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Global Standard for Responsible Supply of Marine Ingredients

Fishery Assessment Methodology and Template Report V2.0

Fishery Under Assessment	**Japanese pilchard *Sardinops sagax* FAO 67, 77**
Date	**May 2018**
Assessor	**Conor Donnelly**

Application details and summary of the assessment outcome				
Name: T.C. Union Agrotech Co. Ltd				
Address:				
Country: Thailand		**Zip:**		
Tel. No.:		**Fax. No.:**		
Email address:		**Applicant Code**		
Key Contact:		**Title:**		
Certification Body Details				
Name of Certification Body:		**SAI Global**		
Assessor Name	**Peer Reviewer**	**Assessment Days**	**Initial/Surveillance/Re-approval**	**Whole fish/ By-product**
Conor Donnelly	Jim Daly	1	Surveillance 2	By-product
Assessment Period	2017-2018			

Scope Details	
Management Authority (Country/State)	USA/Mexico
Main Species	*Sardinops sagax*
Fishery Location	FAO 67, 77
Gear Type(s)	Purse seine
Outcome of Assessment	
Overall Outcome	Pass (Gulf of California subpopulation); Fail (Northern subpopulation)
Clauses Failed	C1.2 (Northern subpopulation)
Peer Review Evaluation	Agree recommendation
Recommendation	Approve Gulf of California subpopulation and do not approve the Northern subpopulation

Assessment Determination
This species is known under a variety of common names and off the west coast of North America is more commonly known as Pacific sardine, Monterrey sardine or Californian sardine. 3 subpopulations are found off the west coast of North America: northern Baja California to Alaska; central and southern Baja California and the Gulf of California. The fishery is mainly concentrated on the northern and Gulf of California subpopulations. Both the northern and Gulf of California subpopulations are subject to species-specific management and are therefore assessed under clause C of this report. In both subpopulations fishery removals are included in the stock assessment process. The northern subpopulation is considered, in its most recent stock assessment, to have a biomass below the proxy limit reference point and removals from the fishery are not considered negligible. Management advice for the northern population for the 2017-18 fishing season is zero catch (Hill, K.T. et al 2017). This subpopulation fails clause C. The Gulf of California subpopulation is considered, in its most recent stock assessment, to have a biomass above the limit proxy reference point so the subpopulation passes clause C. Japanese pilchard is classed as of least concern on the IUCN Red List of Threatened Species and is not listed on CITES (http://www.iucnredlist.org/details/184056/0; date of assessment: April, 2008). **The Gulf of California subpopulation of *Sardinops sagax* in FAO 67, 77 is recommended for approval as by-product material under the IFFO RS Standard. The northern subpopulation of *Sardinops sagax* is not recommended for approval**
Peer Review Comments
A trend of declining stock biomass (northern subpopulation) has been observed since 2005-06, Recruitment in particular from the 2011-15 year classes have been among the weakest in recent history. Current advice for the northern subpopulation (2017/18) is zero catch.
Notes for On-site Auditor
By-product material from the northern subpopulation should be separated from IFFO approved by-product material.

Species-Specific Results

Category	Species	% landings	Outcome (Pass/Fail)	
Category A			A1	
			A2	
			A3	
			A4	
Category B				
Category C	*Sardinops sagax*	NA	Pass (Gulf of California). Fail (Northern subpopulation)	
Category D				

[List all Category A and B species. List approximate total %age of landings which are Category C and D species; these do not need to be individually named here]

HOW TO COMPLETE THIS ASSESSMENT REPORT

This assessment template uses a modular approach to assessing fisheries against the IFFO RS standard.

Whole Fish

The process for completing the template for a **whole fish** assessment is as follows:

1. ALL ASSESSMENTS: Complete the Species Characterisation table, to determine which categories of species are present in the fishery.
2. ALL ASSESSMENTS: Complete clauses M1, M2, M3: Management.
3. IF THERE ARE CATEGORY A SPECIES IN THE FISHERY: Complete clauses A1, A2, A3, A4 for **each** Category A species.
4. IF THERE ARE CATEGORY B SPECIES IN THE FISHERY: Complete the Section B risk assessment for **each** Category B species.
5. IF THERE ARE CATEGORY C SPECIES IN THE FISHERY: Complete clause C1 for **each** Category C species.
6. IF THERE ARE CATEGORY D SPECIES IN THE FISHERY: Complete Section D.
7. ALL ASSESSMENTS: Complete clauses F1, F2, F3: Further Impacts.

A fishery must score a pass in **all applicable clauses** before approval may be recommended. To achieve a pass in a clause, the fishery/species must meet **all** of the minimum requirements.

