



Revised ecologically sustainable development (ESD) risk assessment of the South Australian Commercial Lakes and Coorong Fishery

2019

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Draft revised ecologically sustainable development (ESD) risk assessment of the South Australian Commercial Lakes and Coorong Fishery.

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Table of Contents

Introduction	3
Background.....	3
Methods	4
Performance reports	6
Retained species.....	6
Non-retained species	10
General ecosystem impacts of fishing.....	12
External impacts on the fishery	13
Governance.....	17
Community.....	18
Risk Evaluation	19
Risk treatment options for medium, high and severe risks.	20
References	23
Appendix 1: Risk matrices	25
Appendix 2: Workshop Participants	30
Appendix 3: Risk ratings	30

Introduction

This report provides the outcomes of a review of the 2011 Ecologically Sustainable Development (ESD) risk assessment undertaken by PIRSA in 2019

ESD principles are the basis of fisheries and aquatic resource management in South Australia. ESD in the Act is described as — *“the use, conservation, development and enhancement of the aquatic resources of the State in a way, and at a rate, that will enable people and communities to provide for their economic, social and physical well-being”*. To efficiently meet its ESD accountabilities, PIRSA Fisheries has adopted the National ESD Reporting Framework for Fisheries (Fletcher et al. 2002).

A five-year Management Plan for the South Australian Lakes and Coorong Fishery was approved and adopted in March 2016 by the then Minister for Agriculture, Food and Fisheries (PIRSA 2016). An ESD risk assessment was carried out in 2011 to inform the development of this management plan (PIRSA 2011).

Under part 13 of the Management Plan, a mid-term review is due to take place after three years. A review of the ESD risk assessment is considered an important step in reviewing the management plans to objectively assess if risk rankings have changed over the duration of the management plan. A revised risk assessment will also provide important information for development of a revised management plan if one is required.

Background

The South Australian Lakes and Coorong Fishery is a small scale, multi-species, multi-method community based fishery that operates within a highly modified very dynamic environment, recognised internationally for its unique ecological character. The Lakes and Coorong Fishery include the waters of three separate, but closely linked, ecosystem components. These are: (i) the northern and southern lagoons; (ii) the freshwater Lower Lakes of Lake Alexandrina and Lake Albert; and (iii) the adjacent coastal marine waters along the Sir Richard and Younghusband Peninsula (Figure 1).

The fishery contributed approximately \$18.9 M to South Australia's Gross State Product in 2016-17 of which \$7.4 M came from fishing directly, \$2.2 M was generated by downstream activities and \$9.3 M was generated in other sectors of the state economy. Over the past three financial years, key performance indicators for the fishery have had a decreasing trend for the net sector, and an increasing trend for the Pipi sector. The declines in the net sector are largely attributed by industry to the presence of Long-nosed Fur Seals in the area of the fishery.

The Lakes and Coorong Fishery has had access to resources in freshwater, estuarine and adjacent marine habitats in the lower River Murray system in South Australia since 1846 (Olsen and Evans, 1991). The growth of commercial fishing activities in the Lakes and Coorong region was stimulated by the development of the steamer-barge trade, which

commenced in 1853 through the ports of Goolwa and Milang. In 1984, the *Scheme of Management (Lakes and Coorong Fishery) Regulations 1984* was introduced to formally manage the Lakes and Coorong Fishery as a distinct fishery, separate from the Marine Scalefish Fishery.

The Lakes and Coorong Fishery has been managed through a mixture of input and output controls. Since the early 1980's input controls have included limited entry (36 licences since 2006), with gear entitlements and owner-operator provisions applied to licences. Other input controls include gear restrictions applying to the numbers of nets, net dimensions and mesh sizes. Output controls include legal minimum lengths (LML) for most targeted species and quota management for Piri.

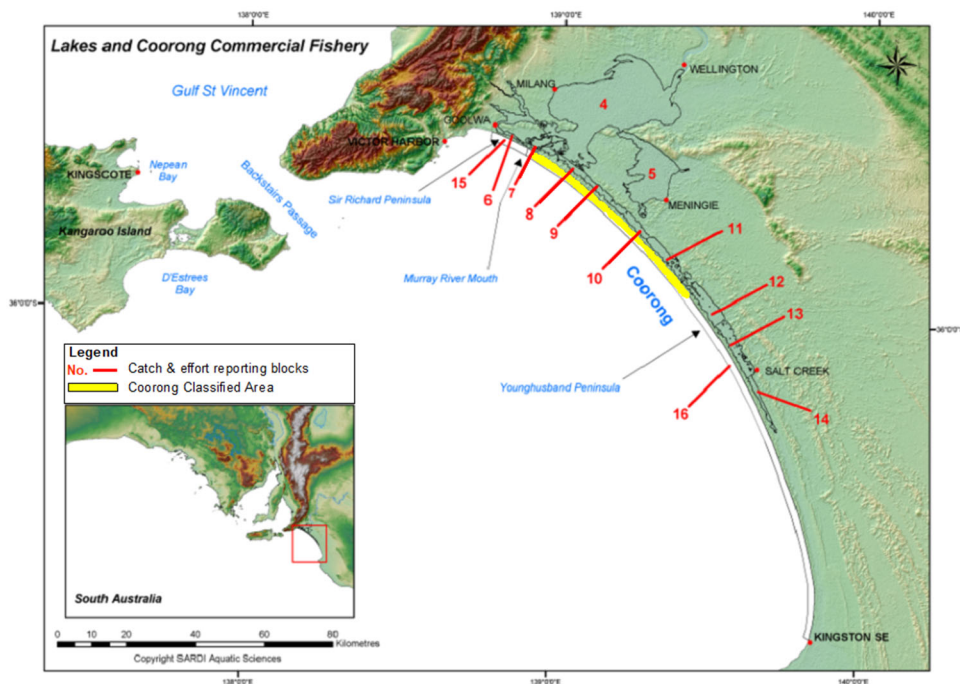


Figure 1: Map of the South Australia Murray Mouth, Lower Lakes and Coorong region showing the Coorong Classified Area from which Piri for human consumption must be taken and catch and effort reporting blocks.

Methods

The scope of this ESD Risk Assessment includes:

1. Commercial fishing in the South Australian Commercial Lakes and Coorong Fishery under normal fishing practices in the area of the fishery.
2. Assessment of potential impacts on the fishery in the next five years

The process for the review of the current risk assessment was:

1. Collated new documented information related to all risks components included in the 2011 risk assessment report that had become available since the last risk assessment.
2. Conducted workshop/s of stakeholders¹ on 28 June 2019 to:
 - a. Identify risk components that were relevant to the new information and determine if the new information would significantly change the risk ranking.
 - b. Complete risk assessments of the identified risk components based on the likelihood and consequence of events described in PIRSA (2011) using consequence and likelihood matrices provided at Appendix 1.
 - c. For those risks for which no new information is available, or the available information was not significant, the risk rating from the 2011 risk assessment was adopted.
3. Risks were prioritised according to their severity detailing the information considered and the reasons (information used, or adoption of previous risk rating) in assigning risk.
4. For higher level risks a full ESD performance report in the context of specific management objectives was prepared. This includes operational objectives, indicators, data required and performance measures.
5. This detailed fishery-specific background report was also prepared.

