Ecologically sustainable development (ESD) risk assessment of the Beach-cast Marine Algae Fishery

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Department of Primary Industries and Regions

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Ecologically Sustainable Development (ESD) risk assessment of the Beach-cast marine algae fishery

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1. Introduction

An Ecologically Sustainable Development (ESD) risk assessment is an important part of the process of assessing the ecological impacts of commercial fisheries. The ESD risk assessment process considers an extensive range of issues, risks and opportunities identified by stakeholders and provides a method for prioritising the identified risks based on consequence and likelihood of impacts.

2. Seagrass and Marine Algae Wrack

Beach-cast accumulations of decaying seagrass and marine algae (wracks) may consist of kelp or other detached marine algae, seagrasses, animal carcasses and other organic matter deposited from the sea onto a beach by waves or winds (Fairweather and Henry 2003; Duong 2008). Harvesting includes the removal, clearance, movement, relocation, or disturbance of any part of a wrack. It is emphasised that this report addresses beach-cast seagrass and marine algal material and does not refer to flora attached to a substrate or drifting in the water column.

Wracks of decaying seagrass and marine algae are considered essential components of coastal ecosystems. They serve several important roles in the ecology of local coastal environments. Wracks contribute to the food web dynamics of beach and near-shore marine communities, including valuable fisheries, by supporting microbial processes and invertebrate fauna which are preyed upon by higher-level consumers and supplying nutrients that can be used by plant and animal communities (Kirkman and Kendrick 1997). Many bird species, some of high conservation status, also use these habitats. Wracks also provide protection to coastal dunes and other important coastal environments (Ivey et al. 2013).

Interest in harvesting has resulted from a rising market demand for algal products both locally and internationally. An authority to collect any marine flora for commercial purposes is required under the *Fisheries Management Act 2007* (the Act). The commercial harvesting of wracks from any beach of the state is under the care, control, and management of the Department of Primary Industries and Regions (PIRSA) on behalf of the community in accordance with the Act. The Act provides a broad statutory framework to ensure the ecologically sustainable management of South Australia's aquatic resources. The regulations which govern the commercial harvest of beach-cast seagrass and marine algae are the *Fisheries Management (Miscellaneous Fishery) Regulations 2013*, the *Fisheries Management (General) Regulations 2017* and the *Fisheries Management (Miscellaneous Developmental Fishery) Regulations 2013*.

2.1 Biological information

Several studies, most notably in South Australia, Western Australia and South Africa, have highlighted the importance of beach-cast seagrass and marine algae accumulations as sources of detritus and of particulate and dissolved nutrients which can contribute to beach and inshore marine food webs (e.g. Griffiths & Stenton-Dozey 1981; Koop & Griffiths 1982; Lenanton et al. 1982; Robertson & Hansen 1982; Griffiths et al. 1983; Duong 2008). Wracks of dead seagrass and algal material are physically broken down by wave and sand abrasion and are biologically decomposed by the action of bacteria and small invertebrates. Decomposition by bacteria releases nitrogen and phosphorous – nutrients necessary for the growth of offshore seagrass

meadows (Bell 1983). In Western Australia, substantially higher concentrations of dissolved nutrients were measured in waters adjacent to beaches covered in decaying wrack material compared with wrack-free beaches, where waters were relatively nutrient-deficient (Bell 1983).

A rich community of detritivores, such as amphipods, isopods (sandflies), coleoptera (beetles) and diptera (flies) rapidly colonises and consumes the decaying vegetation, breaking it down into detritus and particulate carbon (Griffiths & Stenton-Dozey 1981; Marsden 1991; Duong 2008). Griffiths et al. (1983) for example recorded 35 species (of which 22 were insects) amongst kelp wrack, which together accounted for more than 97% of the total intertidal faunal biomass. These organisms can reduce the biomass of dead marine algae to 50% of its initial weight after 2 days and 20% after 14 days, mainly due to consumption by amphipods and dipteran (kelp fly) larvae (Griffiths & Stenton-Dozey 1981; Rieper-Kirchner 1990). Several species of beach flies complete their life cycles within seagrass/algal wrack (Blanche 1992 in Kendrick et al. 1995; Duong 2008). The herbivorous detritivores are in turn preyed upon by beach-dwelling macrofauna such as beetles, birds and isopods (Duong 2008; Campbell 2018). Griffiths et al. (1983) suggest that at some sites on the southwest coast of South Africa, approximately 95% of the food supply of beach macrofauna comes from the regular, enormous influxes of kelp. Duong (2008) found that algal wrack in South Australia, particularly brown algae including kelps, appeared to be a potential source of nutrition for beach and nearshore consumers such as amphipods and dipterans.

Detritus from wracks can also be exported offshore to supply food to demersal and abyssal fauna (Suchanek et al. 1985 in Thresher et al. 1992; Joselyn et al. 1983 in Kendrick et al. 1995). In addition, work in Tasmania (Thresher et al. 1992) strongly suggests that “it might also constitute a widespread and potentially important source of productivity for planktonic ecosystems as well”. These authors found evidence that the food chain supporting first-feeding larvae of Tasmanian Blue Grenadier (*Macruronus novaezelandiae*) – the dominant nektonic (midwater) predator of the region – is based on microbial decomposition of seagrass detritus. First-feeding is often maintained to be a critical period for fish larval survival. Moreover, higher rates of larval growth were associated with periods of frequent winter storms when offshore transport of seagrass detritus from coastal wrack accumulations is at a maximum (Thresher et al. 1992).

Thus, the export of detrital material from wracks may significantly affect the reproductive success of one of temperate Australia’s dominant fish predators (Thresher et al. 1992).

The wrack communities therefore constitutes a significant food resource consisting of fragments of seaweed and seagrasses, bacteria, meiofauna and beach macrofauna. It may remain in situ, providing food for terrestrial detritivores and consumers (including insects and birds) or it may be washed back into the sea during storm or high tide events, where it provides food for benthic coastal communities and important feeding sites for shallow water fish species. Particulate matter from the breakdown of wrack may also have an effect on offshore secondary production although it is not clear to what extent this adds to the inputs from detrital material that is not cast ashore but rather decomposes within the marine environment.

Accumulated wrack can stabilize coastal ecosystems and may contribute to the fertility and stability of substrates behind the fore dunes. Particulate matter from decomposing wrack provides food for offshore species, including fish and benthic coastal communities.

3. Relevant fisheries

3.1 South Australian Beach-Cast Marine Algae Fishery

The Beach-Cast Marine Algae Fishery (BCMAF) in South Australia includes the harvest of beach-cast marine macroalgae and seagrass species through the collection of 'wrack' from prescribed coastal areas adjacent to South Australian waters. Harvest is permitted on the shoreline between the high and low water mark.

In South Australian fisheries, most primary retained species are managed under a harvest strategy against biologically based reference levels, and the risk of all fishing on the broader stock(s) has typically already been determined as part of their stock assessments. Given the nature of the BCMAF, which has no defined stock assessment and the rate that beach-cast marine algae is generated cannot be determined, no harvest strategy is available to reference. Therefore, management arrangements in the fishery must consider the ecological impact of harvesting on species using beach-cast marine algae for habitat and food.

Authorities in the fishery permitting the harvest of marine algae or seagrass wrack in the fishery are issued under the Act and include two licences in the Miscellaneous Fishery, two Exploratory Fishing Permits and one Miscellaneous Research Permit. Authorities in the fishery are non-transferable.

Miscellaneous licences are issued under the constituted Miscellaneous Fishery and legislated under the *Fisheries Management (Miscellaneous Fishery) Regulations 2015*. These licences have been in place for over 15 years.

An Exploratory Fishing Permit is a mechanism for gathering preliminary data to assist in determining whether the commercial harvesting of a particular aquatic resource in a particular manner is sustainable and desirable.

Exploratory Fishing Permits are not transferable, so as to encourage exploratory fishing permit holders to actively explore the viability of the resource and avoid speculation in resource access.

Exploratory Fishing Permits are managed under the Fisheries *Management (Miscellaneous Developmental Fishery) Regulations 2013*. Exploratory permits may transition into developmental permits or be extended to enable further exploration of the viability of creating a commercial licence.

Miscellaneous research permits may be provided for a prescribed period of time to undertake research on specific aquatic species including the gathering of environmental, biological and economic data. Miscellaneous research permits are not designed to transition into fishery licenses.

Existing activities to harvest beach-cast seagrass and marine algae for a commercial purpose are managed by imposing conditions on the licence or permit.

The ESD Risk Assessment process is not designed to amend or review current management arrangements in the fishery, however, risks identified in the assessment may lead to a review of current management arrangements or consideration of additional arrangements as part of the management of the fishery.

A summary of the current authorities in the fishery is provided at **Appendix 1**.

4. Environment

Marine algae grow on shallow rocky substrates and are common on the numerous inshore reefs along the coastline of South Australia. Some species, particularly the kelps, grow to a very large size and form dense subtidal beds. During storms and periods of strong winds, large numbers of these marine algae are torn off or fragmented by wave action and later washed up on beaches. The supply of beach-cast algae, like seagrass, is highly variable over short time and spatial scales, but is again most predominant in winter when very large accumulations may occur. Various seaweed species are found within algal beach wracks; their abundance varies depending on location and the source of the material (Duong 2008). The species targeted by commercial activities are primarily several large brown algae (e.g. *Durvillaea potatorum* and *Ecklonia radiata*) and some of the red algae such as *Gracilaria*.

Seagrass species are aquatic plants that generally grow in shallow sandy or muddy bottom along the coastline of South Australia with extensive meadows occurring in the gulfs. Seagrass beds provide food sources and habitat to aquatic species, contribute to seabed stability through wave energy absorption and sediment accumulation. Various species may be found in beach wrack with *Posidonia spp*. most prevalent.

5. Social and Economic Information

The harvest of beach-cast seagrass and marine algae has the potential to produce exportable, value-added primary products and therefore improve local regional economies. Some of these products may eventually replace existing imported goods. Marine algae are harvested for a variety of uses throughout Australia and overseas. Marine algae are processed immediately either via composting or by drying on outdoor racks and crushing. The use for algal derivates includes food product for abalone aquaculture feed, production of alginate and agar, mineral supplements, cattle feed, garden fertilisers, soil conditioners, pesticides (Colombini & Chelazzi 2003) and boutique applications.

The principal use for seagrass derivates is for composted fertiliser and soil conditioners. There is moderate demand for wrack material to supply the domestic market and harvesters focus on developing products for overseas export.

6. Methodology – ESD Risk Assessment

A significant aspect of the risk assessment and risk management process is communication and consultation with stakeholders. The risk analysis methodology used for this assessment is based on the global standard for risk assessment and risk management (AS/NZS ISO 31000), which has been adopted for use in a fisheries and aquaculture context (see Fletcher et al. 2002, Fletcher 2005; 2015).

The first step in the risk assessment process is to identify ecological issues relevant to the resource and fishery being assessed. Ecological issues are examined using a component tree approach where major components are deconstructed into smaller sub-components that are more specific to allow the development of operational objectives. Secondly, risk identification involves the process of recognising and describing the relevant sources of risk. Once these components have been identified, risk scores are determined by evaluating the potential consequences (impacts) associated with each issue, and the likelihood (probability) of a particular level of consequence occurring.

