FISHERIES
& AQUACULTURE
PIRSA

# ESD Risk Assessment of Miscellaneous Commercial Dive Fishing Activities.

**PIRSA Fisheries and Aquaculture**

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PREMIUM
FOOD AND WINE FROM OUR
CLEAN
ENVIRONMENT

Government
of South Australia
Primary Industries
and Regions SA

## Table of Contents

# 1 Introduction

Miscellaneous dive fishing activities are not formally identified as a discrete fishery under the *Fisheries Management Act 2007*. These activities target multi-species and may use a range of gear types. Many of these species targeted by miscellaneous dive fishing activities are harvested in low volumes. Biological information on the majority of the miscellaneous species is limited.

This Ecologically Sustainable Development (ESD) risk assessment will focus on those miscellaneous species collected by diving including:

- Scallop (Family *Pectinidae*)
- Sea urchin (*Heliocidaris erythrogramma*)
- Native oyster (*Ostrea angasi*).
- Turbo shell (*Turbo undulatus*)
- Specimen shells (various families)

## 1.1 Management arrangements for miscellaneous commercial dive fishing activities

Commercial fishers undertaking miscellaneous commercial dive fishing activities may hold a Miscellaneous Fishery licence granted under *Fisheries Management (Miscellaneous Fishery) Regulations 2015.* In some cases, commercial fishing has been undertaken under Ministerial exemption under section 115 of the *Fisheries Management Act 2007*.

Miscellaneous commercial dive fishing activities in the Miscellaneous Fishery are regulated under these regulations:

- *Fisheries Management (Miscellaneous Fishery) Regulations 2015*
- *Fisheries Management (General) Regulations 2007.*

Due to the small and diverse nature of miscellaneous commercial dive fishing activities, a management plan will not be prepared however PIRSA may develop a policy for management of the activity.

Due to the diverse nature of the activity, there are a range of management arrangements in place, predominately as licence or permit conditions. Management arrangements may include total allowable catch, spatial restrictions, temporal closures, gear restrictions, limited entry, limit on the number of agents allowed to fish at any one time. Reporting of catch and effort is generally required.

Some species harvested using miscellaneous commercial dive fishing activities including native oysters and scallops are included as prescribed species in the Marine Scalefish Fishery, however, Marine Scalefish licence holders are not permitted to collect scallops by diving and hence have limited capacity to commercially harvest these species.

## 1.2 Fishing Gear

The use of underwater dive equipment as a method of commercial harvest in South Australia includes use of hookah, SCUBA and/or snorkelling gear. Divers must collect fish by hand but may use hand-held implements to aid collection. Hand collection using dive gear is considered a relatively benign method of harvest with minimal damage to the habitat by impact from the diver and diver equipment. The removal of fish from the substrate results in very little interaction with the environment and divers generally avoid contact with the bottom to reduce turbidity which limits their ability to locate fish.

# 2 Fisheries

## 2.1 Scallops

### 2.1.1 Fishery overview

Commercial harvest for scallop is small-scale with low volumes of harvest of two species, commercial scallop (*Pecten fumatus* also known as king scallop) and queen scallop (*Chlamys bifrons*).

Scallops have been commercially harvested since the 1970's with high variation in total catch and catch rate. There are currently three Miscellaneous Fishery licence holders that are permitted to hand-collect scallops while diving. Marine Scalefish licence holders are also permitted to harvest scallops but not by diving hence have little capacity to fish for this species. The use of scallop dredges is prohibited in South Australia.

Annual commercial catch of scallops in South Australia have fluctuated greatly since fishing began, mainly driven by changes in participation rates of fishers. A minimum legal size of 6.5cm is in place for both the recreational and commercial fishery. There are no output controls for commercial harvest of scallops.

According to Jones (2009), the estimated recreational harvest of scallops in South Australia in 2007/08 was approximately 7.8 tonnes (live weight). In 2013/14 the reported harvest of scallops by recreational fishers was 11.42 tonnes (Giri and Hall 2015) representing a 68% increase from the previous survey.

### 2.1.2 Biology

Scallops are filter-feeding bivalves that lie unattached to the seabed. Commercial scallops are distributed from New South Wales across southern waters to the west coast of Western Australia including Tasmania. They are found in discrete beds to depths of at least 120m over bare, soft sand or mud (Kailola et al. 1993). Although they can swim actively, adults are generally sedentary.

Scallops are preyed upon by sea star, whelk and octopus. In South Australia, predation of scallops is predominately by the many-armed sea stars, tulip and spindle shells, and spider crabs (Mark Johnson pers comm. in Ivey et al. 2013).

The size at maturity for commercial scallops is 12-18 months (Sause et al. 1987), with spawning occurring from late June to September (Shepherd, 1988). Spawning for *C. Bifrons* was reported to occur between spring and autumn with multiple localised events reported (Stylan and Butler, 2003). In Tasmania commercial scallops are estimated to have a life span of up to 16 years with the majority being between 5-12 years (Fairbridge, 1953).

Commercial scallops are broadcast spawners with external fertilisation in the water column. Larvae are planktonic for 2-4 weeks depending on the species, settling on algae or shell substrate. Due to variation in the intensity of spawning, and in oceanographic events the success of settlement is highly variable temporally and spatially. This variation results in large fluctuations in annual abundance and catch (Shepherd, 1988).

## 2.2 Sea Urchin

### 2.2.1 Fishery overview

Sea urchins are harvested for their roe which can constitute up to 10% of their body weight. Roe is considered a delicacy in many countries demanding high prices. The majority of sea urchins are produced from USA, Chile and Japan (Keesing and Hall, 1998).

Demand for sea urchin roe increased significantly from 1982 to 1998 with world harvest increasing from an estimated 48,000 tonnes to 117,000 tonnes. However, sea urchin fisheries worldwide have been in decline following unregulated development in USA and Chile, and depletion of urchin beds in Japan by the 2011 tsunami and nuclear power plant failure.

There are extensive sea urchin stocks found in Australia, however only three species (*Heliocidaris erythrogramma, Centrostephanus rodgersii* and *H. tuberculata)* have been commercially harvested due to variation in roe quality (colour and texture) and recovery rate. In South Australia, the only species currently harvested commercially is the purple sea urchin (*H. erythrogramma)*.

Commercial harvest of sea urchins in South Australia developed in the late 1990's. Currently the number of licences with access to sea urchins has decreased to three.

Commercial harvest of sea urchins in South Australia usually occurs prior to the spawning season when the quality of roe is optimal, between May and December (Ivey et al. 2013). Harvesting of sea urchins is undertaken by hand by divers operating from small vessels in inshore waters. Urchins are transported live to Adelaide where they are processed. Harvesters have been reported to remove approximately 40% of sea urchins from an area (Ivey et al. 2013).

There are no size limits or output controls for sea urchins at this time.

The total catch of sea urchins in South Australia has fluctuated greatly over the period since fishing began (Ivey et al. 2013).

### 2.2.2 Biology

Purple sea urchin are found along the Southern Australian coast from Shark Bay in Western Australia to southern Queensland, inhabiting intertidal rocky reefs to depths of 35m (Edgar 2008). In South Australia, they are often found on rocks and crevices on shallow, subtidal reefs (Connolly 1986) and are often found associated with Greenlip Abalone (Keesing 2007), moving at night to favourable feeding sites.

Sea urchins feed by grazing on filamentous and encrusting algae found on substrate or can capture drift algae (Connelly 1986). In southern Australia sea urchins are considered the dominant herbivore (Lawrence 2001). The effects of overgrazing by urchins forming urchin 'barrens' has been well documented in Tasmania (Valentine and Johnson 2005).

Size and age estimates for sea urchins is difficult as the size of urchins may change with food availability (Constable 1989). Size at maturity of purple sea urchin has been reported to differ among locations. Constable (1989) reported a size at maturity of 25-30mm and age of 2 years while Sanderson (1996) reported the age at maturity at 5-10 years.

Spawning usually occurs in early summer to late autumn with high water temperate. Sea urchins are broadcast spawners with eggs and sperm released into the water column triggered by environmental cues. The fertilised eggs are large and buoyant developing into non-feeding larvae. The success of fertilisation has been shown to be highly correlated to the distance between female and male urchins at the time of spawning (Lawrence 2001) therefore depletion of urchin abundance may limit reproductive success through reduced fertilisation rates.