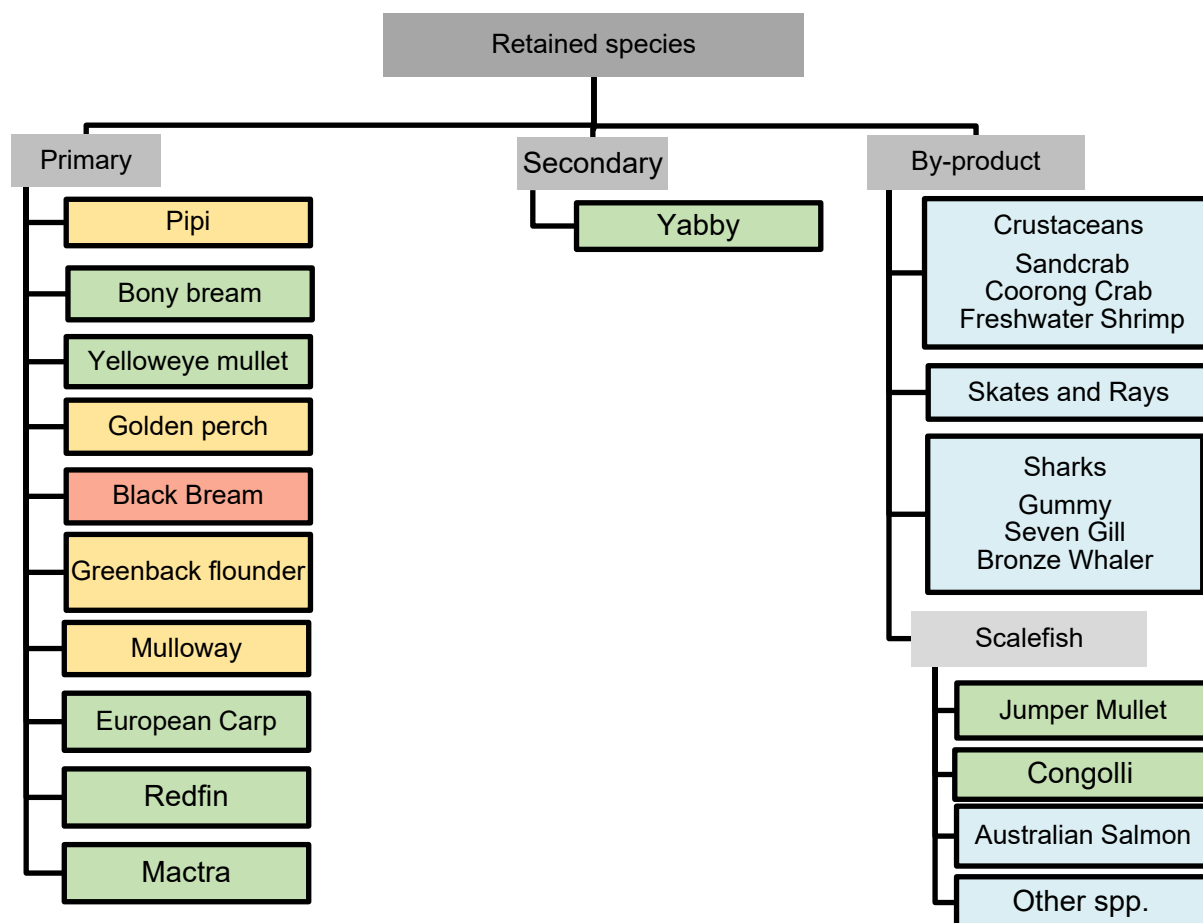
It was agreed at the workshop that a simpler Consequence x Likelihood risk matrix would be used in this risk assessment compared to that used in the 2011 assessment. Where it was agreed in this assessment that the previous risk rating from the 2011 assessment be adopted, this rating was converted using the simpler matrix.

Further detail of the general ESD Risk Assessment methodology can be found in the 2011 risk assessment for the fishery (PIRSA 2011).

¹ A list of participants at the workshop/s are provided at Appendix 2

Performance reports

Retained species



Primary Species

Pipi –MEDIUM

Objective - Ensure the pipi resource is harvested within ecologically sustainable limits.

Goolwa Pipi is a key target species in the LCF. The latest fishery information published in the SARDI report “*Fishery statistics, stock status and performance indicators for the lakes and Coorong Fishery*” (Earl 2019) was considered. This report noted that estimated relative biomass was the second highest on record. Pre-recruits were absent in November 2017 survey but present in the February survey. On the basis of the information available, the Pipi stock in the LCF in 2017/18 was classified as Sustainable.

It considered that the harvest strategy is effectively controlling harvest of pipsis to sustainable levels. It was considered the commercial fishery was having a **moderate (C2)** consequence on the population and that this is **likely (L4)** to continue into the future. The risk rating was therefore **medium**.

Bony bream, Yelloweye mullet –LOW

The latest fishery information published in the SARDI report “*Fishery statistics, stock status and performance indicators for the lakes and Coorong Fishery*” (Earl 2019) was considered. Yelloweye mullet and bony bream are currently classified as ‘sustainable’ in the LCF (Earl 2019). It was considered that the additional information considered did not change the previous risk rating for these species. The previous risk ratings were converted to the updated matrices and adopted for this risk assessment.

Minor (C1) consequence on the population and that this is **likely (L4)** to continue into the future. The risk rating **low**.

Golden Perch –MEDIUM

The latest fishery information published in the SARDI report “*Fishery statistics, stock status and performance indicators for the lakes and Coorong Fishery*” (Earl 2019) was considered. Golden Perch in the LCF is currently classified as ‘sustainable’ (Earl 2019).

Moderate (C2) consequence on the population and that this is **Possible (L3)** to continue into the future. The risk rating **Medium**.

Black Bream –HIGH

It was discussed that growth and recruitment of Black bream are strongly influenced by environmental conditions associated with freshwater flows. It was noted that these flows are influenced by a variety of environmental, as well as, man-made factors. Information in the most recent stock assessment (Earl et al 2016), and most recent stock status (Earl 2019) were considered. The assessment also took into consideration temporary arrangements including exclusion areas and spawning season closures, implemented in 2018 and 2019 to promote recovery of the stock. The Black bream stock in the Coorong estuary is currently classified as ‘depleted’.

High (C3) consequence on the population and that this is **Possible (L3)** to continue into the future. The risk rating **High**.

Greenback Flounder –MEDIUM

Information in the most recent stock assessment (Earl and Ye 2016), and most recent stock status (Earl 2019) were considered. It is believed that Greenback flounder are marine estuarine opportunists that enter estuaries during juvenile and early adult life, but also use marine waters as alternative habitat. The stock structure in the SA is uncertain and the extent of the population in the marine environment adjacent to the Coorong estuary is not known. It was noted that more information about this species is required.

Moderate (C2) consequence on the population and that this is **Possible (L3)** to continue into the future. The risk rating **Medium**.

Mulloway –MEDIUM

Mulloway is a key target species in the LCF. Juveniles are often abundant in estuaries while adults are mainly found in nearshore coastal waters, including the surf zone and around mouths of rivers.

The latest fishery information published in the SARDI report “*Fishery statistics, stock status and performance indicators for the lakes and Coorong Fishery*” (Earl 2019) was considered. Catch rate for Mulloway in 2017/18 was the highest on record and the stock is classified in the LCF as sustainable.

The latest assessment of the LCF for export approval under the *Environmental Protection and Biodiversity Conservation Act 1999* noted concerns regarding the number of individuals being discarded before they reach size maturity (DotE 2019). The workshop participants noted that additional information regarding size structure is required with industry supporting this information be attained through stock assessment monitoring and research activities.