By-products

The process for completing the template for **by-product raw material** is as follows:

1. ALL ASSESSMENTS: Complete the Species Characterisation table with the names of the by-product species and stocks under assessment. The '% landings' column can be left empty; all by-products are considered as Category C and D.
2. IF THERE ARE CATEGORY C BYPRODUCTS UNDER ASSESSMENT: Complete clause C1 for **each** Category C by-product.
3. IF THERE ARE CATEGORY D BYPRODUCTS UNDER ASSESSMENT: Complete Section D.
4. ALL OTHER SECTIONS CAN BE DELETED. Clauses M1 - M3, F1 - F3, and Sections A and B do not need to be completed for a by-product assessment.

By-product approval is awarded on a species-by-species basis. Each by-product species scoring a pass under the appropriate section may be approved against the IFFO RS Standard.

SPECIES CATEGORISATION

The following table should be completed as fully as the available information permits. Any species representing more than 0.1% of the annual catch should be listed, along with an estimate of the proportion of the catch each species represents. The species should then be divided into Type 1 and Type 2 as follows:

- **Type 1 Species** can be considered the 'target' or 'main' species in the fishery. They make up the bulk of annual landings and are subjected to a detailed assessment.
- **Type 2 Species** can be considered the 'bycatch' or 'minor' species in the fishery. They make up a small proportion of the annual landings and are subjected to relatively high-level assessment.

Type 1 Species must represent 95% of the total annual catch. Type 2 Species may represent a maximum of 5% of the annual catch (see Appendix B).

Species which make up less than 0.1% of landings do not need to be listed (NOTE: ETP species are considered separately). The table should be extended if more space is needed. Discarded species should be included when known.

The 'stock' column should be used to differentiate when there are multiple biological or management stocks of one species captured by the fishery. The 'management' column should be used to indicate whether there is an adequate management regime specifically aimed at the individual species/stock. In some cases it will be immediately clear whether there is a species-specific management regime in place (for example, if there is an annual TAC). In less clear circumstances, the rule of thumb should be that if the species meets the minimum requirements of clauses A1-A4, an adequate species-specific management regime is in place.

NOTE: If any species is categorised as Endangered or Critically Endangered on the IUCN Red List, or if it appears in the CITES appendices, it **cannot** be approved for use as an IFFO RS raw material. This applied to whole fish as well as by-products.

TYPE 1 SPECIES (Representing 95% of the catch or more)
Category A: Species-specific management regime in place.
Category B: No species-specific management regime in place.

TYPE 2 SPECIES (Representing 5% OF THE CATCH OR LESS)
Category C: Species-specific management regime in place.
Category D: No species-specific management regime in place.

Common name	Latin name	Stock	% of landings	Management	Category
Japanese pilchard/ California sardine/ Monterrey sardine/ Pacific sardine	*Sardinops sagax*	Northern subpopulation	NA	Species-specific management (USA)	C
		Gulf of California		Species-specific management (Mexico)	

CATEGORY C SPECIES

In a whole fish assessment, Category C species are those which make up less than 5% of landings, but which are subject to a species-specific management regime. In most cases this will be because they are a commercial target in a fishery other than the one under assessment. In a by-product assessment, Category C species are those which are subject to a species-specific management regime, and are usually targeted species in fisheries for human consumption.

Clause C1 should be completed for **each** Category C species. If there are no Category C species in the fishery under assessment, this section can be deleted. A Category C species does not meet the minimum requirements of clause C1 should be re-assessed as a Category D species.

Species Name		***Sardinops sagax***	
C1	**Category C Stock Status - Minimum Requirements**		
	C1.1	Fishery removals of the species in the fishery under assessment are included in the stock assessment process, OR are considered by scientific authorities to be negligible.	Pass
	C1.2	The species is considered, in its most recent stock assessment, to have a biomass above the limit reference point (or proxy), OR removals by the fishery under assessment are considered by scientific authorities to be negligible.	Fail/ Pass
		Clause outcome:	Fail & Pass

Evidence

3 sub-populations occur off the west coast of North America: northern Baja California to Alaska (northern subpopulation); central and southern Baja California and the Gulf of California. The fishery is concentrated on the northern subpopulation and Gulf of California stocks.

Northern subpopulation

The northern subpopulation of *Sardinops sagax* is assessed by the US National Marine Fisheries Service (NMFS), part of NOAA. It extends from northern Baja California, Mexico to British Columbia, Canada and also up to 300nm offshore. The latest stock assessment (Hill K.T. *et al*, 2017) was assessed using two approaches, a survey-based approach (AT) and a model-based assessment (ALT). The model is an integrated assessment model developed using Stock Synthesis (SS version 3.24aa), and includes fishery and survey data collected from mid-2005 through 2016 (Hill K.T. *et al*, 2017). Input data / specifications include catch data and a July-June biological year with two semesters (S1=July-Dec and S2=Jan-Jun). The current Stock Synthesis model aggregates regional fisheries into a southern 'MEXCAL' fleet and a northern 'PNW' fleet (figure 1).