## 2.3 Native Oyster

### 2.3.1 Fishery overview

The Australian native oysters (*Ostrea angasi*) is closely related to the European edible oyster (*O. edulis*) and is currently being developed as an aquaculture species in Australia. This species was once harvested in large numbers but due to a possible parasitic epidemic the population crashed (Edgar 2007).

There is one Miscellaneous Fishery licenced fisher permitted to take native oysters by diving by hand. Management includes setting a total allowable catch for the individual operator.

### 2.3.2 Biology

Native oysters are distributed between New South Wales through to Fremantle in Western Australian including Tasmania, attached to hard substrate or free living in silt and mud from 1-30m (Edgar 2007). Native oysters brood eggs in the body releasing eggs after they have developed to the first stage. This species grows to around 100-180mm.

## 2.4 Turbo

### 2.4.1 Fishery overview

Commercial harvest of turbo in South Australia targets *Turbo undulatus*, a gastropod snail. The product is sold domestically as well as some being exported to overseas markets. The activity is currently permitted through Ministerial exemptions provided to a limited number of fishers. Conditions on the exemptions limit fishing to hand collection with total allowable catches provided to individual fishers. No size limits apply for this species.

Harvest of turbo is currently undertaken all year round. The turbo catch from South Australia has grown since inception in 2000 to 2009 as has catch rates, although catch and effort has dropped marginally since 2010.

There was no reported recreational harvest of turbo in a survey of recreational fishing in 2007/08 (Jones 2009) or 2013/14 (Giri and Hall 2015).

### 2.4.2 Biology

Turbo are distributed in southern waters from New South Wales to Hopetown in Western Australia including Tasmania. (Kailola et al. 1993). Turbo are associated with algal species including the kelp *Eklonia radiate* (Clarkson and Shepherd, 1985) for food and for habitat (in the case of the coralline algae *Corallina officinalis*) (Underwood and Chapman 1995).

There is little available biological information on turbo, although a closely related snail *T. torguatus* spawns twice a year (Ward and Davis 2002). They are broadcast spawners with a likely larval period for turbo of around five days as is the case for other species of this group (S Shepherd pers comm. reported in Ivey et al 2013).

## 2.5 Specimen Shells

### 2.5.1 Fishery overview

Commercial harvest of specimen shells is based on the capture of multiple species from the following families: Cassidae, Olividae, Spondylidae, Cardiidae, Mactridae, Conidae, Solenidae, Clavagellidae, Carditidae, Marginellidae, Cypraeidae, Cymatiidae, Chitonidae, Naticidae, Neritidae, Harpidae, Turridae, Nassaridae, Columbellidae, Patellidae, Voluntidae, Vasidae, Eulimidae, Muricidae, Scalidae, Fasciolariidae, Phasianellidae, Buccinidae, Acmaeidae, Fissurellidae, Siphonariidae, Mitridae, Cancellariidae, Liotiidae, Tellinidae, Thaididae, Triviidae, Trochidae and Veneridae.

Specimen shells are harvested by hand whilst diving to minimise the potential for damage and thereby maintaining the value of the shells, or of beach-washed shells.

There are currently no licences that provide for harvest of specimen shells. The harvest of specimen shells was previously permitted for up to four fishers with Miscellaneous Fishery licences prior to 1988, however in the 1990's interest in the fishery diminished and licences were surrendered. In 2004 only one licence remained and this licence was surrendered by the licence holder in 2013. Management arrangements that were implemented for these licences included spatial restrictions, bag limits on take of black cowrie and restrictions on take of specimens depositing eggs or found on egg masses.

Recreational take of specimen shells is allowed with spatial restrictions and bag limits on the take of black cowrie.

### 2.5.2 Biology

Due to the wide range of species that may be considered to be specimen shells it is difficult to provide information on biology for all of them. However, biological information about the three main species are provided here.

The black cowrie shell in South Australia is considered to be an isolated sub-species of the *friendii*-complex (Wilson 1993) and is highly sought after. Due to the geographic isolation of this species, the South Australian stock is considered vulnerable. Baker (2011) and Baker et al. (2015) reported this species as being recorded from reefs across South Australia over a broad depth range. Ponder and Grayson (1998) reported widespread distribution throughout the state. Baker (2011) noted that over collection in some easily accessible areas was apparent.

*Voluta undulata* (*amoria*) occurs from southern Queensland to Tasmania, including South Australia. It can be found in sublittoral and intertidal waters (Wilson 1993). This species is the most common species targeted by commercial fishers, although of relatively low value.

*Cypraea marginata* is a white, brown spotted ovate cowrie distributed from central South Australia to Monte Bello Island in Western Australia. This species grows to approximately 70mm and inhabits recesses of underwater caves from 5-200m (Wilson 1993). The shell is common in South Australian waters and has a relatively high market value (Ivey et al. 2013).

*Umbilia armeniaca* Ranges from the Kangaroo Is to Rottnest Is in Western Australia over a broad depth range. It is highly valued in the shell trade and considered potentially vulnerable by Baker (2011) due to biological traits and commercial value.

Several other species of specimen shells have been identified as occurring in South Australian waters and having a medium risk from the fishery related to their biology and market value based

on risk rating criteria described in Ponder and Grayson (1998) (Baker 2011). These include *Cypraea (Austrocypraea) reevei, Melo (Melcorona) miltonis, Nannamoria guntheri, Paramoria johnclarki, Austroharpa (Palamharpa) punctate.*

# 3 Methodology - ESD Risk Assessment

PIRSA adopted a process for issue identification, risk assessment, and reporting closely based on the National ESD Framework "*How To Guide"* (see www.fisheries-esd.com) (Fletcher et al. 2002), as well as the Department of Fisheries, Western Australia ESD performance reports pioneered by Dr Rick Fletcher and other WA Fisheries staff.

Identification of issues was informed by the generic ESD component tree approach with each component tree refined specifically for the proposed activity. Each major component tree reflected the primary components of ESD, and the ESD report assesses the performance of proposed activity for each of the relevant ecological, economic, social and governance issues facing it (Table 1). The process also identified where additional (or reduced) management or research attention is needed, and identify strategies and performance criteria to achieve management objectives to the required standard.

Table 1: Primary ESD Components

| | |
|---|---|
| Retained Species<br>Non-retained Species<br>General Ecosystem Impacts | *Ecological Wellbeing* |
| Community<br>Aboriginal Community | *Human Wellbeing* |
| Governance<br>External Factors Affecting Performance of the Fishery | *Ability to Achieve* |

The steps followed to complete this ESD Risk Assessment Report were:

1. A set of "Generic ESD Component Trees" were modified into a set of trees specific to the proposed activity. The final trees are provided in the results section.

A risk assessment of the identified issues (or components) was completed based on the *consequence* arising from the issue and *likelihood* that this consequence will occur (see appendix 1 for further information on consequence levels). The combination of the consequence and likelihood estimated a level of *risk* associated with issues that may undermine or alternatively contribute to ESD objectives (table 2).

The risk assessment was informed by a stakeholder workshop held on 30 July 2014 attended by representatives of PIRSA, SARDI, industry, South Australian Malacological Society, RecFish SA and Conservation Council of South Australia.

Table 2: Risk matrix

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

2. Risks were prioritised according to their severity. For higher level risks - where an increase in management or research attention was considered necessary - a detailed analysis of the issue, associated risks, and preferred risk management strategies are provided. For low risk issues, the reasons for assigning low risk and/or priority were recorded.
3. For higher level risks a full ESD performance report was prepared. This will be completed in the context of specific management objectives and include operational objectives, indicators and performance measures.
4. A background report providing context and necessary supporting information about each fishery was also be prepared to guide the identification of issues, risks and management strategies. This report will include the history of the fishery and its management, the areas of operation and their biological and physical characteristics, target species and by-product and bycatch species, and other relevant information.