Moderate (C2) consequence on the population and that this is **Possible (L3)** to continue into the future. The risk rating **Medium**.

European Carp and Redfin

It was agreed to add Redfin to the list of primary species. Carp and Redfin are both categorized as noxious species under the *Fisheries Management Act 2007* and it is illegal to release these fish alive. Any negative impact on the breeding population from the LCF is considered to provide positive outcomes for the health of the ecosystem.

The proposed release of a Carp virus to control carp numbers in the Murray was noted.

Minor (C1) consequence on the population and that this is **Likely (L4)** to continue into the future. The risk rating **LOW**.

Mactra

Mactra are surf clams that are generally found in deeper water about 100 m from the beach. These species have been added to the retained species components. These are being retained in small quantities and due to their deeper habitat (than Pipis) makes them more difficult to harvest.

Minor (C1) consequence on the population and that this is **Possible (L3)** to continue into the future. The risk rating **Low**.

Secondary Species

Yabby-LOW

It was agreed to move Yabbies as a component to secondary species. It was considered that the additional information did not change the previous risk rating for this species and the risk rating was converted to the updated matrix.

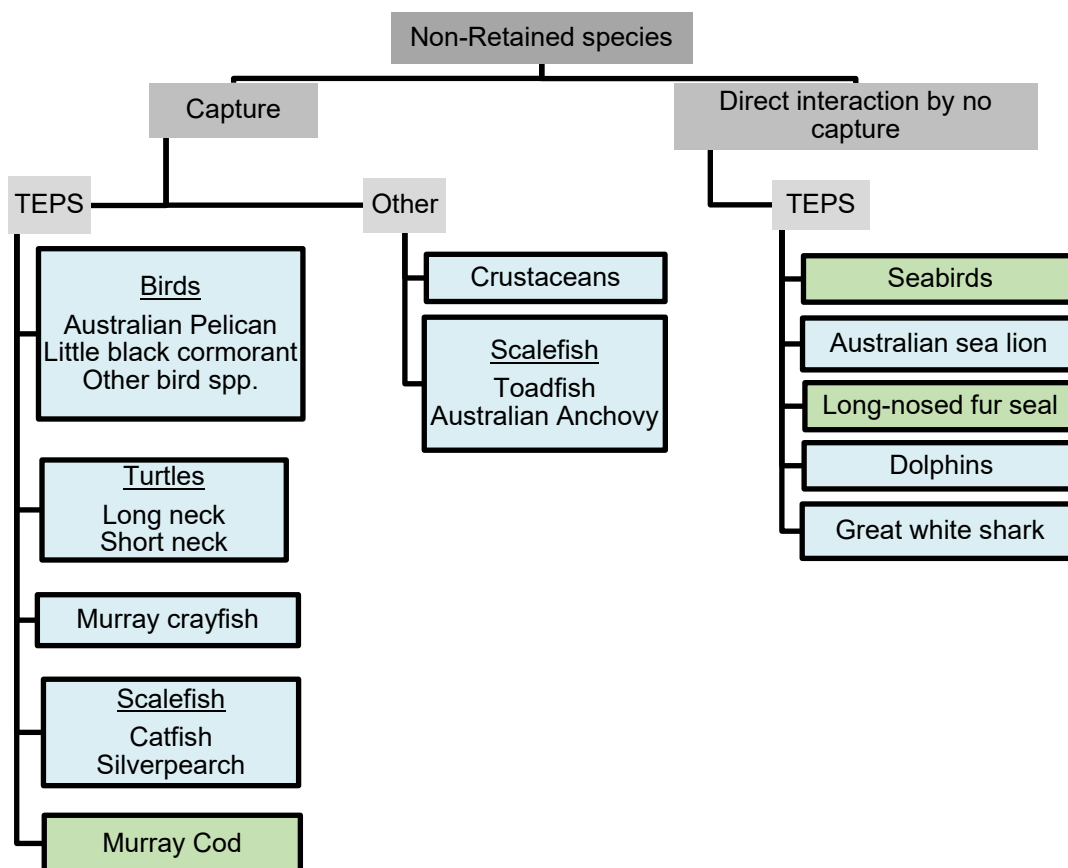
Minor (C1) consequence on the population and that this is **likely (L4)** to continue into the future. The risk rating **Low**.

By-catch species – Low/Negligible

It was considered that due to the limited new information for by-catch species, this did not change the previous risk rating for these species. The previous risk ratings were converted to the updated matrix and adopted for this risk assessment.

For low risk species ranked as low risk previously, the converted scores were considered to be **Minor (C1)** consequence on the population and **likely (L4)** to continue into the future. Risk rating **Low**.

Non-retained species



The participants noted updated information included in the latest Wildlife interaction reports provided by SARDI in regard to identifying any significant changes to interaction rates in the LCF. The latest report was published in 2018 (Mackay 2018).

Long-nosed Fur Seals – LOW

In the past seven years, there has been an increase in interactions with fur seals, predominately being reported by the net sector of the Lakes and Coorong Fishery. These interactions relate to seals attempting to remove fish caught in commercial fishing gear. Licence holders in the LCF are continuing to explore changes to their methods to reduce interactions with fur seals. Mackay (2018) reports that all of these interactions reported no mortalities.

It is noted that the assessment of this component of the risk assessment are related to impacts of the fishery on the population of non-retained species rather than impacts on the fishery. The impacts of fur seals on the performance of the fishery are assessed in the component tree related to external factors impacting on the fishery.

The population of Long-nosed Fur Seals in South Australia was estimated to be 97,000 in 2013/14 (Shaughnessy et al 2015). It was considered that the fishery would have a

minimal impact on the population of Long-nosed Fur Seals in South Australia given the vast majority of interactions resulted in seals being uninjured.

Minor (C1) and that this will **Likely (L4)** occur into the future. The risk rating was therefore **Low**.

