PIRSA

2021 Review of the ESD Risk Assessment of the South Australian Sardine Fishery

Government of South Australia

Department of Primary Industries and Regions

2021 review of the ESD risk assessment of the South Australian Sardine Fishery

Information current as of 19 October 2022

Disclaimer

All Enquiries

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Need

A Management plan for the South Australian Commercial Marine Scalefish Fishery, Part B – management arrangements for the taking of sardines (herein referred to as the Plan) applies for a period from 1 November 2014 until 30 September 2023.

The Minister approved a review of the Plan to be undertaken by the Department of Primary Industries and Regions (PIRSA) on 24 May 2021 with feedback from the SASIA Research and Management Committee (RMC), for the purpose of determining whether the Plan should be amended, replaced or reinstated without amendment. PIRSA undertook the review with feedback from the SASIA Research and Management Committee (RMC). The review was finalized on 22 November 2021 with the Minister approving the plan be replaced with PIRSA preparing a draft replacement management plan with feedback from the SASIA RMC.

To efficiently meet its Ecologically Sustainable Development (ESD) accountabilities under both State and Commonwealth legislation, PIRSA Fisheries and Aquaculture adopts the '*National ESD Reporting Framework for Fisheries'* developed by Fletcher et al. (2002) to provide a consistent way to implement and assess fisheries with respect to the principles of ESD in Australia.

The 'ESD risk assessment of South Australia's Sardine Fishery (SASF)' undertaken in 2013 provided a comprehensive analysis of the impacts and potential impacts of the fishing activity, as well as identifying ecological factors that could impact on the performance of the fishery. This risk assessment informed the development of the 2014 management plan for the SASF.

To inform development of a draft replacement management plan, the 2013 ESD risk assessment for the SASF has been reviewed and updated, through consideration of new information relevant to risks to and from the SASF that has become available since the last assessment. New information was considered regarding if the new information would change the ratings of risks identified in the 2013 assessment or indicated a new risk should be included in an updated risk assessment for the fishery.

The risks required for consideration in preparing a management plan for a fishery under section 43(2) of the *Fisheries Management Act 2007* (the Act) are:

1. identify the impacts or potential impacts of the fishery on its associated ecosystem or ecosystems, including impacts on non-target species of fish or other aquatic resources;
2. identify any ecological factors that could have an impact on the performance of the fishery: and
3. set out strategies to address the most serious risks.

Only these risks were reviewed and updated in this 2021 review.

Method

Consistent with requirements for risks identified in management plans under the Act, this updated risk assessment only considers and reports on the impacts or potential impacts of the fishery on its associated ecosystem or ecosystems, and ecological factors that could have an impact on the performance of the fishery. All other components of the 2013 risk assessment were not reviewed or updated and are not included in this document. A workshop was held on 2 November 2021 with the relevant stakeholders[1] to consider new information available and consider changes to risk ratings to account for new information.

National ESD Reporting Framework for Fisheries

The '*National ESD Reporting Framework for Fisheries*' developed by Fletcher et al. (2002) was used to assess the risks for general ecosystem impacts and external impacts on industry. The method used to assess risks using this framework are described in the 'ESD Risk Assessment of South Australia's Sardine Fishery'.

Table 1 - Risk matrix of consequence and likelihood. The numbers in the cells indicate the risk value, and the colours indicate risk categories (see Table 2Table 3 for more details).

		Consequence Level				
		Negligeable	Minor	Moderate	Major	Extreme
Likelihood Levels		0	1	2	3	4
Remote	1	0	1	2	3	4
Unlikely	2	0	2	4	6	8
Possible	3	0	3	6	9	12
Likely	4	0	4	8	12	16

The overall risk value is calculated by multiplying the consequence score by the likelihood score. The calculated risk values were then linked to one of the colour-coded risk categories, the relationship for which is illustrated by a risk matrix (Table 2).

Table 2: Risk categories and reporting requirements

Risk Category	Risk Values	Management Response	Reporting Requirements
Negligible	0-2	None	Brief Justification
Low	3-4	No Specific Management	Full Justification Report
Moderate	6-8	Specific Management/ Monitoring Needed	Full Performance Report
High	9-16	Increased Management Activities Needed	Full Performance Report

[1] Workshop invitees are identified in Appendix 1.

