinel forage fish feeding species, such as several seabirds, that the management system finally adopted a moratorium to the fishery (<http://sardinagolfodecalifornia.org/wp-content/uploads/2013/08/MINUTA-10DIC14-Y-PROPUESTA.pdf>).



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Gulf of California sardine fishery is far less precautionary than the management of the Pacific coastal sardine fishery. **Experience has shown that the catch needs to be greatly reduced well before they are in danger of dropping to virtually zero** (MacCall et al. 2012. Weak evidence for sardine collapse. *Proc Natl Acad Sci*, www.pnas.org/cgi/doi/10.1073/pnas.1203526109).

PI 1.2.1 There is a robust and precautionary harvest strategy in place.

There is no evidence of a robust and precautionary harvest strategy. During the collapses of the fishery, and particularly this last collapse, fishing effort did not decrease, precipitating the collapse of the fishery. Furthermore, there is now a proposal of a modification of the Official Norm for forage fish fishery NOM 003, which includes, among other things, the elimination of the legal size for the various species that it takes. This point is in total disagreement with a precautionary approach to the harvest strategy.

Another point that goes against a precautionary harvest of the sardine is the fact that there is a requirement for a 30% tolerance of sublegal catch, which refers to the catch of the whole fishing season. This allows for the catch of 100% sublegal size in most of the catches of boats operating in areas and times of the year where small and young recruit sardines occur, namely the Midriff Island Region, a region that has been shown to be a "REFUGIA" zone to many marine species, particularly during periods of low marine productivity.

Even studies of genetics and historical demography of the Pacific Sardine within the Gulf of California, it has been shown that for the last couple hundreds of thousands of years (ca. 175,000 years), the species has used the Midriff Island Region as a REFUGIA area, where it has withstand severe periods of low marine productivity (Lecomte et al. 2004, Living with uncertainty: genetic imprints of climate shifts in East Pacific anchovy (*Engraulis mordax*) and sardine (*Sardinops sagax*). *Molecular Ecology* 13:2169–2182).

Importance of REFUGE ZONES: It has been shown that, during the geologic history of the species (which has inhabited the region for over 200,000 years), its survival and endurance in the Gulf of California through milenias, has been supported mainly through its capacity to retire into natural refugia (Lecomte et al. 2004, op.cit.). In the case of population reductions, either due to oceanographic anomalies or overfishing, an optimal alternative would be to strongly diminish the fishing effort, particularly within the identified refuge zones, such as the Midriff Island Region.



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Citing authors such as Lecomte et al. 2004, op. cit., who have studied the genetic imprints of climate shifts in small pelagic fish such as Pacific sardine, they indicate that:

"Wildlife management must consider the prosperity of individual species, as well as the ecosystems that support these species. While there is little chance of benignly altering the physical processes that create healthy upwelling ecosystems, the implementation of harvest limits can allow local subpopulations to reseed themselves over the short-term. On longer timescales, the conservation of these pelagic species depends on an understanding of micro-evolutionary processes, specifically the role of the refuge basins that allows persistence of a core population. Disruption of the core population could be a recipe for collapse and extinction."

The impact to the population and ecosystem is particularly negative when fishing boats are operating in the recruitment area of the species, in the Midriff Island Area, during the Spring and Summer months of the year, when the juveniles are found in this northern area of their distribution. The recommendation would be to substantially reduce fishing effort in the recruitment areas (Midriff Island Region), at least during the Spring and Summer months, when recruitment is happening.

This is also an important seabird nesting area, where several million seabirds of different species breed (Velarde et al. 2005, Nesting seabirds of the Gulf of California's Offshore islands: diversity, ecology and conservation. Pp. 452-470, in: J.L.E. Cartron, G. Ceballos y R.S. Felger (eds.) Biodiversity, Ecosystems, and Conservation in Northern Mexico, Oxford University Press, New York). Recent genetics and demographic history studies have shown that the Pacific sardine and northern anchovy have had population expansions during the last couple of hundreds of thousands of years, which precede or occur almost simultaneously with the population expansions of some of its predators such as fishing bats and seabirds (Lecomte et al. 2004, op. cit., Mejia et al. 2011, Effective population size dynamics of *Myotis vivesi* during the Pleistocene and Holocene climatic changes. Acta Chiropterologica 13:33-40, Ruiz et al. in press, Demographic history of Heermann's Gull *Larus heermanni* (Charadriiformes: Laridae) from late Quaternary to present: Effects of past climate changes in the Gulf of California, The Auk). This shows that a very close relationship has existed at least between the Pacific sardine and several of its predators in the Gulf of California and renders it, undoubtedly, as a **Key Low Trophic Level** species in the area.

PI 1.2.4 There is an adequate assessment of the stock status.

Although in past years, several meetings in this relation have been held and several experts in the different fields have participated, there is no known and peer-reviewed actual assessment of the stock until now.



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Also, the condition states that fishery independent data should be used to assess the population biomass. The data available are hydroacoustics, spawning biomass and seabird diet composition. Although fishery independent data have been provided and the information is available, we presently have no knowledge of an actual stock assessment.

The results of several seabird researches have shown that the seabird diet composition is an accurate predictor of the commercial fleet total catch and catch per unit effort. This information can provide a threshold value under which the fishing effort could be reduced in order to prevent collapses. There will certainly be reductions of some smaller magnitude due to the intrinsic fluctuating nature of the populations of these small pelagic fishes, but the reductions would be minimal as they were in the past when overfishing had not yet started (e.g. before the first collapse starting with the record catch in 1989). Before this year catches increased in direct relation to effort, indicating a sound stock. After 1989, catches did not increase in relation to effort, and even decreased with increasing effort, signalling an over-exploited stock (Velarde et al. 2004, Seabird ecology, El Niño anomalies, and prediction of sardine fisheries in the Gulf of California. *Ecological Applications* 14(2):607-615). However, this valuable information has not been integrated into the management process.

Pacific sardine stocks are well known to fluctuate at a decadal scale, increasing when the overall oceanographic regime is warm and decreasing when it is cold, as it has been recently (e.g., Lindegren, M. et al. 2011. Climate, fishing, and fluctuations of sardine and anchovy in the California Current. *Proc Natl Acad Sci*. www.pnas.org/cgi/doi/10.1073/pnas.1305733110; Zwolinski & Demer. 2012. A cold oceanographic regime with high exploitation rates in the Northeast Pacific forecasts a collapse of the sardine stock. *Proc Natl Acad Sci*, www.pnas.org/cgi/doi/10.1073/pnas.1113806109). Given what has been learned of these fluctuations and the effect of increasing fishery mortality especially when the stock is in decline has led to a great deal of caution in the management of Pacific sardine fishery along the Pacific coast (Parrish, R.H. 2002. A Monterey Sardine Story. Unpubl. Report, Pacific Fisheries Environmental Group, NMFS, Monterey; MacCall et al. 2012. Weak evidence for sardine collapse. *Proc Natl Acad Sci*, www.pnas.org/cgi/doi/10.1073/pnas.1203526109). In fact, because of the last cold regime, and the decrease of the Pacific stock of sardines, regardless that it still fluctuates from year to year, the Pacific Fisheries Management Council recently closed the fishery for the West Coast of Canada and the US (mortality (<http://www.npr.org/blogs/thetwo-way/2015/04/16/400177895/feds-place-commercial-sardine-fishing-on-hold-for-more-than-a-year>)).