Murray cod –LOW

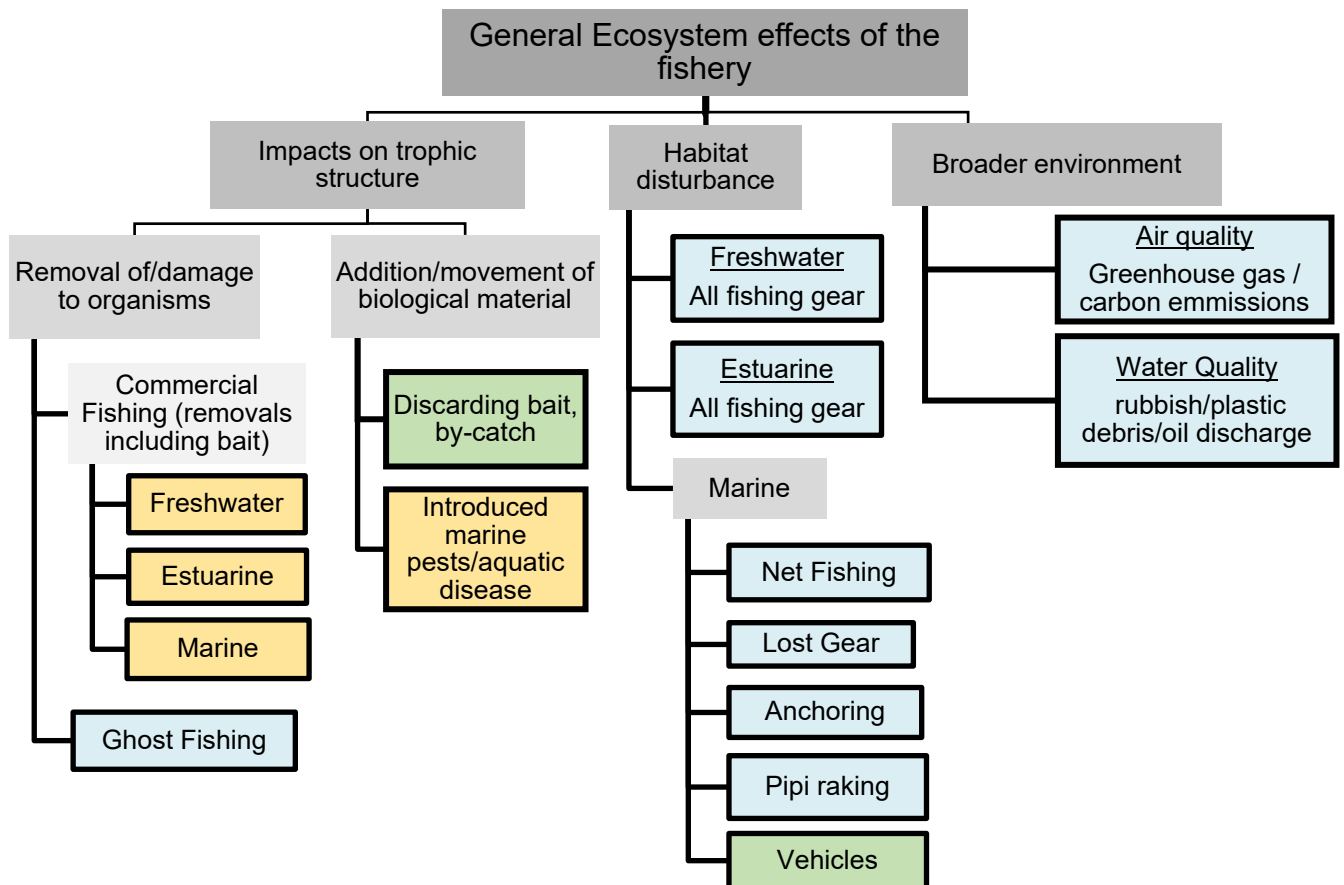
This species is currently protected from harvest. It was noted that the previous risk assessment included Murray Cod as a by-product species of the fishery. This was considered to be inappropriate given the arrangements in place currently prohibiting harvest of this species. For this assessment it was considered that this species is best assessed as a non-retained species. It was considered that the risk rating for this species from the last assessment was still appropriate.

Minor (C1) and that this will **Likely (L4)** occur into the future. The risk rating was therefore **Low**.

All other species

Interactions with other non-retained species (TEPS and others) were considered to have not changed significantly from the previous assessment. Therefore, the previous risk ratings were converted to the updated matrix and adopted for this risk assessment.

General ecosystem impacts of fishing



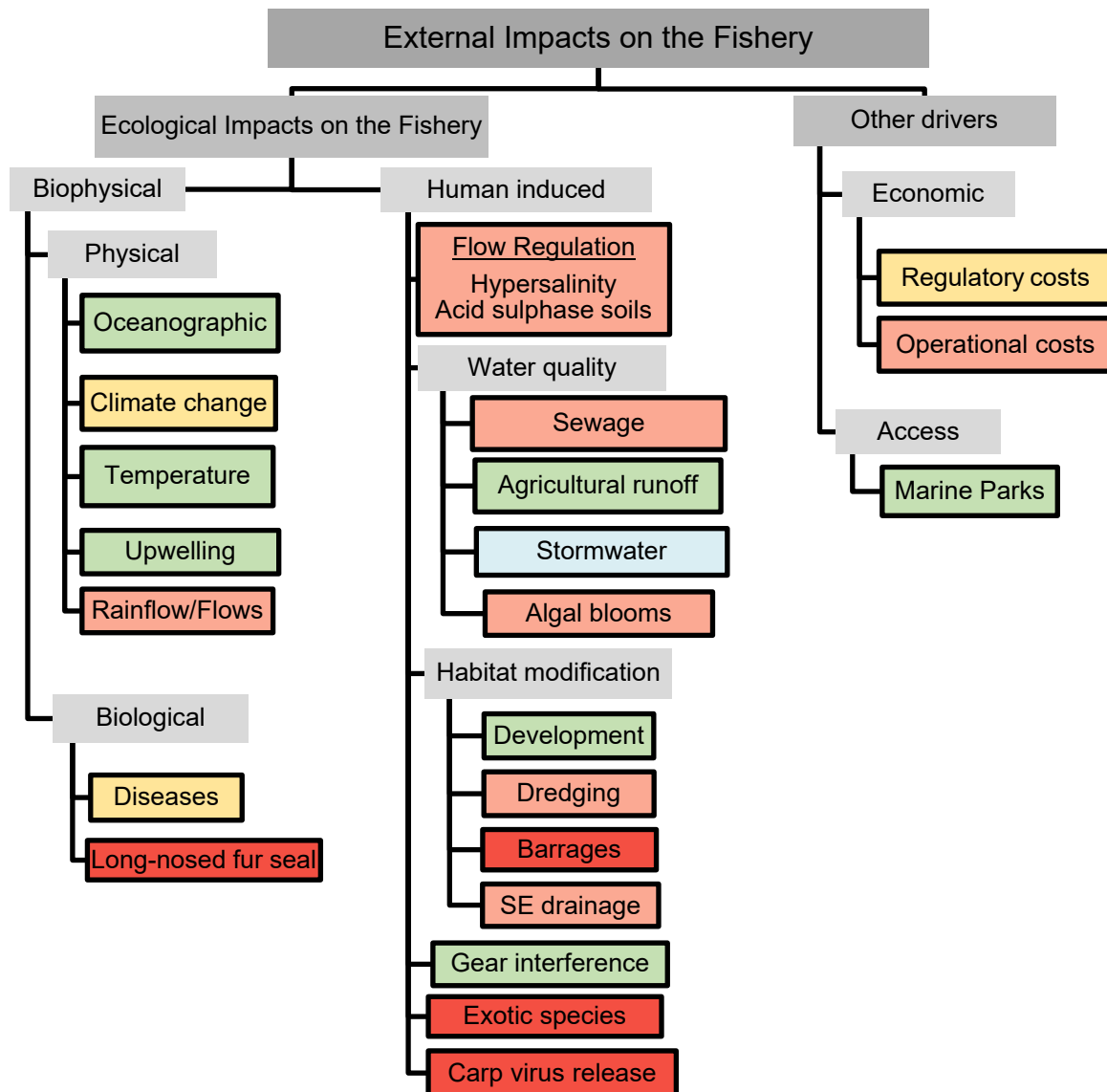
There was limited information available related to general ecosystem impacts of fishing. As it was noted that there had been limited change in the level of fishing activity, it was considered that the risk ratings of a majority of components were to be retained after converting to the updated risk matrix with the exception of impacts of commercial fishing (removals including bait).

Commercial Fishing (removals including bait) –MEDIUM

For all fishing environments (freshwater, estuarine and marine) it was noted that in this component the risk assessed was related to the impact of the fishery on trophic structures of the environment and these components were rescored.