Primary ESD Components (additional sub-components identified in risk assessment)

Retained Species Non-retained Species General Ecosystem Impacts	Ecological Wellbeing
Community	Human Wellbeing
Governance External Factors Affecting Performance of the Fishery	Ability to Achieve

Risk evaluation is completed by comparing the risk scores to established levels of acceptable and undesirable risk to help inform decisions about which risks need management. For issues with levels of risk that are considered medium and greater, risk management involves identifying the likely monitoring and reporting requirements and associated management actions, which can either address and/or assist in reducing the risk.

To prioritise management actions, the risk assessment process identifies the level of individual risks. This process uses a consequence-likelihood analysis, which examines the magnitude of potential consequences from fishing activities on the South Australian Beach-Cast Marine Algae and seagrass resources and identifies the likelihood that those consequences will occur given current management controls (Fletcher 2015).

The consequence levels range from 1 (minor impact) to 4 (major impact) and likelihood levels range from 1 (remote) to 4 (likely). For each issue, the consequence and likelihood levels are evaluated to determine the highest risk score using the risk matrix.

Four specific consequence tables individual to the issue, as defined at **Appendix 2**, were used in the risk assessment to accommodate the variety of issues and potential outcomes:

- Target/retained species
- Bycatch/non-retained species
- Threatened, Endangered and Protected species
- Ecosystem/Environment

Each issue was then assigned a risk level within one of five categories: Negligible, Low, Medium, High or Severe. Scoring involves assessing the likelihood that a consequence level is occurring, or will occur, within a 5-year period. The likelihood levels are defined in **Appendix 3**.

Risk Assessment Overview

1. On 30 March 2023, PIRSA conducted an ESD risk assessment workshop with stakeholders invited to participate **(Appendix 4 participant list)**. The workshop sought to identify and review the perspectives of the participants together with identifying any new information available to inform the assessment process.
2. The previous ESD risk assessment undertaken in 2020 was used as a baseline

for the assessment. Consequence and likelihood ratings used in this assessment (2023) were derived from revised reference tables, which were recently adopted in ESD assessments for the Rock Lobster and Prawn fisheries (**Table 1**).

3. The scope of the assessment was defined as the BCMAF within the intertidal zone adjacent to South Australia. The workshop agreed to consider the next five years as an appropriate timeline for assessment.
4. A set of "Generic ESD Component Trees" were modified into a set of trees specific to the fishery. The final trees are provided in the Results section.
5. A risk assessment of the identified issues (or components) was undertaken based on the *consequence* arising from the issue and *likelihood* that this consequence will occur. The combination of the consequence and likelihood estimated a level of *risk* associated with issues that may undermine or alternatively contribute to ESD objectives. Risks were prioritised according to their severity (**Table 2**).
6. In assessing risks not considered in the workshop, previous ratings were reviewed and in the absence of any new information, these ratings were considered appropriate.
7. For negligible and low risk issues, the reasons for assigning low risk and/or priority were recorded.
8. For medium and greater level risks a full ESD performance report was prepared in the context of specific management objectives, including operational objectives, indicators, and performance measures.
9. Key stakeholders were invited to participate in the risk assessment workshop and were subsequently provided with an opportunity to comment on a draft of this report.

Figure 1: Summary of ESD Framework

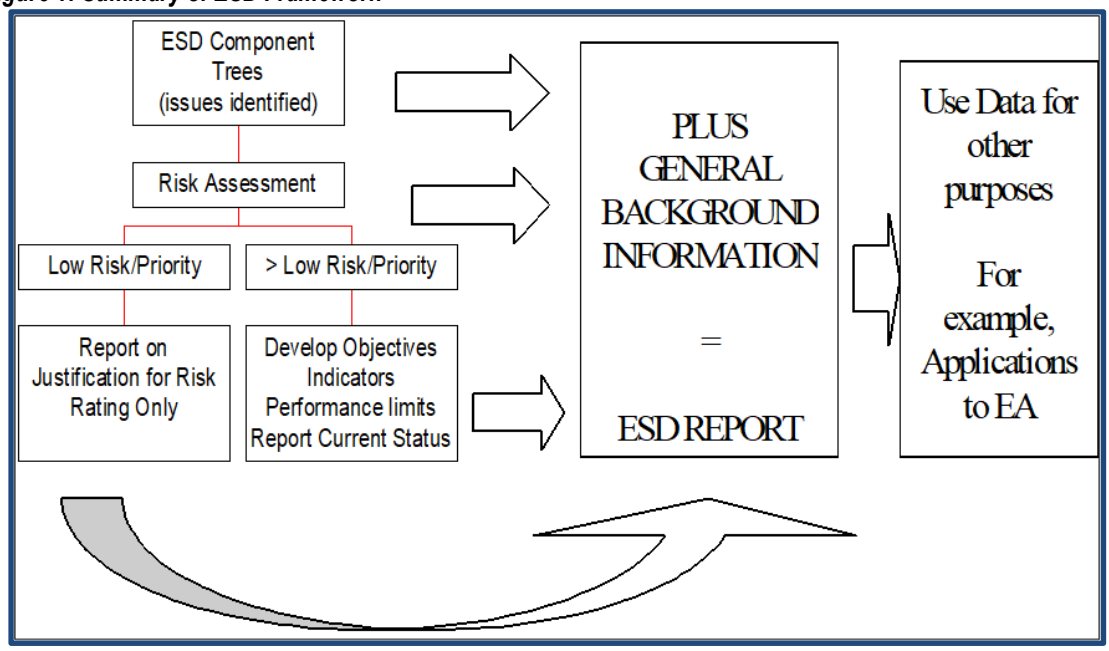


Table 1: Risk matrix (based on AS 4360 / ISO 31000; adapted from WA Department of Fisheries 2015)

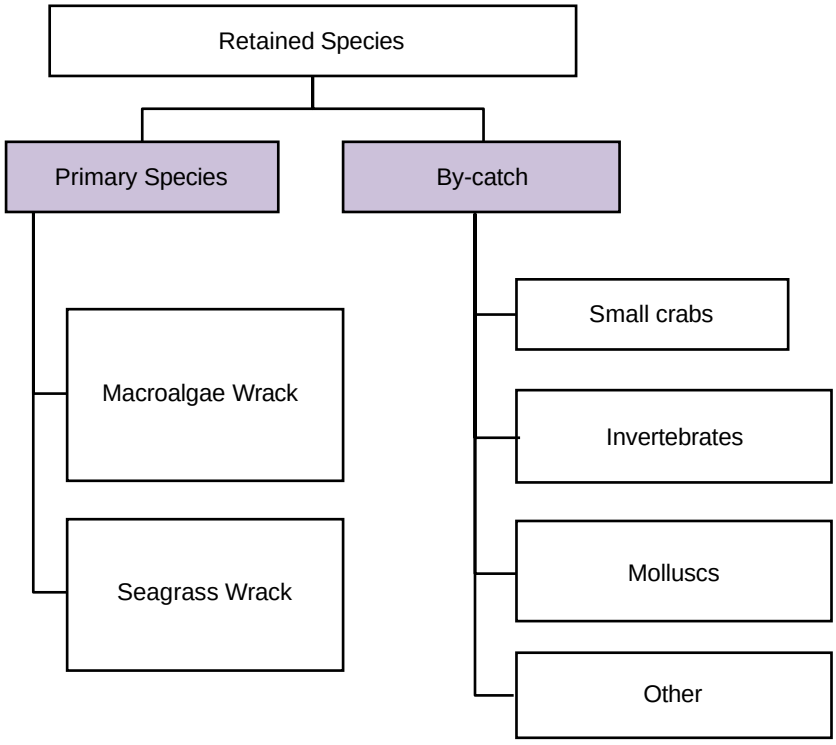
Consequence × Likelihood Risk Matrix		Likelihood			
		Remote (1)	Unlikely (2)	Possible (3)	Likely (4)
Consequence	Minor (1)	Negligible	Negligible	Low	Low
	Moderate (2)	Negligible	Low	Medium	Medium
	High (3)	Low	Medium	High	High
	Major (4)	Low	Medium	Severe	Severe

Table 2: Description of risk levels applied to evaluate individual risk issues (modified from Fletcher 2005).

Risk Levels	Description	Likely Reporting & Monitoring Requirements	Likely Management Action
1 Negligible	Acceptable; Not an issue	Brief justification – no monitoring	Nil
2 Low	Acceptable; No specific control measures needed	Full justification needed – periodic monitoring	None specific
3 Medium	Acceptable; With current risk control measures in place (no new management required)	Full Performance Report – regular monitoring	Specific management and/or monitoring required
4 High	Not desirable; Continue strong management actions OR new / further risk control measures to be introduced in the near future	Full Performance Report – regular monitoring	Increased management activities needed
5 Severe	Unacceptable; If not already introduced, major changes required to management in immediate future	Recovery strategy and detailed monitoring	Increased management activities needed urgently

7. Results

7.1 Issues related to the retained species



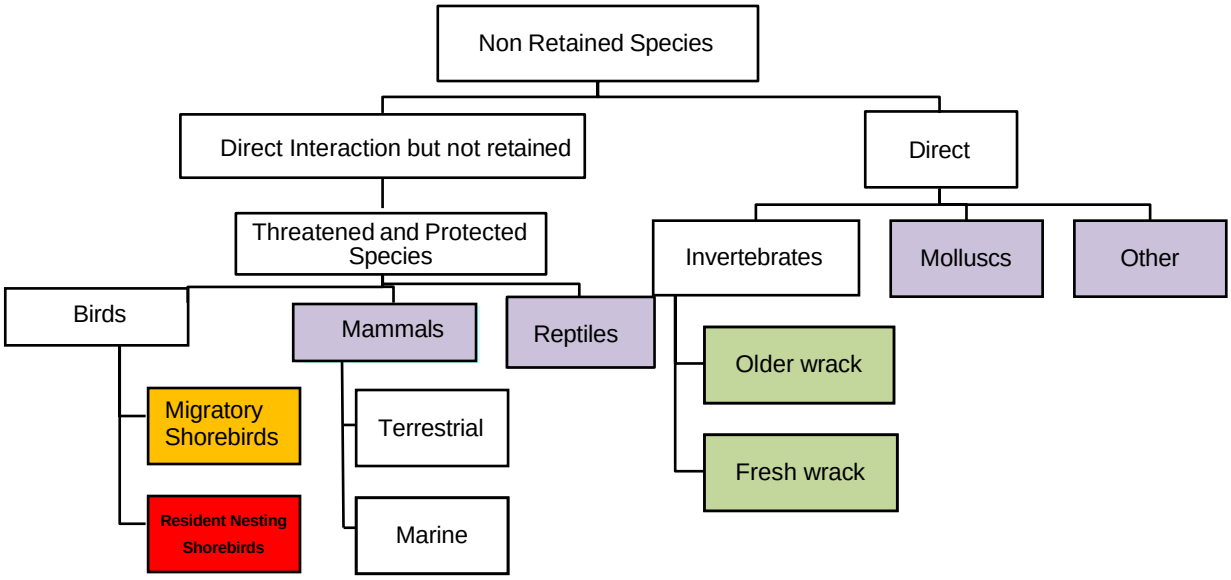
7.1.1 Primary Species

The target species has detached from the ocean substrate and been carried by water movement to accumulate on the shoreline, where it will eventually desiccate and die. Given that the target species cannot be reattached to the ocean substrate and the primary stock is not harvested, the overall assessment was that the current harvest would not have any significant impact on the broader seagrass and marine algae production and growth within the marine environment (consequence level 1) and the likelihood was considered remote (likelihood level 1). **Risk Score (1) = Negligible.**

7.1.2 By-catch

Harvesting in the fishery targets beach-cast seagrass and marine algae wrack, however operations may incidentally retain small numbers of some by-catch species. As harvesting is required to be designed to minimise the removal of sand it was considered that overall by-catch would be low. The impacts of harvest on these by-catch species were considered to be minor (consequence score 1) with the likelihood of this occurring being remote (likelihood score 1). **Risk Score (1) = Negligible.**

7.2 Issues related to the non-retained species



7.2.1 Threatened, Endangered and Protected Species (TEPS)

The issue of the fishery impacting on TEPS through interactions is considered to be important, particularly to bird species. Whilst there is a significant number of shorebirds in South Australia, several species are of particular concern **(Appendix 5)**.

