StarKist Bait Sourcing Profile Report

Prepared by

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Contents

Bait sourcing profiles

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Purpose	The purpose of this document is to lay out the strengths and weaknesses of each bait species used by the StarKist longline fisheries and the recommendations to improve the sustainable sourcing of those species.

Executive Summary

StarKist are committed to sourcing from fisheries that are aligned with the company's own sustainability values and are actively trying to be more sustainable. The aim of the bait sourcing profiles report is to provide an overview of the current bait fisheries used by StarKist in the longline tuna fishery improvement projects (FIPs) and provide recommendations for improving the fisheries as well as advising on the best option for StarKist to use.

It was unclear about the exact species sourced in the StarKist longline fisheries as reports provided highlighted only "frozen sardine". Only one instance of bait purchased by the fishery was described to species level, which was Japanese pilchard (*Sardinops* melanostictus). However, using information from other similar fisheries operating in the same geographical areas, five main bait types were identified. Each bait species has been described in greater detail in the fishery assessments below, however, summaries of the different bait fisheries have been included in this section of the report.

1. Japanese pilchard

The Japanese pilchard appears to be the primary species used by the American Samoa fishery. Information from the species profile on Fish Source and supporting documentation from recent stock assessment data suggests that the stock is healthy and is not experiencing overfishing. However, there seems to be minimal management measures in place for this fishery. The only harvest strategy in place is a total allowable catch (TAC) limit that has only been exceeded once (in 2007). A singular harvest control rule could be found for this fishery and that is to implement a closure period if spawning stock biomass (SSB) falls below a predetermined level. This is monitored by scientists during the annual stock assessments.

The Japanese pilchard fishery uses purse seine gears in the operations, which is largely unselective and, is likely to encounter non-target and endangered, threatened, and protected (ETP) species. However, without specific information from the fishery and observer data, this is not possible to establish.

Overall, in terms of stock sustainability, the Japanese pilchard appears to be a good choice for StarKist supply. Consideration should be made for the non-target and ETP species bycatch risk. The fishery could consider undertaking a pre-assessment and potentially implementing a FIP to work on improving observer catch availability and assessing any improvements required for the fishery.

2. Mexican sardine (*Harengula jaguana*)

It is likely that some of the longline vessels within the StarKist supply chain use Mexican sardine as a primary bait choice, despite this not featuring on the report provided from the American Samoa

fishery. There was a distinct paucity of information available about the Mexican sardine using online sources. In 2015, it was declared “least concern” on the IUCN Red List, however, the species failed the PSA, which means that it would not currently meet the requirements for the MSC Fisheries Standard if it were to enter into assessment as a target species.

No information could be found that describes the current status of the stock, and there is also data paucity regarding the interaction rate with ETP species. However, as this is a purse seine fishery, it is considered that interaction would be high or relative to the other purse seine fisheries listed in this report.

Therefore, it is recommended that a FIP is initiated for this fishery to help improve the likelihood of the species obtaining certification from the MSC and ensure that StarKist is supplying from a fishery that is committing to the same management requirements set by the company.

3. Pacific sardine (*Sardinops sagax*)

Although the report from the American Samoa fishery did not identify Pacific sardine as a primary bait source, it is considered that this species would be used by StarKist longline fisheries. The species is harvested from Mexico and the eastern Pacific Ocean using purse seine gears. There is no specific TAC or other harvest control rules (HCRs) for this stock that would help to improve the status, as well as ensure that overexploitation is avoided. Management is provided by the Mexico National Fisheries Institute (INAPESCA). Recent studies conducted in 2023 demonstrated that the stock is not expected to be in a state of overfishing (Nevarez-Martinez, et al., 2023; Enciso-Enciso, et al., 2023). However, there has been no formal stock assessment conducted on the species, which would benefit the stock by providing indicators for improvements in management measures and HCRs.

The purse seine fishery is expected to interact with a range of ETP species, including sharks, turtles, seabirds, and marine mammals. There was a study conducted in a similar fishery that identified a number of ETP species interactions, that need to be closely monitored to prevent detrimental impacts on their populations. There is no fishery-specific observer data or reports that outline its own interaction with these species and should be considered in the future.

The species also failed the PSA, which means that it would not currently meet the requirements for the MSC Fisheries Standard if it were to enter into assessment as a target species.

Therefore, it is recommended that this fishery enters into a FIP. Once in a FIP, work can be carried out to initiate communications and collaboration with INAPESCA to learn more about the current management, as well as the monitoring control and surveillance (MCS) systems used to enforce management. Likewise, the FIP would be able to work on improving the impact and rate of interaction with non-target and ETP species.

4. Atlantic horse mackerel (*Trachurus trachurus*)

None of the reports received from StarKist outlined that Atlantic horse mackerel was used in the two longline FIPs that StarKist manage. However, in other similar fisheries, this species is a common bait source and could be part of the supply chain from StarKist. Using Fish Source and other studies conducted on the species, information about their stock status demonstrated that the stock is fully exploited. A TAC of 300,000 tonnes has been imposed on this stock and the other species that share the habitat via a multi-species fishery (FAO, 2022).

Furthermore, the purse seine fishery means that bycatch of non-target and ETP species is highly likely and there has been no mention of efforts in place within this fishery of mitigation measures to reduce the interaction. Improvements in this fishery could follow implementing a FIP that works on improving the sustainability practices on the vessels.

Therefore, it is recommended that this fishery enters into a FIP to work on improving the sustainability of the species. Likewise, the FIP would be able to work on improving the impact and rate of interaction with non-target and ETP species.

5. Pacific saury (*Cololabis saira*)

Pacific saury is a migratory pelagic fish species that can be found across the North Pacific Ocean and is commercially important for many North Pacific nations. A 2022 stock assessment using the length-based Bayesian method demonstrated that the current fishing practices are unlikely to be detrimental to the stock health. However, no true stock assessment has been conducted on this species yet, so this is not 100% certain. Likewise, there are no management measures including harvest strategies or harvest control rules.