It was considered that the fishery was having a **moderate (C2)** consequence on trophic structures and it is **Possible (L3)** this will continue into the future. Risk rating **Medium**.

External impacts on the fishery



New information considered in reviewing the risk assessment for this sector included the latest Econsearch report (Econsearch 2018) and recent incidents of closures to Piri fishing due to *E. coli* outbreaks.

The risk ratings of a majority of components were to be retained after converting to the updated risk matrix with the exception of the following components:

- Rainfall / flow regulation
- Climate change
- Sewage
- Algal blooms
- SE drainage
- Operational costs
- Marine Parks

In addition, the following components were added to the component tree

- Long-nosed Fur Seals
- Carp virus release

Rainfall / flow regulation –HIGH

The impacts of rainfall in catchments and subsequent influence on flows was discussed at length with regard to impacts on the performance of the fishery. The reliance on freshwater flows is well documented for some important fish species such as Black Bream.

Given the unpredictable but important nature of rainfall, it was considered that rainfall / freshwater flows were **Likely (L3)** to have a **High (C3)** consequence on the LCF over the next 5 or so years. Thus the risk rating was **High**.

Climate change –HIGH

The impacts of climate change on matters other than rainfall and flow regulation were considered over the period of 5 years (the agreed period for this risk assessment).

It was considered that climate change was **possible (L3)** to have a **moderate (C2)** consequence on the LCF over the next 5 or so years. Thus the risk rating was **High**.

Long-nosed Fur Seals –SEVERE

In the past seven years, there has been an increase in interactions with fur seals, in the net sector of the Lakes and Coorong Fishery. These interactions relate to seals feeding on fish caught in nets resulting in loss of catch and damage to fishing gear and significant loss of income and increased operational costs for operators. Licence holders are continuing to explore options to reduce the impacts of interactions with fur seals; however, they have had limited success. Fishers have modified their practices to reduce soak time in order to reduce the risk of and consequence from fur seal interactions. Fee relief has been provided to effected licence holders. The impact of fur seals on profitability in the net sector of the LCF may be indicated in the decline in a number of profitability indicators reported in the latest Econsearch report (Econsearch 2018).

The impact of Long-nosed Fur Seals on the performance of the fishery was considered to be having a **Major (C4)** consequence on the fishery and was **Likely (L3)** to occur. Risk rating **Severe**.

Sewage –HIGH

E. coli outbreaks have resulted in closures of Goolwa Beach to Piri fishing for both commercial and recreational fishing on a number of occasions since the last assessment (2012, 2016, 2017). Sewage upstream of the beach is one of the possible causes of *E. coli* outbreaks. The increased occurrence of *E. coli* outbreaks in the LCF was considered in rescoring the impact of sewage on the performance of the fishery.

Given the recent incidence of *E. coli* outbreaks this risk of sewage impacting on the performance of the fishery was considered to have a **High (C3)** consequence on the LCF and was **Likely (L3)** to occur over the next 5 or so years. Risk rating **High**.

Algal blooms –HIGH

Similar to *E. coli* outbreaks, the risk of harmful algal blooms impacting on the LCF due to reduced water quality was considered to have increased since the previous assessment and was rescored.

It was considered that algal blooms impacting on the performance of the fishery could have a **High (C3)** consequence on the LCF and was **Likely (L4)** to occur over the next 5 or so years. Risk rating **High**.

SE Drainage –HIGH

The SE drainage scheme has modified the level of freshwater flows into the Coorong lagoons and thus modified the habitats in that area. The impacts of this habitat modification on the LCF are difficult to quantify, however the impacts of the drainage system considered by the workshop participants warranted rescoring.

It was considered that the SE drainage system could have a **High (C3)** consequence on the LCF and was **likely (L4)** to occur in the next five or so years. Thus the risk rating was **High**.

Carp virus release –SEVERE

The proposal to release a carp virus into the River Murray system to control European Carp was considered to be a new risk to the fishery that was not included in the 2011 risk assessment. Of concern to workshop participants in regard to the virus release was fouling of the river from huge amounts of decaying carp, rapid changes to biodiversity in the river as well as impacts on commercial fishers who currently commercially harvest Carp.

It was considered that the virus release could have a **Major (C4)** consequence on the LCF and was **Possible (L3)** that this could occur in the next five or so years. Risk rating **Severe**.

Operational costs –HIGH

There are many factors influencing the operational costs of the LCF and flow on impacts on profitability. The latest report on economic performance of the fishery indicate that labour and fuel were identified as significant costs associated with fishing operations in the LCF. It is identified in the Econsearch report (2018) that profitability for the net sector of the LCF has decreased and has become marginal.

Given the most recent information it was considered that operational costs could have a **High (C3)** consequence on the LCF and was **likely (L4)** to occur in the next five or so years. Risk rating **High**.

Regulatory costs –MEDIUM

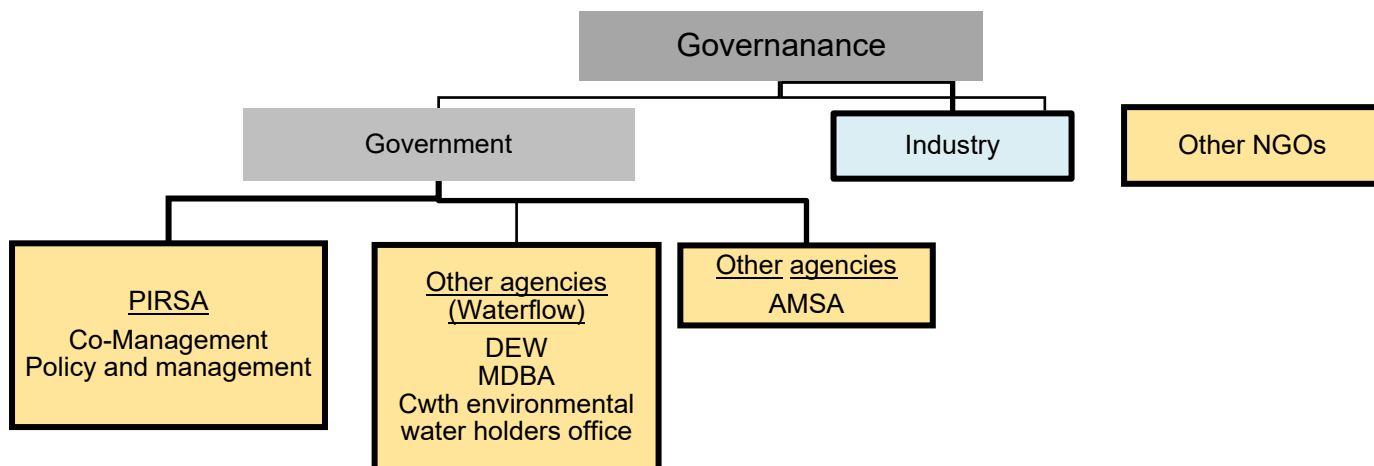
Given the most recent information it was considered that regulatory costs could have a **Moderate (C2)** consequence on the LCF and was **likely (L4)** to occur in the next five or so years. Risk rating **Medium**.

Marine park access –LOW

The impacts of marine parks sanctuary zone implementation (in 2015) were taken into consideration in rescoring this component.

Minor (C1) consequence on the LCF and was **likely (L4)** to occur in the next five or so years. Risk rating **Low**.