Based on model ALT estimates, the U.S. exploitation rate (defined as the calendar year catch divided by the total mid-year biomass) has averaged about 11% since 2005, peaking at 33% in 2013. The U.S. and total exploitation rates were <1% in 2016. Recent catch limits and landings are shown in figure 2 and exploitation rates estimated by the ALT model in figure 3.

Stock biomass, used for calculating annual harvest specifications, is defined as the sum of the biomass for sardine ages one and older (age 1+) at the start of the management year. Time series of estimated stock biomass from model ALT and the AT survey are shown in figure 4. A trend of declining stock biomass has been observed since 2005-06, peaking at 1.8 mmt in 2006, and plateauing at recent historical low levels since 2014. Model ALT stock biomass is projected to be 86,586 mt in July 2017.

It was recommended that management advice for the 2017-2018 fishing year be based upon the model due to forecasting issues. The model estimated stock biomass of *Sardinops sagax* to be below the CUTOFF threshold (150,000mt), the lowest level of biomass for which directed harvest is allowed, and consequently the harvest guideline for directed fisheries in 2017-2018 is 0mt (Hill *et al*, 2017).

Fishery removals of the northern subpopulation are included in the stock assessment process and the subpopulation is considered, in its most recent stock assessment, to have a biomass below the proxy limit reference point. Removals from the fishery are not considered to be negligible as advice has been given to close the fishery to directed fishing in 2017-18 so the subpopulation fails clause C.