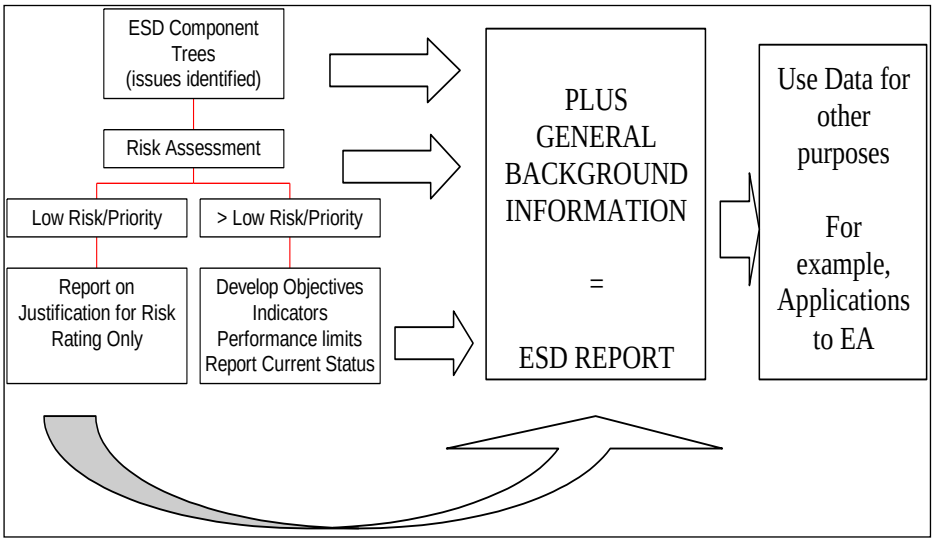


Figure 1: Summary of the ESD reporting framework processes

# 4 Results

## 4.1 Issues related to the retained species in a fishery (all sectors)

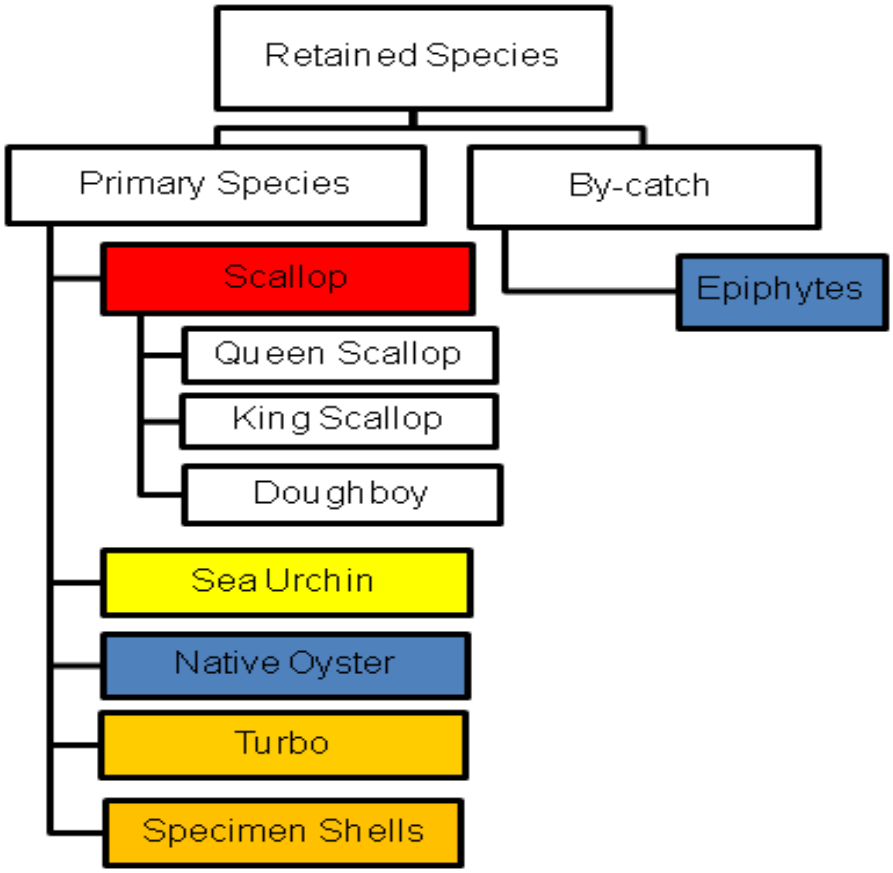


Figure 2: Component tree for the retained species from miscellaneous commercial dive fishing activities.

**Scallops:**

- Consensus: **possible** (3) vs **major** (3) = 9 (**high risk**)
- Four[1] licence holders target three species commercially: Kings, Queens & Doughboy
- No restrictions on take of current level of harvest outside Coffin Bay.
- Most of the catch is being taken from Kangaroo Island, where a voluntary LML of 8.5cm is used.
- Deeper water stocks are untouched, but there is natural die off associated with this species.
- PP commented that due to low price of scallops, licence holders needed to harvest relatively large amounts of scallops to make the activity economically viable. This has led to localised depletion in some areas. These depleted areas require time to recover (recruitment is episodic).
- Not known if current MLL is appropriate as size at maturity for these scallops in South Australia is poorly understood. Cannot assume size at maturity in other states is appropriate here in South Australia given how much size at maturity varies on a spatial scale.

[1] At the time of conducting the Stakeholder Workshop to conduct the ESD risk assessment four licences could access Scallops. One licence has since surrendered the licence.

- Fishing effort is currently low, but it could increase quickly with no way to restrict catch (apart from limited entry). An increase in price for scallops, for example, could result in significant increase in fishing effort and this would increase risk of localised depletion and sustainability of stocks.
- One option proposed to better manage this fishery is to look at implementing appropriate LML.

**Sea Urchins:**

- Consensus: **possible** (3) vs **minor** (1) = 3 (**low risk**)
- No restrictions on size or current level of harvest (there are currently five[2] licence holders).
- Only species currently harvested in South Australia is the purple sea urchin (*H. erythrogramma).*
- Not known if a MLL is appropriate as size at maturity for sea urchins in South Australia is poorly understood. Cannot assume size at maturity in other states is appropriate here in South Australia given how much size at maturity varies on a spatial scale for sea urchins.
- Historical take has been highly variable, but is currently at low level due to low fishing effort and marketing issues (quality of roe varies on temporal).
- Individuals are killed to see the quality or roe.
- Fishers typically harvest 40% of urchin beds, which could lead to localized depletion.
- Risk is lower because only premium product is targeted.

**Native Oyster:**

- Consensus: **unlikely** (2) vs **minor** (1) = 2 (**negligible risk**)
- No reported catch since inception of one and only licence in 2004
- Management arrangements restrict harvest to no more than 6,000 dozen per annum, which can only be taken in Boston Bay and Proper Bay.
- Such arrangements reduced the risk to stocks.

**Turbo: West Coast**

- Consensus: **possible** (3) vs **moderate** (2) = 6 (**medium risk**)
- Turbos are a robust group of animals, with areas of high abundances scattered across the state
- The following advice was provided by SARDI on the West Coast permit application:
    - Historical catch of turbos on the West Coast (under Ministerial exemption) is small and taken from small area, when compared to where turbos are found.
    - Proposed harvest area in permit application is larger than that taken historically, but there are limits on how much can be taken in different spatial areas. This reduces risk of localised depletion.
    - A LML of 30 mm was proposed in permit application. Such a MLL would reduce risk of localized depletion and overall risk to the fishery (from medium to low).

**Turbo: Southeast**

- Consensus: **possible** (3) vs **moderate** (2) = 6 (**medium risk**)
- The following advice was provided by SARDI on the southeast permit application:

[2] In 2017 there were three licences that could access sea urchins.

    - Initial proposal to harvest significantly more catch in the southeast than historically taken (under Ministerial exemption) was considered a high risk of localized depletion, especially as it would be taken in areas of similar size and with no LML.
    - Weather in the southeast limits number of days that can be fished. While this reduces risk of localized depletion, it also reduces likelihood of catching proposed TACC.
    - Applicant was willing to fish new grounds, but only if he had to
- PIRSA proposed implementing arrangements to separate the catch into two distinct spatial areas. On the traditional fishing grounds, the TACC would be set at a similar quantum to previous exemptions. In addition, another 8 tonnes of TACC would be given for exploration (along the coastline up to Kingston).
- Based on the assumption that these spatial arrangements would be implemented, the proposal was considered a medium risk.