Governance

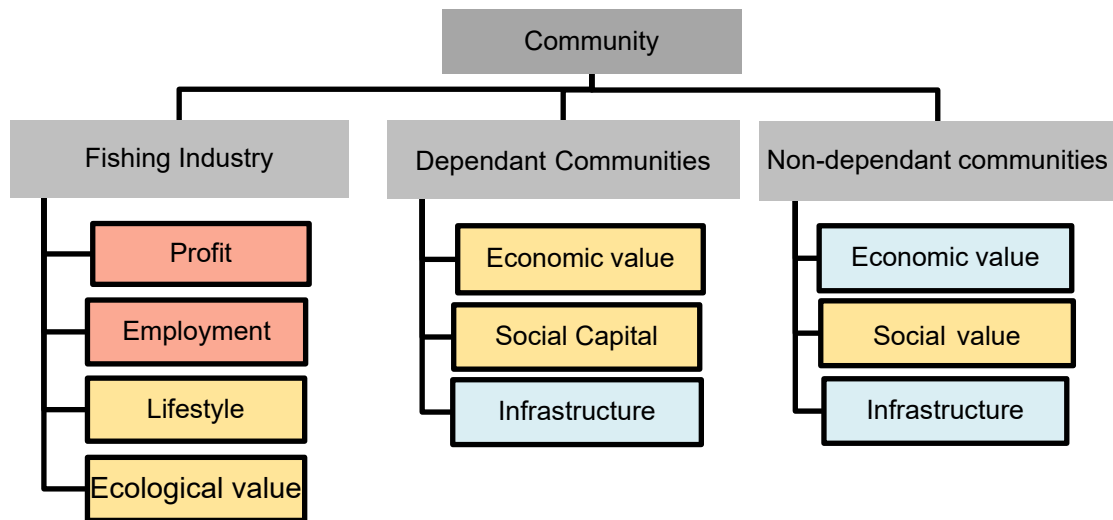


The workshop participants requested simplification to this component tree where possible as reflected in the figure above.

It was noted that the component for governance of the industry was not scored during the previous risk assessment and was therefore considered to be of negligible risk to the fishery.

It was agreed that the risk ratings of the remaining components were to be retained after converting to the updated risk matrix

Community



The workshop participants requested simplification to this component tree where possible as reflected in the figure above.

It was agreed that the risk ratings of the remaining components were to be retained after converting to the updated risk matrix.

Risk Evaluation

A total of 82 issues associated with the South Australian Lakes and Coorong Fishery were scored for risk across five component trees: retained species, non-retained species, general ecosystem, external factors, community wellbeing and governance. The majority of issues were ranked as medium, low or negligible risk (Table 1). Severe risks were identified in components related to external factors impacting the fishery. High risks were identified for one retained species (Black bream), seven components related to external factors impacting the fishery and two community components.

The majority of issues were identified in the External Factors component tree.

Table 1: Summary of ESD Risk outcomes for Lakes and Coorong Fishery

Component Trees	Severe	High	Medium	Low	Negligible	Total
Retained Species		1	4	8	5	18
Non-retained species				3	9	12
General Ecosystem			4	2	9	15
External Factors	4	7	3	7	1	22
Governance			4		1	5
Community		2	5		3	10
Total	4	10	20	20	28	82

Risk treatment options for medium, high and severe risks.

Components	Risk	Reporting and Monitoring	Management Actions
Retained Species			
Pipi	Medium	Continue current fisheries dependant and independent monitoring. Continue with regular reporting	Maintain current management practices as described in the relevant management plan. Continue implementation of annual TACC setting guided by agreed harvest strategy
Golden perch	Medium	Continue current fisheries monitoring and reporting	Maintain current management practices as described in the relevant management plan.
Black bream	High	Continue current fisheries monitoring and reporting	Continue temporary management arrangements and revise as required. Promote improved water management practices.
Greenback flounder	Medium	Continue current fisheries monitoring and reporting	Maintain current management practices as described in the relevant management plan.
Mulloway	Medium	Continue current fisheries monitoring and reporting	Maintain current management practices as described in the relevant management plan.
Non-Retained Species			
Nil			
General Ecosystem effects			
Trophic structure - Removal/Damage - Commercial Fishing - Freshwater	Medium	Continue current fisheries dependant and independent monitoring of target, by-catch and by-product. Continue with regular reporting	Maintain current management practices as described in the relevant management plans.
Trophic structure - Removal/Damage - Commercial Fishing - Estuarine	Medium	Continue current fisheries dependant and independent monitoring of target, by-catch and by-product. Continue with regular reporting	Maintain current management practices as described in the relevant management plans.
Trophic structure - Removal/Damage - Commercial Fishing - Marine	Medium	Continue current fisheries dependant and independent monitoring of target, by-catch and by-product. Continue with regular reporting	Maintain current management practices as described in the relevant management plans.
Addition biological material - Discarding - marine pests/disease	Medium	Continue SASQAP monitoring	Maintain current management practices as described in the relevant management plans.

Components	Risk	Reporting and Monitoring	Management Actions
External factors effecting performance of the fishery			
Ecological – Climate change	Medium	Influenced by factors outside PIRSA. Continue with current monitoring and reporting	Maintain current management practices as described in the relevant management plans
Ecological – Rainfall / Flow regulation	High	Influenced by factors outside PIRSA. Continue with current monitoring and reporting	Maintain current management practices as described in the relevant management plans
Ecological - Disease	Medium	Influenced by factors outside PIRSA. Continue with current monitoring and reporting	Maintain current management practices as described in the relevant management plans
Ecological – Long-nosed fur seals	Severe	Continue to investigate mitigation methods. Continue with current monitoring and reporting	Continue to investigate mitigation methods. Continue with current monitoring and reporting
Human Induced – flow regulation	High	Influenced by factors outside PIRSA. Continue with current monitoring and reporting	Maintain current management practices as described in the relevant management plans
Human Induced – Sewage	High	Influenced by factors outside PIRSA. Continue with current monitoring and reporting	Maintain current management practices as described in the relevant management plans
Human Induced – Algal blooms	High	Influenced by factors outside PIRSA. Continue with current monitoring and reporting	Maintain current management practices as described in the relevant management plans
Habitat modification – Dredging	High	Influenced by factors outside PIRSA. Continue with current monitoring and reporting	Maintain current management practices as described in the relevant management plans
Habitat modification – Barrages	Severe	Influenced by factors outside PIRSA. Continue with current monitoring and reporting	Maintain current management practices as described in the relevant management plans
Habitat modification – SE drainage	High	Influenced by factors outside PIRSA. Continue with current monitoring and reporting	Maintain current management practices as described in the relevant management plans
Habitat modification – exotic species	Severe	Influenced by factors outside PIRSA. Continue with current monitoring and reporting	Maintain current management practices as described in the relevant management plans
Habitat modification – carp virus release	Severe	Influenced by factors outside PIRSA. Continue with current monitoring and reporting	Maintain current management practices as described in the relevant management plans
Economic – Regulatory costs	Medium	Continue to investigate options for efficiency gains	Continue to investigate options for efficiency gains
Economic – Operational costs	High	Continue to investigate options for efficiency gains	Continue to investigate options for efficiency gains
Community			
Fishing Industry - profit	High	Continue periodic monitoring	Review management controls
Fishing Industry - employment	High	Continue periodic monitoring	Review management controls
Fishing Industry – lifestyle	Medium	Continue periodic monitoring	Review management controls
Fishing Industry – ecological value	Medium	Continue periodic monitoring	Review management controls
Dependent Communities – Economic value	Medium	Continue periodic monitoring	Review management controls