There was little-to-no information available about the impact of the fishery on non-target and ETP species. However, considering that the main gears used are dip nets, it is unlikely that the interaction rate with ETP species is high. Likewise, if incidents did occur, it is likely that they could be released quickly and without inflicting detrimental damage on the individuals.

Finally, it is not recommended that StarKist source bait from this fishery due to the lack of true stock assessment and subsequent paucity of management measures. Therefore, it is also recommended that a FIP is initiated for this fishery to understand more about the impact on these non-target species. The FIP workplan could include measures to obtain observer data to understand the current rate of interaction with ETP species, and to then recommend improvements to reduce any detriment.

6. Scad species (*Decapterus* spp.)

There were no scad species outlined in the documents provided by StarKist, but scad have been shown to be a popular bait choice for longline tuna fisheries. There is no information about the specific species of scad that are preferred by longline fisheries. However, it is expected that the derive from a multispecies fishery comprised of several scad species. due to the absence of distinguishable scad stocks, only some species have had stock assessments conducted. The last stock assessment took place in 2015 for four species (redtail scad (*Decapterus kurroides*), shortfin scad (*D. macrosoma*), roughear scad (*D. tabl*), and Japanese scad (*Trachurus japonicus*). The results of the stock assessment demonstrated that they were heavily fished, and to the point of optimum capacity. However, it should also be noted that due to the short lifecycle of these species, a stock assessment in 2015 is not representative of current stocks and may be different.

Furthermore, little is known about the fishery's impact on non-target and ETP species, but it is expected that interactions do occur as a result of the unselective nature of the fishing gears involved in the operations.

Finally, it is not recommended that StarKist source from this fishery until a new stock assessment is conducted for each of the species. Therefore, it is recommended that this species is reassessed to understand more about the current stock health, and that assessments are conducted on a regular basis to prevent outdated information. Likewise, a FIP could be initiated for this fishery to start procuring observer data and learn about the current interaction rate with ETP species. The FIP would then be able to recommend improvements to reduce the rate of these incidents.

Introduction

StarKist longline fisheries use a range of different bait species in their operations when catching tuna. The bait species include Japanese pilchard (*Sardinops melanostictus*) and is expected to include Mexican sardine (*Harengula jaguana*), Pacific sardine (*Sardinops sagax*), Pacific saury (*Cololabis saira*), Atlantic horse mackerel (*Trachurus japonicus*), and scad (*Decapterus* Spp.). As part of the StarKist commitment to sustainability, understanding more about the species and the health of those species' stocks is imperative.

StarKist and other tuna retailers are interested in demonstrating their commitment to sourcing from sustainable fisheries. Therefore, consideration needs to be given to the traceability of bait. Typically, stock assessments and management measures for bait species are not conducted. In data-limited fisheries, such as those for bait species, the Marine Stewardship Council (MSC) permits using the Risk-Based Framework (RBF), a set of tools used to score the sustainability of a stock without the need for traditional stock assessments or other management measures. Part of the RBF is the Productivity-Susceptibility Analysis (PSA), wherein background research of the species is conducted on the attributes listed by the PSA, and the information is scored based on a series of pre-determined rationales. There are eight attributes for Productivity, and three for Susceptibility. The average of these scores is decided in a supporting Excel formula and provides a final score for the species.

A series of PSAs were conducted on the different species used as bait in the StarKist longline tuna fisheries. Using the results, a series of recommendations have been made for the company in order to improve the sourcing habits of the bait species.

For the species that have had stock assessments conducted, these results have been mentioned in the following sections of the report.

Table 1: Fish Source scores for the different species representing the total supply chain from StarKist bait sourcing.

Species	Gear type	Management Strategy	Managers Compliance	Fishers Compliance	Current Health	Future Health
Japanese pilchard	Purse seine	≥ 6	10	10	≥ 6	≥ 6
Mexican sardine	Purse seine	Not Yet Scored	Not Yet Scored	Not Yet Scored	Not Yet Scored	Not Yet Scored
Pacific sardine	Purse seine	< 6	< 6	< 6	≥ 6	≥ 6
Atlantic horse mackerel	Purse seine	≥ 6	10	10	≥ 6	6.6
Pacific saury	Dip nets lift nets	Not Yet Scored	Not Yet Scored	Not Yet Scored	Not Yet Scored	Not Yet Scored
Scad species	Purse seine and ring net	≥ 6	< 6	< 6	Data deficient	<6

Method

Information about the bait sourced and used by the American Samoa fishery within the scope of the StarKist supply chain, was provided by the company by way of email correspondence, invoices, and receipts. From these documents, only one main species of bait could be identified (frozen sardine).

Upon investigation, the species was identified as being the Japanese pilchard. Another, similar longline tuna fishery that has already been certified by the Marine Stewardship Council (MSC), the Pan Pacific yellowfin, bigeye, and albacore longline fishery, was also used to determine common bait type. From this report, it was determined that as well as the Japanese pilchard, Mexican sardine, Pacific sardine, Atlantic horse mackerel, Pacific saury, and scad are also commonly used.

There was no purchasing data available for any of the other finfish species list above, so analysis on the sourcing composition could not be made at this stage. However, a deep dive into each of the species was conducted using sources such as Fish Source, and Fishbase to identify and outline the status of the stock health, the sustainability of the fishery (where available), and any recommendations.

As mentioned in the introduction, a series of PSAs were run for each of the species to learn more about their current standing against the MSC Fisheries Standard, if the bait fisheries were to enter into assessment. The results of the PSAs can be found in the Appendices. The individual species PSAs can be found within each of the species' sections of the report.