**Specimen Shell:**

- Consensus: **possible** (3) vs **moderate** (2) = 6 (**medium risk**)
- The following advice was provided by SARDI on the permit application to take specimen shells:
    - Large number of target species, with significant gaps in their distribution, growth and reproduction.
    - Sustainable yield of target species is unknown.
    - There was no proposed limit on the take of each species, which could result in localized depletion of shells, especially for the rarer and more valuable ones,
    - Reproductive strategies of slow growing, low-fecund species makes them particularly vulnerable and susceptible to localised depletion.
- The use of a camera to monitor fishing activity would provide excellent data on the distribution and abundance of a large range of species, particularly those found at depths divers cannot reach.
- There was acknowledgement that only the highest quality shells would be taken. Also, it did not make much economic sense to flood the market with numerous shells because this would depress average prices. Such economic considerations reduced sustainability concerns to a medium risk.
- South Australian Museum classifies some species as more vulnerable than others. There was agreement that management arrangements for these species be tighter in the first year (restrict the take to only a handful during exploratory phase) until such time as more information was provided).

**Bycatch - Epiphytes**

- Consensus: **unlikely** (2) vs **negligible** (0) = 0 (**negligible risk**)
- Level of take negligible, and unlikely to affect sustainability of epiphyte species.

### 4.2 Issues related to the non-retained species of the activity:

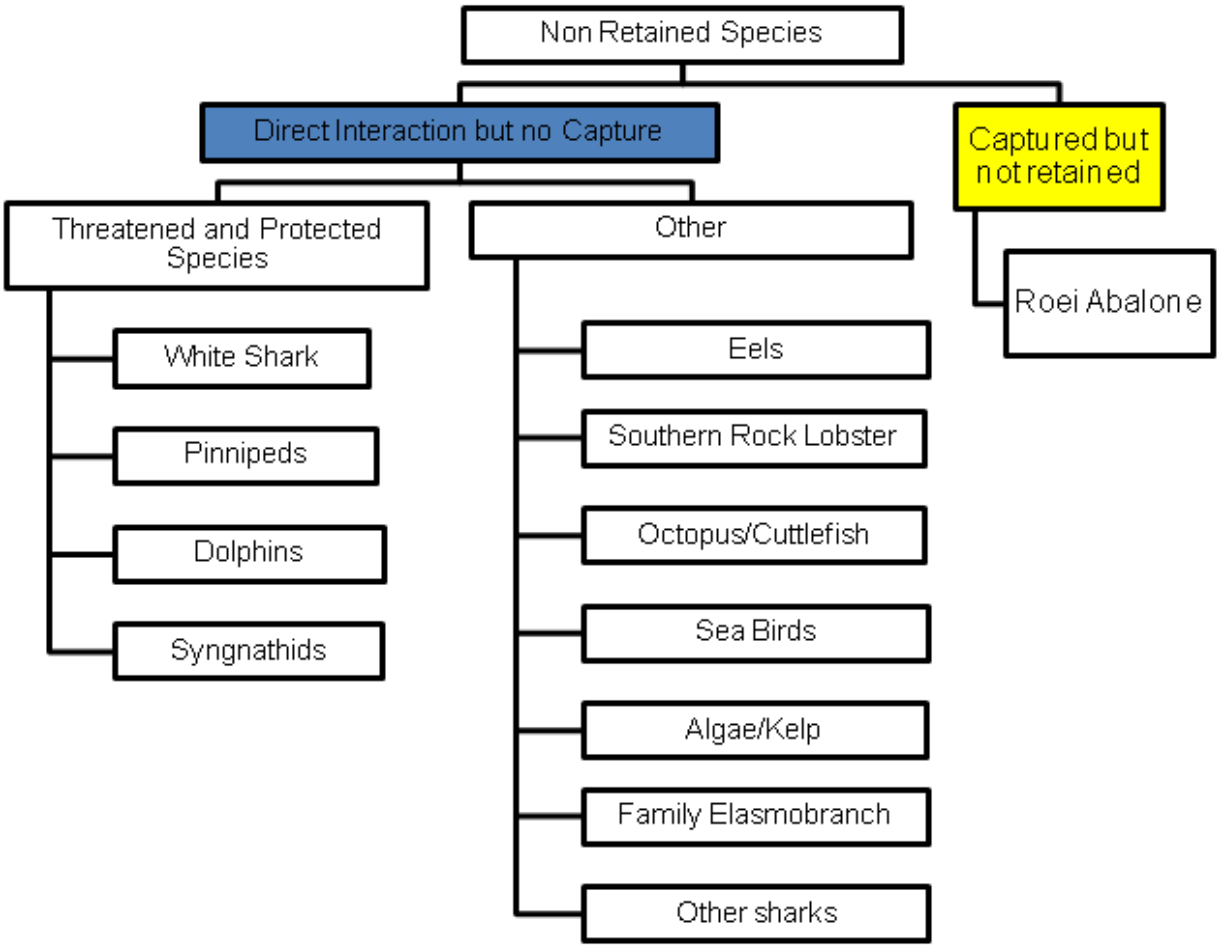


Figure 3: Component tree for the non-retained species from miscellaneous commercial dive fishing activities.

**Captured by not retained:**

- Consensus: **possible** (3) vs **minor** (1) = 3 (**low risk**)
- The issue of taking undersize Roei Abalone was limited to the scallop fishery only.
- Overall level of capture minor.
- Management arrangements prohibit retention of undersize Roei Abalone

**Direct interaction but no capture:**

- Consensus: **remote** (1) vs **negligible** (0) = 0 (**negligible risk**)
- Hand collection and ROV harvest method would not generally result in the capture of non-retained species (they are targeted fishing), but they could interact with them

### 4.3 Issues related to the general environment impacts of a fishery

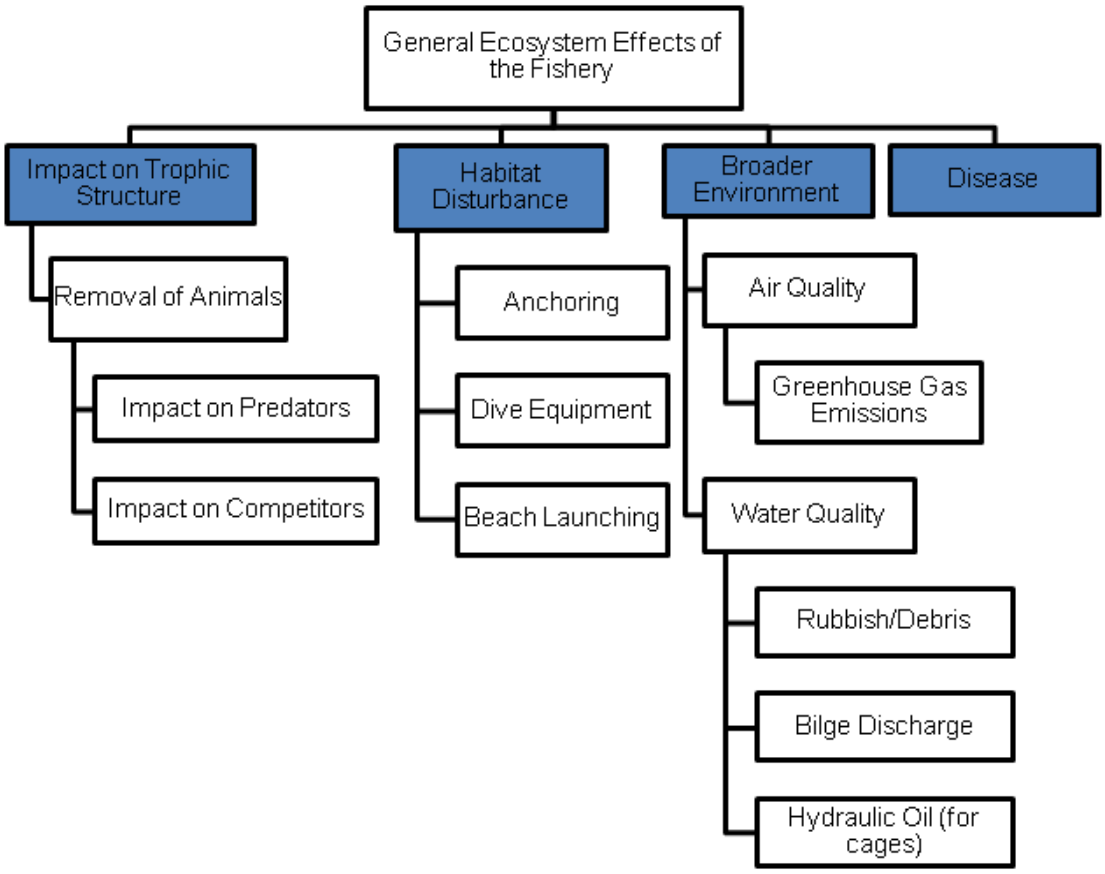


Figure 4: Component tree for the issues related to the general ecosystem effects of miscellaneous commercial dive fishing activities.