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Again, no precautionary action has been observed for the Gulf of California Pacific Sardine fishery, until its catches are practically absent. We believe the return of these stocks would be more certain and faster if a precautionary approach was undertaken at an earlier, more opportune moment. Some of our analysis show that there is a basically stable level of the Pacific Sardine stock, even when there are some environmental (climatic and oceanographic) factors influencing it, as we know happens (Fig. 1). These models show fluctuations occurring around a certain level, which indicates the likely limit of the stock. This is a level indicative of the capacity of recovery of the sardine population, and that catches should not surpass this limit. This is reinforced by the fact that when the fishery first surpassed this limit after the fishing season 1985/86, the strong positive correlation of the catch with the effort was lost (Velarde et al. 2004, op. cit.) and strong fluctuations in catch started to occur every time there was an El Niño Southern Oscillation.

We believe that if catch is stabilized to a certain level not much higher than the 200,000 metric tons signalled by this analysis, relatively stable catch level may be reached and a precautionary approach will undoubtedly be in use:

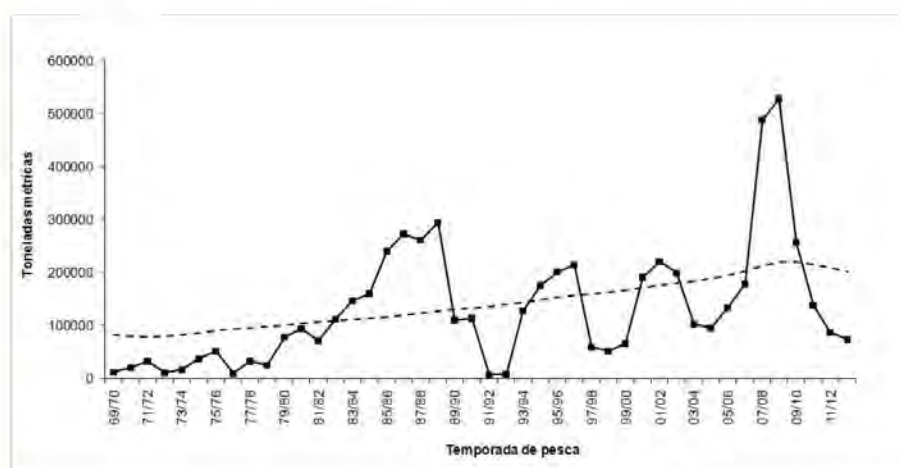


Figure 1. Historical catches of Pacific sardine by the Sonora fleet (1969-2013 (■), indicating the long term tendency represented by the discontinuous line (---), estimated by the Singular Spectrum Analysis method (SSA).



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Therefore, the recommendation would be to establish a stable catch level in accordance to a precautionary approach, based on an estimate of healthy fishery level, considering both the effects of environmental fluctuations on the sardine population size, and the needs of the ecosystem components, using sound scientific and peer reviewed methods.

Principle 2

PI 2.2.2 There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations.

In this case, a very high by-catch of California Brown Pelican and Blue-footed Booby (*Pelecanus occidentalis californicus* and *Sula nebouxii* (Figs. 2 and 3) both species listed in the Mexican protected species list: NOM-059-SEMARNAT-2010) has been demonstrated, through the analysis of 1.5 years worth of data collected by the on-board observers program recently implemented. This information has been analyzed by seabird specialists with decades of experience in the region, and the results show that the mortality of these two species during fishing operations triples the natural mortality.

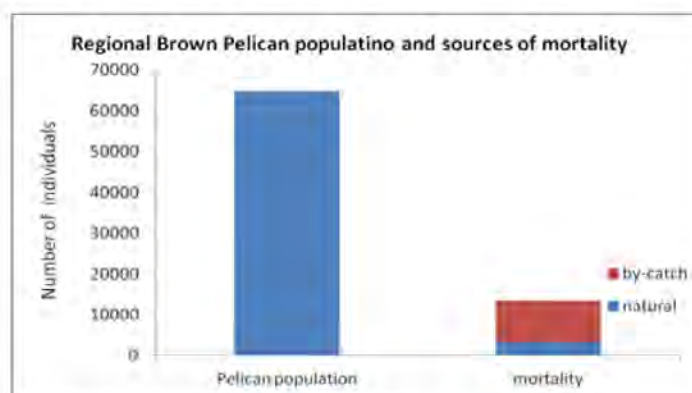


Figure 1. Regional population of California Brown Pelican (*Pelecanus occidentalis californicus*) in the area of influence of the sardine fishing fleet of Sonora, showing natural mortality and mortality estimated in by-catch during fishing operations in 2013/14.

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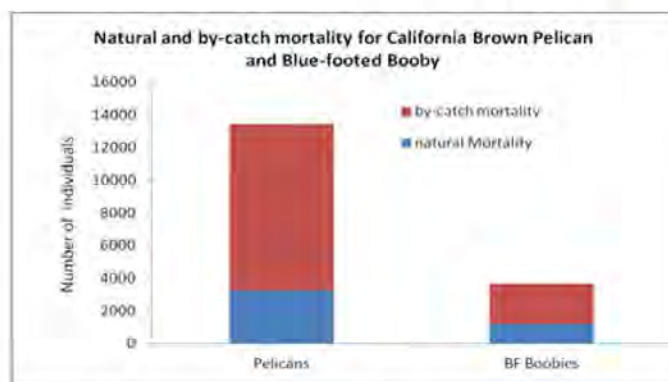


Figura 2. Estimated natural mortality and mortality through by-catch for the California Brown Pelican (*Pelecanus occidentalis californicus*) and Blue-footed Booby (*Sula nebouxi*) in the area of influence of the sardine fishing fleet of the state of Sonora.

There is, at present, no implemented strategy to correctly manage, evaluate and eliminate or, at least, greatly reduce, this high by-catch and there are important factors about the biology of these species to take into consideration, in order to realize that it is of extreme urgency to implement methods in order to prevent the very high mortality that they are incurring through this fishery, which will result in severe decreases in these species populations in the short to mid-term. A prevention strategy must be in place, including methods to mitigate the bycatch and a continued on-board observers' program that evaluates the success of the actions and strategy.