Reporting requirements

The national ESD reporting framework suggests that only those issues scored at moderate or high, which require additional management attention, need to have full ESD performance reports completed. This is the approach that has been adopted by PIRSA in the preparation of fishery ESD reports. The rationale for scoring other issues as low or negligible risk is also documented and forms part of these reports. This encourages transparency and should help stakeholders to understand the basis for risk scores and the justification for no further management, or for additional management action if necessary.

Results

Retained species

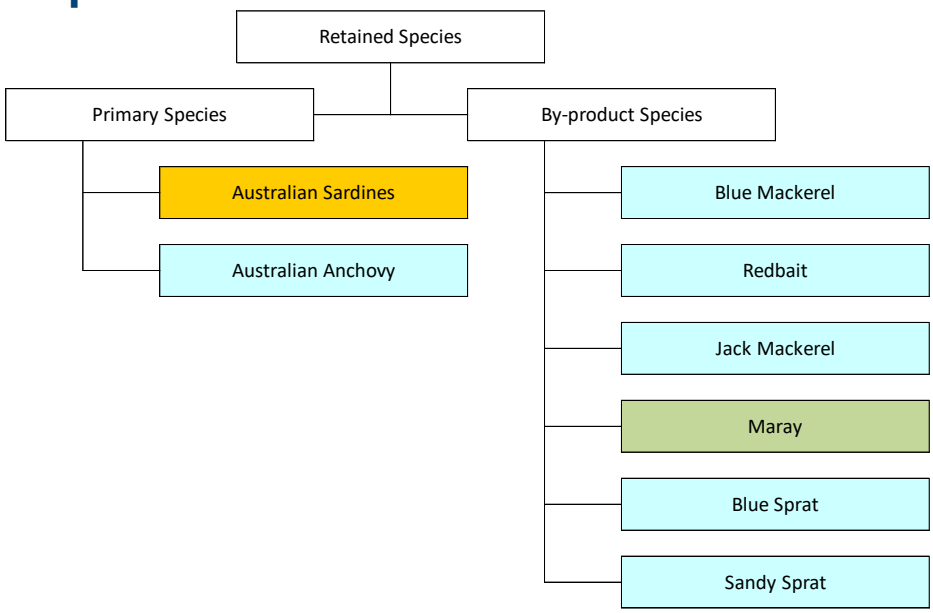

Figure 1 - Retained species component tree for the sardine fishery.

Australian Sardines

New information considered included:

- Stock Assessment of Australian Sardine (*Sardinops sagax*) off South Australia 2021 (Grammer et al 2021).
- Stock Assessment of Australian Sardine (*Sardinops sagax*) off South Australia 2019 (Ward et al 2020b).
- Spawning biomass of Sardine (*Sardinops sagax*) in waters off South Australia in 2020. (Ward et al 2020a).

- Refinement of the Daily Egg Production Method (DEPM) described in Ward et al (2018a, 2019,b 2020a,b); and Grammer et al (2021).

Spawning Biomass estimates indicated stock is at similar to virgin levels and have been categorised as sustainable in all recent years. Spawning area in 2020 was the largest on record. The available length frequency data available does not indicate any impact of the fishery in size frequency (Grammer et al 2021).

DEPM surveys used to estimate stock abundance have been refined since the last risk assessment to reduce uncertainty in the spawning biomass abundance estimates (Ward et al 2021a). Also, the DEPM survey area has been extended to include an area east of Kangaroo Island (Grammer et al 2021).

The stock assessment model used in the fishery has been reviewed since the last risk assessment and now uses an integrated model (Ward et al 2020b and Grammer et al 2021).

Fishing effort has changed slightly with some fishing now taking place east of Kangaroo Island. This may in part reflect spatial management, such as TACC limits in the Gulfs.

Since the last risk assessment, zonal management has been implemented with size-based decision rules that restricts fishing in the Gulfs.

The workshop considered the new information available, however, agreed to retain the previous risk rating for sardines due to the importance of the stocks to the fishery, and the potential for unforeseen circumstances.