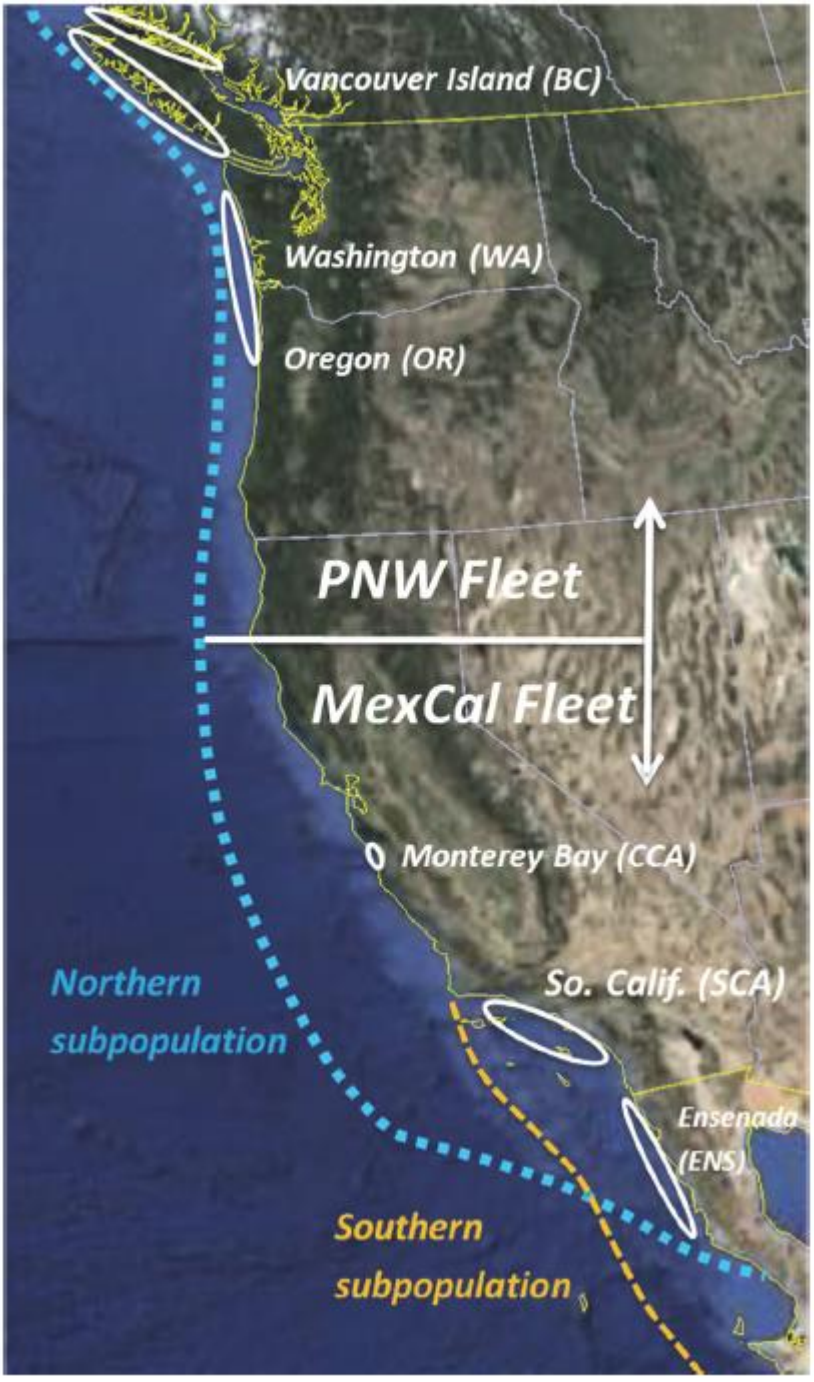

Figure 1. Distribution of the northern subpopulation of Pacific sardine, primary commercial fishing areas and modelled fleets. Source: Hill *et al*, 2017.

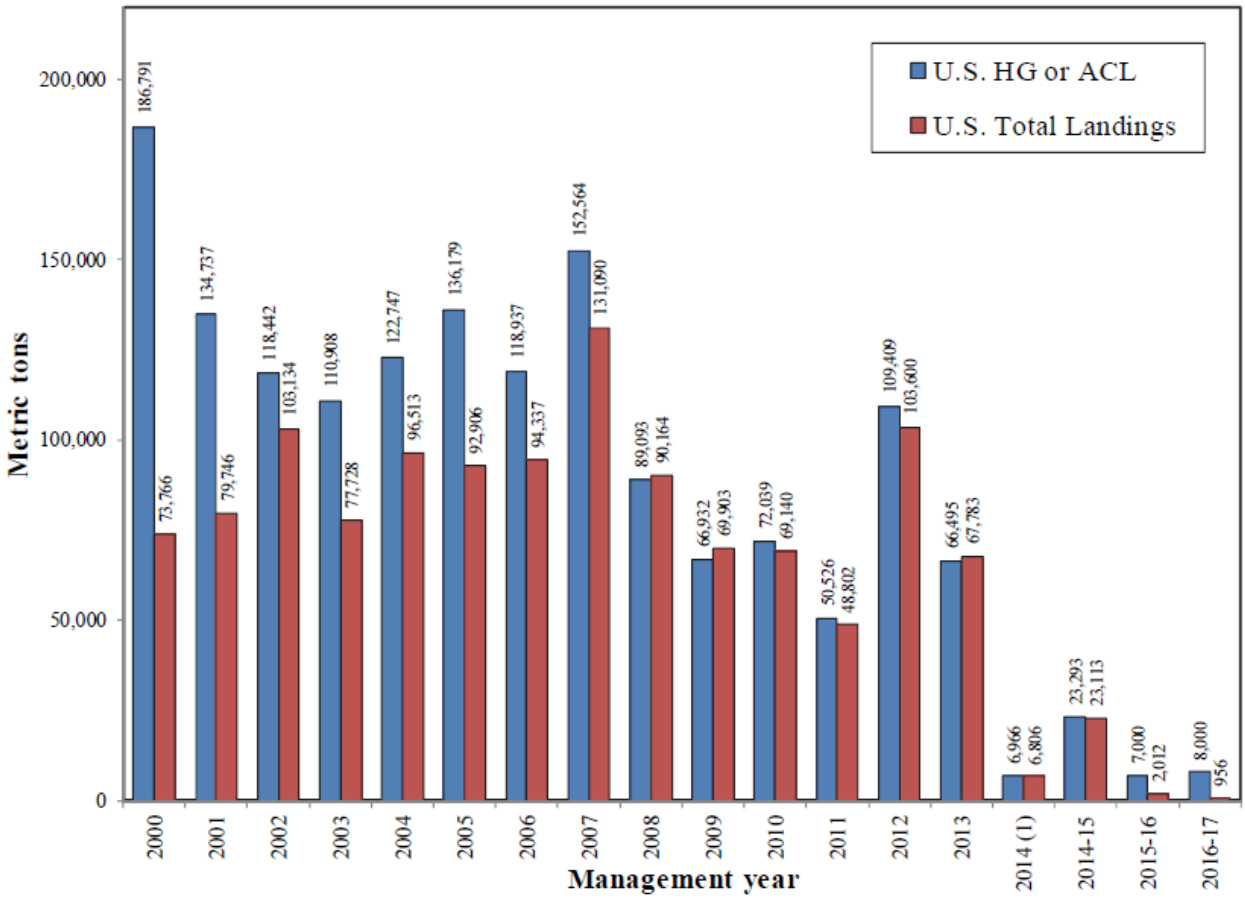

Figure 2. US Sardinops sagax harvest guidelines (HG) or acceptable catch limits (ACL) and landings since onset of federal management. Source: Hill K.T. *et al*, 2017.