It is of extreme importance here to note that seabirds have an extremely low breeding rate and are very susceptible to factors that may affect their survival (particularly adult survival). Seabirds are long lived species, with a high juvenile mortality rate, low adult mortality rate, late sexual maturation, low breeding rate, and the capacity to skip breeding in years when food conditions are poor and breeding failure is highly probable. This breeding strategy allow for a relative stability of the seabirds adult populations. This is due to several reasons, one of which is the experience needed to learn to find adequate amounts of food before being able to feed themselves and raise chicks, experience to acquire and defend nesting territories, both against individuals of the same species and, also, potential predators of eggs and chicks, etc. All these characteristics confer seabirds with a high degree of susceptibility to factors which increase adult mortality, such as that which occurs in the fisheries by-catch. The recent increase in the mortality of the adults can severely unbalance the population's structure and rate of population increase, causing a gradual decrease in the effective population size, which will be evident after a few years.



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This effects have already started to show, as seen in the following graphs (Figs. 4, and 5), that result from long-term monitoring of Brown Pelican nesting population, mainly in the Midriff Island Region.

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Figure 4. California Brown Pelican nest counts in nesting sites in the Midriff Island Region. El Niño years are excluded. Data kindly provided by D.W. Anderson.

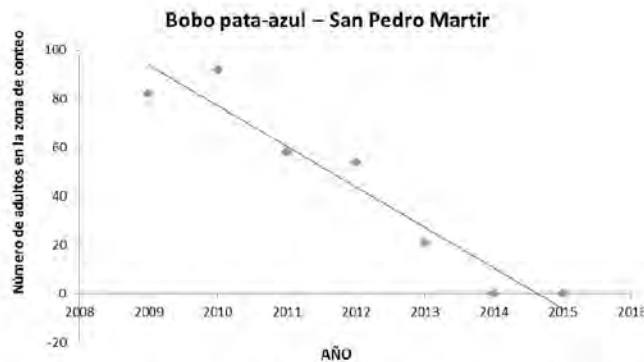


Figure 5. Counts of Blue-footed Booby individuals at nesting area in San Pedro Martir Island. Note decreasing tendency even if anomalous years of 2014 and 2015 are excluded. Data kindly provided by CONANP Guaymas.



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One of the most compelling and necessary strategies is the development and implementation of methods to prevent the incidental catch of non-target species such as seabirds, marine mammals, turtles, other fish and invertebrates, some of which are also commercially important in their own right, and importantly contribute to the local economies of many coastal communities as well as being also involved in important regional (both national and international) economic systems involving the now growing economic activity of ecotourism, among others. We note that MSC did not certify, for example, fisheries for Patagonian toothfish (*Dissostichus eleginoides*) until the issue of by-catch was solved (i.e. the fisheries around South Georgia, Kerguelen Island etc).

One of the highest effects with the sardine fishing operations is through the oiling of the seabirds. Fish oils have been shown to be even more detrimental than petroleum oils for the health and recovery of seabirds (Morandin & O'Hara, 2014, *Science of the Total Environment* 496: 257-263), and in fact some species of seabirds regurgitate/squirt stomach oil (rendered from their prey) as a defense against predators (Warham, J. 1990, The petrels, their ecology and breeding systems. Academic Press, London). Fish oil disrupts seabird feather microstructure and waterproofing. Various studies show that seabirds that have been exposed to fish oil lose their ability to repel water, float, thermoregulate or fly; and as a result, they cannot feed or accomplish normal activities, almost always dying within a few hours or days. It will be much more efficient, both for economic and ecological reasons, to prevent by-catch than, as in the case of seabirds, to have to develop a rescue and rehabilitation program, which would be much more costly and not as efficient, since it has been shown that fish-oiled birds that have been rescued and deoiled in attempts at rehabilitation, exhibit very low rates of survival in the long term (Jaques, D. 2014, Brown Pelican Injury Prevention Project: Northern California Harbors. Pacific Eco Logic report to the Kure/Stuyvesant Trustee Council, pp. ii and 33.).

Both the California Brown Pelican and the Blue-footed Boobie are two species included in the Mexican official Norm for protected species (NOM-059-SEMARNAT-2010) under the categories of THREATENED and UNDER SPECIAL PROTECTION, respectively. These are also migratory species that move to the Pacific Northwest during their non-breeding season and are listed under the Migratory Species Act. **Our recommendation** is that it is of outmost importance to implement effective and proven measures that help eliminate, or at least, greatly reduce the impact of the sardine by-catch of these and other species.



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PI 2.2.3 Information on the nature and amount of by-catch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage by-catch.

Information on the nature and amount of by-catch has allowed us to determine that there is a high risk mainly to California Brown Pelican and Blue-footed Booby, whose natural rate of mortality is tripled by the by-catch. However, there is at present no strategy to prevent this by-catch and evaluate the effectiveness of the method. There has been a commitment by the industry and fisheries authorities to a “rigorous and transparent process where the observers’ program may be peer reviewed by recognized experts in the field”. It was also stipulated that “approximately 10% of the fishing fleet and about 10% of the fishing trips would be covered by observers”, and that “if the peer review shows that the design of the program is not adequate, a revised program will need to be implemented in an appropriate timeframe, so that scientific rigor can be shown as required by the condition”. At present, and although the data show a high by-catch of seabirds, the observers’ program has ceased and, no actions have been taken to eliminate bycatch. Therefore, the 10% coverage to which both the fisheries authorities and the industry committed during the first stage of this process is not being complied with.

Also, there was a commitment for “the design of the observers’ program to be peer reviewed, and results of the program made available publicly, as part of the MSC surveillance audit process. Stakeholders would be invited to comment and contribute to the annual surveillance audits to provide comments that shall be addressed by the team”.

We believe that the above points need to be addressed and properly fulfilled.

PI 2.3.1 The fishery meets national and international requirements for protection of ETP species. The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species.

Our primary concerns specifically relate to the California Brown Pelican and the Blue-footed Boobie (*Pelecanus occidentalis californicus* and *Sula nebouxi*). These are the major species observed suffering the highest negative sardine by-catch effects. Natural adult seabird survival is generally high (for example, for Brown Pelicans from the Gulf of California, adult survival has been found to be high, ~95%/year once adulthood is reached at 3-5 years of age; D. W. Anderson, pers. comm.), while their breeding rate is normally very low, and highly variable. This makes them extremely susceptible to factors that may affect their adult survival, such as mortality or lethal affectation during fishing operations. These and other life history characteristics confer seabirds a high susceptibility to factors that increase adult mortality.