Consequence level 2 (moderate) and Likelihood level 4 (likely) – Risk Moderate

Anchovy

No new information available

Anchovies have a separate TACC to Sardines. The catch of anchovies is not a frequent event as fishers are targeting Sardines. There is not significant change in fishing activity or catch of Anchovy since the last assessment.

It was agreed to retain the previous risk rating scores. Risk Negligeable

Mackerel and Redbait

Includes Jack Mackerel, Blue Mackerel and Redbait.

New information considered included:

- Commonwealth Small Pelagic Fishery: Status Summary Report 2020. Report to the Australian Fisheries Management Authority (Ward and Grammer, 2021).

- Spawning biomass of Blue Mackerel (*Scomber australasicus*) and Australian Sardine (*Sardinops sagax*) in the East sub-area of the Small Pelagic Fishery. Report to the Australian Fisheries Management Authority (Ward et al 2021b).
- Spawning biomass of Jack Mackerel (*Trachurus declivis*) and Sardine (*Sardinops sagax*) between western Kangaroo Island, South Australia and south-western Tasmania. Report to the Australian Fisheries Management Authority (Ward et al 2018b)
- Spawning biomass of Redbait (*Emmelichthys nitidus*) between western Kangaroo Island, South Australia and south-western Tasmania in October 2017. Report to the Australian Fisheries Management Authority (Ward et al 2019a)
- These fish are mainly caught in the East Sub-area of the Commonwealth Small Pelagic Fishery (SPF)with limited to no catch taken in the West Sub-area. Antidotal evidence from bycatch surveys indicate negligible amounts of these species are caught in SASF. DEPM surveys for these species are undertaken in both Sub-areas of the SPF with no significant issues identified for any of these stocks (Ward et al 2018b, 2019a, 2021b).

There is no significant change in fishing activity or catch of these fish since the last assessment.

It was agreed to retain the previous risk rating scores. Risk Negligeable

Maray

Maray have been added to the permitted species list for SASF since the last risk assessment. However, there has not been a change in the catch for this species since their inclusion. The catch of Maray is decremented from the Sardine TACC. There is no significant change in fishing activity for Maray or catch of these fish since the last assessment.

Acknowledging the low catch and lack of importance species to the fishery, as well as the lack of knowledge about the species, it was agreed to retain the previous risk rating scores. Risk Low

Blue Sprat / Sandy Sprat

There is no significant change in fishing activity or catch of these fish since the last assessment.