Following the PSA, a fishery assessment was conducted for each species that aimed to identify the strengths and weaknesses of the fishery, and a set of improvement recommendations related to internal, and external responsibilities. The internal recommendations are related directly to the StarKist as ways to improve where they source from. The external recommendations are those directed at the broader regional fisheries management but will also require input from StarKist to encourage the changes.

Species profiles

The aim of this section is to outline the individual profiles for each bait species source by the StarKist longline fisheries to understand more about their current strengths, weaknesses, and any recommendations to improve the sustainability.

Japanese sardine *(Sardinops melanostictus)*

The Japanese sardine, was once one of the largest single-species fisheries in the world until the 1940s when the stocks collapsed (FAO, 2023). Since then, different studies have shown varying degrees of stock health, and some still report the stock as being in an overfished state and experiencing overfishing (Sarr, et al., 2021). The Fisheries Research and Education Agency (FRA) conducts annual stock assessments of this species, and the latest was published in August 2023. The results of the stock assessment demonstrated that the 2022 fishing catch had increased from recent years. However, the report also mentioned that fishing mortality has maintained a level below or approximately the same as the stock's maximum sustainable yield (MSY). Further, since 2017, the spawning stock biomass (SSB) has shown to have increased over this time as well (FRA, 2023). The stock remains above the point of recruitment impairment (PRI) and despite there being no recovery plan for the stock, there is a harvest control rule that implements a fishery closure if the estimated SSB falls below a certain level. A harvest strategy is in place within the fishery by way of a total allowable catch (TAC) rate. A TAC has been implemented since 1997, and continually evaluated to assess the level. The only time that the TAC has been exceeded was in 2007 but never since. Therefore, it is generally considered to be complied with, and the Japanese Fisheries Agency (JFA) will inform the fishers if the TAC is being approached to prevent it occurring.

The results of the PSA demonstrate that the species would fail at the MSC assessment level due to the susceptibility of the species to the fishery, which still must be scored despite being the target species. However, the life history traits of the species make it a good candidate for use as tuna bait.

Table 2: Productivity susceptibility analysis for the Japanese pilchard

Performance Indicator	1.1.1	
Productivity		
Scoring element (species)	Japanese sardine (*Sardinops melanostictus*)	
Attribute	**Justification**	**Score**
Average age at maturity	1-3 years (Sarr, et al., 2021)	**1**
Average maximum age	9 years old maximum age (Kawabata, et al., 2011; Sarr, et al., 2021)	**1**
Fecundity	At least 30,000 eggs (Sarr, et al., 2021)	**1**
Average maximum size Not scored for invertebrates	24 cm (Sarr, et al., 2021)	**1**

Average size at maturity Not scored for invertebrates	180 mm (18 cm) (Sarr, et al., 2021)	**1**
Reproductive strategy	Broadcast spawner (Sarr, et al., 2021)	**1**
Trophic level	3.4 (Sarr, et al., 2021) 2.8 (Froese & Pauly, 2023)	**3 (precautionary)**
Density dependence Invertebrates only	NA	**NA**
Susceptibility		
Fishery Only where the scoring element is scored cumulatively	*Insert list of fisheries impacting the given scoring element (MSC Fisheries Standard Toolbox A4.4.3a)*	
Attribute	**Justification**	**Score**
Areal Overlap	As the Japanese sardines are located in the Sea of Japan and East China sea, and are the target species for the bait fishery, it can be assumed that the overlap is >30%	**3**
Encounterability	As with Areal Overlap, the Japanese sardine is the target species and therefore encounterability will also be very high.	**3**
Selectivity of gear type	Purse seine fishing, as is used in Japanese sardine fisheries is largely unselective and will encircle both adults and juveniles with no discrimination	**3**
Post capture mortality	As target species to purse seine fisheries, all of the retained species will be dead, so the post capture mortality is high	**3**
Catch (weight) Only where the scoring element is scored cumulatively	*N/a*	***N/a***
Score		

REFS	

Table 3: Fishery assessment for the Japanese pilchard

Species	Japanese pilchard (*Sardinops melanosticta*)
Gear	Purse Seine
Location	Japan
Suppliers	Pacific Group S.A. DE C.V.
Certification or FIP	There is a FIP for the Japanese pilchard that was reported as being completed in 2023 COMPLETED Japan Hokkaido Japanese sardine - purse seine | Fishery Progress
Amount purchased (2020-2021)	316 MT
Strengths of the fishery	• Japanese fisheries harvest two pilchard stocks, the Japanese Pacific Ocean, and Tsushima Warm Current stocks. • Both stocks are assessed every year and are managed by total allowable catch (TAC). The TAC has only been exceeded once since the system was implemented in 1997. • Although not at a high abundance level, the Japanese Pacific stock is above its limit reference point and appears to be increasing in recent years. • A good amount of information about the fishery and relevant ecosystems is publicly available. • There are also a series of management measures including a TAC and a harvest control rule that leads to a fishery closure if the SSB falls below 22,000 MT. • Some spatial management in place that license or permit certain areas that vessels can and cannot fish.
Weaknesses of the fishery	• The TAC is set for both stocks combined, so harvests are not managed by stock. • The purse seine fishery is essentially multispecies, and some of the other target species, such as Japanese anchovy and Japanese horse mackerel, are commonly caught but their stocks are at low abundance levels. • Purse seine fisheries also have high bycatch rates, which could include those that are endangered, threatened, and protected (ETP). • Japanese fishing vessels are also not required to monitor encounters with ETP species so information on ETP species is limited. • Management of juvenile stocks are distinct from older fish individuals.