**Impact on Trophic Structure:**

- Consensus: **unlikely** (2) vs **minor** (1) = 2 (**negligible risk**)
- Based on low level of take, there would be no measurable impacts on whole of trophic level.

**Habitat Disturbance:**

- Consensus: **unlikely** (2) vs **negligible** (0) = 0 (**negligible risk**)
- Based on level of fishing activity and targeted fishing method, there would no measurable impacts on the habitat.

**Broader Environment:**

- Consensus: **unlikely** (2) vs **negligible** (0) = 0 (**negligible risk**)
- Based on level of fishing activity and targeted fishing method, there would be no measurable impacts on the broader environment.

**Disease:**

- Consensus: **unlikely** (2) vs **negligible** (0) = 0 (**negligible risk**)
- No known diseases for these species

### 4.4 Contribution of the fishery/industry to community wellbeing:

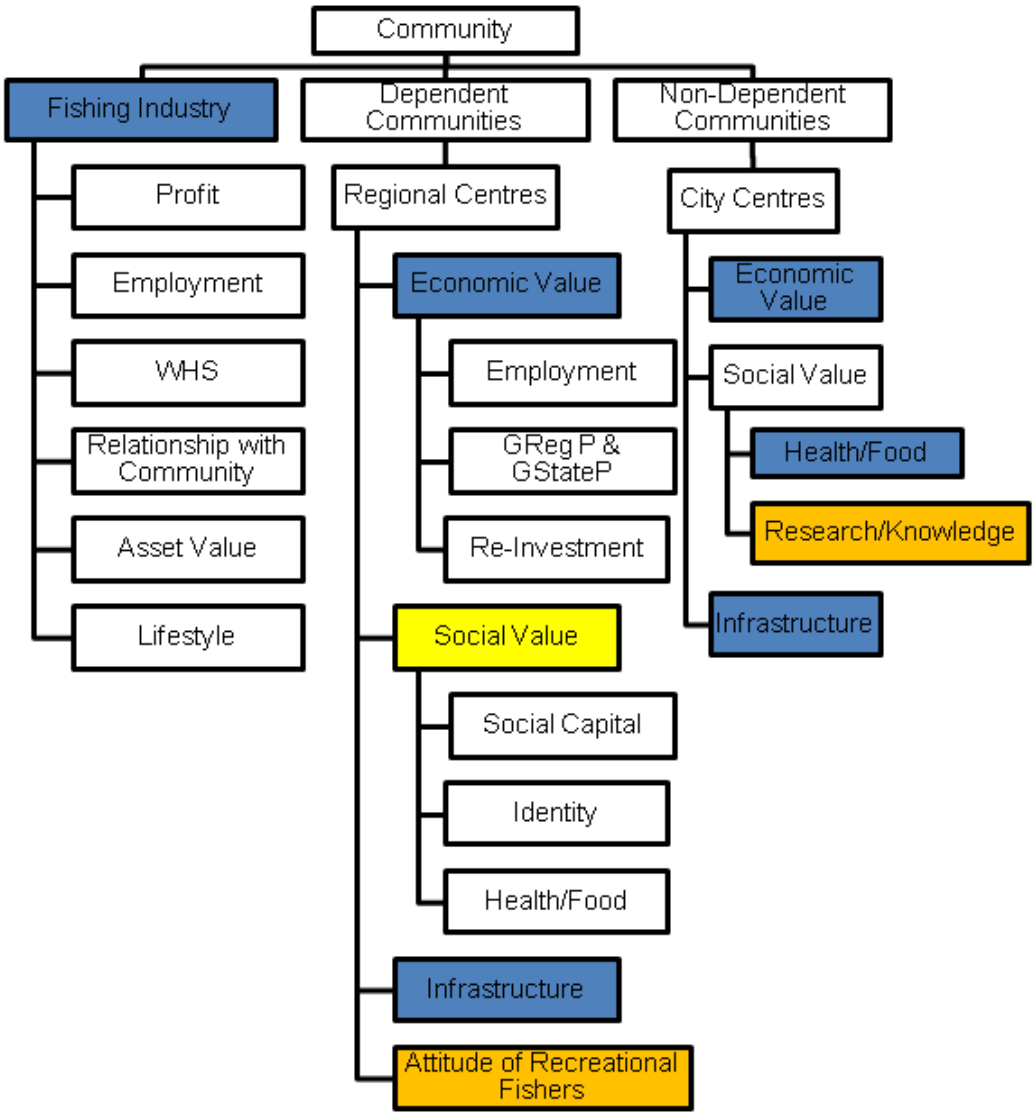


Figure 5: Component tree for the contribution of miscellaneous commercial dive fishing activities to community wellbeing

**Fishing Industry:**

- Consensus: **negligible risk**
- The contribution of miscellaneous commercial dive fishing activities to the fishing industry would be negligible given its small size

**Regional Centres - Economic Value:**

- Consensus: **negligible risk**
- The economic value of miscellaneous commercial dive fishing activities to the regional centres is negligible given its small size

**Regional Centres - Social Value:**

- Consensus: **low risk**
- There will be some social value to regional centres from miscellaneous commercial dive fishing activities particularly in the information provided when monitoring of specimen shell fishing activity

**Regional Centre – Infrastructure:**

- Consensus: **negligible risk**
- The contribution of miscellaneous commercial dive fishing activities to regional centre infrastructure would be negligible given the small size of this activity

**Regional Centre – Attitude of Recreational Fishers:**

- Consensus: **moderate risk**
- Some recreational fishers and members of the community are likely to have negative views of any commercial fishery, including the small number of operators involved in miscellaneous commercial dive fishing activities

**City Centres – Economic Value:**

- Consensus: **negligible risk**
- The economic value from miscellaneous commercial dive fishing activities to the city centres is negligible given the small size of this fishery

**City Centres – Health/Food:**

- Consensus: **negligible risk**
- The health/food value from miscellaneous commercial dive fishing activities to the city centres is negligible given the small size of this fishery

**City Centres – Research/Knowledge:**

- Consensus: **medium risk**
- Specimen shell and scallop harvest may provide research/knowledge of benefit to community, particularly specimen shell harvest which should provide information about what species are found in waters too deep to dive

**City Centres – Infrastructure:**

- Consensus: **negligible risk**
- The contribution from miscellaneous commercial dive fishing activities to city centre infrastructure would be negligible given the small size of this fishery