It was agreed to retain the previous risk rating scores. Risk Negligeable

Non-retained species

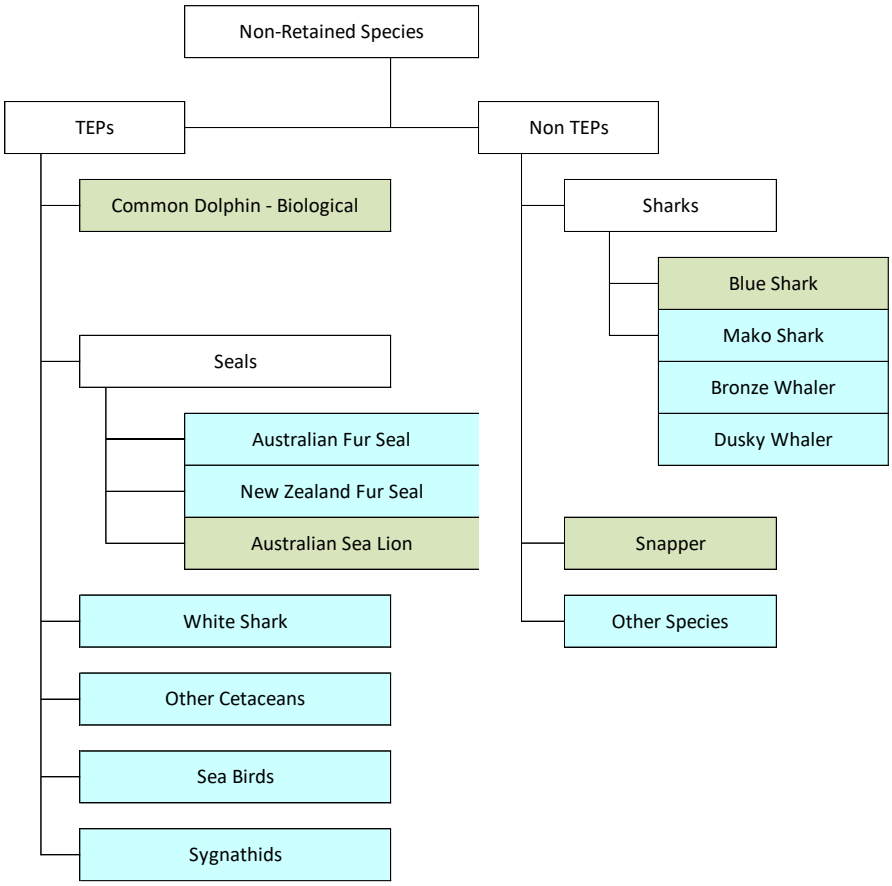

Figure 2 - Non-retained species component tree for the sardine fishery.

Common Dolphin

New information considered in regard to Common dolphin interactions in the SASF included:

- Assessment of dolphin interactions, effectiveness of Code of Practice and fishing behaviour in the South Australian Sardine Fishery: 2020-21. (Kirkwood et al 2021)
- Assessment of the sustainability of common dolphin interactions with the South Australian Sardine Fishery (FRDC Project 2019-063) (SARDI in prep)
- Literature review of mitigation measures in small pelagic fisheries project (FRDC Project 2020-049). (SARDI in prep)

There remains a discrepancy between reporting rates for interactions with dolphins with and without observer present as described in Kirkwood et al (2021) and documents referenced in that report.

The previous risk assessment considered unpublished information from a survey of dolphins undertaken in 2011. This data is now published (Parra et al. 2021) and was considered in this assessment. The 2011 surveys estimated >20,000 common dolphins

were present in Spencer Gulf, Gulf St Vincent, Investigator Strait and central shelf waters. Based on conservative values, the population could sustain a potential biological removal through anthropogenic means of up to 189 [2]dolphins per year (Parra et al. 2021).

A further survey has now been undertaken in 2021. The 2021 survey was over a smaller area than the 2011 survey and over a shorter time period. The 2021 estimate of dolphins was similar to the estimate from the 2011 survey with similar broad ranges of confidence intervals.

It was noted there appeared to be no substantial change in the dolphin abundance between 2011 and 2021 based on the survey outcomes. The two surveys are fairly similar with both taking into account sub-surface abundance of dolphins.

It was broadly noted the dolphin mortalities estimated in the SASF were unlikely to reduce dolphin populations, however, there is uncertainty in those estimates of mortalities due to the discrepancies in apparent interaction/mortality rates and fishing behaviour when observers were not onboard vessels (Kirkwood et al 2021).

It was noted that potential increases in dolphin interactions in the last couple of years may be related to increasing dolphin population or habituation of dolphins to the fishing activity in the SASF.

The compliance program in the SASF is rigorous with no other State fishery having the level of education of the Code of Practice (COP) of crew and skippers (PIRSA pers comms). The COP)is an important consideration of the risk rating. The effective implementation of the COP is recognised as important in minimising risk of dolphin interactions.

Based on the updated information (dolphin population levels, observed interaction rates, efficacy of the COP), the workshop participants considered the fishery was unlikely to impact on the sustainability of the dolphin population (Likelihood level 2). The ecological consequences of the interaction affecting the common dolphin population were considered to be moderate (Consequence level 2). Considering the number of dolphins in the region and their apparent attraction to net sets, it is considered possible that within a 5-year period, a single set could result in a substantial number of mortalities (>10). In this scenario, while it was still unlikely such an event would impact the sustainability of the dolphin population, such an event could impact the fishery.

Risk rating Low.

[2] Parra et al. issued a corrigendum updating this potential biological removal level to 95 (Frontiers | Corrigendum: Abundance and Potential Biological Removal of Common Dolphins Subject to Fishery-Impacts in South Australian Waters (frontiersin.org)). This information was not available at the time the risk assessment was undertaken.

Australian Fur Seal

Noted there was new abundance information for this species (SARDI pers comms), however this new information didn't change the risk score from Negligeable.

New Zealand Fur Seal

Noted there was new abundance information for this species (SARDI pers comms), however this new information didn't not change the risk score from Negligeable.