Calendar Year	USA	Total
2005	4.4%	5.4%
2006	4.3%	5.0%
2007	7.0%	8.7%
2008	7.1%	9.9%
2009	7.9%	12.2%
2010	8.8%	14.7%
2011	7.6%	16.5%
2012	26.2%	34.1%
2013	33.1%	40.1%
2014	24.0%	24.4%
2015	4.0%	4.0%
2016	0.4%	0.4%

Figure 3. US and total exploitation rates for the northern subpopulation, calculated from model ALT. Source: Hill K.T. et al, 2017.

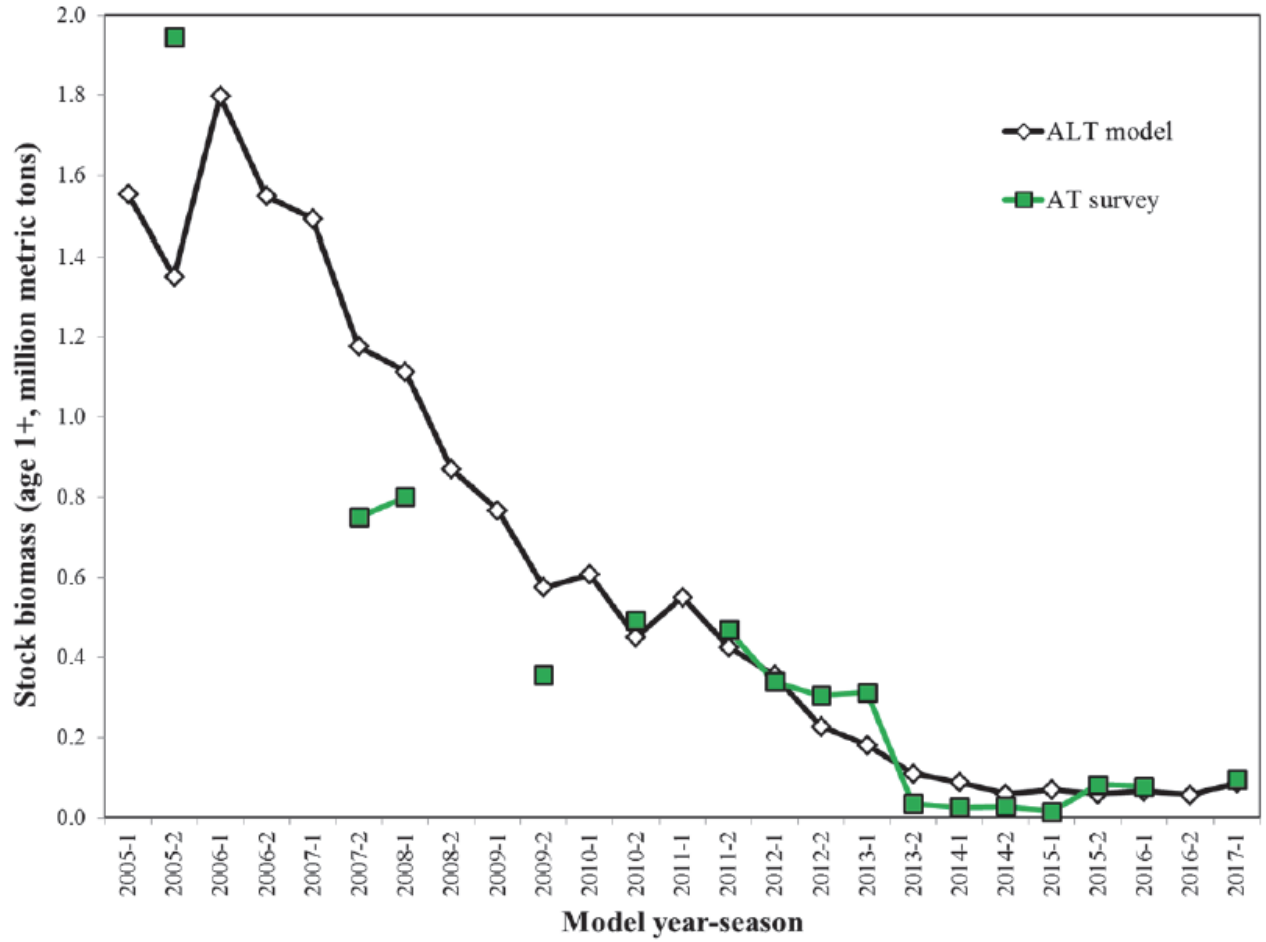

Figure 4. Time series of estimates stock biomass (mmt) from model ALT and AT survey. Source: Hill K.T. *et al*, 2017.