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This increase in the mortality of the adult Brown Pelicans and Blue-footed Boobies could severely disrupt population structure and stability, causing a gradual decrease in the effective population size, which will only be evident until after some years have passed. Yet, the highest long-term impact of sardine fishing operations on seabird by-catch is not so much through the direct mortality or injuries, but through the oiling of the seabirds, which may lead to mortality only after several days, due to the effect of oil on seabirds feathers, which hinder flight, thermoregulation and allow the plumage to be water logged, rendering them unable to thermoregulate causing hypothermia.

Both the California Brown Pelican and the Blue-footed Boobie are included in the Mexican Official Norm for protected species (NOM-059-SEMARNAT-2010) under the categories of THREATENED and UNDER SPECIAL PROTECTION, respectively. These are also migratory species, many breeding along the US West Coast and even from as far as the North American Arctic and they are included and protected internationally in the Migratory Bird Treaty Act between the U.S., Mexico, and Canada. It is of outmost importance to implement preventive measures that help prevent or, minimally greatly reduce the impact of the sardine by-catch on these and other migratory seabird species, as well as other migratory and resident Gulf of California species, found commonly nowhere else in the world, other than the Gulf of California.

It has been our experience that the industry and governmental agencies deny the problem, its importance, and the responsibility to solve the issue. Our recommendation is that the problem be acknowledged, methods for solving it be implemented, and an evaluation program put in place so that, if the initial measures to solve the problem are not adequate some others are designed, implemented and tested, until a proven and adequate solution is reached.

PI 2.5.2 There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function.

It has become apparent that management of small pelagic fishes, and especially that of the Pacific sardine, should follow a precautionary approach (Cury, P.M. et al. 2000, Small pelagic in upwelling systems: patterns of interaction and structural changes in "wasp-waist" ecosystems. ICES J. Mar. Sci. 57: 603-618; Pikitch, E. et al. 2012. Little Fish, Big Impact: Managing a Crucial Link in Ocean Food Webs. Lenfest Ocean Program, Washington, D.C.; Pikitch, E. et al. 2014. The global contribution of forage fish to marine fisheries and ecosystems. Fish and Fisheries 15:43-64).

This is a crucial step in the management of this **most important** forage fish species.



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Such management can not be done using Catch Per Unit Effort (CPUE) of the fishery as a reliable measure of its abundance. Several studies have demonstrated that many small pelagic fishes aggregate more aggressively as their populations decline. Therefore, Total Catches will vary independent of CPUE, which will be extremely inconsistent, and uninformative of the state of the stock (Rose, G.A. and Kulka, D.W. 1999. Hyperaggregation of fish and fisheries: How catch-per-unit-effort increased as the northern cod (*Gadus morhua*) declined. Can. J. Fish. Aquat. Sci. 56: 118-127). This seems to be the case for the Pacific sardine fishery in the Gulf of California, and strongly suggests that there should be a quota fixed for the sardine fishery, and other small-pelagic fishes, in order to prevent a future resource or ecosystem crisis, an administration measure similar to the conservative approach of the Pacific Fisheries Management Council, applied to the Pacific United States Stock.

The recommendation is that a dynamic management decision making is put in place, which integrates all possible stock evaluation methods at our disposal, most importantly those that are fishery independent, as well as one that takes into consideration both the effects of environmental fluctuations on the stock, and the needs of all the components of the ecosystem before allotting a proportion of the evaluated stock to the fishery. Only through this means will the fishery reach a sustainable condition.

PI 2.5.3 There is adequate knowledge of the impacts of the fishery on the ecosystem.

Not much information exists on this topic for the Gulf of California. However, in the last decade, several studies have demonstrated that heavy mortality from fisheries increases stock fluctuations (Anderson, C.N.K. et al. 2008. Why fishing magnifies fluctuations in fish abundance. *Nature* 452: 835-839; Hsieh, C. et al. 2006. Fishing elevates variability in the abundance of exploited species, *Nature* 443: 859-862; Essington, T.E. et al. 2015. Fishing amplifies forage fish population collapses. *PNAS* www.pnas.org/cgi/doi/10.1073/pnas.1422020112. And, in a recent paper regarding this specific resource, Velarde et al. (2004 op. cit.) show that this is exactly what has been happening with the Pacific sardine catches in the Gulf of California. Furthermore, they show that the sardine also drops in the diet of three seabird species breeding in the region, 2-3 years **before** the drop in commercial sardine catches, rendering this parameter an **excellent indicator of future declines** in sardine catches by the fishing fleet (Velarde et al. 2013, Seabird diets provide early warning of sardine fishery declines in the Gulf of California. *Scientific Reports* **3**, doi:10.1038/srep01332; <http://www.nature.com/srep/2013/130225/srep01332/full/srep01332.html>) and (Velarde et al. 2014a, Seabirds diet predicts following-season commercial catch of Gulf of California Pacific Sardine and Northern Anchovy, *J Mar Syst.*, doi:10.1016/j.jmarsys.2014.08.014).



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In addition, Velarde et al. (2014b) in a seabird case study have further shown that the decline in the availability of their food will lead to an added stress factor for the seabird population, affecting their long term breeding success, leading to a steady population decline, evident only after some years (https://drive.google.com/folderview?id=0BwIN_m2EHKsyVDB1eEt5SHIzeXc&usp=sharing). This added stress could be the reduction in food availability, the increased adult mortality in fishing operations or, even worse, both factors simultaneously.

Furthermore, in another most recent study, Velarde et al. 2015 (Too hot for confort: warm oceanographic anomalies drive seabirds nesting north, in press in Science Advances - a new open-access Science journal) show, using a path analysis, that the compounded effects of oceanographic anomalies, Pacific sardine fishing effort and Pacific sardine catches by the commercial fleet induces reduced or zero breeding success in seabirds in the following year, as well as their change in breeding distribution, demonstrating that the added effects of fishing effort and catch are almost as high as that of the effect of the oceanographic anomaly.

Likewise, recent studies demonstrate that the Pacific sardine is particularly valuable in the maintenance of the condition and health of its predators, such as in maintaining high reproductive success in the California Sealion (*Zalophus californianus*) (D. Auriolles, pers.com.). Because these pelagic fish are known to be ecological key species in the stability of upwelling-based, coastal food webs (Ainley et al., 2015. California current system — Predators and the preyscape J Mar Syst, <http://dx.doi.org/10.1016/j.jmarsys.2014.10.011>), negatively affecting their population-levels will create severe imbalances. Furthermore, studies have shown that sardines maintain their nutritional value after they have spawned, a unique ability of the species, making it an essential nutrient source for its predators (Rodríguez V.M.T. 2009. Contenido energético y ácidos grasos biomarcadores en dos rutas tróficas que llegan al lobo marino, M.S. Thesis, CICIMAR-IPN).

