FCF Bait Sourcing Profile and PSAs Report

Prepared by

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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 FCF longline fisheries and the recommendations to improve the sustainable sourcing of those species.

Executive Summary

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

FCF provided a summary regarding the bait used in its longline fishery. Japanese sardine (*Sardinops melanostictus*) is highlighted as the most frequently used bait – 38% of sourced bait species in 2024. However, using information from other similar fisheries operating in the same geographical areas, four 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 sardine (*Sardinops melanostictus*)

The Japanese sardine appears to be the primary species used by the WCPO fishery. Stock assessment published by Fisheries Research and Education Agency of Japan (FRA) suggests that the stock is not overfished ($B/B_{MSY} > 1$) but is experiencing overfishing ($F/F_{MSY} > 1$). 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 sardine 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.

Based on our assessment, Japanese sardine is assessed as high risk through a PSA and not recommended to source for bait, mainly due to its unselective nature fishing gear and high trophic level. In addition, the stock assessment conducted in 2023 by FRA suggested high fishing mortality – $F_{2022}/F_{MSY} > 1$.

2. Shortfin scad (*Decapterus macrosoma*)

According to the information from Fish Source species profile, shortfin scad is a prominent fish species found in tropical and subtropical waters, particularly in the Indo-Pacific region. This pelagic fish is characterised by its streamlined body, large eyes, and distinctive short pectoral fins, which contribute to its agile swimming abilities. Shortfin scad typically inhabit coastal areas, often forming large schools near reefs and in open waters. However, only the stock in Ecuadorian continental water is assessed and is indicated as overfished and experiencing overfishing (Canales, 2021).

The studies in Antique, Philippines also shows that shortfin scad in general have a fast growth rate but a short life span. Even though its growth pattern was generally isometric, the species was caught in the first year of its life, which probably resulted in growth overfishing (Sagrado Magallanes, 2022)

The studies in the waters of Ternate, North Maluku, Indonesia does not explicitly indicate whether the stock is experiencing overfishing or has overfished, however, it clearly states that the yearly catches of shortfin scad in that region has exceeded the MSY value (Ratna Suharti, 2024). Other regions largely remain unknown.

The global demand for shortfin scad has led to various fishing practices, including purse seining and gillnetting. While they are generally considered a resilient species, overfishing and habitat degradation pose threats to their populations in certain regions.

3. Bali sardinella (*Sardinella lemuru*)

Bali sardinella is a commonly seen bait species for longline fishery. It is commonly found in the warm waters of the Indian and Pacific Oceans, particularly around Indonesia, the Philippines, and coastal regions of Southeast Asia. Seining and gillnetting are the most common fishing methods that target Bali sardinella.

The stock status of Bali sardinella has been a concern due to overfishing and habitat degradation. Whilst specific assessments vary by region, there are indications of declining populations in some areas (M Natsir, 2021)and some regions are not considered experiencing overfishing (Tri Haryanto, 2025).

The management strategy for Bali sardinella remains primary, including using digital landing recorder to monitor catch landing in major ports (Muncar and Pengambengan) and total allowable catch (TAC). As stock assessment reports are not publicly available, there is high uncertainty on the data available due to no updated information for a comprehensive evaluation.

4. Mackerel scad (*Decapterus macarellus*)

Mackerel scad is widely spread across the globe, particularly in coastal areas. The species is primarily caught by purse seine fishery (Joseph Salawa Sululu, 2025) (Stobberup, 2006). Net fishing is so used in other regions such as China. Biological assessment for stocks of mackerel scad was conducted in several regions, including Tanzania coastal water and South China Sea.

Stock in South China Sea is subject to overfishing. The spawning potential ratio (SPR) was used as the reference point, particularly for data-poor fisheries. Under length-based Bayesian biomass (LBB) model, the stock is considered healthy and experiencing overfishing as the estimated relative stock size B/B_{MSY} is 1.3 (95% CI = 0.889–1.78) and the estimated $F_{CURRENT}/F_{MSY}$ increased from 0.745 (95%

CI = 0.567 – 0.965) in 2012–2014 to 2.1 (95% CI = 1.79 – 2.46) in 2019–2021, indicating that the current fishing mortality is twice as high as natural mortality. However, it resulted to overfished ($B/B_{MSY} < 1$) Under length-based spawning potential ratio (LBSPR) model due to catching an excess of juveniles (Youwei Xu, 2023).