The workshop recommended that risks to bird species be categorised into *Migratory Shorebirds* and *Resident Nesting Shorebirds.* This strategy recognised the variability of the impacts on each shorebird category. It was recognized that in general, migratory shorebirds spend less time in the area of the fishery than residential shorebirds, usually arriving in Spring and generally departing in early Autumn to breed outside of the region. It is noted however, that some migratory birds remain in the region, particularly immature juveniles remaining to "over-winter". These migratory birds tend to group together at foraging sites.

Resident nesting shorebirds spend the majority of their life in coastal areas, using the wrack structure for permanent habitat including breeding. Individuals pair up between August and March for the breeding period, then group together outside of this period, and tend to congregate in areas of beach wrack for food sources.

One individual species for each category was used as a reference to guide the risk assessment.

<u>Resident Nesting Shorebirds</u>

Resident nesting shorebirds rely on the beach-cast marine algae and seagrass wrack for shelter, habitat and microclimate (Davis & Keppel 2021) in addition to food sources. There are at least 15 species of resident nesting shorebirds which inhabit the region. The Hooded Plover was used to provide guidance to the assessment of impacts of resident nesting shorebirds. The participants in the workshop suggested that the 100 metre buffer zones for Hooded Plover nesting currently implemented under PIRSA's management arrangements be extended to improve protection of sites. Consequently, the workshop participants considered only having a 100 metre buffer added to the risk exposure of this species.

Migratory Shorebirds

Migratory shorebirds arrive from September onwards to their non-breeding grounds in South Australia. Beach-cast marine algae and seagrass wrack are considered important for foraging and roosting for migratory shorebirds, as these contain essential food (amphipods and larvae) and provides camouflage and protection from inclement weather. The majority of migratory shorebirds leave in March/April (DotE 2015) with Sanderlings departing into the first 2 weeks of May. One exception is the Double Banded Plover which has a 'reverse migration' arriving in Australia in autumn/winter and present on beaches during this period. There are 37 migratory shorebirds listed in the *Environmental Protection Biodiversity and Conservation Act 1999.* The Ruddy Turnstone was used to provide guidance to the assessment of impacts on migratory shorebirds.

It is recognised there are multiple facets to the potential impacts on shorebirds by operations in the fishery. These include impacts through direct interactions with the birds via human presence and harvesting activities, as well as indirect interactions through vehicle presence causing disturbance, including alarm flights. It is recognised that shorebird type and presence would vary significantly by region.

Concerns were raised by the workshop participants regarding the level of resident nesting shorebird mortality from vehicle presence in key areas at specific times. It has been previously noted that given vehicles are permitted to drive on beaches in South Australia, concern has been raised that the shorebirds using these beaches for feeding, roosting and nesting may experience high levels of disturbance (Campbell & Anderson 2007).

Whilst vehicular access associated with the harvesting activities poses a level of risk, access to the harvest areas is not restricted to authority holders in the fishery as harvest areas are accessible by all recreational vehicles and beach users.

There are numerous studies outlining the impacts of harvest of wrack and associated activities on shorebirds. It is also acknowledged that impacts will vary by region, season and coastal environment. As shorebirds feed on invertebrates in the wrack, management arrangements that reduce the amount of wrack to be taken, leaving more on the beach, will provide additional feed for birds.

It was noted that this risk is dependent on the type of harvest and mechanical means would represent a greater risk than hand foraging. Mechanical harvest provides less visibility to identify birds or habitat and a reduced ability to avoid negative interactions. Mechanical harvest is considered more likely to result in habitat disturbance in comparison with hand collection.

The workshop identified that the consequence of interaction between harvesting and TEP bird species in the migratory shorebird category could have a high consequence (Consequence level 3) and the likelihood was considered to be possible (Likelihood level 3). **Risk Score (9) = High**

The workshop identified that the consequence of interaction between harvesting and TEP bird species in the resident nesting shorebirds category could have a major consequence (Consequence level 4) and the likelihood was possible (Likelihood level 3). **Risk Score (12) = Severe**

The impact of habitat disturbance and movement of biological material, and trophic level impacts of this movement, is assessed in the next section related to the general environment impacts of a fishery.

7.2.2 Mammals

It is considered the potential for interactions with mammals, both marine based and terrestrial, and the fishery to be very minimal. The workshop identified that the

consequence of interaction with the fishery would be minor (Consequence level 1) and the likelihood of an interaction was remote (Likelihood level 1). **Risk Score (1) = Negligible**

7.2.3 Reptiles

It is considered the potential for interactions with reptiles and the fishery to be minimal. The workshop identified that the consequence of interaction with the fishery would have a minor consequence (Consequence level 1) and the likelihood of an interaction was remote (Likelihood level 1). **Risk Score (1) = Negligible**

7.2.4 Invertebrates – Older Wrack

It was considered that the older wrack deposited on the beach would have established invertebrate communities associated with it. There is concern in relation to the impact on shorebirds from the removal of older wrack with associated invertebrates on which these birds forage rather than the risk to the invertebrate species themselves. The workshop identified that the risk to invertebrates from removal of older marine algae wrack was considered to have a minor consequence (Consequence level 1) and the likelihood of this was likely (Likelihood Level 4). **Risk Score (4) = Low**

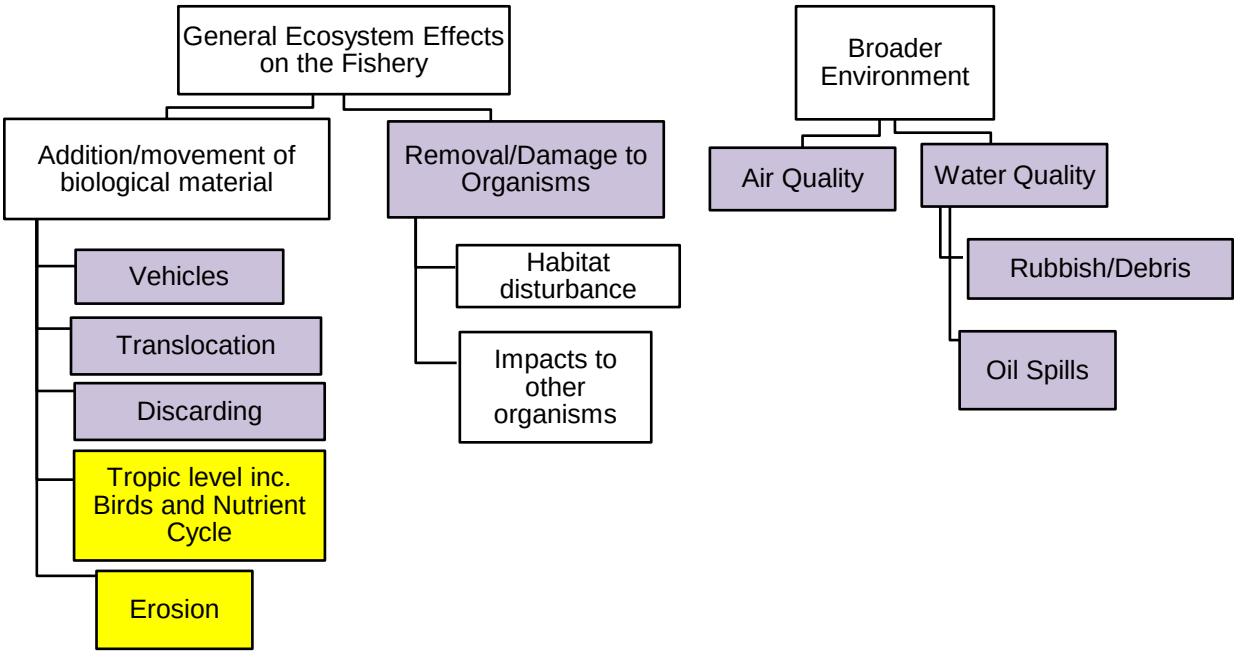
7.2.5 Invertebrates – Fresh Wrack

The risk to invertebrates in fresh wrack was considered to be lower given that fresh marine algae wrack would have less invertebrates colonising it than older wrack. The workshop identified that the risk to invertebrates from removal of fresh marine algae wrack was considered to have a minor consequence (Consequence level 1) and the likelihood of this was possible (Likelihood Level 3). **Risk Score (3) = Low**

7.2.6 Molluscs and Other

The remainder of the identified potential ‘direct’ interactions with molluscs and other species were considered negligible. The workshop identified that the consequence of interaction with current harvest activities would have a minor consequence (1) and the likelihood of an interaction was remote (Likelihood level 1). **Risk Score (1) = Negligible**

7.3 Issues related to the general environment impacts of the fishery



With respect to trophic level impacts on the environment it is noted that nutrient release from wrack is associated with its decomposition. In addition, it is considered that there are orders of magnitude with more marine algae in the water (attached and drifting) that contribute to natural systems. It is therefore considered that tropic level impacts of beach-cast seagrass and marine algae wrack harvest would have some adverse effects in comparison to the harvest of fresh beach-cast marine algae. This includes the potential for impact on other organisms such as shore birds and inshore marine species. It is noted however, that for the majority of the fishery, harvest is restricted to fresh unattached material.

Decomposing seagrass and seaweed continues to be important to the productivity in marine ecosystems as they provide particulate and dissolved nutrients which form the basis of beach and inshore marine foodwebs. Management arrangements, which are prescribed through licence or permit conditions reduce the amount of wrack that can be taken on any one occasion and in a specific area. Limitations on the number of harvest days also maintain areas of wrack on the beach, providing wrack for birds to nest and forage and for nutrient recycling. The workshop identified impact on trophic levels – including birds and the nutrient cycle were considered to have a consequence of moderate (Consequence level 2) and a likelihood of possible (Likelihood level 3). **Risk score (6) = Medium**

Beach structure and region vary in terms of storm and wave action which in turn alters levels of wrack. These natural events are likely to have significant impacts on the general ecosystem.

A number of impacts on the general ecosystem have been identified in the area of the fishery. It was considered that the coastal environment is impacted by storms and high wave volume and that these natural events are likely to have a significant impact. Beach structure and region vary in terms of storm and wave action which in turn alters

levels of wrack settlement by area.