Gulf of California subpopulation

Scientific research and advice in support of the management of Mexican fisheries is provided by the National Fisheries Institute (INAPESCA). A stock assessment of *Sardinops sagax* is conducted annually, and considers all fishery removals and the biological characteristics of the species. Stock assessments use regular Virtual Population Analysis, length based (Jones') VPA and statistical catch at age using ASAP using catch and effort data from the fleet. The most recent assessment in 2016 used auxiliary information including; a series of CPUE values from scientific cruises, the indices of abundance from acoustic surveys, an index of egg and larvae, an index representing spawning probability and the proportion of sardines in the diet of seabirds.

In recent years the status of the *Sardinops sagax* has been of concern due to a sharp decline in catches from a historic high of 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 5). 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. The stock assessments concluded that recruitment is highly variable and suggested that environmental conditions, notably El Niño events, may play an important role in such variability. These assessments also indicate that total abundance closely follows the trend in recruitment (Alvarez et al, 2017).

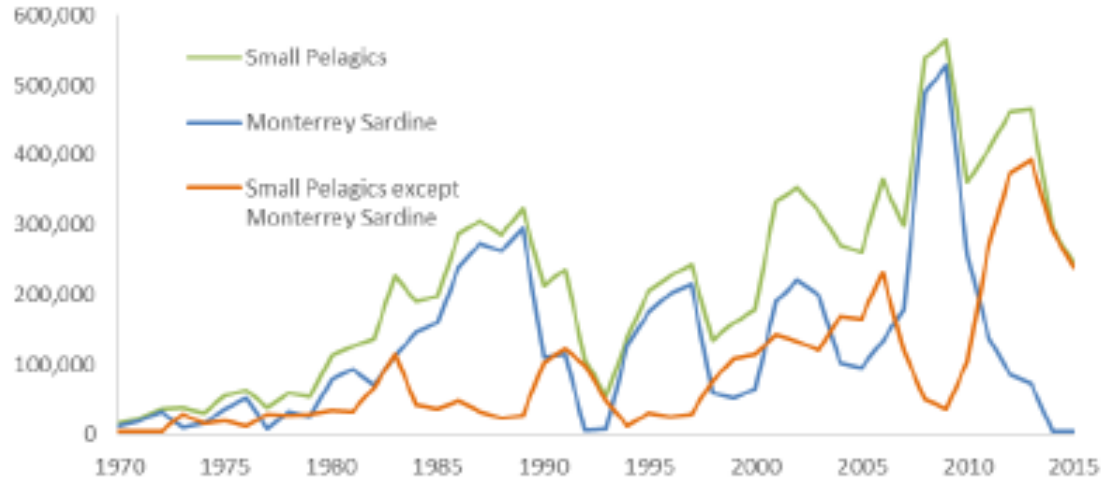

Figure 5. Comparative trends of catch history for *Sardinops sagax* (Monterrey sardine) vs all other small pelagic species in the fishery of the northern/central Gulf of California, Mexico. From data of Nevárez-Martínez et al. 2016a. Source: Alvarez *et al*, 2017.

However, Alvarez et al, 2017 refer to evidence that indicates overfishing may have played a role in the fall of the *Sardinops sagax* stock in the early 1990s (figure 6). Comparison of the reported trend in the catch compared to the estimated historic values of the BAC shows that in the late 1980s and early 1990s, the actual catch may have been close to the BAC or exceeded it (Nevarez-Martinez et al. 2016 cited in Alvarez et al, 2017). A similar pattern appears more recently from around 2008 and overfishing may have taken place momentarily as a result of unfavourable environmental conditions not being accounted for in management (Alvarez et al, 2017).

(Note: Biologically Acceptable Catch = a prudent level of catch that can vary between 5 and 25% of the estimated biomass although fishing mortality rate producing MSY has been estimated in the most recent stock assessment at 0.29 (Nevarez-Martinez 2016, cited in Alvarez et al, 2017)).