Regulation about mesh was suggested to reduce the impact to juvenile mackerel scad. Furthermore, as a migratory species, the need of collaboration from adjacent countries is emphasised in order to jointly design a robust management policy.

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 FCF source from this fishery until more stock assessments in different regions are conducted. 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.

5. Milkfish (*Chanos chanos*)

Milkfish, found in farms, estuaries, and coastal waters, is a species that is widely distributed in the Indo-Pacific region. It is known for its high nutritional value and is a staple in many coastal communities. The milkfish sourced by FCF during 2024 were farmed in Indonesia.

Management strategy for milkfish focuses on broodstock, health, and hatchery technology. In addition, the wild milkfish is listed as least concerned in IUCN Red List since 2016.

The key findings and summary of risk are identified after PSA and desk-based research:

- **High risk: Japanese sardine**
- **Medium risk: shortfin scad (eastern Indonesia), Bali sardinella (Indonesia), mackerel scad (Indonesia)**
- **Low risk: shortfin scad (South China Sea), mackerel scad (South Chian Sea), farmed milkfish (Indonesia)**

Critical decision making when selecting bait to minimise risk:

- **Trophic level: lower trophic level is preferrable.**
- **Fishing gear selectivity: higher selectivity is preferrable.**

For those that are avoid unless necessary, we recommend trying to source from those fisheries that are in improvement programmes who are addressing the identified issues.

Table 1: Summarised table and recommendation

Species Common Name	Species	Ocean Region of Harvest	Fishing method	Certification scheme	MSC Score	Recommend?	Rationales
Japanese sardine	*Sardinops melanostictus*	Northwest Pacific	Purse seine	MSC In-assessment	< 60 (56)	Avoid	Due to a high trophic level and susceptibility score, including low selectivity of gear type.
Shortfin scad	*Decapterus macrosoma*	Eastern Indonesia	Purse seine	FIP	60 – 79 (66)	Avoid unless necessary	Due to a high trophic level and susceptibility score, including low selectivity of gear type.
		Eastern Indonesia	Gillnet	NA	60 – 79 (66)	Avoid unless necessary	Due to a high trophic level and susceptibility score, including low selectivity of gear type.
		South China Sea	Nets (with lights)		≥ 80 (82)	Ideal	Despite a relative low selectivity of gear type, the species has a high trophic level and susceptibility score.
Bali sardinella	*Sardinella lemuru*	Indonesia	Purse seine	NA	60 – 79 (69)	Avoid unless necessary	Despite low trophic level of the species, the susceptibility score is high, including low selectivity of gear type.
Mackerel scad	*Decapterus macarellus*	Indonesia	Purse seine	NA	60 – 79 (66)	Avoid unless necessary	Due to a high trophic level and susceptibility score, including low selectivity of gear type.
		South China Sea	Nets (with lights)		≥ 80 (82)	Ideal	Despite a relative low selectivity of gear type, the species has a high trophic level and susceptibility score.
Milkfish	*Chanos chanos*	Indonesian farms	Farmed	NA	≥ 80	Ideal	As per MSC guidance, farmed fish meet an automatic score of 80+ by default. However, we need actions to determine the composition of feed used to ensure the traceability and transparency of sourcing.

Introduction

FCF longline fisheries use a range of different bait species in their operations when catching tuna. The bait species include Japanese sardine (*Sardinops melanostictus*), Bali sardinella (*Sardinella lemuru*), Indonesian milkfish (*Chanos chanos*) and some scad species including Shortfin scad (*Decapterus macrosoma*) and Mackerel scad (*Decapterus macarellus*). As part of the FCF commitment to sustainability, understanding more about the species and the health of those species' stocks is imperative.

FCF 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 FCF 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 2: Fish Source scores for the different species representing the total supply chain from FCF bait sourcing.

Species	Gear type	Management Strategy	Managers Compliance	Fishers Compliance	Current Health	Future Health
Japanese sardine	Purse seine	≥ 6	10	10	≥ 6	≥ 6
Shortfin scad	Purse seine	≥ 6	≥ 8	< 6	2.6	2.2
	Gillnet	≥ 6	≥ 8	< 6	2.6	2.2
	Nets (with light attraction)	≥ 6	≥ 8	< 6	2.6	2.2
Bali sardinella	Purse seine	≥ 6	< 6	< 6	Data deficient	Data deficient
Mackerel scad	Purse seine	NA	NA	NA	NA	NA
	Net (with light attraction)	NA	NA	NA	NA	NA
Milkfish	Farmed	NA	NA	NA	NA	NA

Method

Information about the bait sourced and used by the FCF longline fishery within the scope of the FCF supply chain, was provided by the company by way of email correspondence, invoices, and receipts. Upon investigation, the Japanese sardine is considered the major species for longline bait. From this report, it was determined that as well as the Japanese sardine, shortfin scad, Bali sardinella, and mackerel scad are also commonly used (sourcing percentage > 5%).