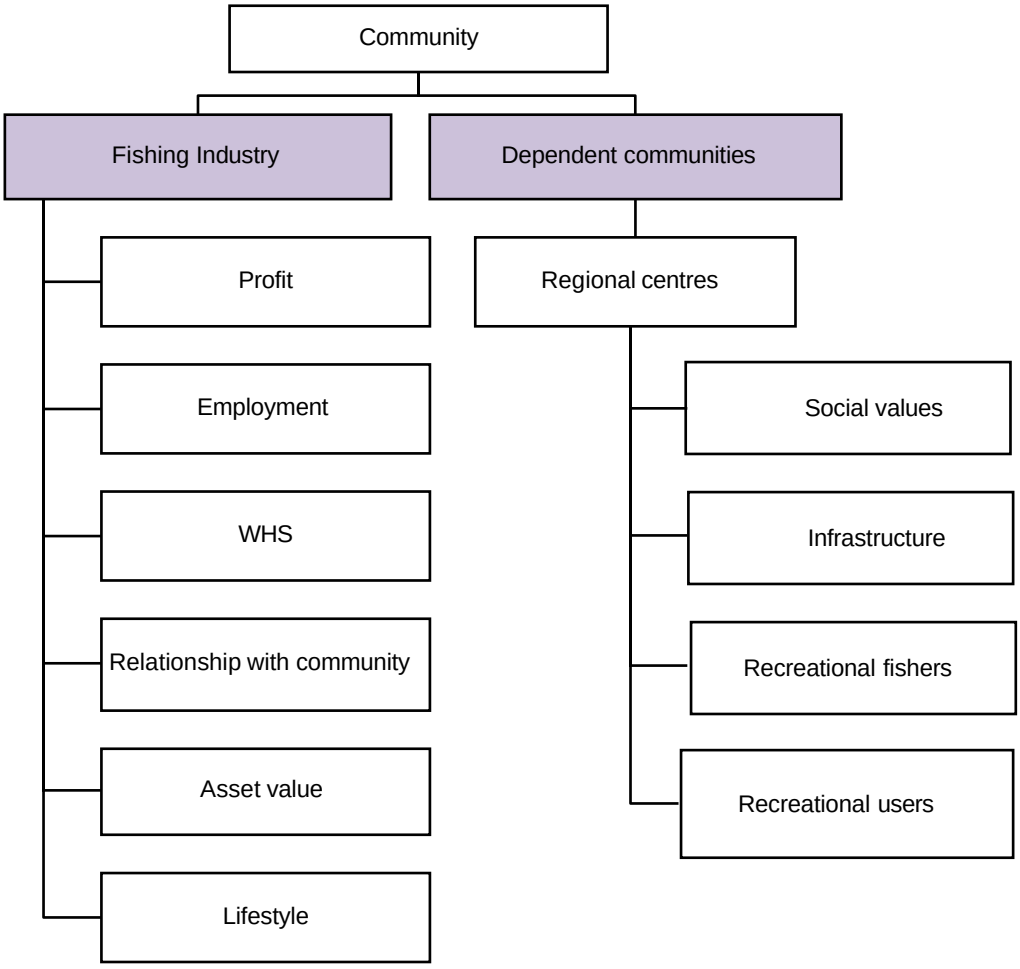
There is a level of recreational access, including vehicular to the beaches in the fishery as well as walking access in most areas. These anthropogenic interactions would also have an effect on the general ecosystem.

Erosion concerns were identified, however the impact related to the potential harvest of wrack on erosion of sand dunes is highly dependent on the region and environmental structure. Seagrass enhances the formation and stabilisation of coastal sand dunes and beaches, fibrous composition acting as a trap to bind drifting sands and reduce sand erosion in winter. Seagrasses are composed primarily of cellulose fibre with characteristics that inhibit breakdown while marine algae is subject to very rapid deterioration. Management arrangements in the fishery include a restriction on harvest within four metres of dunes and restriction to established access tracks reducing vehicular and foot traffic to areas. The workshop identified impacts of current harvest activity over the spatial extent of the fishery could have a major consequence (Consequence level 4) and a likelihood level of unlikely (Likelihood level 2). **Risk score (8) = Medium**

The consequence of an oil spill was considered to be moderate (Consequence level 2) with the likelihood of this being remote (Likelihood level 1) **Risk score (2) = Negligible**. This result is reflective of the limited participants in the fishery and the general harvest operations prohibiting heavy machinery across the majority of the fishery.

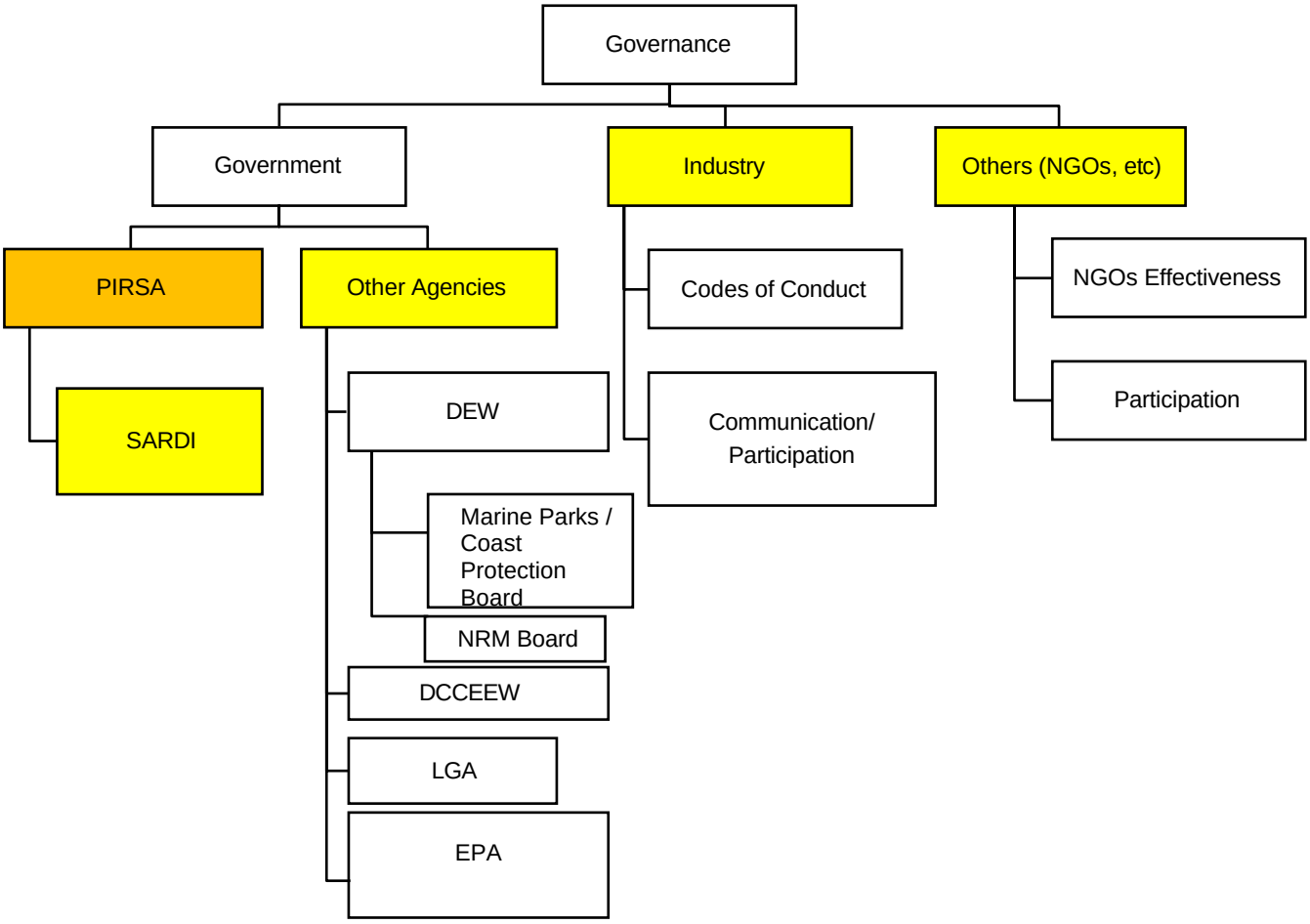
In consideration of the limited participants in the industry and the nature of the harvesting operations, all other general environment components were considered to have a minor consequence (Consequence level 1) and remote likelihood (Likelihood level 1). **Risk Score (1) = Negligible**

7.4 Contribution of the fishery/industry to community wellbeing



Given the limited participants in the fishery and spatial nature of harvest, all components are considered to have a minor consequence (Consequence level 1) with a likelihood of remote (Likelihood level 1). **Risk Score (1) = Negligible**

7.5 Issues related to the governance of the fishery/industry



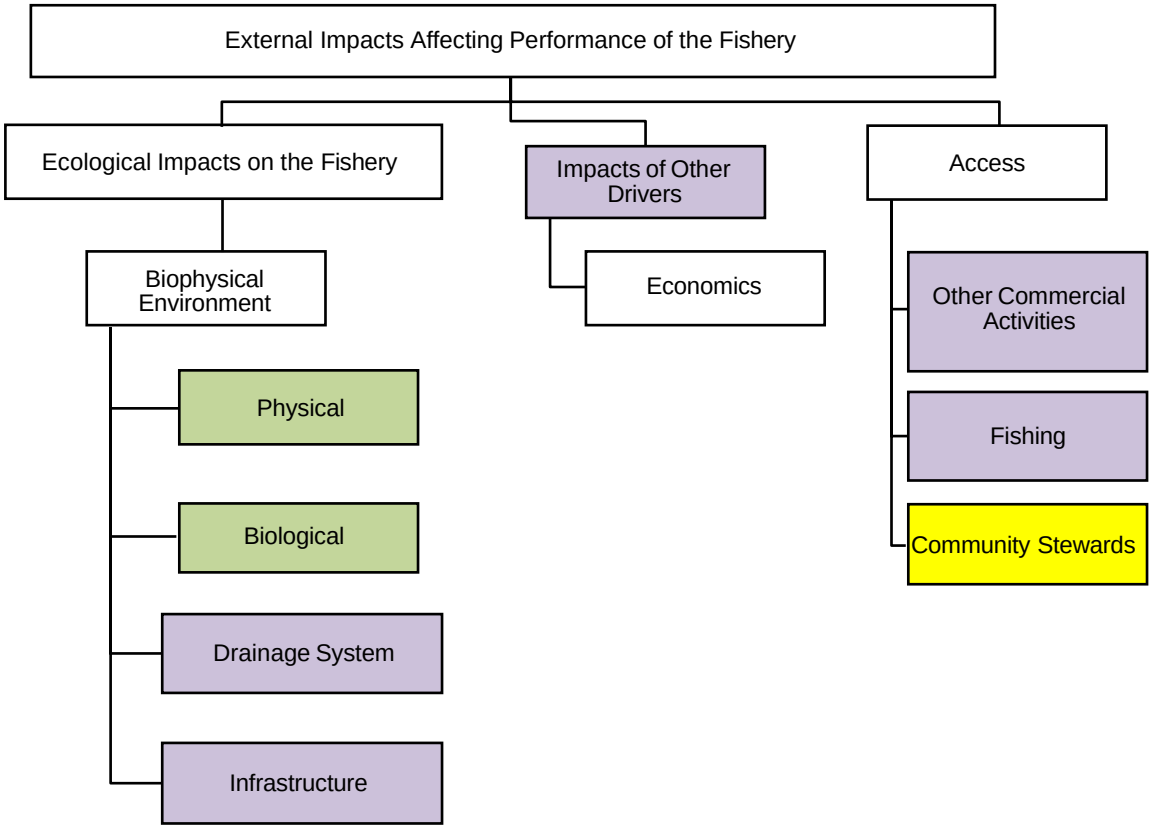
The workshop recognised that PIRSA is a governance risk to the operation, in terms of restricting the fishing capacity of authority holders through management measures to restrict fishing, which may impact financially on operators. The workshop identified that the consequence of such impacts to the fishery was high (Consequence level 3) with a likelihood of possible (Likelihood level 3). **Risk Score (9) = High**

Other agencies or stakeholders which could impact on the licence / permit holders include the Department for Climate Change, Energy, the Environment and Water (DCCEEW), Local Government Associations (LGAs), the Department for Environment and Water (DEW), the Environment Protection Authority (EPA), SARDI or non-government organisations (industry groups or conservation groups). Licence or Permit holders operating in specific Marine Park zones must hold a relevant permit issued by DEW.