Internal Recommendations	• Ensure suppliers are meeting requirements, including social and environmental.
	• Work with the JFA to:
	  ○ Develop and fully enforce harvest control rules for the stock.
	  ○ Implement precautionary harvest strategies, including the adoption and implementation of limit and target reference points, and monitoring strategies.
	  ○ Obtain observer data and logbook records from the JFA about the sardine fishery to understand the impact on non-target species, and specifically ETP species.
	  ○ If observer data is not available, consider installing EM systems on board to ensure.
	• Ensure full traceability of all products back to the individual vessels to allow verification of legality. Verify source information and full chain traceability through audits or third-party traceability certification. For fisheries without robust traceability systems in place, invest in meaningful improvements to bring the fisheries and supply chain in compliance with best practices.
	• Push suppliers to engage with agencies to ensure labour and social issues are not present within workforce.

External Recommendations	• Implement precautionary harvest strategies, including the adoption and implementation of limit and target reference points, and monitoring strategies. • Develop the existing observer programme into a comprehensive data collection programme that includes bycatch and non-target species catch (both ETP and non-ETP species) and initiate a data collection program for habitats and ecosystem.

Mexican sardine (*Harengula jaguana*)

The Mexican sardine, also known as the scaled sardine or scaled herring, inhabits the coastal waters of the western Atlantic Ocean and Gulf of Mexico. Whilst the current stock status is unknown, research from the west Atlantic Ocean and across the inhabited coastal states demonstrates variability in the landings of Mexican sardine. Some fisheries directly target the species during the spawning season, which could negatively impact the recruitment of the species. Due to the accessible locations of spawning individuals in the coastal environments and seagrass, estuary, and mangrove habitats, over exploitation of these individuals is highly likely (Munroe, et al., 2019). No management measures for this species could be found online and more information is required about the specific fishery supplying the bait to the StarKist fleet.

The fishery failed the PSA due to the susceptibility of the species to the fishing gears, which is common for target species. However, this means that it would not pass MSC assessment as it currently stands. Despite the species' positive life history traits, without appropriate awareness of stock status and therefore poor management, it is not recommended that this species be used for bait until a FIP is initiated or measures improve.

Table 4: Productivity susceptibility analysis for the Mexican sardine

Performance Indicator	1.1.1	
Productivity		
Scoring element (species)	Pacific sardine (*Harengula jaguana)*	
Attribute	**Justification**	**Score**
Average age at maturity	1-3 years (Fishbase, 2023)	**1**
Average maximum age	3 years old maximum age (Fishbase, 2023)	**1**
Fecundity	5,000-52,000 eggs (Fishbase, 2023)	**1**
Average maximum size Not scored for invertebrates	21 cm (Fishbase, 2023)	**1**
Average size at maturity Not scored for invertebrates	7-9 cm (Fishbase, 2023)	**1**
Reproductive strategy	Broadcast spawner (Fishbase, 2023)	**1**
Trophic level	3.4 (Fishbase, 2023)	**3**
Density dependence Invertebrates only	NA	**NA**
Susceptibility		
Fishery Only where the scoring element is scored cumulatively	*Insert list of fisheries impacting the given scoring element (MSC Fisheries Standard Toolbox A4.4.3a)*	
Attribute	**Justification**	**Score**

Areal Overlap	They are the target species for the bait fishery, it can be assumed that the overlap is >30%	**3**
Encounterability	As with Areal Overlap, the Mexican sardine is the target species and therefore encounterability will also be very high.	**3**
Selectivity of gear type	Purse seine fishing, as is used in Mexican sardine fisheries is largely unselective and will encircle both adults and juveniles with no discrimination	**3**
Post capture mortality	As target species to purse seine fisheries, all of the retained species will be dead, so the post capture mortality is high	**3**
Catch (weight) Only where the scoring element is scored cumulatively	*N/a*	***N/a***
Score		
REFS		

Table 5: Fishery assessment for the Japanese pilchard

Species	Mexican sardine (*Harengula jaguana*)
Gear	Purse Seine
Location	USA
Suppliers	Unknown
Certification or FIP	No reported FIP or MSC certified fishery
Amount purchased (2020-2021)	Unknown
Strengths of the fishery	• The species is listed as “least concern” on the IUCN Red List.
Weaknesses of the fishery	• There is no information about the current management measures in place to ensure the sustainable exploitation of the stock from fisheries.

	• There is no recent information about the stock status of the species, which should be used to inform management measures. • There is no information about the interaction rate of the fishery with non-target and ETP species.
Internal Recommendations	• Initiate a FIP for the species • Ensure suppliers are meeting StarKist requirements, including social and environmental. • Ensure full traceability of all products back to the individual vessels to allow verification of legality. Verify source information and full chain traceability through audits or third-party traceability certification. For fisheries without robust traceability systems in place, invest in meaningful improvements to bring the fisheries and supply chain in compliance with best practices. • Encourage the participation in research to improve knowledge on the biology of the species and stock structure. • Improve the data collection system and survey coverage for all fleets, especially for the artisanal gears (gillnets and traps). • Implement observers onboard the vessels to ensure adequate coverage of ETP species interactions is reported. • Implement and ETP species management policy to prevent and mitigate against further interactions, as well as improve the rate of post-release survival of any animals that are by-caught.
External Recommendations	• Implement precautionary harvest strategies, including the adoption and implementation of limit and target reference points, and monitoring strategies. • Develop the existing observer programme into a comprehensive data collection programme that includes bycatch and non-target species catch (both ETP and non-ETP species) and initiate a data collection program for habitats and ecosystem. • Based upon the results from the population genetics studies, develop and implement regular stock assessments, using revised models that take into account the effects of environmental variability on the stock. • Establish a comprehensive and transparent monitoring program to cover the whole distribution region to collect fishery dependent and independent data to evaluate the stocks, collect information on ETP species (emphasis on marine mammals and seabirds), bycatch and environmental impacts.