Table 3: List of species sourced by FCF and percentage in 2024

Export country	Common names	Scientific names	Stock	% of sourcing 2024
Japan	Japanese sardine	*Sardinops melanostictus*	Tsushima	38%
Russia			Kuroshio	< 5%
Indonesia	Mackerel scad	*Decapterus macarellus*	South China Sea	10 – 20%
			Eastern Indonesia	
China	Bali sardinella	*Sardinella lemuru*	Indonesia	10 – 20%
China	Shortfin scad	*Decapterus macrosoma*	Indonesia	10 – 20%
			South China Sea	
Indonesia	Milkfish	*Chanos chanos*	Indonesia	5%
South Africa	Pacific sardine	*Sardinops sagax*	South Africa	< 5%

Only summarised percentage of bait species sourced by FCF sourcing team list above, so the 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 biological assessment papers, 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 the assessment. The results of the PSAs can be found in the **Error! Reference source not found.**. The individual species PSAs can be found within each of the species' sections of the report.

If species has multiple stocks – species inhabits different regions and is assessed separately, we will conduct multiple PSAs to justify the stock status.

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 FCF 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 FCF to encourage the changes.

Japanese sardine will not undergo PSA due to the complete stock assessment is regularly assessed by Japanese Fisheries Research and Education Agency (FRA). Milkfish, as a farmed fish, does not apply to PSA either. Pacific sardine is not assessed as the sourced percentage does not exceed 5%.

Species Profiles and PSAs

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

Japanese sardine (*Sardinops melanostictus*)

Considered as the main bait species sourced by FCF in 2024 (38%), we assess this species based on recent stock assessment conducted by the Fisheries Research and Education Agency of Japan (FRA) in 2023 instead of PSA.

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, Kindong, & Tian , 2021). The 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).

Stock assessment conducted in 2023 also indicates that the species in 2022 was not overfished ($B/B_{MSY} > 1$) but is experiencing overfishing ($F/F_{MSY} > 1$). 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 for the stocks to manage these stocks to a TRP of SSB_{MSY} with LRPs set at 60% of MSY and 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.

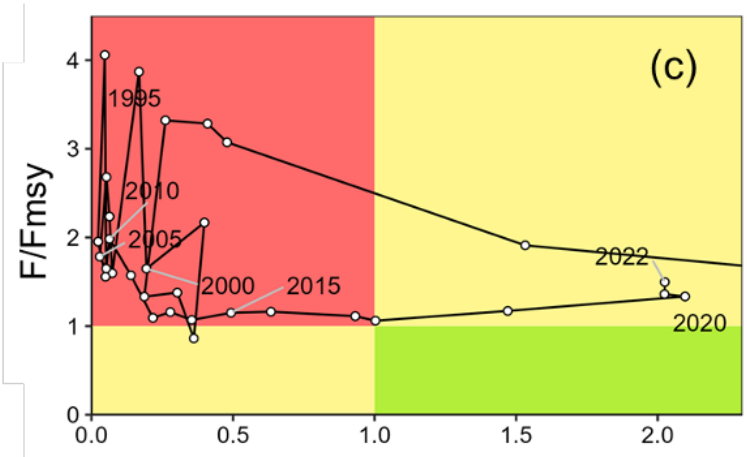

Figure 1: The Kobe plot indicating historical and current status of Japanese sardine in relation to MSY-based reference points reprinted from Japan's domestic stock assessment of Japanese Sardine (Furuichi, 2023)

Table 4: Productivity susceptibility analysis for the Japanese sardine (Kuroshio stock)