Current licence / permit holders operate under conditions that are partly based on the outcomes of recommendations from the DCCEEW, under Part 13A of the EPBC Act.

The conditions implemented by PIRSA as the regulator of the BCMAF must be complied with in order to maintain export approval. The conditions have set a precedent for any future activities of a similar nature, where the conditions must be considered as a minimum. The workshop identified that these bodies could have direct management implications which could impact the economic viability and access to the activity area for harvest operations. The consequence was considered high (Consequence level 3) with a likelihood of unlikely (Likelihood level 2) for all other agencies. **Risk Score (6) = Medium**

7.6 External impacts affecting performance of the fishery



There was no evidence to warrant a change in the risk ratings from previous assessments. Given the limited participants in the fishery, and relatively small area of operations, the physical and biological risks are considered low and have a consequence level of minor (Consequence level 1) and a likelihood rating of likely (Likelihood rating 4).
Risk score (4) = Low

Economics are identified as an external driver but considered to be of negligible risk given that the fishery has been operating for over 20 years. Fishing and other commercial activities are unlikely to have any notable impact on the fishery given its unique nature. These components, like economics, have an assessed consequence level of minor (Consequence level 1) with a likelihood level of remote (Likelihood level 1).
Risk score (1) = Negligible

The involvement of the community steward groups is considered significant and should be managed through ongoing consultation between PIRSA and stakeholders with an interest in the areas being used by authority holders. Assessed consequence levels of moderate (Consequence level 2) and likelihood Levels of possible (Likelihood level 3).
Risk score (6) = Medium

7.7 Summary of ESD Reporting Framework

In summary, the ESD reporting framework for all components of the fishery identified three (3) components of potentially severe or high risks through the workshop process related to PIRSA governance of the fishery and interactions with shorebirds.

Seven (7) medium risks were identified in relation to the effect on the trophic levels of the general ecosystem, erosion, governance (outside PIRSA) and community stewardship.

The remainder of components were identified as having low or negligible risk associated the fishery. A table summarising the outcomes of components assessed is provided in the table below.

Summary of ESD risk score outcomes

Component Tree	Severe	High	Medium	Low	Negligible
Retained Species					2
Non-retained species	1	1		2	4
General Ecosystem			2		8
General Community					2
Governance		1	4		
External Factors affecting Fishery Performance			1	2	5
Total	1	2	7	4	21

7.8 Performance report for high and medium risk components

Summary report of all components of ESD risk assessment

Component	Risk/Issue	Risk Rating	Objective Developed	Strategies Developed	Indicator Developed	Indicator Robustness	Actions
Retained Species							
Primary Species – Seagrass and Macroalgae wrack		Negligible	N/A	N/A	N/A	N/A	N/A
Retained Species– By-catch		Negligible	N/A	N/A	N/A	N/A	N/A
Non Retained Species							
Direct interaction but no capture – TEPS – Resident Nesting Shorebirds		Severe	Yes	Yes	Yes	High	*
Direct interaction but no capture – TEPS – Migratory Shorebirds		High	Yes	Yes	Yes	High	*
Direct interaction but no capture – TEPS – Mammals		Negligible	N/A	N/A	N/A	N/A	N/A
Direct interaction but no capture – TEPS – Reptiles		Negligible	N/A	N/A	N/A	N/A	N/A
Direct – Invertebrates - Older Wrack		Low	N/A	N/A	N/A	N/A	N/A
Direct – Invertebrates - Fresh Wrack		Low	N/A	N/A	N/A	N/A	N/A
Direct – Molluscs		Negligible	N/A	N/A	N/A	N/A	N/A
Direct – Other		Negligible	N/A	N/A	N/A	N/A	N/A

General Environment						
General Ecosystem Effects of the Fishery – Vehicles	Negligible	N/A	N/A	N/A	N/A	N/A
General Ecosystem Effects of the Fishery – Translocation	Negligible	N/A	N/A	N/A	N/A	N/A
General Ecosystem Effects of the Fishery – Trophic Levels Including Birds and Nutrient Cycle	Medium	Yes	Yes	Yes	High	*
General Ecosystem Effects of the Fishery – Erosion	Medium	Yes	Yes	Yes	High	*
General Ecosystem Effects of the Fishery – Discarding	Negligible	N/A	N/A	N/A	N/A	N/A
General Ecosystem Effects of the Fishery – Removal / Damage to Organisms	Negligible	N/A	N/A	N/A	N/A	N/A
Broader Environment – Air Quality	Negligible	N/A	N/A	N/A	N/A	N/A
Broader Environment – Water Quality - Rubbish/debris	Negligible	N/A	N/A	N/A	N/A	N/A
Broader Environment – Water Quality - Oil Spills	Negligible	Yes	Yes	Yes	High	***
General Community						
Fishing Industry	Negligible	N/A	N/A	N/A	N/A	N/A
Dependent Communities	Negligible	N/A	N/A	N/A	N/A	N/A
Governance						
Governance – PIRSA	High	Yes	Yes	Yes	High	*
Governance – SARDI	Medium	Yes	Yes	Yes	Medium	***
Government – Other agencies	Medium	Yes	Yes	Yes	Medium	***

Governance – Industry	Medium	Yes	Yes	Yes	Medium	***
Governance – Others (NGOs)	Medium	Yes	Yes	No	N/A	***
External impacts on the fishery						
Ecological impacts on the fishery – Physical	Low	N/A	N/A	N/A	N/A	N/A
Ecological impacts on the fishery – Biological	Low	N/A	N/A	N/A	N/A	N/A
Ecological impacts on the fishery – Drainage System	Negligible	N/A	N/A	N/A	N/A	N/A
Ecological impacts on the fishery – Infrastructure	Negligible	N/A	N/A	N/A	N/A	N/A
Impacts of Other Drivers	Negligible	N/A	N/A	N/A	N/A	N/A
Access – Other Commercial Activities	Negligible	N/A	N/A	N/A	N/A	N/A
Access – Fishing	Negligible	N/A	N/A	N/A	N/A	N/A
Access – Community Stewards	Medium	Yes	Yes	Yes	High	*

Notes: * Additional management arrangements to be considered, ** to be monitored, *** no current actions identified

Full performance report for medium risks and above

Component	Risk/Issue	Description	Risk rating	Objective	Current Strategies	Performance Indicator	Indicator Robustness	External Drivers
Non Retained Species (7.2)	Direct interaction but no capture – TEPS – Resident Nesting Shorebirds	Risk of fishery impacts on TEPS species – Resident Nesting Shorebirds	Severe	To ensure harvesting impacts do not result in serious or irreversible harm to TEP species' populations.	Protection of TEPS specifically resident nesting birds, birds with dependent young. Harvest prohibited within 100 m either side of an area where *Hooded Plovers* are nesting or caring for dependent young Harvest prohibited within 4 m of foredunes Restriction on harvest days during specified periods in specified areas No harvest adjacent to marine park zones Bird identification resources to be carried to correctly identify bird species Restricted to existing vehicle access tracks Reporting of TEPS interactions	Number of interactions reported in wildlife interaction logbooks	High	Negative impacts of interactions between birds and other users of beaches in the harvest area including anthropogenic activities (vehicles, dogs and people on beaches), coastal development etc.

	Direct interaction but no capture – TEPS – Migratory Shorebirds	Risk of fishery impacts on TEPS species – Migratory Shorebirds	High	To ensure harvesting impacts do not result in serious or irreversible harm to TEP species' populations.	Harvest prohibited within 4 m of foredunes Restriction on harvest days during specified periods in specified areas Bird identification resources to be carried to correctly identify bird species Reporting of TEPS interactions	Number of interactions reported in wildlife interaction logbooks	High	Negative impacts of interactions between birds and other users of beaches in the harvest area including anthropogenic activities (vehicles, dogs and people on beaches), coastal development etc.
General Environmental Impacts of the Fishery (7.3)	Addition / movement of biological material	Trophic Level Including Birds and Nutrient Cycle	Medium	To ensure the effects of harvesting do not result in serious or irreversible harm to ecosystem structure and function.	Restriction of harvest days during specified periods and in specified areas Maximum harvest quantities in some areas Harvest not permitted adjacent to Marine Park zones in some areas Only fresh unattached Algae and Seagrass to be removed across the majority of the fishery	Wrack maintained at a sustainable level on the beach at all times.	Low	Negative impacts of other users of beaches in the harvest area including anthropogenic activities (vehicles, dogs and people on beaches), coastal development etc.

	Addition / movement of biological material	Erosion	Medium	To ensure the effects of harvesting do not result in serious or irreversible harm to ecosystem structure and function.	Operations to minimise incidental take of material including return of sand to dune areas Restriction of harvest within 4 m of foredunes Maximum vehicle and trailer weights in specified areas Vehicle access restricted to existing tracks Only fresh unattached Algae and Seagrass to be removed across the majority of the fishery	Wrack maintained at a sustainable level on the beach at all times. No notable changes to coastal structure.	Low	Negative impacts of other users of beaches in the harvest area including anthropogenic activities (vehicles, dogs and people on beaches), coastal development etc.
Governance (7.4)	PIRSA	Risk to the fishery through lack of sufficient resources to manage fishery efficiently and access security for the permit holder	High	PIRSA to apply management measures to ensure the sustainable harvest of Beach Cast and Marine Algae and that harvesting does not adversely impact the environment.	Proposed management arrangements are developed in consultation with participants and stakeholder. Management arrangements allow for efficient fishing operations within constraints of ecological sustainability.	A primary contact person for permit holders is maintained. Regular contact between PIRSA and permit holders maintained. Fishing endorsements to access the resource is maintained if management arrangements allow for activity within the constraints of ecologically sustainability.	High	

	Other Government agencies	Risk to the fishery from other Government agencies	Medium	PIRSA to apply management measures to ensure the sustainable harvest of Beach Cast and Marine Algae and that harvesting does not adversely impact the environment.	Proposed management arrangements provided for public comment and communicated to other agencies.	Management arrangements for current or proposed activity is publicly available	Medium	Policies and procedures of other departments may conflict with the objectives of the fishery
	Industry	Risk of the Industry governance	Medium	PIRSA to apply management measures to ensure the sustainable harvest of Beach Cast and Marine Algae and that harvesting does not adversely impact the environment.	Proposed management arrangements are developed in consultation with industry. Code of practice to be developed by industry.	Management arrangements for any current or proposed activity is publicly available	Medium	
	Others (NGOs)	Risk to the fishery from governance arrangements of other organisations (NGOs)	Medium	PIRSA to apply management measures to ensure the sustainable harvest of Beach Cast and Marine Algae and that harvesting does not adversely impact the environment.	Proposed management arrangements provided for public comment. Stakeholders directly engaged regarding the ongoing management of the fishery	Management arrangements for any current or proposed activity is publicly available Level of engagement and participation from NGOs	Medium	Misunderstanding about the industry may result in loss of community confidence in the industry Note * consider standard list of stakeholder groups to consult on any new

								applicants to the fishery
External factors affecting the performance of the fishery (7.6)	Dependent Communities-Community Stewards	Community Steward participation where appropriate	Medium	Community confidence in fisheries agencies to manage fisheries enabled	Proposed management arrangements provided for public comment and communicated to other agencies.	Management arrangements for the proposed activity is publicly available	Medium	Misunderstanding about the industry may result in loss of community confidence in the industry