Pacific sardine (*Sardinops sagax*)

The pacific sardine was also not specifically listed as a bait species used by the American Samoa fishery within the StarKist supply chain. However, it is a typical species used in longline fisheries and has historically been sourced by StarKist, which infers that future sourcing of the species may occur. The species is also listed as "least concern" by the IUCN Red List, however, as a result of the unselective nature of purse seine fishing, the species did not pass the PSA. Nevertheless, two 2023 research papers demonstrated that the stock is not considered to be over exploited (Nevarez-Martinez, et al., 2023; Enciso-Enciso, et al., 2023). The stock assessment conducted in 2023 demonstrated that the stock of Pacific sardine has been adequately exploited and not exceeded the biologically accepted catch (BAC) except for two years in 2014 and 2017.

Interaction with ETP species is not known for this specific species. However, studies conducted on a similar fishery demonstrated high interaction rates with a number of different ETP species including sharks, turtles, seabirds, and marine mammals. Improvements should be made to ensure that the fishery is reporting all incidents of ETP species interaction and implementing appropriate mitigation techniques to reduce post-release mortality.

The species failed the PSA due to the susceptibility scores. The life history traits of this species indicate that they are appropriate for exploitation, however the significant lack of management measures reduces the extent of sustainable exploitation of the species.

Table 6: Productivity susceptibility analysis for the Pacific sardine

Performance Indicator	1.1.1	
Productivity		
Scoring element (species)	Pacific sardine (*Sardinops sagax)*	
Attribute	**Justification**	**Score**
Average age at maturity	1-3 years (FishBase, 2023)	**1**
Average maximum age	25 years old maximum age (FishBase, 2023)	**2**
Fecundity	10,000 – 45,000 eggs (FishBase, 2023)	**1**
Average maximum size Not scored for invertebrates	39 cm (FishBase, 2023)	**1**
Average size at maturity Not scored for invertebrates	13 cm (COSEWIC, 2002)	**1**
Reproductive strategy	Broadcast spawner (FishBase, 2023)	**1**

Trophic level	2.8 (FishBase, 2023)	**2**
Density dependence Invertebrates only	NA	**NA**
Susceptibility		
Fishery Only where the scoring element is scored cumulatively	*Insert list of fisheries impacting the given scoring element (MSC Fisheries Standard Toolbox A4.4.3a)*	
Attribute	**Justification**	**Score**
Areal Overlap	They are the target species for the bait fishery, it can be assumed that the overlap is >30%	**3**
Encounterability	As with Areal Overlap, the Pacific sardine is the target species and therefore encounterability will also be very high.	**3**
Selectivity of gear type	Purse seine fishing, as is used in the Pacific sardine fishery is largely unselective and will encircle both adults and juveniles with no discrimination	**3**
Post capture mortality	As target species to purse seine fisheries, all of the retained species will be dead, so the post capture mortality is high	**3**
Catch (weight) Only where the scoring element is scored cumulatively	*N/a*	***N/a***
Score		
REFS		

Table 7: Fishery assessment for the Pacific sardine

Species	Pacific sardine (*Sardinops sagax*)
Gear	Purse Seine
Location	Mexico
Suppliers	Unknown
Certification or FIP	No reported FIP or MSC certified fishery
Amount purchased (2020-2021)	Unknown
Strengths of the fishery	• Two recent studies performed on the stock status of the fishery demonstrated variability in the level of exploitation rates from 1971-2021. However, both sets of research also demonstrated that the stock is expected to be harvested sustainably and not to a level of over exploitation ((Nevarez-Martinez, et al., 2023; Enciso-Enciso, et al., 2023). • The fishery is managed by the Mexico National Fisheries Institute (INAPESCA) • A BAC is in place within the fishery as an HCR.
Weaknesses of the fishery	• A study conducted in 2021 of fishing sets in 2013-2014 demonstrated a number of ETP species interactions with the fishery. The species included great white shark (*Carcharadon carcharias*), scalloped hammerhead (*Sphyrna lewini*), Galapagos green turtle (*Chelonia agassizii*), Californian sea lion (*Zalophus californianus*), bottlenose dolphin (*Tursiops truncates*), and longbeaked common dolphin (*Delphinus capensis*) (Morales-Bokorquez, et al., 2021). There is no specific fishery reports from these dates to demonstrate more recent ETP species interactions. • Stock assessments are not reported for this stock in Mexico to provide information on status of the Pacific Sardine stock in this jurisdiction. • A quota system is not in place yet in this fishery in Mexican waters. IUU fishing activities exist in the artisanal sector, although bycatch is assumed as low.
Internal Recommendations	• Initiate a FIP • Ensure suppliers are meeting StarKist requirements, including social and environmental commitments. • Encourage the participation in research to improve knowledge on the biology of the species and stock structure. • Improve the data collection system and survey coverage for all fleets, especially for the artisanal gears (gillnets and traps).

	• Implement observers onboard the vessels to ensure adequate coverage of ETP species interactions is reported. • Implement and ETP species management policy to prevent and mitigate against further interactions, as well as improve the rate of post-release survival of any animals that are by-caught. • Coordinate with INAPESCA to learn more about the monitoring, control, and surveillance mechanisms to ensure compliance with current regulations, especially the use of illegal fishing gear. • Suggest improvements to the MCS systems if lacking • Ensure full traceability of all products back to the individual vessels to allow verification of legality. Verify source information and full chain traceability through audits or third-party traceability certification. For fisheries without robust traceability systems in place, invest in meaningful improvements to bring the fisheries and supply chain in compliance with best practices.
External Recommendations	• Based upon the results from the population genetics studies, develop and implement regular stock assessments, using revised models that take into account the effects of environmental variability on the stock. • Establish a trilateral fishery management committee with members from the interested states (USA, Canada, and Mexico) to establish TAC and quotas/fishing unit for the whole region. • Establish a comprehensive and transparent monitoring program to cover the whole distribution region to collect fishery dependent and independent data to evaluate the stocks, collect information on ETP species (emphasis on marine mammals and seabirds), bycatch and environmental impacts.