Performance Indicator	2.1.1	
Productivity		
Scoring element (species)	Japanese sardine (*Sardinops melanostictus*)	
Attribute	**Justification**	**Score**
Average age at maturity	1-3 years (Sarr, Kindong, & Tian , 2021)	**1**
Average maximum age	9 years old maximum age (Kawabata, 2011) (Sarr, Kindong, & Tian , 2021)	**1**
Fecundity	At least 30,000 eggs (Sarr, Kindong, & Tian , 2021)	**1**
Average maximum size Not scored for invertebrates	24 cm (Sarr, Kindong, & Tian , 2021)	**1**
Average size at maturity Not scored for invertebrates	18 cm (Sarr, Kindong, & Tian , 2021)	**1**
Reproductive strategy	Broadcast spawner (Sarr, Kindong, & Tian , 2021)	**1**
Trophic level	3.4 (Sarr, Kindong, & Tian , 2021) 2.8 (Froese R. &., 2023)	**3 (Precautionary)**
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	*NA*	
Score		**56**

Table 5: Fishery assessment for the Japanese sardine

Species	Japanese sardine (*Sardinops melanosticta*)
Gear	Purse Seine
Location	Japan / Russia
Certification or FIP/MSC	There is a FIP for the Japanese sardine that was reported as being completed in 2023 COMPLETED Japan Hokkaido Japanese sardine - purse seine | Fishery Progress; Ikeshita-Kanematsu Japanese sardine purse seine.
Percentage sourced (2024)	Nearly 40 %

Strengths of the fishery	• Japanese fisheries harvest two sardine 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 and unselective nature, 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 FRA 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 programme for habitats and ecosystem.

Shortfin scad (*Decapterus macrosoma*)

Shortfin scad, according to FCF bait sourcing statistics in 2024, occupied 10 – 20% of sourcing. Majority of shortfin scad was sourced from China. However, the species is widely spread across Indo-pacific, Atlantic and Red Sea, at the coastal regions. Whilst the stock status is unknown, it is assessed by IUCN as "Least Concern".

As shortfin scad is captured by a variety of fishing gear, including purse seine, gillnet, and other net fishing, we will conduct PSA respectively. 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 and gillnet fisheries at coastal regions, it is considered that bycatch interaction would be high. The species captured by purse seine and gillnet is assessed as high risk in the PSA largely due to the unselective nature and high encounterability as it is one of the target species and the regions inhabit various number of species. Other gears such light falling net is poorly studied in terms of selectivity, however, as this is one of the bycatch mitigation measures, it should be assessed as low risk.

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 FCF is supplying from a fishery that is committing to the same management requirements set by the company.

Table 6: Productivity susceptibility analysis for the Shortfin scad (purse seine in eastern Indonesian stock)

Performance Indicator	2.2.1	
Productivity		
Scoring element (species)	Shortfin scad (*Decapterus macrosoma*)	
Attribute	**Justification**	**Score**
Average age at maturity	2 years (Ohshimo, 2010)	**1**
Average maximum age	5 years (Ohshimo, 2010)	**1**
Fecundity	43,000 (Froese, 2017)	**1**
Average maximum size	35 cm (Smith-Vaniz, Carangidae, 1986)	**1**

Not scored for invertebrates		
Average size at maturity Not scored for invertebrates	16.8 cm (https://www.fishbase.se/summary/1938)	**1**
Reproductive strategy	Broadcast spawner (Heidi Retnoningtyas, 2024)	**1**
Trophic level	3.4±0.45 se (https://www.fishbase.se/summary/1938)	**3**
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	Indo-Pacific and Southeast Atlantic: from Knysna to Natal, South Africa to Australia, including Persian Gulf and the Red Sea, and in the Central Pacific Islands from South Korea to Gulf of California to Peru, including Galapagos Islands. Small-scale purse seine is the dominant type of fishing gear used to catch *D. macrosoma*. Gillnet is also used in some regions in the Philippines. It can be assumed that the overlap is more than 30%. (Smith-Vaniz, 1995) (Melanie C. Villarao, 2023)	**3**
Encounterability	As with Areal Overlap, the shortfin scad is considered highly exploited by local purse seine fishery in each region and therefore encounterability will be referred to as high risk.	**3**

Selectivity of gear type	Purse seining is a non-selective fishing method that captures everything that it surrounds, including protected species. https://www.fisheries.noaa.gov/national/bycatch/fishing-gear-purse-seines	**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	*NA*	
Score		**66**

Table 7: Productivity susceptibility analysis for the Shortfin scad (gillnet in eastern Indonesian stock)

Performance Indicator	2.2.1	
Productivity		
Scoring element (species)	Shortfin scad (*Decapterus macrosoma*)	
Attribute	**Justification**	**Score**
Average age at maturity	2 years (Ohshimo, 2010)	**1**
Average maximum age	5 years (Ohshimo, 2010)	**1**
Fecundity	43,000 (Froese, 2017)	**1**