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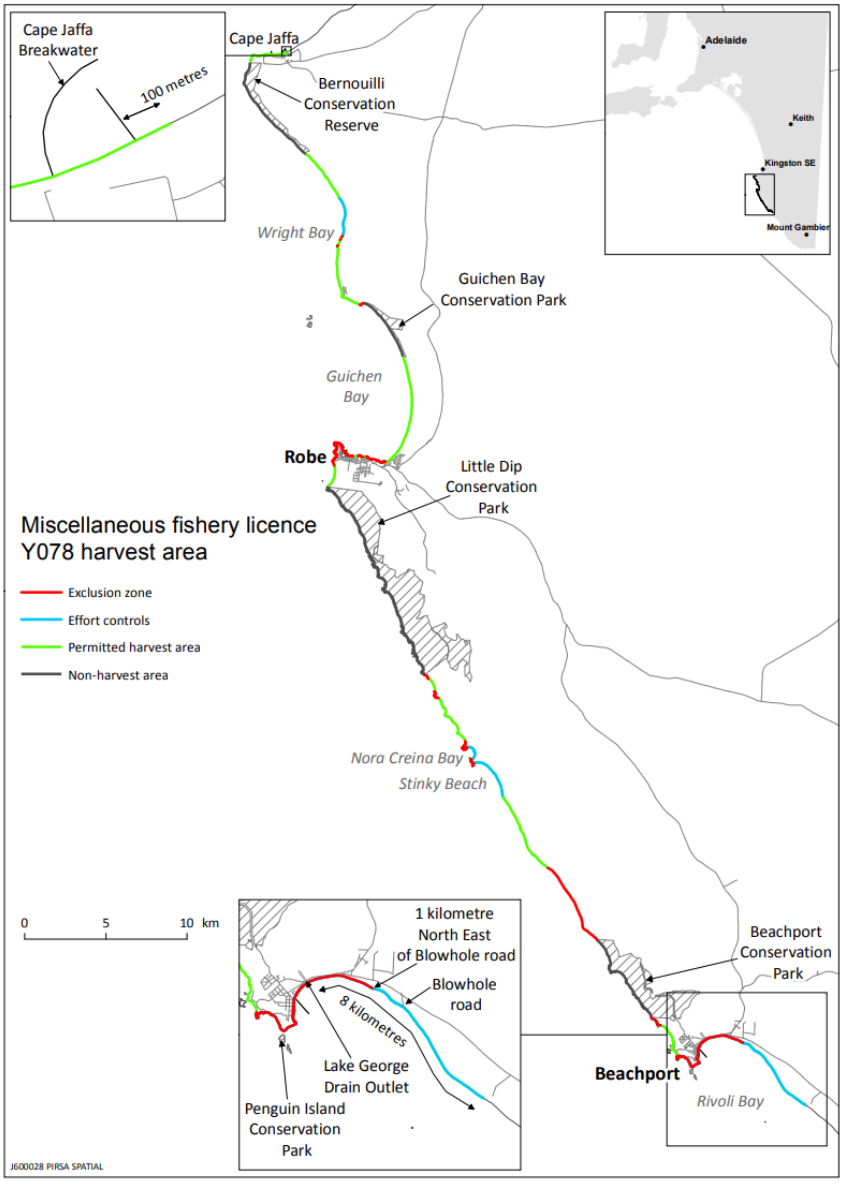
9 Appendix

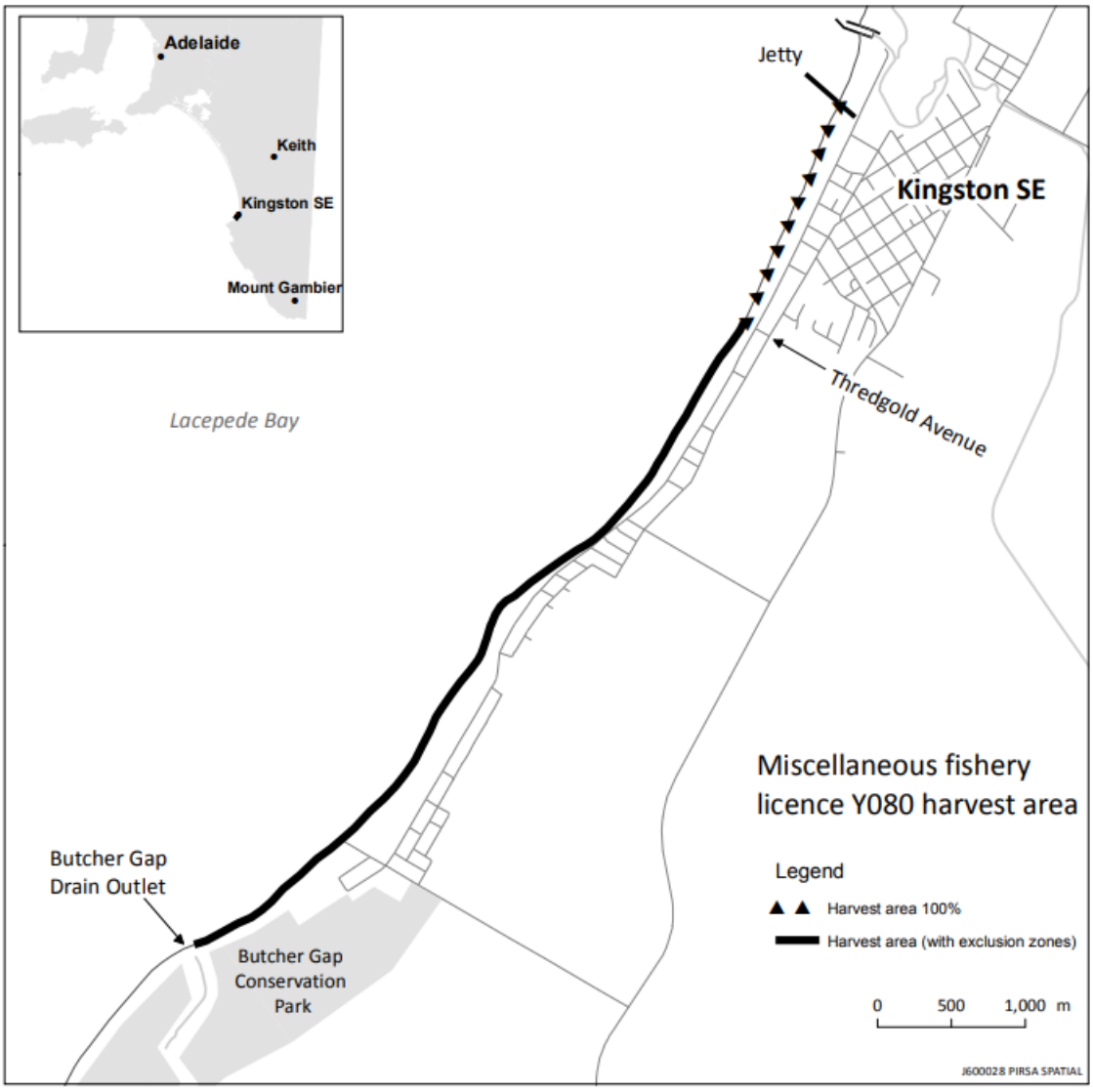
Appendix 1: Summary of current authorities in the fishery

Authority	**Miscellaneous Licence Y078**
Area	Between 100 metres north of the northern breakwater at Cape Jaffa Marina and eight (8) kilometres in a south easterly direction along the beach from the Lake George outlet near Beachport subject to exclusions zones, non-harvest areas and effort-controlled areas (see map)
Permitted species	Fresh, unattached beach-cast marine algae wrack including Chlorophyta (green algae); Phaeophyta (brown algae); or Rhodophyta (red algae) with Bull Kelp the main target species
Gear	Hand collection, assisted by mechanical winch
Season	Year round with harvesting activity in the areas described below restricted in the period from: • 1 September to 30 April (inclusive) in any calendar year to a maximum of eight (8) calendar days (or any part thereof) per calendar month; and • 1 May to 15 May (inclusive) for a maximum of four (4) calendar days (or any part thereof) per calendar month. i. Wrights Bay - means the area between 37° 02' 26.49" S, 139° 44' 34.09" E and 37° 01' 10.87" S, 139° 44' 22.48" E ii. Nora Creina - means the area between 37° 19' 15.76" S, 139° 50' 41.40" E and 37° 19' 39.41" S, 139° 50' 54.30" E iii. Stinky Beach - means the area between 37° 19' 47.93" S, 139° 51' 00.23" E and 37° 20' 48.83" S, 139° 52' 15.87" E iv. Rivoli Bay - means the area between a point 1 km north east of Blowhole Rd at or near 37° 28' 40.81" S, 140° 02' 43.82" E and a point eight (8) kilometers south east along the beach from the Lake George outlet at or near 37° 30' 38.59" S, 140° 05' 29.29" E These effort restrictions in areas identified as important to shorebirds are in place to allow for migratory birds and resident nesting birds to undertake natural activities undisturbed.
Management arrangements	• Only fresh, unattached beachcast marine algae may be disturbed during the harvesting activity • No fishing activity can occur within 100 metres either side of any nesting areas where Thinornis rubricollis (hooded plovers) are currently nesting and/or caring for dependent young • Harvesting activity must be designed to avoid the removal of sand and minimise any incidental disturbance to marine fauna and infauna. Where possible, sand taken incidentally to the harvesting activity is to be returned to the foreshore • Harvesting activity is prohibited within four metres of the base