Atlantic horse mackerel (*Trachurus trachurus*)

Atlantic horse mackerel is found in the northern Atlantic Ocean and is a popular option for tuna fisheries as bait for longline gears due to the natural predation by tuna species. Horse mackerel fisheries are of high commercial importance, as they supply a significant source of income to local economies (Lavin, et al., 2007). Despite their commercial importance, North Atlantic horse mackerel stocks have not been assessed since 2014. During the 2014 stock assessment, fishing mortality at Maximum Sustainable Yield (F_{MSY}) is defined as 0.13 and based on $F_{0.1}$ from the Yield Per Recruit (YPR) analysis. The target Fishing mortality (F) following the ICES MSY approach was determined as F=0.12 for 2015 (ICES, 2014). However, as of 2010, fishing mortality has been higher than F_{MSY} meaning that unsustainable practices are occurring in this fishery (FishSource, 2023). Furthermore, spawning stock biomass (SSB) is reported to be on a declining trend, linked to low recruitment levels that stem from 2014. In 2022, the FAO conducted a study on several small pelagic stocks in the Atlantic Ocean and found that stocks of Atlantic horse mackerel are fully exploited.

No information could be found about StarKist supplying from Atlantic horse mackerel fisheries as their bait source. However, as a commonly used bait type, it is highly likely that the two StarKist longline FIPs will use this species.

Table 8: Productivity susceptibility analysis for the Atlantic horse mackerel

Performance Indicator	1.1.1	
Productivity		
Scoring element (species)	Atlantic horse mackerel (*Trachurus trachurus*)	
Attribute	**Justification**	**Score**
Average age at maturity	2-4 years (FishBase, 2023)	**1**
Average maximum age	11 years old maximum age (FishBase, 2023)	**1**
Fecundity	At least 140,000 eggs (FishBase, 2023)	**1**
Average maximum size Not scored for invertebrates	70 cm (FishBase, 2023)	**1**
Average size at maturity Not scored for invertebrates	24 cm (FishBase, 2023)	**1**
Reproductive strategy	Broadcast spawner (FishBase, 2023)	**1**
Trophic level	3.7 (FishBase, 2023)	**3**
Density dependence Invertebrates only	NA	**NA**
Susceptibility		
Fishery Only where the scoring element is scored cumulatively	*Insert list of fisheries impacting the given scoring element (MSC Fisheries Standard Toolbox A4.4.3a)*	
Attribute	**Justification**	**Score**

Areal Overlap	As the Atlantic horse mackerel stocks are located in the Northeast Atlantic Ocean, and are the target species for the bait fishery, it can be assumed that the overlap is >30%	**3**
Encounterability	As with Areal Overlap, the Atlantic horse mackerel is the target species and therefore encounterability will also be very high.	**3**
Selectivity of gear type	Purse seine fishing, as is used in Atlantic horse mackerel fisheries is largely unselective and will encircle both adults and juveniles with no discrimination	**3**
Post capture mortality	As target species to purse seine fisheries, all of the retained species will be dead, so the post capture mortality is high	**3**
Catch (weight) Only where the scoring element is scored cumulatively	*N/a*	***N/a***
Score		
REFS		

Table 9: Fishery assessment for the Atlantic horse mackerel

Species	Atlantic horse mackerel (*Trachurus trachurus*)
Gear	Purse seine
Location	Northeast Atlantic
Suppliers	Unknown
Certification or FIP	None
Amount purchased (2021-2022)	Unknown
Strengths	• For 2015 set TAC followed the scientific advice. • Catch in 2012 and 2013 were below the set TAC. • Bycatch of protected species is not assumed to be significant. • A revised management plan is currently under development.

Weaknesses	• The Reproductive biomass (SSB) declined steadily between 1988 and 2000 and is expected to decline below MSY $B_{trigger}$ in 2014. • Fishing mortality has been increasing since 2007 and has been above F_{MSY} since 2012. • Recruitment has been low from 2004 onwards. • No recent catch data is available to determine if the TAC has been adhered to. • No precautionary reference points are defined; previous reference points were not consistent with the perceived state of stock. • There is large uncertainty in the absolute estimates of Spawning Stock Biomass. The only fishery-independent information for this stock is a measure of egg production from surveys conducted every three years. Not all countries provide data on discards; however, discards are considered negligible. • No information is available about non-target species bycatch and, specifically that of ETP designation. • However, it is clear that cetacean bycatch, including smaller species like bottlenose dolphins, porpoises, pilot whales, and minke whales have been seen in horse mackerel trawlers. These are not known to be "endangered" in the region, however, considering the new MSC Fisheries Standard version 3.0, they are considered "out-of-scope" (OOS). • Indirect effects of horse mackerel removal from the trophic system and food web are unknown but considered to be important because they contribute
Internal Recommendations	• Ensure suppliers are meeting requirements, including social and environmental. • Initiate a fishery improvement project (FIP) to evaluate and address sustainability issues in the fishery. • Encourage regional management to conduct stock assessments on the species to learn more about the health. • Using the information from the stock assessments, recommend harvest strategies and harvest control rules (HCRs) for the species. • Push for suppliers to enter environmental programmes such as FIPs or MSC certification. • Push suppliers to engage with agencies to ensure labour and social issues are not present within workforce.

External Recommendations	• Develop and implement a stock assessment programme to assess all stocks based on the best available science and develop appropriate stock-specific management advice. • Identify the reference points for the stock (target and limit) to enable effective monitoring of management compliance. • Develop the existing observer programme into a comprehensive data collection programme that includes bycatch and non-target species catch (both ETP and non-ETP species) and initiate a data collection program for habitats and ecosystem. • Failing observer implementation, consider adding EM systems to the vessels to ensure data about non-target catch is recorded.