Similarly, using a time series of artisanal fishery landing records for the Bahía de los Ángeles area (where an artisanal fishery community occurs on the Baja California coast, at the Midriff Island Region), it was found that the larger fish that are predatory on Pacific sardine, have had collapses approximately two years after the collapses of Pacific sardine fishery (Fig. 6). This graph was generated using a landings time series provided by the fishery department from the State of Baja California fisheries office, and official data from the sardine fisheries landings.



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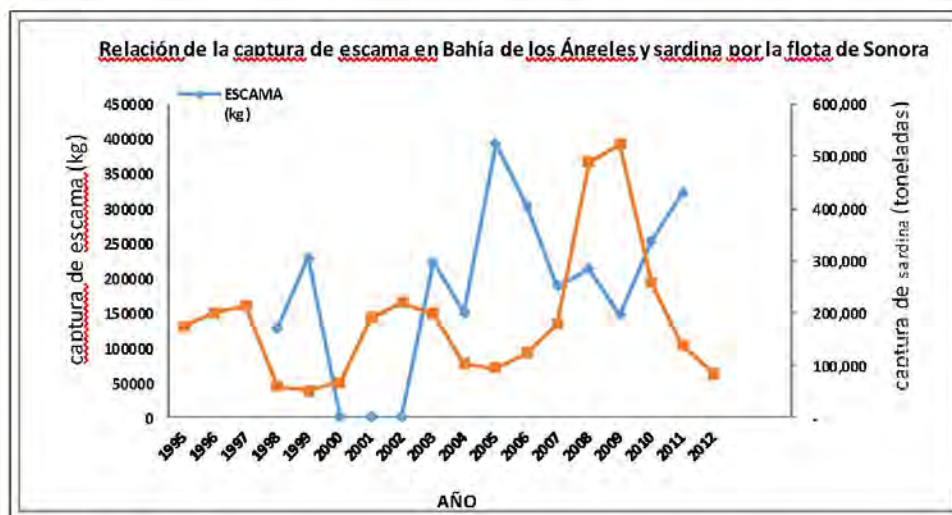


Figure 6. Relationship found between catch of Pacific sardine by the Sonora industrial fleet (squares) and catches of some large predatory fish in the Bahía de los Ángeles artisanal fishery (diamonds), indicating catch drops of artisanal fishery closely following, with about 2 years lag, the collapses of sardine catches. Data kindly provided, in both cases, by the fisheries state offices.

A final recommendation would be that the Technical Research Committee is incorporated to the review of the management plan for small pelagic fishes. At present, there is a total lack of ecosystem considerations in the existing plan and it is my belief this aspect needs to be considered and included in the reviewed version, just as the ecosystem perspective is integrated and used in the most recent and advanced management strategies around the world, if a sustainable use of a resource and the whole ecosystem is the goal.

Again, I thank you for your attention of these observations and considerations.

Best,

Enriqueta Velarde
Researcher

11. Appendix 4 Surveillance Frequency

The surveillance program will be conducted according to the Default Surveillance Level 6. This includes an annual on-site audit with two surveillance team members. This program is considered most appropriate for an initial certification period where there are conditions on the fishery. Surveillance audits are planned to be conducted near the anniversary date of the fishery certificate, in accordance with requirements of FCRV2.0 7.23.6.

Table 37. Fishery Surveillance Program

Surveillance Level	Year 1	Year 2	Year 3	Year 4
<i>Default Level 6</i>	<i>On-site surveillance audit</i>	<i>On-site surveillance audit</i>	<i>On-site surveillance audit</i>	<i>On-site surveillance audit & re-certification site visit</i>

12. Appendix 5 Objections Process

13. Appendix 6 Supporting Evidence

13.1 Vessel List



Cámara Nacional de la Industria Pesquera

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**LIST OF VESSELS THAT ARE COVERED UNDER THE UNIT OF CERTIFICATION
FOR SARDINOPS**

JUNE, 2016

OWNER	BOAT NAME	PERMIT No.	CONCESIÓN 20 YEAR
*PESQUERA SANTA MONICA S.A. DE C.V.	B.M SARDINA VI	12604779334	
	PEGUSA I	12604779351	
*HERNANDEZ Y PTANIK SA DE CV	BM DON ISAAC	10203079307	
*PESQUERA PROESA S.A. DE C.V.	BM PROESA I	10203079308	
*PESQUERA SIGLO S.A. DE C.V.	COZAR III	12604779355	
	CHUYITO XXX	12604779357	
	COZAR XI	12604779356	
	KORE	12604779002	
	JUAN PABLO I	12604779327	
	MANOLO	12604779325	
*PESQUERA COSTA ROCA S.A. DE C.V.	PESCADOR II	12604779358	
	NENE CONDE	12604779363	
	LAZARO CARDENAS III	12604779322	
	DON BETO	12609679314	
	SANDOKAN	12609679314	
	SALGARI	10203079320	
	DELTA YAQUI	12604779337	
	BAKATETE	12604779360	
*PESQUERA PTACNIK Y PTACNIK S.A. DE C.V.	ONTAGOTA	10203004520	
*SARDINEROS LA PITAHAYOSA S.A. DE C.V.	SELECTA		CP-022/2012
	SELECTA I		CP-409/2000
	SELECTA II		CP-020/2012
	SELECTA III		CP-021/2012
	PROPEMEX PP-1-S		CP-296/2000
*SELECTA DE GUAYMAS S.A. DE C.V.	SELECTA V		CP-009/2012
	PROPEMEX PP-2-S		CP-292/2000
	SARDINA IX		CP-293/2000
*NAVIERA Y PESQUERA DEL PACIFICO S.A. DE C.V.	PESCADOR IV	12609679311	
	PESCADOR V	12647793012	
	DON ELIAS	10305379301	
*INDUSTRIAS BARDAS S.A. DE C.V.	BARDA I	12604779366	
	BARDA III	12604779319	
	ISLA DE CEDROS	12604779320	
	ZENIT II	12609679315	
*PESCA E INDUSTRIALIZACION DEL PACIFICO S.A. DE C.V.	PISA I	12604779329	
	PISA II	12604779364	
*PESQUERA CABRALES S.A. DE C.V.	EL AZTECA	10203079316	

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Cámara Nacional de la Industria Pesquera

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*MAZ SARDINA S.A. DE C.V.	PORTOLA I	125080793082
	PORTOLA II	125080793081
	PORTOLA III	125080793080
	PORTOLA IV	126047793037
	PORTOLA V	125080793094
	PORTOLA VI	125080793095
*MARITIMA INTERCONTINENTAL S.A. DE C.V.	CARLI-FORNIA	126047793073
	PROPEMEX DP-2S	12604779342
	EL CHUCHIN	12604779335

Leon Tissot
ING. LEON TISSOT PLANT.