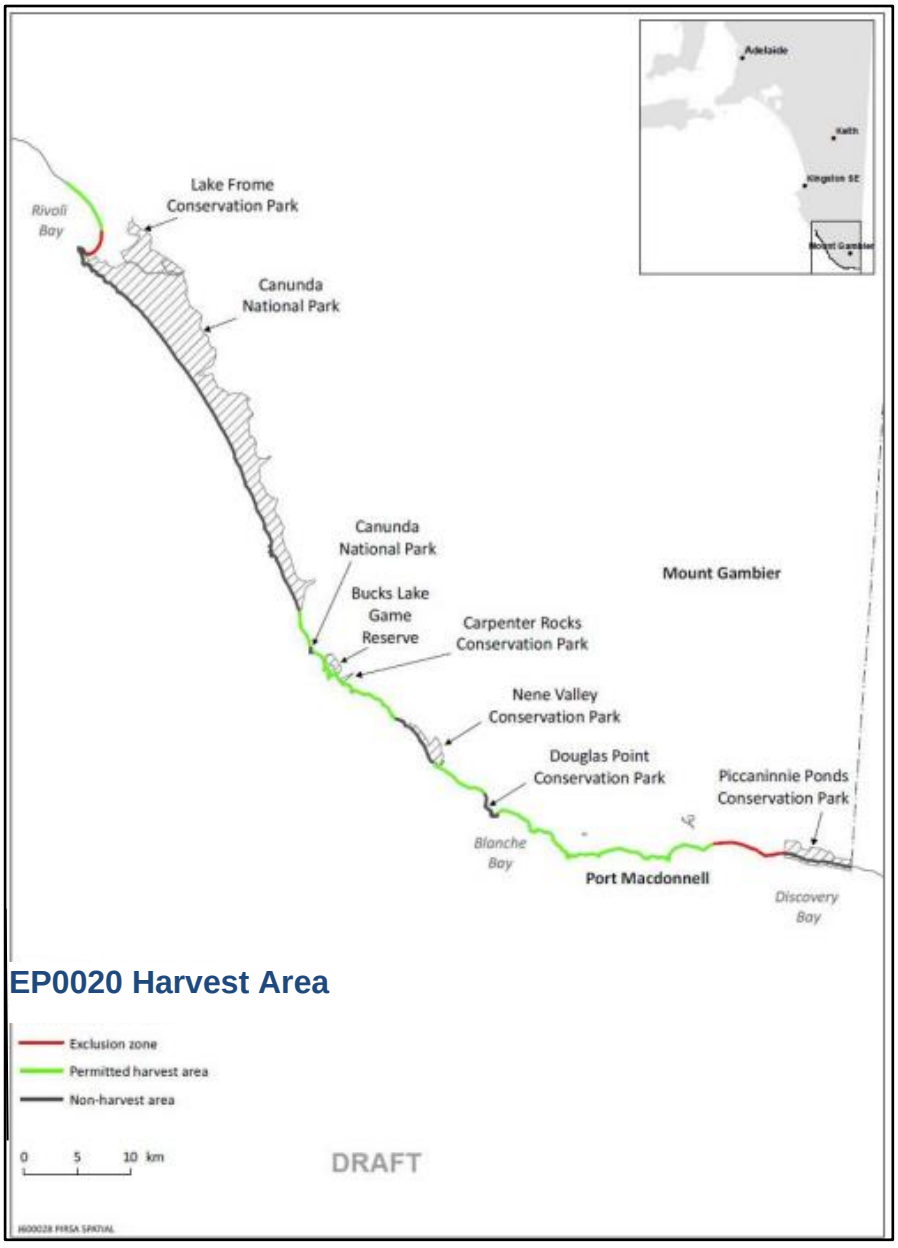
	of the foredune of any sand dunes within the harvest area. • Maximum trailer gross vehicle mass 3.5 tonnes • The area of the licence must only be accessed via existing coastal access routes • The licence holder is required to complete records of any interactions with threatened, endangered or protected species (listed under State and/or Commonwealth legislation), including shorebirds in the Wildlife Interaction Logbook. For the benefit of monitoring migratory bird activity this will include bird sightings and alarm flights as well as negative bird interactions • The license holder must complete and submit monthly returns including harvest quantities



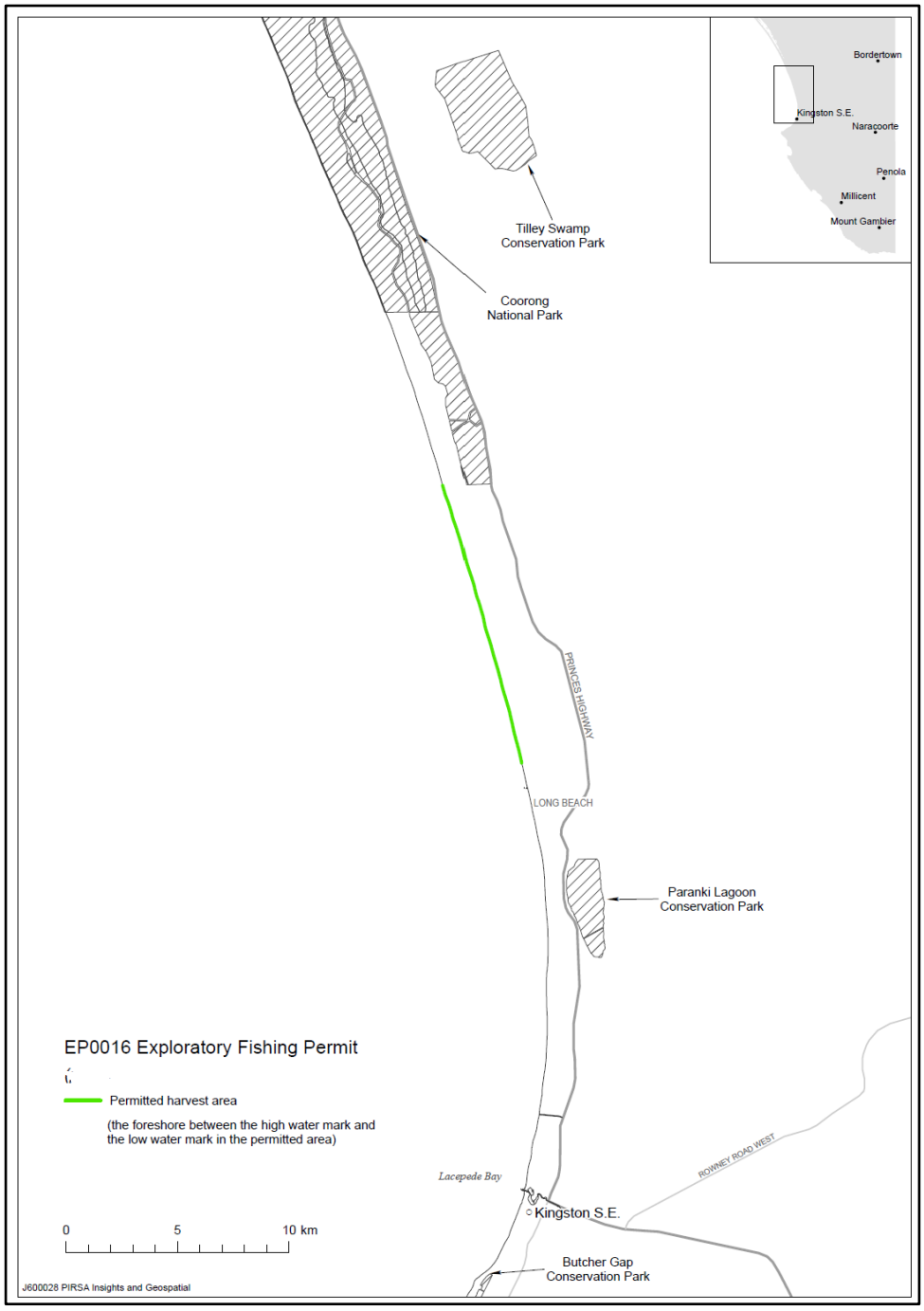
Authority	**Miscellaneous Licence Y080**
Area	Main foreshore beach in Kingston, between low water mark and high water mark extending from Butchers Gap Drain Outlet adjacent to Section 18 Hundred of Lacepede to the Southern groyne wall of the Maria Creek channel
Permitted species	Unattached beach-cast seagrass and marine algae wrack.
Gear	Heavy machinery including excavators and loading trucks
Season	Year round
Commercial harvest	The Kingston District Council use contractors to remove beach-cast wrack material from the beach and re-locate it for amenity purposes
Management arrangements	• Harvest is restricted to unattached, beach-cast seagrass and macroalgae wrack • The harvest operations must be designed to minimise the removal of sand and infauna. Sand taken incidental to the harvesting activity must be returned to the foredune • From the Kingston town jetty to the boat ramp opposite Thredgold Ave, the licence holder may harvest all wrack • From Butchers Gap Drain Outlet adjacent to section 18 Hundred Lacepede to the boat ramp opposite Thredgold Ave, the licence holder must implement exclusion zones to ensure that no more than 75% of the estimated biomass is removed • The licence holder is required to complete records of any interactions with threatened, endangered or protected species (listed under State and/or Commonwealth legislation), including shorebirds in the Wildlife Interaction Logbook. For the benefit of monitoring migratory bird activity this will include bird sightings and alarm flights as well as negative bird interactions • Where sand dunes are present no harvesting activity is to take place within four metres of the fore dune • The licence holder must complete and submit monthly returns including harvest quantities


Adelaide
Keith
Kingston SE
Mount Gambier
Jetty
Kingston SE
Thredgold Avenue
Lacepede Bay
Butcher Gap
Drain Outlet
Butcher Gap
Conservation
Park
Miscellaneous fishery
licence Y080 harvest area
Legend
Harvest area 100%
Harvest area (with exclusion zones)
0
500
1,000 m
J600028 PIRSA SPATIAL

Authority	Exploratory Permit EP0020
Area	8 kilometres SE of the Lake George outlet at Beachport to the Victorian border, interspersed with exclusion zones (see map).
Permitted species	Fresh, unattached beach-cast marine algae wrack including Chlorophyta (green algae); Phaeophyta (brown algae); or Rhodophyta (red algae) with Bull Kelp the main target species
Gear	Hand collection, assisted by mechanical winch
Season	Year round with harvesting activity in the permitted area restricted in the period from: • 1 September to 30 April (inclusive) in any calendar year to a maximum of eight (8) calendar days (or any part thereof) per calendar month; and • 1 May to 15 May (inclusive) for a maximum of four (4) calendar days (or any part thereof) per calendar month. These effort restrictions in areas identified as important to shorebirds are in place to allow for migratory birds and resident nesting birds to undertake natural activities undisturbed.
Management arrangements	• Only fresh, unattached beachcast marine algae may be disturbed during the harvesting activity • No fishing activity can occur within 100 metres either side of any nesting areas where *Thinornis rubricollis* (hooded plovers) are currently nesting and/or caring for dependent young • Harvesting activity undertaken pursuant to this permit must be designed to avoid the removal of sand and minimise any incidental disturbance to marine fauna and infauna. Where reasonable and practicable, sand taken incidentally to the harvesting activity is to be returned to the foreshore • Harvesting activity is prohibited within four metres of the base of the foredune of any sand dunes within the harvest area • The area of the permit must only be accessed via existing access routes. Vehicles must transit through the exclusion zones as close to the water line as possible • Maximum trailer gross vehicle mass of 3.5 tonnes. • The authority holder must submit a return recording the daily catch and harvest activities in respect of each calendar month within 15 days of the end of the month to which it relates. Information to be recorded includes: • The authority holder must complete records of any interactions with threatened, endangered or protected species (listed under State and/or Commonwealth legislation), including shorebirds

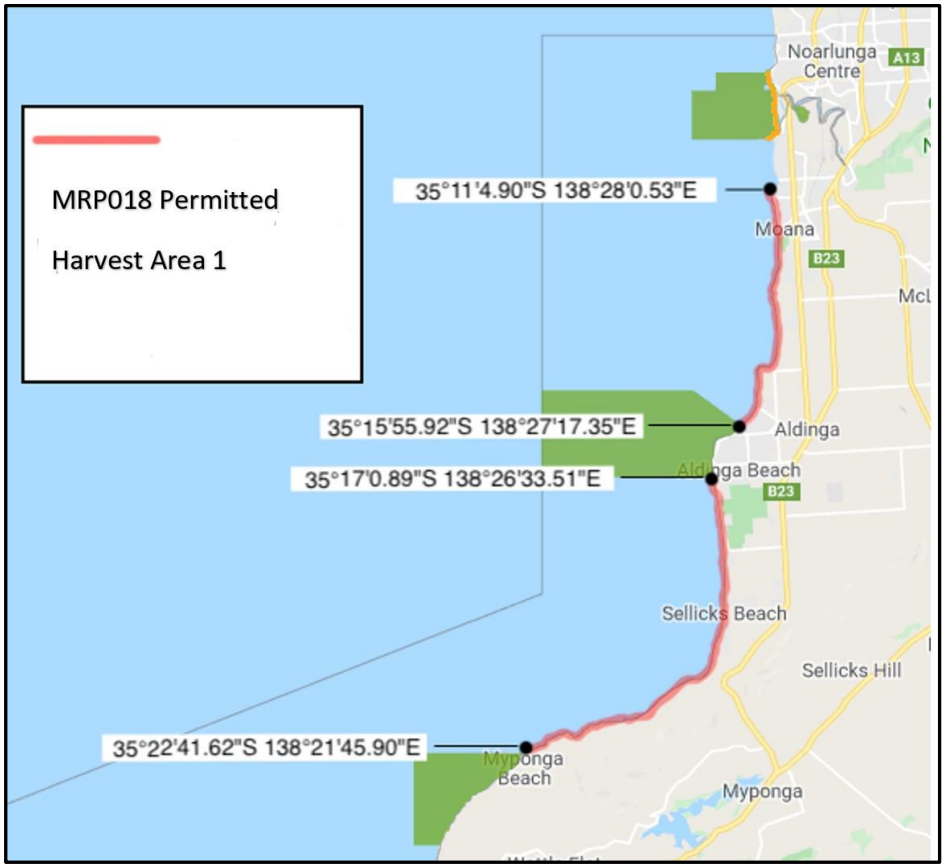

Adelaide
Keith
Kingston SE
Mount Gambier
Rivoli Bay
Lake Frome Conservation Park
Canunda National Park
Canunda National Park
Bucks Lake Game Reserve
Carpenter Rocks Conservation Park
Mount Gambier
Nene Valley Conservation Park
Douglas Point Conservation Park
Piccaninnie Ponds Conservation Park
Blanche Bay
Port Macdonnell
Discovery Bay
EP0020 Harvest Area
Exclusion zone
Permitted harvest area
Non-harvest area
0 5 10 km
DRAFT