Components	Risk	Reporting and Monitoring	Management Actions
Dependent Communities – Social capital	Medium	Continue periodic monitoring	Review management controls
Non-Dependent Communities – Social capital	Medium		
Governance			
PIRSA	Medium		
Other agencies (Waterflow)	Medium		
Other Agencies	Medium		
Other – NGOs	Medium		

References

- DotE. (2018). Assessment of the South Australian Lakes and Coorong Fishery February 2019, Commonwealth of Australia 2019.
<https://www.environment.gov.au/marine/fisheries/sa/coorong>
- Earl, J. (2019). Fishery statistics, stock status and performance indicators for the South Australian Lakes and Coorong Fishery. Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2009/000669-10. SARDI Research Report Series No. 1020. 43pp.
https://pir.sa.gov.au/_data/assets/pdf_file/0008/344690/Fishery_statistics_stock_status_and_performance_indicators_for_the_South_Australian_Lakes_and_Coorong_Fishery.pdf
- Earl, J. and Ye, Q. (2016). Greenback Flounder (*Rhombosolea tapirina*) Stock Assessment Report 2014/15. Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2007/000315-2. SARDI Research Report Series No. 889. 40pp.
- Earl, J., Ward, T.M. and Ye, Q. (2016). Black Bream (*Acanthopagrus butcheri*) Stock Assessment Report 2014/15. Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2008/000810-2. SARDI Research Report Series No. 885. 44pp.
https://pir.sa.gov.au/_data/assets/pdf_file/0011/288965/Black_Bream_Acanthopagrus_butcheri_Stock_Assessment_Report_201415_Report_to_PIRSA_Fisheries_and_Aquaculture.pdf
- Econsearch (2018). Economic and Social Indicators for the Lakes and Coorong Fishery 2016/17. Report to PIRSA. https://www.bdo.com.au/getmedia/186c6a81-e51d-432b-9b5f-87aaad32465b/Lakes_and_Coorong_Final_180716.pdf.aspx
- Fletcher, W.J (2015). Review and refinement of an existing qualitative risk assessment method for application within an ecosystem-based management framework. ICES Journal of Marine Science 72(3): 1043-1056.
- Fletcher, W.J., Shaw, J., Gaughan, D.J. and Metcalf, S.J. (2011). Ecosystem Based Fisheries Management case study report – West Coast Bioregion. Fisheries Research Report No. 225. Department of Fisheries, Western Australia. 116 pp.
- Fletcher, W.J., Chesson, J., Fisher M., Sainsbury, K.J., Hundloe, T., Smith, A.D.M. and Whitworth, B. (2002). National ESD Reporting Framework for Australian Fisheries: The 'How To' Guide for Wild Capture Fisheries. FRDC Project 2000/145, Canberra, Australia.
- Mackay, A.I. (2018). Operational Interactions with Threatened, Endangered or Protected Species in South Australian Managed Fisheries Data Summary: 2007/08 - 2016/17. Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2009/000544-8. SARDI

Research Report Series No. 981. 72pp.

[https://pir.sa.gov.au/_data/assets/pdf_file/0005/333149/Operational Interactions with Threatened, Endangered or Protected Species in South Australian Managed Fisheries Data Summary 200708 - 201617.pdf](https://pir.sa.gov.au/_data/assets/pdf_file/0005/333149/Operational_Interactions_with_Threatened_Endangered_or_Protected_Species_in_South_Australian_Managed_Fisheries_Data_Summary_200708_-_201617.pdf)

PIRSA. (2016). Management Plan for the South Australian Commercial Lakes and Coorong Fishery.

[https://pir.sa.gov.au/_data/assets/pdf_file/0016/12742/SA Commercial Lakes and Coorong Fishery Management Plan.pdf](https://pir.sa.gov.au/_data/assets/pdf_file/0016/12742/SA_Commercial_Lakes_and_Coorong_Fishery_Management_Plan.pdf)

PIRSA. (2011). Ecologically sustainable development (ESD) risk assessment of the South Australian Lakes and Coorong Fishery.

Shaughnessy PD., Goldsworthy SD., and Mackay AI. (2015). The long-nosed fur seal (*Arctocephalus forsteri*) in South Australia in 2013–14: abundance, status and trends. Australian Journal of Zoology. 63(2) 101-110

Appendix 1: Risk matrices

Consequence, Likelihood and Risk Levels Based on AS 4360 / ISO 31000, modified from Fletcher et al. (2011) and Fletcher (2015)

Consequence × Likelihood Risk Matrix		Likelihood			
		Remote (1)	Unlikely (2)	Possible (3)	Likely (4)
Consequence	Minor (1)	Negligible	Negligible	Low	Low
	Moderate (2)	Negligible	Low	Medium	Medium
	High (3)	Low	Medium	High	High
	Major (4)	Low	Medium	Severe	Severe

LIKELIHOOD LEVELS

These are defined as the likelihood of a particular consequence level actually occurring within the assessment period.

1	Remote	The consequence has never been heard of in these circumstances, but it is not impossible within the timeframe (Probability <5%).
2	Unlikely	The consequence is not expected to occur in the timeframe but it has been known to occur elsewhere under special circumstances (Probability 5 - <20%).
3	Possible	Evidence to suggest this consequence level is possible and may occur in some circumstances within the timeframe (Probability 20 - <50%).
4	Likely	A particular consequence level is expected to occur in the timeframe (Probability ≥50%).

CONSEQUENCE LEVELS

These are the potential outcomes (levels of impact) of an event or occurrence that affect objectives.

Note that if an issue is not considered to have any measurable impact, it is considered to be a 0 consequence.

Generic		
1	Minor	Measurable but minimal impacts that are highly acceptable and easily meet objective.
2	Moderate	Maximum acceptable level of impact that would still meet the objective.
3	High	Above acceptable level of impact. Broad and/or long-term negative effects on objective which may no longer be met. Restoration can be achieved within a short to moderate time frame.
4	Major	Well above acceptable level of impact. Very serious effects on objective which is clearly not being met and may require a long restoration time or may not be possible.

1. Ecological: Target/Retained Species		
1	Minor	Fishing impacts either not detectable against background variability for this population; or if detectable, minimal impact on population size and none on dynamics. Spawning biomass > Target level
2	Moderate	Fishery operating at maximum acceptable level of depletion. Spawning biomass < Target level but > Threshold level (B_{MSY})
3	High	Level of depletion unacceptable but still not affecting recruitment levels of stock. Spawning biomass < Threshold level (B_{MSY}) but > Limit level (B_{REC})
4	Major	Level of depletion is already affecting (or will definitely affect) future recruitment potential of the stock. Spawning biomass < Limit level (B_{REC})

2. Ecological: Non-Retained (Bycatch) Species		
1	Minor	Species assessed elsewhere and/or take is very small and area of capture small compared with known distribution (< 20%).
2	Moderate	Relative area of, or susceptibility to, capture is < 50% and species do not have a vulnerable life history.
3	High	N/A - Once a consequence reaches this point, it should be examined using target/retained species table.
4	Major	N/A.