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13.2 Summary Results for Determination of Pacific Sardines as Key LTL

Excerpt from unpublished report by Espinosa-Romero and Monte-Luna (2016) “Trophic role of Pacific sardine (*Sardinops sagax*) in the Gulf of California ecosystem”

3. Summary of results

- There is evidence that Pacific sardine considerably contributes to the diet (in 10% or more) of sea lions (*Zalophus californianus*), Heermann's gull (*Larus heermanni*), Elegant tern (*Sterna elegans*), Brown booby (*Sula leucogaster*), Brown pelican (*Pelicanus occidentalis*), and Striped marlin (*Tetrapturus audax*). This could suggest Pacific sardine is an important source of energy flow from lower to higher levels, particularly for these species.
- The Proportional Connectance value of Pacific sardine is of 4.57%, which is lower than the percentage (8%) in which a species is a key LTL.
- The Supportive Role to Fishery ecosystems (SURF) value equals to .1765, a value greater than .001, which indicates that Pacific sardine is a key LTL stock.
- Pacific sardine contribution to consumer biomass is not available for Pacific sardine in ecosystem models.
- Diet information shows that there are functionally similar species to the candidate, which could have similar contribution of energy from lower to higher trophic levels. Evidence of species that are having similar contributions to Pacific sardine predators' diet are: *C. mysticetus* (to sea lions, brown booby), *E. mordax* (to Heermann's gull, elegant tern), *Anchoa sp* (to brown booby), and *S. japonicas* (to striped marlin).
- Pacific sardine used to be the main most dominant species (42% of the catch in the last 10 years and 45% in the last 15 years) in the small pelagic catch. However, in the last two years, the composition of the catch has changed given the changes in the availability of small-pelagic species to the fishery. In the last two years *O. libertate* has represented 45 to 49% of the catch and *C. mysticetus* 22 to 28%.

4. Conclusions and recommendations

In the GoC, the small-pelagic fishery includes seven main species, from which Pacific sardine, when is abundant represents 95% of the total catch, and when is not abundant around 5%. Historical series of catch show variations from up to 97%, like the drop in 1992 when the catch went from 300 to seven thousand tones in a four-year period, or between 2005 and 2009 when the catch increased from 87 thousand to 520 thousand tones. From 1970 the number of vessels and number of trips have been determined by the availability of the resource. In the case of Pacific sardine in the GoC, catch represents a better indicator than catch per unit effort when measuring abundance.

Fishing effort pressure and environmental change have been considered by diverse authors as the main causes of fluctuations of Pacific sardine catch in the GoC (Cisneros et al. 1995, 1997). However, in Lluch's model 85% of the catch variation was explained by recruitment, seawater temperature, and upwelling processes (the model does not incorporate fishing effort) (Lluch et al. 1999). This leaves a 15% of the variation explained by other factors, such as fishing and natural mortality. From this model one could assume that environmental change overshadows the effect of fishing on Pacific sardine populations.

The constant variations of Pacific sardine catch (population) in the GoC have critical implications for the marine ecosystem as well as for those who rely on the fishery. For

example, when the catch (and biomass) decreased 97% in 1992, species that fed mainly on Pacific sardine, like seabirds and marine mammals, suffered reductions in their populations and diet composition (Velarde et al. 1994). The fishing fleet, in a three to four-year period, reduced the vessels from 80 to 30 and the number of trips from 4000 to less than 1000. This represented a high social and economic costs. On the contrary, in 2009 when sardine was abundant, it was the dominant species in its predator diet (Velarde et al. 2013), the population of predators increased and the catch increased as high as before the fall in 1992.

The relative importance of Pacific sardine as a key LTL in the GoC can change according to its abundance, which respond to environmental variations. However, using the precautionary approach, an agreement under the Code of Conduct for Responsible Fisheries, Pacific sardine could be considered and managed as a key trophic level.

Given the changes in the size population of Pacific sardine in the GoC influence the structure and functioning of the ecosystem, it is also important to manage the fishery using an ecosystem-based approach. Arreguín-Sánchez et al. (in review) developed a procedure, based on trophic relationships and information theory (Ulanowicz 1986) in which the biomass of a species is subtracted to measure the disorder or effects in the ecosystem, expressed as entropy. This implies that fisheries management is based on the ecosystem using the exploited populations and not the other way around, like happens with other methodologies.

Applying the ecosystem-based management approach to the center-north of the GoC, a catch limit rate has been estimated for Pacific sardine, 36%. This means if the fishery exploits more than 36% the fishing biomass, the fishery will compromise the functioning and organization of the ecosystem; the loss of resilience and biomass availability for other predators could be irreversible. It should be noted that since the beginning of the fishery, this limit has been reached, not even when the catch reached the highest in 2009. In the context of the precautionary principle, the catch limit rate of 36% of the fishable biomass, represent a limit, not a target objective. Given this, it should be taken into account that fisheries respond to the population growth. This synergy is hard to control. That is why management measures should be defined and applied before the fishery reaches the limits.

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- Aguilar-Castro, N. A. 2004. Ecología trófica de juveniles del tiburón martillo *Sphyrna lewini* (Griff fin & Smith, 1834) en el Golfo de California. MSc Thesis. Centro Interdisciplinario de Ciencias Marinas-IPN. 111p.
- Andrade, Z. 2005. Hábitos alimenticios del tiburón *Carcharhinus falciformis* en el Océano

13.3 List of Non-Target Species

Table 38. Summary of catch composition estimates for the small pelagics fleet in the 2012-2013 and 2013-2014 fishing seasons. Catch for small pelagics species was obtained from landings data (Nevárez-Martínez et al., 2016c). The catch volumes for the other species was derived by multiplying the estimated catch volumes recorded in the observed trips by the total number of trips of the fleet (Arizmendi-Rodríguez 2016).