Authority	**Exploratory Permit EP0016**
Area	The foreshore area between the high water mark and the low water mark of coastal beaches in the area between a point on the shore at or near 36° 38.941' S 139° 51.084' E and a point approximately 12.8km in a northerly direction along the beach at or near 36º 32.179' S and 139º48.822' E. (see map – total area 12.8km)
Permitted species	Beach-cast seagrass and marine algae wrack. Marine algae include the divisions of red, brown and green algae.
By-product species	No by-product species harvested
Gear	Mechanical collection via modified grapple on weight limited vehicles
Season	Year round with a maximum of eight (8) calendar days (or part thereof) per any calendar month
Management arrangements	• Only fresh, unattached beach-cast seagrass or marine algae may be disturbed during the harvesting activity • The amount of beach-cast seagrass and marine algal wrack that can be harvested on any one day is limited to 25 percent of total volume in any one area • No harvest activity can occur within 100 metres either side of any nesting areas where *Thinornis rubricollis* (hooded plovers) are currently nesting and/or caring for dependent young • Harvesting activity is prohibited within four metres of the base of the foredune of any sand dunes within the harvest area • Maximum individual gross vehicle mass not exceeding 6.5 tonnes • Harvesting activity undertaken pursuant to this permit must be designed to avoid the removal of sand and minimise any incidental disturbance to marine fauna and infauna. Where reasonable and practicable, sand taken incidentally to the harvesting activity is to be returned to the foreshore • The authority holder must complete records of any interactions with threatened, endangered or protected species (listed under State and/or Commonwealth legislation), including shorebirds • The authority holder must submit a Periodic return recording the daily catch and harvest activities in respect of each calendar month within 15 days of the end of the month to which it relates. Information to be recorded includes:


Bordertown
Kingston S.E.
Naracoorte
Penola
Millicent
Mount Gambier
Tilley Swamp
Conservation Park
Coorong
National Park
PRINCES HIGHWAY
LONG BEACH
Paranki Lagoon
Conservation Park
EP0016 Exploratory Fishing Permit
Permitted harvest area
(the foreshore between the high water mark and
the low water mark in the permitted area)
Lacepede Bay
ROWNEY ROAD WEST
Kingston S.E.
0
5
10 km
Butcher Gap
Conservation Park
J600028 PIRSA Insights and Geospatial

Authority	**Miscellaneous Research Permit MRP018**
Area	The foreshore between high and low water marks on identified beaches of Fleurieu Peninsula, excluding sanctuary, restricted access or habitat protection zones of any marine park unless permitted under the Marine Parks Act 2007, in the following areas between a point on the shore at or near: (see map) 1. 35° 12’ 01.2”S, 138° 28’ 13.9”E and 35º 15' 26.9"S, 138º 27'1.4"E; 2. 35º 17' 0.89"S, 138º 26' 33.51"E and 35º 22' 41.62"S, 138º 21'45.90"E; and 3. 35º 30' 48.86"S, 138º 42' 45.49"E and 35° 33’ 25.80”S, 138° 2’ 26.01”E.
Permitted species	Beachcast Ecklonia radiata, Saragssum spp., Colpomenia sp., Macrocystis spp., Codium sp., Hormosira banksia sp., and Gracilaria spp.
Gear	Hand collection
Season	Year round with the following restrictions: • During the following periods the permitted activity may only occur as follows: 1. 1 September to 30 April (inclusive) in any calendar year to a maximum of eight (8) calendar days (or any part thereof) per calendar month; and 2. 1 May to 15 May (inclusive) for a maximum of four (4) calendar days (or any part thereof).
Management arrangements	• Within the specified areas where harvesting is permitted only unattached, beachcast material of *Ecklonia radiata, Saragssum spp., Colpomenia sp., Macrocystis spp., Codium sp., Hormosira banksia sp.* or *Gracilaria spp.* may be taken • A maximum total harvest of 900 kg wet weight of beachcast marine algae of each of *Ecklonia radiata, Saragssum spp., Colpomenia sp., Macrocystis spp., Codium sp., Hormosira banksia sp.* or *Gracilaria spp.* may be harvested per year • The permit holder must not take more than 10% of the total beachcast marine algae present in any one area at any one time • The permitted activity must not occur within 100 metres of any populated town or private dwelling • The permitted activity must not occur: 1. On any day during a weekend; 2. On any public holiday; and 3. Between the times 7.00am – 9.00am and 4.00pm

	– 6.00pm on any week day • Only fresh, naturally detached beachcast marine algae may be disturbed during the permitted activity • The marine algae may only be harvested by hand • The permit holder may use up to one (1) hand propelled trolley within the specified areas to hold the marine algae harvested • The permitted activity must not occur within 100 metres either side of areas where *Thinornis rubricollis* (hooded plovers) are currently nesting and/or caring for dependent young • The permitted activity must avoid the removal of sand and minimise any incidental disturbance to marine fauna and infauna. Where reasonable and practicable, sand taken incidentally to the harvesting activity is to be returned to the foreshore • The permitted activity is to be undertaken, where reasonable and practicable, as close to the ocean's edge as possible and must not occur within four metres of the base of the foredune of any sand dunes within the specified area • The area of the permit must only be accessed via existing access routes • The permit holder must submit a return recording the daily catch and harvest activities in respect of each calendar month within 15 days of the end of the month to which it relates • The permit holder must complete records of any interactions with threatened, endangered or protected species (listed under State and/or Commonwealth legislation), including shorebirds


MRP018 Permitted
Harvest Area 1
35°11'4.90"S 138°28'0.53"E
35°15'55.92"S 138°27'17.35"E
35°17'0.89"S 138°26'33.51"E
35°22'41.62"S 138°21'45.90"E
Noarlunga Centre
A13
Moana
B23
Aldinga
Aldinga Beach
Sellicks Beach
Sellicks Hill
Myponga Beach
Myponga


Victor Harbor - Goolwa
Urimbirra Wildlife Park
Middleton
Goolwa Beach
Hindmarsh Island
Port Elliot
Hayborough
McCracken
Victor Harbor
Encounter Bay
Murray Mouth Lookout
B37
A13
35°30'48.86"S 138°42'45.49"E
35°31'58.19"S 138°41'23.71"E
35°33'25.80"S 138°52'26.01"E
35°35'34.66"S 138°35'56.48"E
MRP018 Permitted
Harvest Area 2

Appendix 2 - Consequence categories

Level	As defined for major target species
Minor (1)	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 (B_{MEY})
Moderate (2)	Fishery operating at maximum acceptable level of depletion Spawning biomass < Target level (B_{MEY}) but > Threshold level (B_{MSY})
Severe (3)	Level of depletion unacceptable but still not affecting recruitment levels of stock Spawning biomass < Threshold level (B_{MSY}) but >Limit level (B_{REC})
Major (4)	Level of depletion is already affecting (or will definitely affect) future recruitment potential/ levels of the stock Spawning biomass < Limit level (B_{REC})

2. Bycatch/Non-Target Species		
1	Minor	Measurable but minor levels of depletion of fish stock.
2	Moderate	Maximum acceptable level of depletion of stock.
3	High	Level of depletion of stock unacceptable but still not affecting recruitment level of the stock.
4	Major	Level of depletion of stock are already affecting (or will definitely affect) future recruitment potential of the stock.

3. Endangered, Threatened and Protected Species (TEPs)		
1	Minor	Few individuals directly impacted in most years.
2	Moderate	Level of capture is the maximum that will not impact on recovery.
3	High	Recovery may be affected.
4	Major	Recovery times are clearly being impacted.

5. 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.

Appendix 3 - Likelihood Definitions

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

Appendix 4 – Participant List

Participant	Stakeholder group
Sandy Morison	Independent Chair
Steve Shanks	PIRSA
Hamish Telfer	PIRSA
Jason Tanner	SARDI
Charlotte Nitshcke	Conservation Council SA
Yvie Eglinton	DEW – Marine Parks
Robyn Morcom	DEW – Coastal Protection
Deborah Furbank	Birdlife Australia
Kerri Bartley	Birdlife Australia
Maureen Christie	Friends of Shorebirds SE
Ross Anderson	DEW
Simon Bryars (Via TEAMS)	DEW
Leo Lin	Commercial Miscellaneous Licence Holder (Y078)

Appendix 5 – Shorebirds of concern

Species	Scientific name	Listing Status
Orange Bellied Parrot	*Neophema chrysogaster*	Critically Endangered
Curlew Sandpiper	*Calidris ferruginea*	Critically endangered
Northern Siberian Bar-tailed Godwit spp. menzbieri	*Limosa lapponica menzbieri*	Critically endangered
Great Knot	*Calidris tenuirostris*	Critically endangered
Eastern Curlew	*Numenius madagascariensis*	Critically endangered
Red Knot ssp. Rogersi and piersmai	*Calidris canutus*	Endangered
Lesser Sand Plover	*Charadrius mongolus*	Endangered
Hooded Plover	*Thinornis rubricollis*	Vulnerable
Australian Fairy Tern	*Sternula Nereis*	Vulnerable (state endangered)
Western Alaskan Bar-tailed Godwit spp, baueri	*Limolsa lapponica baueri*	Vulnerable
Greater Sand Plover	*Chardrius leschenaultii*	Vulnerable
Australian Pied Oystercatcher	*Haematopus longirostris*	Rare (state government)
Sooty Oystercatcher	*Haematopus fuliginosus*	Rare (state government)
Ruddy Turnstone	*Arenaria interpres*	Migratory (federal) Rare (state)
Sanderling	*Calidris alba*	Migratory (federal) Rare (state)
Pacific Golden Plover	*Pluvialis fulva*	Migratory (federal) Rare (state)
Red Necked Stint	*Calidris ruficollis*	Migratory
Sharp Tailed Sandpiper	*Calidris acuminata*	Migratory
Red Capped Plover	*Charadrius ruticapillus*	Common Species
Greater Crested Tern	*Thalasseus bergii*	Common Species

**Note: some species may be regional specific*