3. Ecological: Threatened, Endangered and Protected Species (TEPS)		
1	Minor	Few individuals directly impacted in most years, level of capture/interaction is well below that which will generate public concern.
2	Moderate	Level of capture is the maximum that will not impact on recovery or cause unacceptable public concern.
3	High	Recovery may be affected and/or some clear, but short-term public concern will be generated.
4	Major	Recover times are clearly being impacted and/or public concern is widespread.

4. Ecological: Habitat		
1	Minor	Measurable impacts but very localized. Area directly affected well below maximum accepted.
2	Moderate	Maximum acceptable level of impact to habitat with no long-term impacts on region-wide habitat dynamics.
3	High	Above acceptable level of loss/impact with region-wide dynamics or related systems may begin to be impacted.
4	Major	Level of habitat loss clearly generating region-wide effects on dynamics and related systems.

5. Ecological: Ecosystem/Environment		
1	Minor	Measurable but minor changes to the environment or ecosystem structure but no measurable change to function.
2	Moderate	Maximum acceptable level of change to the environment or ecosystem structure with no material change in function.
3	High	Ecosystem function altered to an unacceptable level with some function or major components now missing and/or new species are prevalent.
4	Major	Long-term, significant impact with an extreme change to both ecosystem structure and function; different dynamics now occur with different species/groups now the major targets of capture or surveys.

6. Economic		
1	Minor	A small, measurable but temporary impact on the economic pathways for the industry or the community.
2	Moderate	Some level of reduction for a major fishery or a large reduction in a small fishery that the community is not dependent upon.
3	High	Major sector decline and economic generation with clear flow on effects to the community.
4	Major	Permanent and widespread collapse of economic activity for industry and the community including possible debts.

7. Public Reputation & Image		
1	Minor	Low negative impact and news profile.
2	Moderate	Some public embarrassment, moderate news profile and minor ministerial involvement.
3	High	High public embarrassment, high impact and news profile, third-party actions, public and significant ministerial involvement.
4	Major	Extreme public embarrassment, prolonged news coverage, third-party actions/enquiry and government censure.

8. Safety & Health		
1	Minor	First aid only.
2	Moderate	Some minor medical treatment required, visit to doctor's surgery. Less than a week off work.
3	High	Hospitalisation and/or intensive and extended treatment period required for recovery.
4	Major	Serious or extensive injuries, disease, permanent disability or death.

9. Social Amenity & Lifestyle		
1	Minor	Temporary or minor additional stakeholder restrictions or loss of expectations (< 1 year).
2	Moderate	Ongoing restrictions or decrease in expectations.
3	High	Long-term suspension or restriction of expectations in some key activities.
4	Major	Permanent loss of all expectations in key activities.

10. Community (Social Structures & Culture)		
1	Minor	Impacts may be measurable but minimal concerns.
2	Moderate	Clear impacts but no local communities threatened or social dislocations.
3	High	Major impacts at least at a local level, with disruptions now evident.
4	Major	Impacts occurring at a broader (regional) level or severe local impacts.

11. Operational Effectiveness		
1	Minor	Minor delay in achievement of a key deliverable.
2	Moderate	Minor element of one key deliverable unable to be achieved on time.
3	High	Significant delay but achievement of key deliverable.
4	Major	Non-achievement of more than one key deliverable, or major delay to entire strategic directive.

Appendix 2: Workshop Participants

Participants

- Annabel Jones – Facilitator
- Gary Hera-Singh
- Peter Doolette
- Tom Robinson - Industry
- Simon Bryers - DEW
- Levi Nash – RecFish SA
- Belinda McGrath-Steer - PIRSA
- Jason Earl - SARDI
- Greg Ferguson - SARDI
- Neil MacDonald - Industry

Appendix 3: Risk ratings

Table 2: Risk ratings for each component. Neg = negligible, * indicates risk rating adopted from 2011 assessment and converted to updated matrices.

Components	Consequence	Likelihood	Risk
Retained Species			
Primary - Pipi	2	4	Medium
Bony bream	1	4	Low*
Yelloweye mullet	1	4	Low*
Golden perch	2	3	Medium
Black bream	3	3	High
Greenback flounder	2	3	Medium
Mulloway	2	3	Medium
European carp	1	4	Low*
Redfin	1	4	Low*
Mactra	1	3	Low
Secondary - Yabby	1	4	Low
By-product - Crustaceans	Neg		Neg*
Skates & Rays	Neg		Neg*
Sharks	1	4	Low*
Jumper Mullet	1	4	Low*
Congolli	Neg		Neg*
Australian Salmon	Neg		Neg*
Other finfish spp	Neg		Neg*
Non-Retained Species			
Capture - TEPS - Birds	Neg		Neg*
TEPS - Turtles	Neg		Neg*
Murray crayfish	Neg		Neg*
TEPS - Scalefish	Neg		Neg*
Murray cod	1	4	Low*
Other crustaceans	Neg		Neg*
Other scalefish	Neg		Neg*
Non-capture - TEPS- seabirds	1	4	Low*
TEPS Australian sea lion	Neg		Neg*

Components	Consequence	Likelihood	Risk
TEPS - Long-nosed fur seal	1	4	Low
TEPS - dolphins	Neg		Neg*
TEPS - GWS	Neg		Neg*
General Ecosystem effects			
Trophic structure - Removal/Damage - Commercial Fishing - Freshwater	2	3	Medium
Commercial Fishing - Estuarine	2	3	Medium
Commercial Fishing - Marine	2	3	Medium
ghost fishing	Neg		Neg*
Addition biological material - Discarding	1	4	Low*
marine pests/disease	4	2	Medium*
Habitat disturbance - Freshwater	Neg		Neg*
Estuarine	Neg		Neg*
Marine - Net	Neg		Neg*
Marine - Lost gear	Neg		Neg*
Marine - Anchoring	Neg		Neg*
Marine - Pipi raking	Neg		Neg*
Marine - vehicles	1	4	Low*
Broader environment - Air quality	Neg		Neg*
Water quality	Neg		Neg*
External factors effecting performance of the fishery			
Ecological Physical - Oceanography	1	3	Low*
Climate change	2	3	Medium
Temperature	1	3	Low*
Upwelling	1	3	Low*
Rainflow/Flows	3	4	High
Disease	3	2	Medium*
Long-nosed fur seals	4	3	Severe
Human induced - Flow regulation	3	3	High
Water quality - sewage	3	3	High
Water quality - Agricultural runoff	1	4	Low*
Water quality - Stormwater	Neg		Neg*
Water quality - Algal blooms	3	4	High
Habitat modification - Development	1	4	Low*
Dredging	3	3	High*
Barrages	4	4	Severe*
SE drainage	3	4	High
Gear interference	1	4	Low*
Exotic species	4	4	Severe*
Carp virus release	4	3	Severe
Economic - Regulatory costs	2	4	Medium
Operational costs	3	4	High
Access - marine parks	1	4	Low
Community			
Fishing Industry - Profit	3	3	High*
Employment	3	3	High*
Lifestyle	2	3	Medium*
Ecological value	2	3	Medium*
Dependent communities - Economic value	2	3	Medium*
Social capital	2	3	Medium*

Components	Consequence	Likelihood	Risk
Infrastructure	Neg		Neg*
Non-dependent communities - Economic value	Neg		Neg*
Social capital	2	3	Medium*
Infrastructure	Neg		Neg*
Governance			
PIRSA	2	3	Medium*
Other agencies (waterflow)	2	3	Medium*
Other agencies	2	3	Medium*
Industry	Neg		Neg*
Other NGOs	2	3	Medium*