Pacific saury (*Cololabis saira*)

Pacific saury is a migratory pelagic fish species that can be found across the North Pacific Ocean and is commercially important for many North Pacific nations, including Japan, Taiwan, Russia, Korea, China, and Vanuatu. Due to increasing fishing pressure in recent years, the species has been listed among priority fish species in the North Pacific Fisheries Commission (NPFC). The Pacific saury has high commercial value and recent interest in the stock status led to the 2022 stock assessment using length-based Bayesian Evaluation method being conducted. The results of the stock assessment demonstrated that the current exploitation rate of the fishery will not damage the stock. Current biomass is at a high level (B/B_0 = 0.82 and B/B_{MSY} = 2.10) (Yongchuang, et al., 2022).

No information could be found about StarKist supplying from Pacific saury fisheries as their bait source. However, as a commonly used bait type, it is highly likely that the two StarKist longline FIPs will use this species.

Table 10: Productivity susceptibility analysis for the Pacific saury

Performance Indicator	1.1.1	
Productivity		
Scoring element (species)	Pacific saury (*Cololabis saira*)	
Attribute	**Justification**	**Score**
Average age at maturity	2.5-3.5 years (FishBase, 2023)	**1**
Average maximum age	4 years old maximum age (FishBase, 2023)	**1**
Fecundity	At least 140,000 eggs (FishBase, 2023)	**1**

Average maximum size Not scored for invertebrates	70 cm (FishBase, 2023)	**1**
Average size at maturity Not scored for invertebrates	40 cm (FishBase, 2023)	**1**
Reproductive strategy	Broadcast spawner (FishBase, 2023)	**1**
Trophic level	3.7 (FishBase, 2023)	**3**
Density dependence Invertebrates only	NA	**NA**
Susceptibility		
Fishery Only where the scoring element is scored cumulatively	*Insert list of fisheries impacting the given scoring element (MSC Fisheries Standard Toolbox A4.4.3a)*	
Attribute	**Justification**	**Score**
Areal Overlap	As the Pacific saury stocks are located in the Pacific Ocean, and are the target species for the bait fishery, it can be assumed that the overlap is >30%	**3**
Encounterability	As with Areal Overlap, the Pacific saury is the target species and therefore encounterability will also be very high.	**3**
Selectivity of gear type	Dip netting and lift nets, as are used in Pacific saury fisheries is largely unselective but less so than purse seine gears, so will likely contribute to fewer incidents of bycatch. However, selecting adults from a population will still be challenging.	**2**
Post capture mortality	As target species, all of the retained species will be dead, so the post capture mortality is high	**3**
Catch (weight) Only where the scoring element is scored cumulatively	*N/a*	***N/a***

Score	
REFS	

Table 11: Fishery assessment for the Pacific saury

Species	Pacific saury (*Cololabis saira*)
Gear	Dip nets and lift nets
Location	North Pacific Ocean
Suppliers	Unknown
Certification or FIP	None
Amount purchased (2021-2022)	Unknown
FIP/MSC allowance	
Strengths	• In 2020, a research paper documented the results of a recent stock assessment using Catch-MSY conducted on North Pacific saury. This is thought to be a good alternative for fisheries that are data-limited and cannot describe true MSY (Yongchuang, et al., 2022) • Another recent study in 2022 researched the Length-Based Bayesian evaluation method demonstrated that North Pacific saury are not overfished and not experiencing overfishing (Shi, et al., 2022). • Lift and dip nets are less invasive than larger fishing gears like purse seine nets and longlines.
Weaknesses	• No true stock assessment has been conducted on the species yet. • There is no information available about harvest strategies or harvest control rules in place within the fishery. • Management measures are not only not described but there is no evidence of enforcement from national managing bodies like the North Pacific Fisheries Commission (NPFC). • Catches of Pacific saury have not been published so there is no way of knowing how catch rates have changed over the years.

Internal Recommendations	• Collaborate with the NPFC to conduct a real stock assessment to determine accurate MSY. • Work with the NPFC to develop harvest strategies and harvest control rules for North Pacific saury stocks. • Ensure that all management measures are fully enforced and reported on. • Ensure suppliers are meeting requirements, including social and environmental. • Initiate a fishery improvement project (FIP) to evaluate and address sustainability issues in the fishery. • Assess observer data (if available) and implement EM systems onboard vessels if observer data is not readily available. • Push suppliers to engage with agencies to ensure labour and social issues are not present within workforce.
External Recommendations	• Develop and implement a stock assessment programme to assess all stocks based on the best available science and develop appropriate stock-specific management advice. • Identify the reference points for the stock (target and limit) to enable effective monitoring of management compliance. • Develop the existing observer programme into a comprehensive data collection programme that includes bycatch and non-target species catch (both ETP and non-ETP species) and initiate a data collection program for habitats and ecosystem. • Failing observer implementation, consider adding EM systems to the vessels to ensure data about non-target catch is recorded.

Scad (*Decapterus* spp.)

The specific species of scad was not identified during this analysis; however, it is highly likely that the species originates from Filipino, Indonesian, Vietnamese, and/or Chinese fisheries. The fishery for scad is a multispecies fishery of different scad species and in the Philippines, a series of fishery management areas (FMAs) have been established since 2019 to apply the ecosystems approach to fisheries management. A stock assessment that was carried out on four species in 2015 demonstrates that all four stocks are reaching capacity of exploitation. There was no other information available about other scad species, and without knowing the specific species used as bait, no comment can be made on the sustainability of the specific bait fishery from which StarKist sources.

The multispecies fishery is expected to use a range of different fishing gears, including gillnets, purse seines, longlines, and traps. Despite no specific impacts being recorded for the multispecies fishery, it can be assumed that these fishing gears are interacting with ETP and other non-target species.