Australian Sea Lion

New information included:

- Wildlife interaction reporting across South Australian fisheries 2019/20 (SARDI 2021)
- Australian sea lion listing assessment. (Goldsworthy 2020)

Noted the new abundance estimates for Australian Sea Lion (ASL) were available (see Goldsworthy 2020). Due to population declines in recent decades, the status of the species has been upgraded from Vulnerable to Endangered. Noted there were no mortalities of ASL reported in the purse seine fishery (SARDI 2021) and seals are very adept at getting in and out of nets.

Noted the new information for this species, however this new information didn't change the risk score from Low.

TEPS – White Sharks

One mortality of a White Shark since the last risk assessment was reported in 2018/19. The interaction with this species was noted, however didn't change the risk score. Risk rating retained at Negligeable.

TEPS – Other

No interactions with Other Cetaceans, Seabirds, Syngnathids were reported. Risk ratings for Other Cetaceans, Seabirds, Syngnathids were retained at Negligeable.

Non-TEPS – Sharks

Mako Shark – No new information. No reported interactions with this species. Risk rating retained at Negligeable.

Blue Sharks - has never been recorded as caught in the SASF. Oceanic and unlikely to interact with the SASF. Risk rating retained at Low

Bronze Whaler Sharks - Noted this species is reported to occasionally be captured in sardine net but released unharmed. However, as these fish are usually released alive and

the stocks are considered to be in abundance, the impact of this fishery on the species is considered negligible against background levels. Risk rating changed to Negligeable.

Dusky Whaler - The risk to Dusky whalers was scored separate to Bronze whalers due to their reduced abundance. They are difficult to differentiate from Bronze whalers. While interactions with these sharks are not specifically recorded (as they are not considered a protected species) it is understood in most instances it is bronze whalers that are caught and most of these are released alive. It is therefore considered the impact of the SASF on the species is negligible against background levels. Risk rating considered to be Negligeable

Snapper – The workshop considered the most recent snapper stock status assessment in the area of the fishery (Fowler et al 2020). Snapper stocks are reduced, however, the SASF does not tend to fish in areas where aggregations of snapper are likely to be encountered. Due to the low likelihood of capture of snapper, noting stocks are low, the risk score of the SASF on the population of Snapper was maintained at Low.

Other species – Species of interest in this “other species” category included blue swimmer crabs, prawns and whiting. The workshop considered there was reliable information that blue swimmer crabs, prawns and whiting occasional occur in by-catch of the SASF. The impact on these species however, was considered negligeable as by-catch of these species is rare, and impact of the SASF would not be measurable against background levels. Risk rating for these species was considered to be Negligeable.

The workshop considered the previous risk ratings for barracuda, toadfish and cuttlefish. It was considered by the workshop participants that these species are not taken as by-catch in the SASF and it was recommended these species be removed as separate components in the risk assessment.

General ecosystem

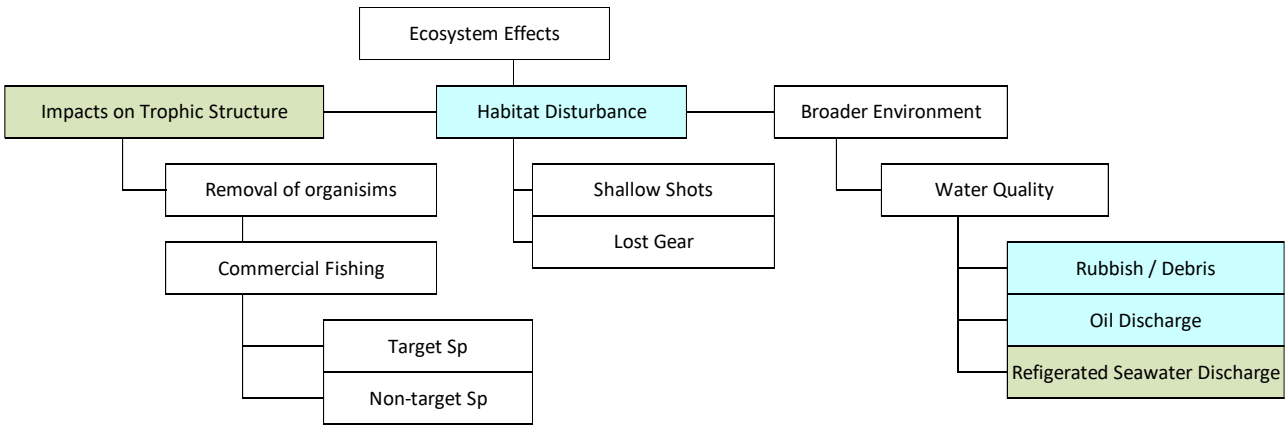

Figure 3 - General ecosystem component tree for the sardine fishery.