	Common Name	Scientific Name	Landed/ Estimated Catch (mt) 2012-13 & 2013-2015	% of Total Catch	MSC Classification
1	Monterey Sardine	<i>Sardinops sagax</i>	77,150.00	10.22%	P1 - Target
2	Thread Herring spp.	<i>Opisthonema spp.</i>	235,266.00	31.18%	P1 - Target
3	Chub Mackerel	<i>Scomber japonicas</i>	61,197.00	8.11%	Retained Main
4	Red-eye round herring/	<i>Etrumeus teres</i>	19,271.00	2.55%	Retained Minor
5	California Anchovy	<i>Engraulis mordax</i>	152,605.00	20.22%	Retained Main
6	Bigmouth sardine/	<i>Cetengraulis mysticetus</i>	193,431.00	25.63%	Retained Minor
7	Leatherjackets	<i>Oligoplites. Spp</i>	14,816.00	1.96%	Retained Minor
8	Spotted eagle ray	<i>Aetobatus narinari</i>	0.67	0.00%	Retained minor
9	Eastern Pacific bonefish	<i>Albula esuncula</i>	0.05	0.00%	Retained minor
10	Bonefish	<i>Albula sp</i>	0.17	0.00%	Retained minor
11	Bigeye thresher	<i>Alopias superciliosus</i>	0.19	0.00%	Retained minor
12	Catfish	<i>Ariopsis sp</i>	154.21	0.02%	Retained minor
13	White weakfish	<i>Atractoscion nobilis</i>	0.19	0.00%	Retained minor
14	Tuna	<i>Auxis sp</i>	0.14	0.00%	Retained minor
15	Ronco croaker	<i>Bairdiella icistia</i>	0.00	0.00%	Retained minor
16	Finescale triggerfish	<i>Balistes polylepis</i>	32.61	0.00%	Retained minor
17	Pacific leopard flounder	<i>Bothus leopardinus</i>	0.00	0.00%	Retained minor
18	Flounder	<i>Bothus sp</i>	0.00	0.00%	Retained minor
19	Pacific porgy	<i>Calamus brachysomus</i>	1.45	0.00%	Retained minor
20	Swimming crab	<i>Callinectes bellicosus</i>	0.01	0.00%	Retained minor
21	Arched swimming crab	<i>Callinectes arcuatus</i>	0.01	0.00%	Retained minor
22	Swimming crabs	<i>Callinectes sp</i>	0.03	0.00%	Retained minor
23	Jacks and pompanos	<i>Carangidae</i>	0.67	0.00%	Retained minor
24	Threadfin jack	<i>Carangoides otrynter</i>	0.01	0.00%	Retained minor
25	Pacific crevalle jack	<i>Caranx caninus</i>	23.61	0.00%	Retained minor
26	Jacks	<i>Caranx sp</i>	0.00	0.00%	Retained minor
27	Pacific smalltail shark	<i>Carcharhinus cerdale</i>	8.05	0.00%	Retained minor
28	Dusky shark	<i>Carcharhinus obscurus</i>	1.70	0.00%	Retained minor
29	Black croaker	<i>Cheilotrema saturnum</i>	5.40	0.00%	Retained minor
30	Pacific bumper	<i>Chloroscombrus orqueta</i>	0.21	0.00%	Retained minor
31	Flounder	<i>Citharichthys sp</i>	0.01	0.00%	Retained minor
32	Mahi	<i>Coryphaena hippurus</i>	2.79	0.00%	Retained minor
33	Striped Weakfish	<i>Cynoscion reticulatus</i>	146.20	0.02%	Retained minor
34	Orangemouth weakfish	<i>Cynoscion xanthulus</i>	0.03	0.00%	Retained minor
35	Drums	<i>Cynoscion sp</i>	17.62	0.00%	Retained minor
36	Diamond stingray	<i>Dasyatis dipterura</i>	0.21	0.00%	Retained minor
37	Mojarras	<i>Diapterus brevirostris</i>	5.52	0.00%	Retained minor
38	Mexican sand perch	<i>Diplectrum macropoma</i>	0.01	0.00%	Retained minor

39	Inshore sand perch	<i>Diplectrum pacificum</i>	0.01	0.00%	Retained minor
40	Perch	<i>Diplectrum sp</i>	0.00	0.00%	Retained minor
41	Ocellated electric ray	<i>Diplobatis ommata</i>	0.01	0.00%	Retained minor
42	Humboldt Squid	<i>Dosidicus gigas</i>	0.00	0.00%	Retained minor
43	Grouper	<i>Epinephelus sp</i>	0.19	0.00%	Retained minor
44	Fringed flounder	<i>Etropus crossotus</i>	0.01	0.00%	Retained minor
45	Flounder	<i>Etropus sp</i>	0.00	0.00%	Retained minor
46	Mojarra	<i>Eucinostomus entomelas</i>	29.75	0.00%	Retained minor
47	Mojarras	<i>Eugerres sp</i>	0.01	0.00%	Retained minor
48	Black skipjack	<i>Euthynnus lineatus</i>	20.09	0.00%	Retained minor
49	Café Brown Shrimp	<i>Farfantepenaeus californiensis</i>	0.01	0.00%	Retained minor
50	Mojarras	<i>Gerreidae</i>	124.46	0.02%	Retained minor
51	Grunt	<i>Haemulidae</i>	0.27	0.00%	Retained minor
52	Shining grunt	<i>Haemulopsis nitidus</i>	0.00	0.00%	Retained minor
53	Rock wrasse	<i>Halichoeres semicinctus</i>	0.01	0.00%	Retained minor
54	Horn shark	<i>Heterodontus francisci</i>	0.06	0.00%	Retained minor
55	Mexican barred snapper	<i>Hoplopagrus guentherii</i>	0.31	0.00%	Retained minor
56	Pacific silverstripe halfbeak	<i>Hyporhamphus naos</i>	0.00	0.00%	Retained minor
57	Halfbeak	<i>Hyporhamphus sp</i>	0.20	0.00%	Retained minor
58	Makos	<i>Lamnidae</i>	6.24	0.00%	Retained minor
59	Blue Shrimp	<i>Litopenaeus stylirostris</i>	0.24	0.00%	Retained minor
60	Pacific tripletail	<i>Lobotes pacificus</i>	0.26	0.00%	Retained minor
61	Squid	<i>Lolliguncula sp</i>	-	0.00%	Retained minor
62	Snapper	<i>Lutjanidae</i>	0.37	0.00%	Retained minor
63	Colorado snapper	<i>Lutjanus colorado</i>	0.82	0.00%	Retained minor
64	Pacific red snapper	<i>Lutjanus peru</i>	0.85	0.00%	Retained minor
65	Snappers	<i>Lutjanus sp</i>	1.09	0.00%	Retained minor
66	Clam	<i>Megapitaria squalida</i>	0.00	0.00%	Retained minor
67	Tallfin croaker	<i>Micropogonias altipinnis</i>	9.06	0.00%	Retained minor
68	Croaker	<i>Micropogonias megalops</i>	43.45	0.01%	Retained minor
69	Flathead grey mullet	<i>Mugil cephalus</i>	44.34	0.01%	Retained minor
70	Morays	<i>Muraenidae</i>	0.06	0.00%	Retained minor
71	Gray smoothhound	<i>Mustelus californicus</i>	0.24	0.00%	Retained minor
72	Bat eagle ray	<i>Myliobatis californica</i>	0.39	0.00%	Retained minor
73	Giant electric ray	<i>Narcine entemedor</i>	0.11	0.00%	Retained minor
74	Roosterfish	<i>Nematistius pectoralis</i>	0.05	0.00%	Retained minor
75	Octopus	<i>Octopus sp</i>	0.00	0.00%	Retained minor
76	Pacific snake eel	<i>Ophichthus triserialis</i>	0.01	0.00%	Retained minor
77	Eel	<i>Ophidion sp</i>	0.00	0.00%	Retained minor
78	Bronze-striped grunt	<i>Orthopristis reddingi</i>	109.17	0.01%	Retained minor
79	Spotted sand bass	<i>Paralabrax maculatofasciatus</i>	0.57	0.00%	Retained minor
80	Flounders	<i>Paralichthyidae</i>	0.10	0.00%	Retained minor
81	Speckled flounder	<i>Paralichthys woolmani</i>	0.61	0.00%	Retained minor
82	Penaeid shrimp	<i>Penaeidae</i>	0.08	0.00%	Retained minor
83	Salema butterfish	<i>Peprilus snyderi</i>	2.29	0.00%	Retained minor
84	Sea snail	<i>Phyllonotus erythrostoma</i>	-	0.00%	Retained minor