### 4.5 Issues related to the governance of the fishery/industry:

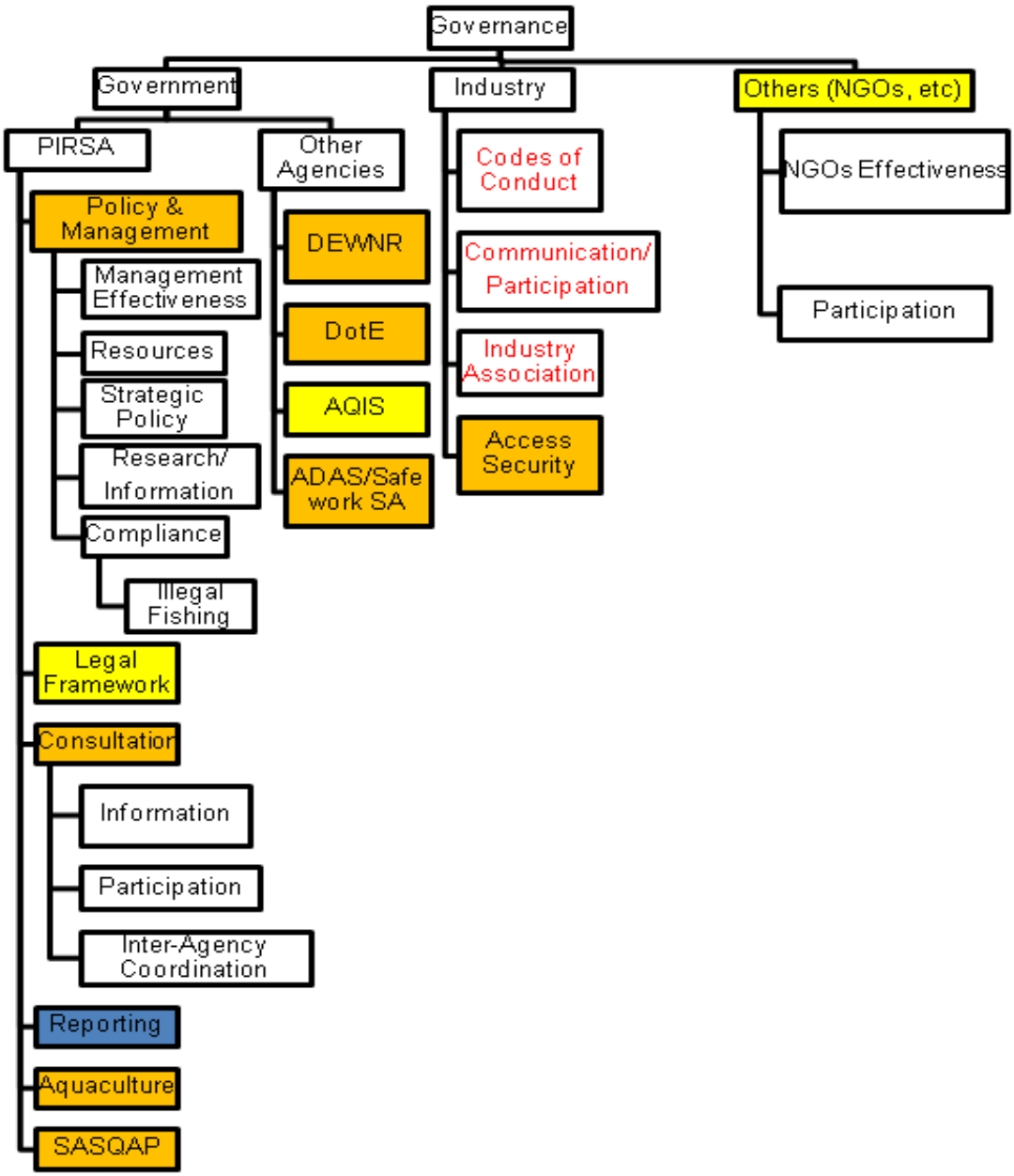


Figure 6: Component tree for issues related to the governance of miscellaneous commercial dive fishing activities

**Policy and Management:**

- Consensus: **medium risk**
- PIRSA can impact on fishery when making decisions on how to manage the fishery
- Non-transferability is a medium risk to profitability of licence holders.

**Legal Framework:**

- Consensus: **low risk**
- The impact of the legal framework is of low risk to miscellaneous commercial dive fishing activities

**Consultation:**

- Consensus: **medium risk**
- Lack of an industry body that represents fishers involved in miscellaneous commercial dive fishing activities makes it hard for PIRSA to consult with fishers efficiently.

**Reporting:**

- Consensus: **negligible risk** (no reasoning provided at workshop)

**Aquaculture:**

- Consensus: **medium risk**
- Risk of oyster aquaculture leases in Coffins Bay pose a medium risk to sea urchin and native oyster fisheries who compete for the same food sources

**SASQAP:**

- Consensus: **medium risk**
- The costs of SASQAP accreditation are very high for the low value species from miscellaneous commercial dive fishing activities. Also, SASQAP often closes areas like Coffin Bay and Kangaroo Island to fishing when there is a disease risk.

**DEWNR:**

- Consensus: **medium risk**
- Loss of access due to marine parks

**DotE:**

- Consensus: **medium risk**
- Costs and management restrictions involved to get export approval

**AQIS:**

- Consensus: **low risk**
- Costs and management restrictions to obtain AQIS approval

**ADAS/Safework SA**

- Consensus: **medium risk**
- Due to tightening of management restrictions associated with diving

**Codes of Conduct/Industry Association/Communication & Participation:**

- Note: no consensus, issues were deferred to another time

**Access Security:**

- Consensus: **medium risk**
- Scallop and urchin fishers would prefer each licence holder to be assigned specific areas to fish (i.e. spatial restrictions), as a means to reduce risk of localised depletion.

**Others (NGO's etc):**

- Consensus: **low risk**
- For Specimen Shell only, the Malacological Society will have an impact on the Fishery.

### 4.6 External impacts affecting performance of the fishery:

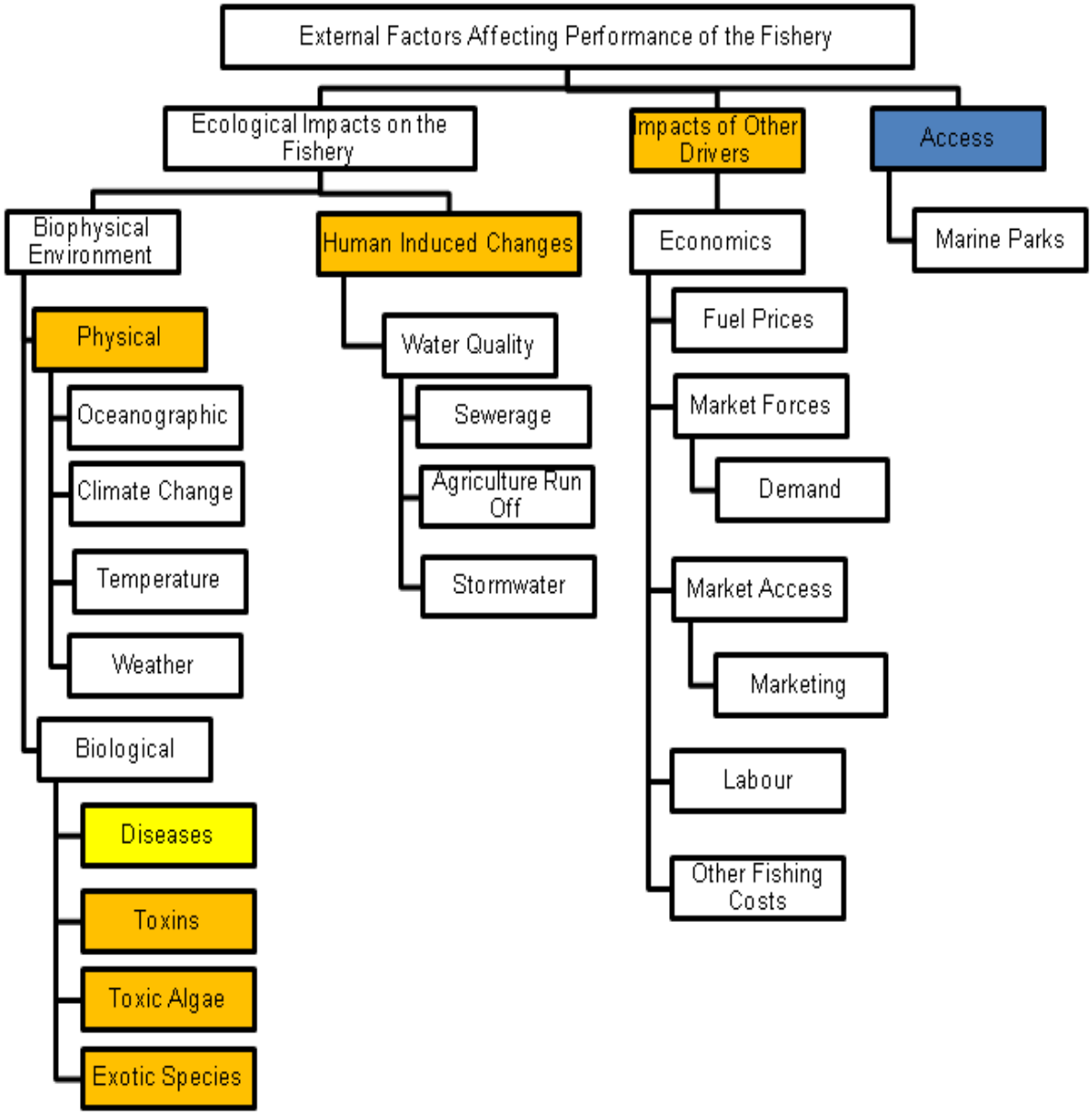


Figure 7: Component tree for the external impacts affecting the performance of miscellaneous commercial dive fishing activities.