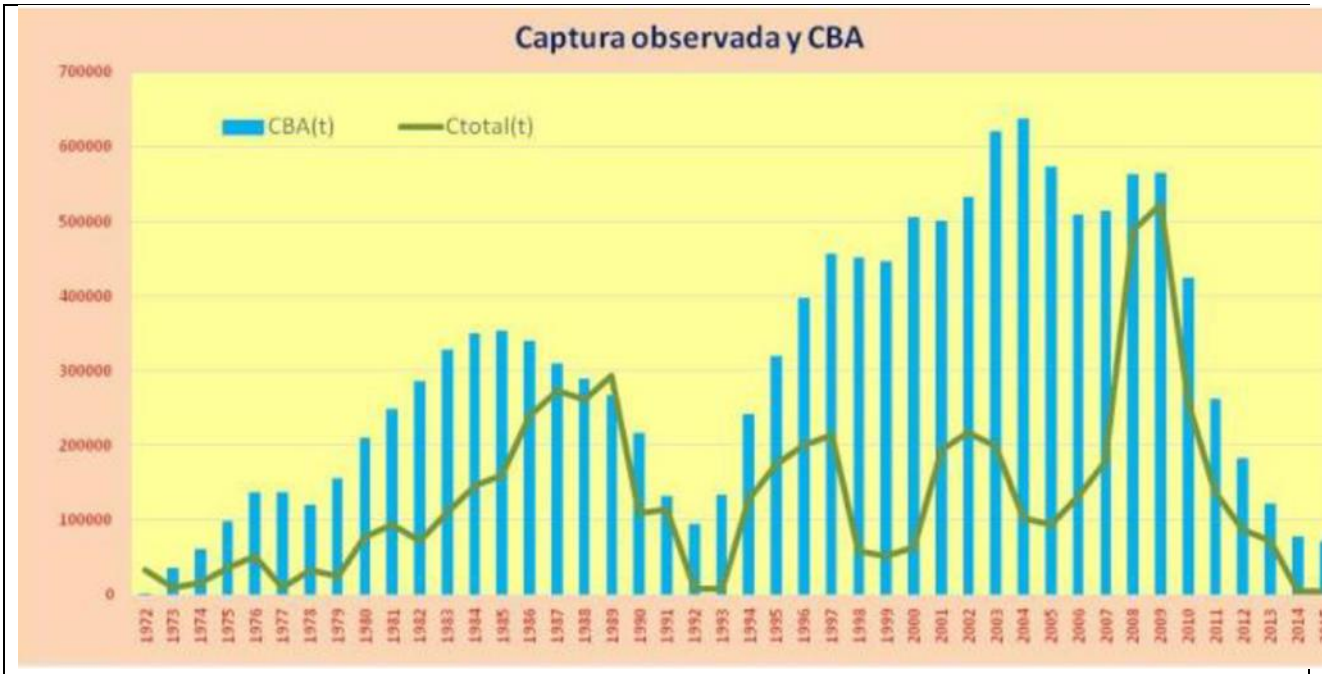

Figure 6. Comparison of catch records (green line) of *Sardinops sagax* in the Gulf of California with the estimated Biologically Acceptable Catch (bars) obtained with the control rule in the Management Plan. Reproduced from Nevarez-Martinez et al. 2016. Source: Alvarez et al, 2017.

The occurrence of a strong El Niño event was confirmed in 2015. Under these oceanographic conditions INAPESCA consider that the best possible explanation for the recent low catches is that the stock has shifted distribution to the north of the Gulf, and to deeper waters making the fish unavailable to the fishery. Fisheries independent cruises, with the ability to detect biomass to a depth of 250m were conducted by INAPESCA in 2014 and showed that most small pelagic species, including the *Sardinops sagax*, were scattered and in low abundance which reflected the low availability to the fishery which operates between 40 and 100m (Alvarez-Trasviña et al. 2015 cited in Alvarez et al. 2017). The expectation is for the abundance of *Sardinops sagax* to continue at low levels until the 2020s.

The most recent assessment by Nevarez-Martinez et al. (2016, cited in Alvarez et al, 2017) estimated total biomass at nearly one million tonnes whereas adult biomass was estimated to be around 420,000 tonnes between 2013/14 and 2014/15. The biomass was estimated by acoustic methods, but Alvarez et al (2017) note expert advice that these are underestimates of the true abundance as a result of technical issues with the survey. The assessment estimated that F was, for most of the time series under 0.15 with the exception of the periods in the late 1980s/early 1990s and from 2008 to 2013. During these periods the harvest rate exceeded 0.18 which corresponds to 0.29, the ASAP estimate of the fishing mortality rate producing MSY (Fmsy). It is therefore estimated that except for these periods, the stock has not been through periods of overfishing and has been under the BAC (consistent with achieving MSY).

Fishery removals of the Gulf of California subpopulation are included in the stock assessment process and the subpopulation is considered, in its most recent stock assessment, to have a biomass above the limit reference point (or proxy). The subpopulation passes clause C.