Impacts on trophic structure from commercial fishery – Target and non-target species

New information considered at the workshop included:

- Demographic and morphological responses to prey depletion in a crested tern (*Sterna bergii*) population: can fish mortality events highlight performance indicators for fisheries management? (McLeay et al 2009)
- Foraging behaviour and habitat use of a short-ranging seabird, the crested tern (McLeay et al 2010).
- Age and sex-dependent survival of crested terns (*Thalasseus bergii*) on Troubridge Island, Gulf St. Vincent, South Australia (Attwood-Henderson 2016).

Trophic level interactions of the SASF have been considered in previous modelling work (McLeay et al 2009, 2010, Attwood-Henderson 2016). This work identified crested terns and little penguins as species of interest with regard to sardines.

Suggest running the trophic level model every 5 years to continue to monitor any changes to ecosystem impacts in regard to Sardines in the area of the fishery.

Recommended retaining the previous risk rating of Low.

Benthic Habitat Disturbance

Considered as one risk component encompassing lost gear and shallow shots. Agreed this risk was better termed “benthic” habitat disturbance to discern it from other ecosystem disturbance.

It was noted this is a purse seine fishery where gear may potentially touch the bottom, but not moving across the bottom to the same decree as trawl fishery gear. Fishers avoid contact between fishing gear and the seafloor as this could result in gear loss or damage with significant cost implications.

Recommended retaining the previous risk rating of Negligible.

Water quality – Rubbish or debris

Industry indicated all rubbish is brought back to port. Recommended retaining the previous risk rating of Negligible.

Water quality – Oil Discharge

Industry indicated all oil waste is disposed of at port facilities. Recommended retaining the previous risk rating of Negligible.

Water quality – refrigerated sea water discharge

This component was related to unloading of sardines (and the water in which the sardines are held) from fishing vessels to transport vehicles at ports, mostly at Port Lincoln and occasionally in Coffin Bay. The water used to hold sardines is mainly sea water with salt (in some cases) added to reduce the holding temperature. Water may also contain scales and other fish waste. It was agreed to change the name of this risk to “refrigerated sea water” discharge rather than the previous term “Brine Discharge”.

A Code of Practice has been developed in regard to water discharge with discharging at sea where possible and practicable. Very little water is discharged in sensitive areas such as Coffin Bay.

It was noted there were a number of other activities that also occur in the vicinity of Port Lincoln’s port area including grain and fertiliser loading which would also impact on the local water quality. The previous risk assessment did not include information related to ecosystem impacts of these other activities in scoring the risk, and it was agreed to rescore this risk using the ecosystem impact consequence tables.

Considering the already changed environment in the vicinity of the wharf at Port Lincoln, the consequence of the SASF impact of discharge of refrigerated sea water during offloading of sardines was considered to be “maximum acceptable level of change to the environment or ecosystem structure with no material change in function”. On the basis the impact of the fishery would not be unacceptable compared to other activities in the area (Consequence level 2) and the likelihood of this consequence was unlikely (Likelihood level 2) = Risk rating of Low.