Average maximum size Not scored for invertebrates	35 cm (Smith-Vaniz, Carangidae, 1986)	**1**
Average size at maturity Not scored for invertebrates	16.8 cm (https://www.fishbase.se/summary/1938)	**1**
Reproductive strategy	Broadcast spawner (Heidi Retnoningtyas, 2024)	**1**
Trophic level	3.4±0.45 se (https://www.fishbase.se/summary/1938)	**3**
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	Indo-Pacific and Southeast Atlantic: from Knysna to Natal, South Africa to Australia, including Persian Gulf and the Red Sea, and in the Central Pacific Islands from South Korea to Gulf of California to Peru, including Galapagos Islands. Small-scale purse seine is the dominant type of fishing gear used to catch *D. macrosoma*. Gillnet is also used in some regions in the Philippines. It can be assumed that the overlap is more than 30%. (Smith-Vaniz, 1995) (Melanie C. Villarao, 2023)	**3**
Encounterability	As with Areal Overlap, the shortfin scad is considered highly exploited by local purse seine fishery in each region	**3**

	and therefore encounterability will be referred to as high risk.	
Selectivity of gear type	Gillnet selectivity is only dependent on the size of the fish relative to that of the mesh, which is also considered as unselective gear. https://www.fao.org/4/x7788e/X7788E03.htm	**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	*NA*	
Score		**66**

Table 8: Productivity susceptibility analysis for the Shortfin scad (South China Sea stock)

Performance Indicator	2.2.1	
Productivity		
Scoring element (species)	Shortfin scad (*Decapterus macrosoma*)	
Attribute	**Justification**	**Score**
Average age at maturity	2 years (Ohshimo, 2010)	**1**
Average maximum age	5 years (Ohshimo, 2010)	**1**
Fecundity	43,000	**1**

	(Froese, 2017)	
Average maximum size Not scored for invertebrates	35 cm (Smith-Vaniz, Carangidae, 1986)	**1**
Average size at maturity Not scored for invertebrates	16.8 cm (https://www.fishbase.se/summary/1938)	**1**
Reproductive strategy	Broadcast spawner (Heidi Retnoningtyas, 2024)	**1**
Trophic level	3.4±0.45 se (https://www.fishbase.se/summary/1938)	**3**
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	Indo-Pacific and Southeast Atlantic: from Knysna to Natal, South Africa to Australia, including Persian Gulf and the Red Sea, and in the Central Pacific Islands from South Korea to Gulf of California to Peru, including Galapagos Islands. It can be assumed that the overlap is more than 30% as the light falling net used in South China Sea is dominated by mackerel scad (*Decapterus macarellus*) and shortfin scad (*D. macrosoma*). (Youwei Xu, 2023)	**3**
Encounterability	As with Areal Overlap, the shortfin scad is considered highly exploited by local light falling-net fishery in each region and therefore encounterability will be referred to as high risk.	**3**

Selectivity of gear type	Most of the small pelagic species in the tropics display positive phototaxis. These include sardinella, anchovy, saury, small mackerel and bait fish. Net fishing using light attraction aims to increase catch efficiency and selectivity by attracting target species while potentially deterring or reducing the capture of unwanted bycatch. (Hannah R.W., 2015)	**2**
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	*NA*	
Score		**82**

Table 9: Fishery assessment for the shortfin scad

Species	Shortfin scad (*Decapterus macrosoma*)
Gear	Purse Seine / Gillnet / Net
Location	Indo-pacific
Suppliers	Unknown
Certification or FIP/MSC	Ecuador small pelagics - purse seine (CNP)
Percentage sourced (2024)	10 – 20%
Strengths of the fishery	• The species is listed as "least concern" on the IUCN Red List. • Few regional studies focusing on biological and population aspects.
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 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 FCF 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 programme 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 programme 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.

Bali sardinella (*Sardinella lemuru*)

Majority of Bali sardinella sourced by FCF comes from China, occupying 10 – 20% of bait sourcing quantity. Although not confirmed the fishing areas, Bali sardinella are mostly fished through purse seining and gillnetting and stock status varies by regions.

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.