References

Alvarez, C., Andraka, S., Anhalzer, G. and Morgan, S. (2017). Small Pelagics Fishery in Sonora, Gulf of California. MSC Fishery Assessment Report. December 19, 2017. SCS Global Services Ltd. https://fisheries.msc.org/en/fisheries/small-pelagics-fishery-in-sonora-gulf-of-california/@@assessments

Hill, K.T., P.R. Crone, J.P. Zwolinski, 2017. Assessment of the Pacific sardine resource in 2017 for U.S. management in 2017-18. US Department of Commerce. NOAA Tech. Memo. NMFS-SWFSC-576. 262 p. http://www.pcouncil.org/wp-content/uploads/2017/05/Appendix-C-2017-sardine-assessment-NOAA-TM-NMFS-SWFSC-576.pdf
Standard clauses 1.3.2.2

SOCIAL CRITERION

In addition to the scored criteria listed above, applicants must commit to ensuring that vessels operating in the fishery adhere to internationally recognised guidance on human rights. They must also commit to ensuring there is no use of enforced or unpaid labour in the fleet(s) operating upon the resource.

Appendix A - Determining Resilience Ratings

The assessment of Category B species described in this assessment report template utilises a resilience rating system suggested by the American Fisheries Society. This approach was chosen because it is also used by FishBase, and so the resilience ratings for many thousands of species are freely available online. As described by FishBase, the following is the process used to arrive at the resilience ratings:

"*The American Fisheries Society (AFS) has suggested values for several biological parameters that allow classification of a fish population or species into categories of high, medium, low and very low resilience or productivity (Musick 1999). If no reliable estimate of r_m (see below) is available, the assignment is to the lowest category for which any of the available parameters fits. For each of these categories, AFS has suggested thresholds for decline over the longer of 10 years or three generations. If an observed decline measured in biomass or numbers of mature individuals exceeds the indicated threshold value, the population or species is considered vulnerable to extinction unless explicitly shown otherwise. If one sex strongly limits the reproductive capacity of the species or population, then only the decline in the limiting sex should be considered. We decided to restrict the automatic assignment of resilience categories in the Key Facts page to values of K, t_m and t_{max} and those records of fecundity estimates that referred to minimum number of eggs or pups per female per year, assuming that these were equivalent to average fecundity at first maturity (Musick 1999). Note that many small fishes may spawn several times per year (we exclude these for the time being) and large live bearers such as the coelacanth may have gestation periods of more than one year (we corrected fecundity estimates for those cases reported in the literature). Also, we excluded resilience estimates based on r_m (see below) as we are not yet confident with the reliability of the current method for estimating rm. If users have independent r_m or fecundity estimates, they can refer to Table 1 for using this information*."

Parameter	**High**	**Medium**	**Low**	**Very low**
Threshold	0.99	0.95	0.85	0.70
r_{max} (1/year)	> 0.5	0.16 – 0.50	0.05 – 0.15	< 0.05
K (1/year)	> 0.3	0.16 – 0.30	0.05 – 0.15	< 0.05
Fecundity (1/year)	> 10,000	100 – 1000	10 – 100	< 10
t_m (years)	< 1	2 – 4	5 – 10	> 10
t_{max} (years)	1 - 3	4 – 10	11 – 30	> 30

Taken from the FishBase manual, "Estimation of Life-History Key Facts":
http://www.fishbase.us/manual/English/key%20facts.htm#resilience]

Appendix B – Background on the 5% catch rule

The proposed fishery assessment methodology uses a species categorisation approach to divide the catch in the assessment fishery into groups. These groups are:

- **Category A:** "Target" species with a species-specific management regime in place.
- **Category B:** "Target" species with no species-specific management regime in place.
- **Category C:** "Non-target" species with a species-specific management regime in place.
- **Category D:** "Non-target" species with no species-specific management regime in place

The distinction between 'target' and 'non-target' species is made to enable the assessment to consider the impact of the fishery on all the species caught regularly, without requiring a full assessment be conducted for each. Thus 'target' species are subjected to a more detailed assessment, while 'non-target' species are considered more briefly. For the purposes of the IFFO RS fishery assessment, 'target' and 'non-target' species are defined by their prevalence in the catch, by weight. Applicants must declare which species are considered 'target' species in the fishery, and the combined weight of these must be at least 95% of the annual catch. The remaining 5% can be made up of 'non-target' species. Note also that ETP species are considered separately, irrespective of their frequency of occurrence in the catch.

The proposed use of 5% as a limit for 'non-target' species is one area in which feedback is being sought via the public consultation. The decision to propose a value of 5% ensures consistency with other fishery assessment programmes, such as the MSC which uses 5% to distinguish between 'main' and 'minor' species (see MSC Standard, SA3.4 and GSA3.4.2); and Seafood Watch, which uses 5% when defining the 'main' species for the assessment (see Seafood Watch Standard, Criterion 2). The value is also consistent with the approached used in Version 1 of the IFFO RS Standard, in which up to 5% of the raw material could be comprised of 'unassessed' species.