External factors affecting fishery performance

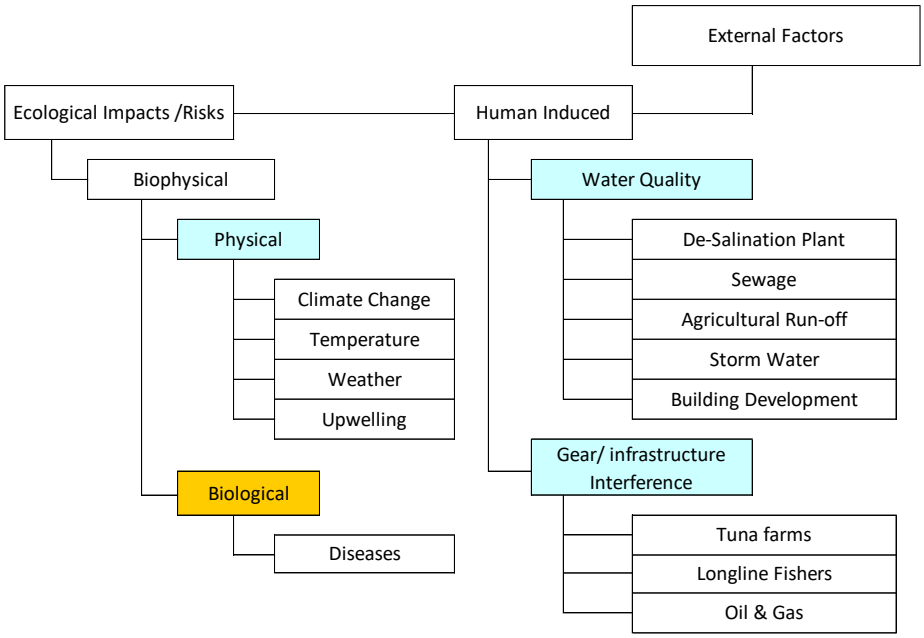

Figure 4 - External impacts component tree for the Sardine Fishery

Physical - climate change, temperature,

Considered information on climate change and sea water temperatures in the context of the timeframe for this risk assessment (ten years) would have a negligible effect on the risk rating. Recommended retaining the previous risk rating of Negligible.

Biological – disease

It was noted sardine stocks in South Australia recovered relatively quickly from the mortality events in 1995 and 1998 (Ward et al 2001), however a disease event could occur again. Recommended retaining the previous risk rating of Moderate.

Human Induced – Water Quality

Recommended retaining the previous risk rating of Negligible.

Human Induced – Gear and Infrastructure interference

Recommended retaining the previous risk rating of Negligible.

Risk Evaluation

In summary, a total of 31 issues associated with the SASF relevant to ecological components were scored for risk across four component trees: retained species, non-retained species, general ecosystem and external factors. Two issues were evaluated as Moderate, seven as Low risk and the remaining 22 issues ranked as Negligible.

Table 3: Summary of risk ratings

Component Trees	High	Moderate	Low	Negligible	Total
Retained Species		1	1	6	8
Non-retained species			4	10	14
General Ecosystem			2	3	5
External Factors		1	0	3	4
Total		2	7	22	31

Performance reports

Table 4: Performance Report for High and Moderate Risks

Component	Risk/Issue	Description	Risk/ Importance	Objective	Strategies
Retained species	Australian Sardines	The risk of maintaining the biomass at a sustainable level	Moderate	Maintain biomass at sustainable stock status	Manage fishery under harvest strategy. Maintain DEPM surveys
External Factors	Biological – Disease	The risk of external factors of mortality event of sardines impacting on the performance of the fishery	Moderate	Maintain biomass at sustainable stock status	Maintain communications with Aquatic Health/Biosecurity SA Licence holders to communicate any fish kills detected

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Appendices

Appendix 1 ESD Risk Assessment workshop

Table 5: Workshop Invitees to ESD Risk Assessment workshop on 2 November 2021

Name	Representing	Attendee/Apology
Ms Catherine Sayer	Independent Chair	Attended
Mr Paul Watson	South Australian Sardine Industry Association	Attended
Mr Craig Meakin	Department for Environment and Water	Attended
Dr Annabel Jones	Department of Primary Industries and Regions	Attended
Ms Yolande Markey	Department of Primary Industries and Regions	Attended
Dr Roger Kirkwood	South Australian Research and Development Institute	Attended
Dr Simon Goldsworthy	South Australian Research and Development Institute	Attended
Dr Gretchen Grammer	South Australian Research and Development Institute	Attended
Mr Andrew Carr	Department of Primary Industries and Regions	Apology
Dr Stephen Mayfield	South Australian Research and Development Institute	Apology
Mr James Brook	Conservation Council of South Australia	Apology

Appendix 2: Risk Assessment Tables

Table 6 - Consequence categories for the major target/vulnerable species. The default objective is - maintain the biomass above the target reference point".