85	Thornback guitarfish	<i>Platyrrhinoidis triseriata</i>	0.09	0.00%	Retained minor
86	Ocellated turbot	<i>Pleuronichthys ocellatus</i>	0.03	0.00%	Retained minor
87	Longspine grunt	<i>Pomadasys macracanthus</i>	0.01	0.00%	Retained minor
88	Daisy midshipman	<i>Porichthys margaritatus</i>	0.00	0.00%	Retained minor
89	Midshipman	<i>Porichthys sp</i>	0.00	0.00%	Retained minor
90	Bignose Conger	<i>Rhynchoconger nitens</i>	0.00	0.00%	Retained minor
91	Shovelnose guitarfish	<i>Rhinobatos productus</i>	0.17	0.00%	Retained minor
92	Guitarfish	<i>Rhinobatos sp</i>	0.04	0.00%	Retained minor
93	Pacific cownose ray	<i>Rhinoptera steindachneri</i>	3.93	0.00%	Retained minor
94	Parrotfish	<i>Scaridae</i>	0.06	0.00%	Retained minor
95	Drums or Croakers	<i>Sciaenidae</i>	0.09	0.00%	Retained minor
96	Pacific sierra	<i>Scomberomorus sierra</i>	44.86	0.01%	Retained minor
97	Scorpionfishes/ Rockfishes	<i>Scorpaenidae</i>	0.07	0.00%	Retained minor
98	Bigeye scad	<i>Selar crumenophthalmus</i>	0.01	0.00%	Retained minor
99	Hairfin lookdown	<i>Selene brevoortii</i>	0.00	0.00%	Retained minor
100	Peruvian moonfish	<i>Selene peruviana</i>	0.06	0.00%	Retained minor
101	Yellowtail amberjack	<i>Seriola lalandi</i>	0.46	0.00%	Retained minor
102	Prawns	<i>Sycionia spp.</i>	0.00	0.00%	Retained minor
103	Prawns	<i>Sicyonia penicillata</i>	0.00	0.00%	Retained minor
104	Bullseye puffer	<i>Sphoeroides annulatus</i>	0.23	0.00%	Retained minor
105	Puffer	<i>Sphoeroides sp</i>	0.05	0.00%	Retained minor
106	Mexican barracuda	<i>Sphyrna ensis</i>	0.48	0.00%	Retained minor
107	Scalloped hammerhead	<i>Sphyrna lewini</i>	8.86	0.00%	Retained minor
108	Shrimps	<i>Squilla sp</i>	0.00	0.00%	Retained minor
109	Target shrimps	<i>Stomolophus meleagris</i>	0.16	0.00%	Retained minor
110	Elongate tonguefish	<i>Symphurus elongatus</i>	0.00	0.00%	Retained minor
111	Banded tonguefish	<i>Symphurus fasciolaris</i>	0.00	0.00%	Retained minor
112	Lee's tonguefish	<i>Symphurus leei</i>	0.00	0.00%	Retained minor
113	Tonguefish	<i>Symphurus sp</i>	0.00	0.00%	Retained minor
114	Shorthead lizardfish	<i>Synodus scituliceps</i>	0.04	0.00%	Retained minor
115	California lizardfish	<i>Synodus lucioceps</i>	0.01	0.00%	Retained minor
116	Lizardfish	<i>Synodus sp</i>	0.03	0.00%	Retained minor
117	Puffer Fishes	<i>Tetraodontidae</i>	0.00	0.00%	Retained minor
118	Blackblotch pompano	<i>Trachinotus kennedyi</i>	0.16	0.00%	Retained minor
119	Largehead hairtail	<i>Trichiurus lepturus</i>	17.14	0.00%	Retained minor
120	Haller's round ray	<i>Urobatis halleri</i>	3.01	0.00%	Retained minor
121	Stingray	<i>Urobatis sp</i>	0.32	0.00%	Retained minor
122	Triggerfish	<i>Xanthichthys sp</i>	0.01	0.00%	Retained minor
123	Fantail flounder	<i>Xystreureys liolepis</i>	0.09	0.00%	Retained minor
TOTAL CATCH			754,614	100.00%	

13.4 Client Action Plan Support Letters

SAGARPA
SECRETARÍA DE AGRICULTURA,
GANADERÍA, DESARROLLO RURAL,
PESCA Y ALIMENTACIÓN



Instituto Nacional de Pesca
Centro Regional de Investigación Pesquera Guaymas
Jefatura del CRIP Guaymas

March 9th, 2017

DR. SIAN MORGAN
Sustainable Seafood Scientist
SCS Global Services
2000 Powell St
Emeryville, CA 94608

Dear Dr. Morgan


The National Fisheries Institute (Instituto Nacional de la Pesca, INAPESCA) confirms that it has read and Understands the Client Action Plan created by the Cámara Nacional de la Pesca (CANAINPES) for the Marine Stewardship Council (MSC) re-assessment of the Small Pelagics Fishery in Sonora, Gulf of California, being performed under the auspices of SCS Global Services.

INAPESCA recognizes its involvement in the plan and that its actions affect the ability of CANAINPES to comply with the Client Action Plan. INAPESCA agrees to endeavor to support CANAINPES in compliance with the milestones in the Client Action Plan.

Future correspondence regarding the Action Plan and the Small Pelagics Fishery in Sonora, Gulf of California can be directed to: Dr. Manuel Nevarez

I say goodbye without another particular taking the opportunity to send a cordial greeting.

SINCERELY


DRA. ALMA ROSA GARCÍA JUÁREZ
HEAD OF CENTER



C.c.p. Dr. Manuel O. Nevarez Martinez.- Regional Coordinator Pelagicos Minors
File

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End of the Report