Table 10: Productivity susceptibility analysis for the Bali sardinella (Indonesian stock)

Performance Indicator	2.2.1	
Productivity		
Scoring element (species)	Bali sardinella (*Sardinella lemuru*)	
Attribute	**Justification**	**Score**
Average age at maturity	0.8 years (Jew, 2022)	**1**
Average maximum age	2.8 years (Jew, 2022)	**1**
Fecundity	4,507 to 43,733 eggs (Joson-Pagulayan AE, 2019)	**1**
Average maximum size Not scored for invertebrates	23 cm https://www.fishbase.se/summary/Sardinella-lemuru.html	**1**
Average size at maturity Not scored for invertebrates	14.3 cm https://www.fishbase.se/summary/Sardinella-lemuru.html	**1**

Reproductive strategy	Broadcast spawner (Soerjodinoto, 1960)	**1**
Trophic level	2.5 https://www.fishbase.se/summary/Sardinella-lemuru.html	**1**
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 *Sardinella lemuru* stocks is a coastal small pelagic that inhabits tropical waters of the Indo-Pacific region, from the eastern Indian Ocean, southern coast of East Java and Bali (Indonesia), and Western Australia, to the western Pacific Ocean, and is the target species for the bait fishery, it can be assumed that the overlap is > 30%. (Whitehead, 1985)	**3**
Encounterability	As with Areal Overlap, the *Sardinella lemuru* is the target species and therefore encounterability will also be very high.	**3**
Selectivity of gear type	Purse seine is the main fishing gear that targets the species in Indonesian coastal waters. In the remaining fishing gears, *S. lemuru* is viewed as bycatch. Purse seine is deemed as a non-selective fishing method. https://www.fishsource.org/stock_page/2041	**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)	*NA*	

Only where the scoring element is scored cumulatively		
Score		**69**

Table 11: Fishery assessment for the Bali sardinella

Species	Bali sardinella (*Sardinella lemuru*)
Gear	Purse Seine
Location	Southeast Asian coastal waters
Suppliers	Unknown
Certification or FIP/MSC	No reported FIP or MSC certified fishery
Percentage sourced (2024)	10 – 20%
Strengths of the fishery	• An aggregated catch limit for small pelagics in Fishery Management Area 573 was adopted by the Indonesian Ministry of Marine Affairs and Fisheries (MMAF) in 2017. • The One Data system policy, in 2018, implemented e-logbooks, an observer programme, and port sampling, improving fishers' compliance.
Weaknesses of the fishery	• Bali sardinella is listed as “near threatened” on the IUCN Red List since 2017. • Stock assessment and catch limits use an aggregated approach where species are lumped at their ecologically related group per fisheries management area, lacking an evaluation and management measures at the species level. • Despite various management regimes, there is a persistent risk of overfishing, particularly under the Open Access (OA) regime, which leads to intensified competition among fishermen and a lack of profitability. • 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 FCF 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 programme 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 programme 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.

Mackerel scad (*Decapterus macarellus*)

The majority of mackerel scad sourced by FCF comes from Indonesia and has occupied 10 – 20% of bait sourcing quantity. Stock status and fishing gears are varied across different fishing areas, this species is also widely captured in South China Sea, other regional waters in Philippines and Indonesia, and Tanzanian waters.

Mackerel scads were found to be the main species of the small pelagic catch in north Sulawesi, caught primarily by purse seines, and contributed 18% to the total catch in the respective fisheries management area (FMA 716) (MMAF, 2016) (Heidi Retnoningtyas, 2024). Stock in South China Sea is considered overfished based on length-based spawning potential ratio (LBSPR) and the species is mostly captured by light falling-net (Youwei Xu, 2023).

Although some papers have indicated the overfishing and overfished status of mackerel scad in different regions and provided management suggestion, including increasing minimum mesh size for net fishing, there is no specific regulation found to manage and rebuild the stock of mackerel scad.

Table 12: Productivity susceptibility analysis for the Decapterus macarellus (Indonesian stock)

Performance Indicator	2.2.1	
Productivity		
Scoring element (species)	Mackerel scad (*Decapterus macarellus*)	
Attribute	**Justification**	**Score**
Average age at maturity	2 years (Ohshimo, 2010)	**1**
Average maximum age	8 years (Ohshimo, 2010)	**1**
Fecundity	35,391 to 167,915 (Arif Munandar, 2024)	**1**
Average maximum size Not scored for invertebrates	46 cm (Jiménez Prado, 2004)	**1**