**Physical:**

- Consensus: **medium risk**
- Oceanographic/climate change/temperature have been found to have major impact on the reproduction, recruitment and growth of species such as scallops
- Weather can limit the number of days that licence holders can dive.

**Diseases:**

- Consensus: **low risk**
- No notifiable diseases currently identified for species harvested by miscellaneous commercial dive fishing activities.

**Toxins/Toxic Algae/Exotic Species:**

- Consensus: **medium risk**
- Filter feeders: scallops and native oyster at risk of absorbing toxins and susceptible to toxic algae.
- SASQAP/EPA testing in place to reduce risk. Currently no testing for paralytic shellfish toxin by SASQAP for urchins and turbo.
- Exotic species compete with target species for space and food (mainly Scallops/Urchins/Native Oyster).

**Human Induced Changes:**

- Consensus: **medium risk**
- Filter feeders: Scallops and Native Oyster are always a risk of absorbing toxins
- SASAP/EPA testing in place to mitigate this risk.

**Impacts by Other Drivers:**

- Consensus: **medium risk**
- Economics key factor in risk to viability of all fisheries.
- Operating costs have increased in recent times while the price of product has remained relatively the same, reducing margins.
- Impacts of other drivers such as access to overseas markets is a medium risk to profitability of all fisheries. More research required into packaging (live) and promoting product overseas.

**Access:**

- Consensus: **negligible risk**
- Marine parks have had a negligible impact on access to fishing areas.

### 4.7 Summary of ESD Reporting Framework

Table 3: Summary of ESD risk rating outcomes

| Component Trees | High | Medium | Low | Negligible | Total |
|---|---|---|---|---|---|
| Retained Species | 1 | 2 | 1 | 2 | 6 |
| Non-retained species | 0 | 0 | 1 | 1 | 2 |
| General Ecosystem | 0 | 0 | 0 | 4 | 4 |
| General Community | 0 | 2 | 1 | 6 | 9 |
| Governance | 0 | 8 | 3 | 1 | 12 |
| External Factors affecting Fishery Performance | 0 | 6 | 1 | 1 | 8 |
| Total | 1 | 18 | 7 | 15 | 41 |

### 4.8 Performance report for high and medium risk components

Full ESD performance reports are provided for each of the identified high and medium risk components including proposed objectives and strategies for mitigating identified risks (Table 4).
A summary of outcomes for all components assessed are provided in Table 5.

Table 4: Full performance report for High and Medium risks

| Component | Risk/Issue | Description | Risk rating | Proposed Objectives | Proposed Strategies | Proposed Performance Indicator |
|---|---|---|---|---|---|---|
| Retained species | Scallop | Risk of fishery impacts on spawning biomass of scallops – primary species | High | Maintain stocks of all scallops, turbos and specimen shells at sustainable levels | • Collection of scallops by hand only<br>• Total Allowable Catch for Turbo<br>• Collection of turbo by hand only<br>• Bag limits on take of black cowrie<br>• Specimen shells depositing eggs or on egg masses are protected | Total catch scallops<br>Total catch turbo<br>Total catch in numbers of Specimen Shell species by individual species |
| | Turbo | Risk of fishery impacts on spawning biomass of turbo – primary species | Medium | | | |
| | Specimen Shells | Risk of fishery impacts on spawning biomass of specimen shells – primary species | Medium | | | |
| Community wellbeing | Attitude of Recreational Fishers | Contribution of the fishery to community-dependent communities-regional centres | Medium | Attitudes of recreational fishers mitigated by effective communication of management arrangements | • Proposed management arrangements provided for public comment and communicated to the public. | Management arrangements communicated on PIRSA Website |
| | Research/Knowledge | Contribution of the fishery to community-dependent communities-city centres | Medium | Information derived from the activity benefits knowledge of dive fisheries | • Monitoring requirements for dive fisheries informs knowledge gaps for dive fisheries | Monitoring arrangements for dive fisheries are in place for all dive fishing activities. |
| Governance | Policy and Management | Risk to the fishery related to governance – Government – PIRSA | Medium | Management of the activity is consistent with ESD principles | • Management arrangements developed for the fishery are consistent with the *Fisheries Management Act 2007.* | No performance indicators proposed |
| | Consultation | Risk to the fishery related to governance – Government – PIRSA | Medium | Participation of industry in management of the activity through consultation | • Management arrangements are developed in consultation with industry | No performance indicators proposed |

| | | | | | | |
|---|---|---|---|---|---|---|
| Governance | Aquaculture | Risk to the fishery related to governance – Government – PIRSA | Medium | Management arrangements for the dive fisheries are communicated to PIRSA Aquaculture | • Management arrangements for the dive fisheries are communicated to PIRSA Aquaculture | No performance indicators proposed |
| | SASQAP | Risk to the fishery related to governance – Government – PIRSA | Medium | Management arrangements for the dive fisheries are communicated to PIRSA Biosecurity | • Management arrangements for the dive fisheries are communicated to PIRSA Biosecurity | No performance indicators proposed |
| | DEWNR | Risk to the fishery related to governance – Government – Other Agencies | Medium | Management arrangements for the dive fisheries are communicated to Other Agencies | • Management arrangements for the dive fisheries are communicated to Other Agencies | No performance indicators proposed |
| | DotE | Risk to the fishery related to governance – Government – Other Agencies | Medium | Management arrangements for the dive fisheries are communicated to Other Agencies | • Management arrangements for the dive fisheries are communicated to Other Agencies | No performance indicators proposed |
| | ADAS/Safe work SA | Risk to the fishery related to governance – Government – Other Agencies | Medium | Management arrangements for the dive fisheries are communicated to Other Agencies | • Management arrangements for the dive fisheries are communicated to Other Agencies | No performance indicators proposed |
| | Access Security | Risk to the fishery related to governance – Industry | Medium | Management arrangements allow for fishing operations to be efficient within sustainability bounds | • Management arrangements are developed in consultation with industry | No performance indicators proposed |
| External factors affecting the performance of the fishery | Physical | Risk to the fishery from ecological impacts on the fishery – Biophysical environment – Physical | Medium | Management arrangements allow for fishing operations to be efficient within sustainability bounds | • Management arrangements are developed in consultation with industry | No performance indicators proposed |
| | Toxins | Risk to the fishery from ecological impacts on the fishery – Biophysical environment – biological | Medium | SASQAP/EPA process adequately mitigate impacts | • Management arrangements for the dive fisheries are communicated to PIRSA Biosecurity | No performance indicators proposed |

| | | | | | | |
|---|---|---|---|---|---|---|
| External factors affecting the performance of the fishery | Toxic Algae | Risk to the fishery from ecological impacts on the fishery – Biophysical environment – biological | Medium | SASQAP/EPA process adequately mitigate impacts | • Management arrangements for the dive fisheries are communicated to PIRSA Biosecurity | No performance indicators proposed |
| | Exotic Species | Risk to the fishery from ecological impacts on the fishery – Biophysical environment – biological | Medium | SASQAP/EPA process adequately mitigate impacts | • Management arrangements for the dive fisheries are communicated to PIRSA Biosecurity | No performance indicators proposed |
| | Human Induced Changes | Risk to the fishery from ecological impacts on the fishery | Medium | SASQAP/EPA process adequately mitigate impacts | • Management arrangements for the dive fisheries are communicated to PIRSA Biosecurity | No performance indicators proposed |
| | Impacts of other drivers | Risk to the fishery from ecological impacts on the fishery | Medium | Management arrangements allow for fishing operations to be efficient within sustainability bounds | • Management arrangements are developed in consultation with industry | No performance indicators proposed |