Level	Ecological (Target/Vulnerable Species)
Negligible (0)	No measureable decline Exploited Stock Abundance Range 100% to 90% unfished levels
Minor (1)	Either not detectable against background variability for this population; or if detectable, minimal impact on population size and none on dynamics. Exploited Stock Abundance Range < 90% to 70% unfished levels
Moderate (2)	Fishery operating at, or close to, the exploitation rate that will deliver MSY. Exploited Stock Abundance Range < 70% to > Bmsy
Major (3)	Stock has been reduced to levels below MSY and may also be getting into the range where recruitment overfishing may occur. Exploited Stock Abundance Range < Bmsy to > Brec
Extreme (4)	Stock size or significant species range contraction > 50% have occurred and recruitment levels reduced affecting future recruitment and their capacity to increase from a depleted state (i.e. recruitment overfishing) Exploited Stock Abundance Range < Brec

Table 7 - Consequence categories for the by-product species/minor by-catch species. The default objective is - to maintain appropriate levels of biomass of by-catch species to minimize any significant impact on their dynamics and the broader ecosystem.

Level	Ecological (by-product/general by-catch)
Negligible (0)	Very few individuals are captured in relation to likely population size (<1%)
Minor (1)	Take in this fishery is small (< 10%), compared to total take by all fisheries and these species are covered explicitly elsewhere. Take and area of capture by this fishery is small, compared to known area of distribution (< 20%).
Moderate (2)	Relative area of, or susceptibility to capture is suspected to be less than 50% and species do not have vulnerable life history traits.
Major (3)	No information is available on the relative area or susceptibility to capture or on the vulnerability of life history traits of this type of species AND The relative levels of capture/susceptibility suspected/known to be greater than 50% and species should be examined explicitly
Extreme (4)	N/A Once a consequence reaches this point it should be examined using target species table.

Table 8 - Consequence categories for the by-catch of protected species. The default objective is - to maintain levels of catch of these species at acceptable levels.

Level	Protected species by-catch
Negligible (0)	Some level of interaction may occur but either no mortalities generated or extremely few are recorded at the time scale of years.
Minor (1)	Very few individuals of the protected species are directly impacted in most years, no general level of public concern
Moderate (2)	The fishery catches or impacts these species at the maximum level that is accepted
Major (3)	The catch or impact by the fishery on the protected species is above that accepted by broader community but there are few/no additional stock implications
Extreme (4)	The catch or impact is well above the acceptable level and this is may be having significant additional impacts on the already threatened status.

Table 9 - Consequence categories for the impacts on habitats. The default objective is - to maintain the spatial extent of habitat impacts from the fishing activity to a comparatively small percentage of the habitat/ community.

Level	Ecological (ECOSYSTEM)
Negligible (0)	No measurable change in community structure would be possible against background variations
Minor (1)	Some relatively minor shifts in relative abundance may be occurring but it may be hard to identify any measurable changes at whole of trophic levels outside of natural variation.
Moderate (2)	Clear measurable changes to the ecosystem components without there being a major change in function. (i.e. no loss of components or real biodiversity), these changes are acceptable. None of the main captured species play a 'true' keystone role
Major (3)	Ecosystem function altered significantly and some function or components are locally missing/declining/increasing &/or allowed new species to appear. The level of change is not acceptable to enable one or more high level objective to be achieved. Recovery measured in many years to decadal.
Extreme (4)	An extreme change to ecosystem structure and function. Very different dynamics now occur with different species/groups now the major targets of capture and/or dominating the ecosystem. Could lead to a total collapse of ecosystem processes. Long-term recovery period may be greater than decades

Table 10 - Likelihood Definitions – these are usually defined for the likelihood of a particular consequence level actually occurring within the assessment period.

Level	**Descriptor**
Likely (4)	A particular consequence level is expected to occur (Probability of 40 - 100%)
Possible (3)	Evidence to suggest this consequence level is possible and may occur in some circumstances (Probability of 10 - 35%)
Unlikely (2)	The consequence is not expected to occur but it has been known to occur elsewhere (Probability of 2 -10%)
Remote (1)	The consequence has never been heard of in these circumstances, but it is not impossible (Probability < 2%)

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