Average size at maturity Not scored for invertebrates	23.8 cm (Arif Munandar, 2024)	**1**
Reproductive strategy	Broadcast spawner (Arif Munandar, 2024)	**1**
Trophic level	4.0 ± 0.2 se https://www.fishbase.se/summary/993	**3**
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	Circumglobal. Mostly in coastal area, including Western Atlantic: Nova Scotia, Canada and Bermuda to approximately Rio de Janeiro, Brazil. Eastern Atlantic: St. Helena, Ascension, Cape Verde, and Gulf of Guinea; Azores and Madeira. Indian Ocean: Red Sea, Gulf of Aden, Seychelles, Mascarenes, South Africa, and Sri Lanka. Eastern Pacific: Gulf of California and Revillagigedo Island to Ecuador. Mackerel scad is the target species for the bait fishery; it can be assumed that the overlap is > 30%. https://www.fishbase.se/summary/993	**3**
Encounterability	As with Areal Overlap, the encounterability will also be very high. (Youwei Xu, 2023), (Heidi Retnoningtyas, 2024)	**3**
Selectivity of gear type	Purse seine is the main fishing gear in Indonesia for targeting mackerel scad, which is deemed as a fishing gear with unselective nature.	**3**

	(Heidi Retnoningtyas, 2024)	
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	*NA*	
Score		**66**

Table 13: Productivity susceptibility analysis for the Decapterus macarellus (South China Sea stock)

Performance Indicator	2.2.1	
Productivity		
Scoring element (species)	Mackerel scad (*Decapterus macarellus*)	
Attribute	**Justification**	**Score**
Average age at maturity	2 years (Ohshimo, 2010)	**1**
Average maximum age	8 years (Ohshimo, 2010)	**1**
Fecundity	35,391 to 167,915 (Arif Munandar, 2024)	**1**
Average maximum size Not scored for invertebrates	46 cm (Jiménez Prado, 2004)	**1**

Average size at maturity Not scored for invertebrates	23.8 cm (Arif Munandar, 2024)	**1**
Reproductive strategy	Broadcast spawner (Arif Munandar, 2024)	**1**
Trophic level	4.0 ± 0.2 se https://www.fishbase.se/summary/993	**3**
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	Circumglobal. Mostly in coastal area, including Western Atlantic: Nova Scotia, Canada and Bermuda to approximately Rio de Janeiro, Brazil. Eastern Atlantic: St. Helena, Ascension, Cape Verde, and Gulf of Guinea; Azores and Madeira. Indian Ocean: Red Sea, Gulf of Aden, Seychelles, Mascarenes, South Africa, and Sri Lanka. Eastern Pacific: Gulf of California and Revillagigedo Island to Ecuador. Mackerel scad is the target species for the bait fishery; it can be assumed that the overlap is >30%. https://www.fishbase.se/summary/993	**3**
Encounterability	As with Areal Overlap, the encounterability will also be very high.	**3**
Selectivity of gear type	Fishing gear for capturing mackerel scad in South China Sea is mainly light falling net, which is considered as a highly selective gear. However, given the mesh size is not	**2**

	managed yet, the study shows as excess of juvenile mackerel scad was captured. (Youwei Xu, 2023)	
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	*NA*	
Score		**82**

Table 14: Fishery assessment for the mackerel scad

Species	Mackerel scad (*Decapterus macarellus*)
Gear	Purse Seine / Net
Location	Southeast Asia / China
Suppliers	Unknown
Certification or FIP/MSC	No reported FIP or MSC certified fishery
Percentage sourced (2024)	10 – 20%
Strengths of the fishery	• The species is listed as "least concern" on the IUCN Red List. • Some biological assessments conducted in several coastal regions.
Weaknesses of the fishery	• Stock assessment is often conducted for the entire small pelagic group without separating individual species, leading to a lack of specific utilisation status for mackerel scad. • Despite its wide distribution, the movement patterns and stock structures of mackerel scad are still poorly understood. • Potential overfishing appears in regional fisheries (Prigi waters Trenggalek Regency in East Java, Indonesia)
Internal Recommendations	• Initiate a FIP • Ensure suppliers are meeting FCF 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	• 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 programme 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 programme 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.

Milkfish (*Chanos chanos*)

Milkfish, sourced from Indonesian farms, occupies around 5% of the FCF total sourced bait species in 2024. Milkfish is one of the potential farmed fish that could be used as bait in the tuna industry, as it has been successfully trialled in the past. Milkfish farming for food fish production is already well established in Indonesia and other countries such as the Philippines, Taiwan, and Pacific Island countries. It is considered to be an environmentally sound farming system due to milkfish's low food chain positioning - herbivorous or omnivorous feeding habit.