Table 12: Productivity susceptibility analysis for scad

Performance Indicator	1.1.1	
Productivity		
Scoring element (species)	Scad (*Decapterus* spp.)	
Attribute	**Justification**	**Score**
Average age at maturity	2 years (Ohshimo, et al., 2010)	**1**
Average maximum age	4-5 years (Ohshimo, et al., 2010)	**1**
Fecundity	20,000 – 150,000 eggs	**1**
Average maximum size Not scored for invertebrates	30 cm	**2**
Average size at maturity Not scored for invertebrates	50 cm	**2**
Reproductive strategy	Broadcast spawner	**1**
Trophic level	3.2	**2**
Density dependence Invertebrates only	NA	**NA**
Susceptibility		
Fishery Only where the scoring element is scored cumulatively	*Insert list of fisheries impacting the given scoring element (MSC Fisheries Standard Toolbox A4.4.3a)*	
Attribute	**Justification**	**Score**
Areal Overlap	As the milkfish stocks are located in aquaculture systems, and are the target species for the bait fishery, it can be assumed that the overlap is >30%	**3**

Encounterability	As with Areal Overlap, the milkfish is the target species and therefore encounterability will also be very high.	**3**
Selectivity of gear type	Aquaculture specifically breeds milkfish for production, therefore the only species caught is the target species. This means that it is a selective method of fishing and is unlikely to come into contact with non-target species	**1**
Post capture mortality	As target species, all of the retained species will be dead, so the post capture mortality is high	**3**
Catch (weight) Only where the scoring element is scored cumulatively	*N/a*	***N/a***
Score		
REFS		

Table 13: Fishery assessment for scad

Species	Scad (*Decapterus* Spp.)
Gear	Purse seine, Ring nets
Location	Philippines
Suppliers	Unknown
Certification or FIP	None
Amount purchased (2021-2022)	Unknown
Strengths	• Stock assessments for scads exist for some fishing grounds within FMA-10. • Some management measures established in accordance with the Fisheries Code. • Municipal fishers and boat registration and licensing led by local governments. • MPAs established. • There are two authorities in the Philippines, the Department of Agriculture (DA), and the Bureau of Fisheries and Aquatic Resources (BFAR), under

	which, fisheries management is shared. Fisheries Management Areas (FMAs) are established under the Fisheries Code and include the establishment of harvest control rules (HCRs) and reference points of the FMAs. • There are a series of spatial fishery closures listed in the fisheries code. • MCS systems to combat IUU fishing are required of commercial fishing vessels
Weaknesses	• Stock structure for scads in the Philippines is unknown. • Last stock assessment available is based on data from 2015. • No harvest control rules established specifically for scads. • Municipal-based fisheries enumeration and monitoring not implemented in most areas. • Capacity to fully enforce fisheries laws at municipal and FMA levels is insufficient. • Poaching and/or bycatch of legally protected species persist in some fisheries. • Management effectiveness of most MPAs limited. • High exploitation rates with some stocks being heavily fished to “unsustainable levels”. • No estimation of the impact of scad fisheries on ETP species, but there is a high proportion of dolphins, whales, whale sharks, mantas, and mobula within this area and some are still target by Filipino fisheries. • Impact of scad fisheries on habitats is unknown. However, trawl fishing gears are known to be highly detrimental to seafloor habitats, including reefs. • Despite MPA coverage, it is expected that only 3% of that is effectively managed. • Ecosystem impacts are not known.
Internal Recommendations	• Improve fisheries data collection and reporting system. • Evaluate fishery impacts and sustainability. • Develop a more reliable and transparent licensing and boat-gear registry. • Establish VMS for commercial fishing boats. • Strengthen local capacity for municipal-based fisheries enumeration, monitoring, and law enforcement. • Recognition and support for MPAs established. • Implement FMAs to focus on the ecosystem approach to fisheries management.

External Recommendations	• Implement observers onboard the vessels to improve reporting of non-target species bycatch (including ETP species) • Enforce management measures. • Conduct regular assessments of the stock to understand more about the health and sustainability of catches. • Use the results of the stock assessment to inform management measures, harvest strategies, and HCRs. • Ensure all management measures are fully enforced.

Appendices

Table 14: PSA scores and results for each of the bait species described in this report and sourced by StarKist longline fisheries

							Productivity Scores [1-3]								Susceptibility Scores [1-3]					PSA Score			
Scoring element	First of each scoring element	Family name	Scientific name	Common name	Species type	Fishery descriptor	Average age at maturity	Average max age	Fecundity	Average max size	Average size at Maturity	Reproductive strategy	Trophic level	Total Productivity (average)	Availability	Encounterability	Selectivity	Post-capture mortality	Total (multiplicative)		MSC PSA-derived score	Risk Category Name	MSC scoring guidepost
1	First	Clupeidae	Sardinops melanosticta	Japanese pilchard	Vertebrate	Purse seine	1	1	1	1	1	1	3	1.29	3	3	3	3	3.00	3.26	56	High	<60
2	First	Dorostomatidae	Harengula jaguana	Mexican sardine	Vertebrate	Purse seine	1	1	1	1	1	1	3	1.29	3	3	3	3	3.00	3.26	56	High	<60
3	First	Alosidae	Sardinops sagax	Pacific sardine	Vertebrate	Purse seine	1	2	1	1	1	1	2	1.29	3	3	3	3	3.00	3.26	56	High	<60
4	First	Carangidae	Trachurus trachurus	Atlantic horse mackerel	Vertebrate	Purse seine	1	1	1	1	1	1	1	1.00	3	3	3	3	3.00	3.16	61	Med	60-79
5	First	Scomberesocidae	Cololabis saira	Pacific saury	Vertebrate	Purse seine	1	1	1	1	1	1	1	1.00	3	3	2	3	2.33	2.53	83	Low	≥80
6	First	Carangidae	Decapterus spp.	Scad	Vertebrate	Purse seine	1	1	1	2	2	1	2	1.43	3	3	1	3	1.65	2.18	92	Low	≥80

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