Table 5: Overview of ESD Risk Assessment for all components H=High, M=Medium, L=Low, N=Negligible, * Review on-going/ annual, ** Review under development of a policy for management, *** Review at next ESD assessment, **** Industry deliverable)

| Component | Risk | Objective Developed | Performance Indicator Measured | Robustness | Current performance | Actions |
|---|---|---|---|---|---|---|
| **Issues related to the retained species** | | | | | | |
| Primary Species – Scallop | H | Yes | Yes | M | Acceptable | ** |
| Primary Species – Sea Urchin | L | Yes | Yes | M | Acceptable | ** |
| Primary Species – Native Oyster | N | Yes | Yes | M | Acceptable | ** |
| Primary Species – Turbo | M | Yes | Yes | M | Acceptable | ** |
| Primary Species – Specimen Shell | M | Yes | Yes | M | Acceptable | ** |
| | | | | | | |
| By-catch - Epiphytes | N | Yes | No | L | n/a | *** |
| | | | | | | |
| **Issues related to the non retained species** | | | | | | |
| Direct interaction but no capture | N | Yes | Yes | M | Acceptable | *** |
| | | | | | | |
| Captured but not retained | L | No | No | L | n/a | *** |
| | | | | | | |
| **Issues related to the general environment impacts of a fishery** | | | | | | |
| Impact on trophic structure | N | Yes | No | L | n/a | *** |
| | | | | | | |
| Habitat Disturbance | N | Yes | No | L | n/a | *** |
| | | | | | | |
| Broader Environment | N | Yes | No | L | n/a | *** |
| | | | | | | |
| Disease | N | No | No | L | n/a | *** |
| | | | | | | |
| **Contribution of the fishery/industry to community wellbeing** | | | | | | |
| Fishing Industry | N | No | No | n/a | n/a | *** |
| | | | | | | |
| Dependent communities – regional centres – Economic Value | N | No | No | n/a | n/a | *** |
| | | | | | | |
| Dependent communities – regional centres – Social Value | L | No | No | n/a | n/a | *** |
| | | | | | | |
| Dependent communities – regional centres – Infrastructure | N | No | No | n/a | n/a | *** |
| | | | | | | |
| Dependent communities – regional centres –Attitude of recreational fishers | M | No | No | n/a | n/a | *** |
| | | | | | | |
| Non-dependent communities –city centres – Economic value | N | No | No | n/a | n/a | *** |
| Non-dependent communities –city centres –Social value – Health/Food | N | No | No | n/a | n/a | *** |
| Non-dependent communities –city centres – Social value – Research/knowledge | M | No | No | n/a | n/a | *** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Non-dependent communities –city centres – Infrastructure | N | No | No | n/a | n/a | *** |
| | | | | | | |
| **Issues related to the governance of the fishery/industry** | | | | | | |
| Government - PIRSA – Policy & Management | M | No | No | n/a | n/a | *** |
| | | | | | | |
| Government - PIRSA – Legal Framework | L | No | No | n/a | n/a | *** |
| | | | | | | |
| Government - PIRSA – Consultation | M | No | No | n/a | n/a | *** |
| | | | | | | |
| Government - PIRSA - Reporting | N | No | No | n/a | n/a | *** |
| | | | | | | |
| Government - PIRSA - Aquaculture | M | No | No | n/a | n/a | *** |
| | | | | | | |
| Government - PIRSA – SASQAP | M | No | No | n/a | n/a | *** |
| | | | | | | |
| Government – Other agencies– SA DEWNR | M | No | No | n/a | n/a | *** |
| Government – Other agencies– Cwth DotE | M | No | No | n/a | n/a | *** |
| Government – Other agencies– AQIS | L | No | No | n/a | n/a | *** |
| Government – Other agencies– ADAS Safework SA | M | No | No | n/a | n/a | *** |
| | | | | | | |
| Industry– Access Security | M | No | No | n/a | n/a | *** |
| | | | | | | |
| Other (NGOs)– | L | No | No | n/a | n/a | *** |
| | | | | | | |
| **External Factors Affecting Performance of the Fishery** | | | | | | |
| Ecological Impacts – Biophysical environment – Physical | M | No | No | n/a | n/a | *** |
| | | | | | | |
| Ecological Impacts – Biophysical environment – Biological - Disease | L | No | No | n/a | n/a | *** |
| Ecological Impacts – Biophysical environment – Biological - Toxins | M | No | No | n/a | n/a | *** |
| Ecological Impacts – Biophysical environment – Biological – Toxic algae | M | No | No | n/a | n/a | *** |
| Ecological Impacts – Biophysical environment – Biological - Exotic species | M | No | No | n/a | n/a | *** |
| | | | | | | |
| Ecological Impacts – Human induced changes – | M | No | No | n/a | n/a | *** |
| | | | | | | |
| Impacts of other drivers | M | No | No | n/a | n/a | *** |
| | | | | | | |
| Access | N | No | No | n/a | n/a | *** |

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# 6 Appendix

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

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

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

| Level | Ecological (by-product/general by-catch) |
|---|---|
| Negligible (0) | Very few individuals are captured in relation to likely population size (<1%) |
| Minor (1) | Take in this fishery is small (< 10%), compared to total take by all fisheries and these species a explicitly elsewhere.<br>Take and area of capture by this fishery is small, compared to known area of distribution (< 20 |
| Moderate (2) | Relative area of, or susceptibility to capture is suspected to be less than 50% and species do n vulnerable life history traits. |
| Major (3) | No information is available on the relative area or susceptibility to capture or on the vulnerabilit traits of this type of species AND<br>The relative levels of capture/susceptibility suspected/known to be greater than 50% and speci examined explicitly |
| Extreme (4) | N/A Once a consequence reaches this point it should be examined using target species table. |

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

| Level | Protected species by-catch |
|---|---|
| Negligible (0) | Some level of interaction may occur but either no mortalities generated or extremely few are recorded at the time scale |
| Minor (1) | Very few individuals of the protected species are directly impacted in most years, no general level of public concern |
| Moderate (2) | The fishery catches or impacts these species at the maximum level that is accepted |

| | |
|---|---|
| Major (3) | The catch or impact by the fishery on the protected species is above that accepted by broader community but there are additional stock implications |
| Extreme (4) | The catch or impact is well above the acceptable level and this is may be having significant additional impacts on the al threatened status. |

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

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

Table 10 - Consequence categories for economic outcomes. The default objective is – the maintenance or enhancement of economic activity.

| Level | Ecological (HABITAT) |
|---|---|
| Negligible (0) | No measurable impact on the habitat would be possible. |
| Minor (1) | Barely measurable impacts on habitat(s) which are very localised compared to total habitat area.<br>(Suggestion – these impacts could be < 5%; < 3%; <2%) of the original area of habitat) |
| Moderate (2) | There are likely to be more widespread impacts on the habitat but the levels are still considerable acceptable given th affected, the types of impact occurring and the recovery capacity of the habitat<br>(Suggestion – for impact on non-fragile habitats this may be up to 50% [similar to population dynamics theory] - but fo habitats, to stay in this category the percentage area affected may need to be smaller, e.g. 20% and for critical habita |
| Major (3) | The level of impact on habitats may be larger than is sensible to ensure that the habitat will not be able to recover ad cause strong downstream effects from loss of function.<br>(Suggestion - Where the activity makes a significant impact in the area affected and the area > 25 - 50% [based on r habitat is being removed; whilst for critical habitats this would be < 10%) |
| Extreme (4) | Too much of the habitat is being affected, which may endanger its long-term survival and result in severe changes to function and the entire habitat is in danger of being affected in a major way/removed.<br>(Suggestion this may equate to 70 - 90% of the habitat being affected or removed by the activity; for more fragile hab be > 30% and for critical habitats 10-20%) |

Table 11 - Consequence categories for social disruptions. The default objective is – maintenance or enhancement of appropriate social structures and outcomes.

| Level | Social Implications |
|---|---|
| Negligible (0) | Not measurable or no direct involvement |
| Minor (1) | Direct impacts may be measurable but minimal concerns |
| Moderate (2) | Some direct impacts on social structures but not to the point where local communities are threatened or social disloca |
| Major (3) | Severe impacts on social structures, at least at a local level. |
| Extreme (4) | Changes will cause a complete alteration to some social structures that are present within a region of a country |

Table 12 - Suggested consequence levels for economic outcomes. The default objective is - maintenance or enhancement of economic activity.

| Level | Economic |
|---|---|
| Negligible (0) | None or not detectable |
| Minor (1) | Possible detectable, but no real impact on the economic pathways for the industry or the community. |
| Moderate (2) | Some level of reduction for a major fishery or a large reduction in a small fishery that the community is not dependent |
| Major (3) | Fishery/industry has declined significantly in economic generation and this will have clear flow on effects to other part community. May result in some level of political intervention. |
| Extreme (4) | Total collapse of any economic activity coming from what was an industry that the community derived a significant lev income or employment (resource dependency), including possible debts. High levels of political intervention likely. |

Table 13 - Likelihood Definitions – these are usually defined for the likelihood of a particular consequence level actually occurring within the assessment period.

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