In Indonesia, the farming of milkfish has been practiced for food fish production for many years, leading to a wealth of skills and experience in this area. As a result, there is a capability to produce live milkfish fingerlings for use as bait. Techniques for producing milkfish eggs, rearing larvae, and culturing fish in brackish water ponds and freshwater cages in reservoirs have been developed over the years. The availability of milkfish larvae through artificial propagation in hatcheries will enhance the production of milkfish fry for live bait (Padiyar, 2014).

The feed used in milkfish feeding trail, (Saheb, 2007) shows that 35% of the feed is composed by fish meal; however, it is complicated to understand the source and detailed ingredients at this stage. As PSA does not apply to farmed species, to summarise, FCF-sourced milkfish is automatically recognised as **low risk (80+)** for bait sourcing; nonetheless, further action needs to be planned to understand the details of ingredients in milkfish feeds.

Table 15: Fishery assessment for the milkfish (Indonesia)

Species	Milkfish (*Chanos chanos*)
Gear	Farm
Location	Indonesia
Suppliers	Unknown
Certification or FIP/MSC	No reported FIP or MSC certified fishery
Percentage sourced (2024)	5%
Strengths of the fishery	• Low trophic level • Highly selective nature of milkfish farming • No ETP encounter
Weaknesses of the fishery	• Initial trials faced issues such as high mortality rates during transportation and handling, requiring improved management practices. • Due to thick mangrove forests in coastal areas, there is limited scope for brackish water farming, it is also known that establishing hatcheries and farms for milkfish requires significant capital investment, which may be a constraint for private fishing companies. • Unknown composition of feed.
Internal Recommendations	• Initiate an AIP. • Ensure suppliers are meeting FCF 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. • Ensure full traceability of all products back to the individual farms 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	• To provide FCF detailed information regarding feed used for farmed milkfish. • To analyse the composition of fishmeal used in the feed.

Conclusion and Next steps

Based on the PSAs, Japanese sardine is explicitly marked as a high-risk species due to its low gear selectivity and high trophic level. Shortfin scad and mackerel scad captured by net fishing with light attraction are welcomed for FCF due to the higher gear selectivity whilst the species captured by purse seine are assessed as medium risk. Bali sardinella is assessed as medium risk largely due to relatively lower trophic level despite mostly captured by purse seine fishery. Indonesian farmed milkfish, despite one of the most expensive bait species, is also an ideal choice due to high selectivity, absence of ETP encountering and its low trophic level. However, further analysis of feed used is required to better understand the ingredients and analyse the contents of fishmeal.

Given the unselective nature of purse seine and gillnet, sourcing bait species from the fishery with highly selective fishing gear and farms is recommended. Client is also recommended to source low-trophic bait species.

According to the data collated from FCF, we have not yet confirmed the weight information and the precise fishing ground where the sourced bait was captured, which further emphasises the need to enhance traceability and transparency of bait sourcing within FCF supply chain. This will help FCF to better understand the stocks and fisheries they sourced from suppliers. In addition, the scope of bait sourcing traceability shall further extend to the species from which vessel owners sourced.

Through PSAs and desk-based research, it is notable that FCF sourcing team should avoid sourcing species with both low gear selectivity and high trophic level, especially Japanese sardine, the only species scored as high risk. It is concluded that the bait species captured dominantly by purse seine and gillnet are assessed as medium risk, whilst species captured by net fishing with light attraction have a low risk due to gear selectivity. Moreover, FCF shall begin addressing to vessel owners about the importance of choosing the bait based on environmental assessments instead of simply taking the price and captain’s preference into consideration.

Below bait sourcing template aims to provide the responsible team in FCF with information that the team members and vessel owners shall fill in to effectively collect comprehensive bait information for future assessment.

Table 16: FCF Bait Sourcing Template

FCF Bait Sourcing Template			
Supplier	e.g., PT. xxx		
Based country	e.g., Indonesia		
Date of sourcing	e.g., 27/03/2025		
Buyer (Company and intended vessel name)	e.g., ABC No.1	**IMO**	e.g., 1111111
Gear type	e.g., Longline		
Species information	**Description**		
Common name	e.g., Shortfin scad		
Scientific name	e.g., *Decapterus macrosoma*		
Captured area	e.g., South China Sea / farms in Indonesia / Banda Sea		
Sourced weight	e.g., 15 metric tonnes		
Fishing method	e.g., Light falling net / purse seine / handline		
Ingredients of feed used (farmed species only)	e.g., Phytoplankton		

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