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## Ecosystem Based Fisheries Management (EBFM) Risk Assessment of the Western Australian Sea Cucumber Fishery

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**Western Australian Marine Stewardship Council  
Report Series No. 13**

**Ecosystem Based Fisheries  
Management (EBFM) Risk  
Assessment of the Western  
Australian Sea Cucumber Fishery**

Webster, F. and Hart, A.

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## Executive Summary

The Department of Primary Industries and Regional Development (DPIRD) utilises an Ecosystem-Based Fisheries Management (EBFM) approach which considers all relevant ecological, social, economic and governance issues to deliver community outcomes. In order to assess the level of fisheries' impacts and prioritise management activities across these four areas, periodic ecological risk assessments are undertaken for fisheries resources in Western Australia (WA).

This report provides a comprehensive overview of the commercial Western Australian Sea Cucumber Fishery (SCF) and the outcomes from the 2016 ecological risk assessment for this fishery. Two key species, sandfish (*Holothuria scabra*) and redfish (*Actinopyga echinites*), are targeted by the commercial SCF through hand collection by diving and wading primarily in shallow waters of northern WA.

The risk analysis methodology utilised for the 2016 risk assessment was based on the global standard for risk assessment and risk management (AS/NZS ISO 31000). This methodology utilises a consequence-likelihood analysis, which involves the examination of the magnitude of potential consequences from fishing activities and the likelihood that those consequences will occur given current management controls.

Due to the small scale and relatively benign operations of the SCF the risk assessment was undertaken by Departmental scientists and managers. The outcomes of the ERA were sent as a report for comment and review to industry, other government departments and recreational peak bodies and non-government organisations.

There were 56 issues identified in the SCF, the majority of which were scored as low or negligible risk. Two factors were scored as medium risk and six as high risk. The treatment and management of risks scored medium or higher is addressed in the final chapter of this report.

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## List of Abbreviations

C	Consequence level
CALM	<i>Conservation and Land Management Act 1984</i>
Department	Department of Primary Industries and Regional Development, Western Australia (formerly Department of Fisheries)
EBFM	Ecosystem-based Fisheries Management
ERA	Ecological Risk Assessment
ESD	Ecologically-Sustainable Development
ETP	Endangered, threatened or protected
FRMR	<i>Fish Resource Management Regulations 1995</i>
L	Likelihood level
OHS	Occupational Health and Safety
MAFMF	Marine Aquarium Fish Managed Fishery
MSC	Marine Stewardship Council
NCB	North Coast Bioregion
GCB	Gascoyne Coast Bioregion
OCS	Offshore Constitutional Settlement
OCP	Operational Compliance Plan
SCF	Sea Cucumber Fishery
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WTO	Wildlife Trade Operations





# 1 Introduction

In accordance with international treaties and initiatives, the Australian Government is committed to implementing the principles of Ecologically Sustainable Development (ESD). ESD is a dynamic concept that seeks to integrate short- and long-term economic, social and environmental effects into the decision-making processes of government and industry. As per the *National Strategy for Ecologically Sustainable Development* (Commonwealth of Australia 1992), ESD is defined as “*using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased*”. ESD is accepted as the foundation for natural resource management in Australia and is a major component of all fisheries legislation, at both Commonwealth and State levels.

The WA Government is committed to the concepts of ESD, and these principles are implicitly contained in the objectives of fisheries legislation. In 2002, the then Minister for Fisheries released a *Policy for the Implementation of Ecologically Sustainable Development for Fisheries and Aquaculture within Western Australia* (Fletcher 2002) to articulate how the Department can demonstrate to both the government and the broader community that these requirements are being achieved.

A major element of this policy was reporting on the progress of each commercial fishery against the major ESD objectives, and this document reports on the progress of the Western Australian Sea Cucumber Fishery (SCF) against these objectives. The reporting framework operates by identifying the relevant issues for a fishery within three main categories of (1) ecological sustainability, (2) community well-being and (3) ability to achieve industry objectives through governance. Once the issues are identified a process to prioritise each is undertaken, typically using a formal risk assessment process.

The risk assessment process can be summarised as a consideration of the potential consequences of an issue and how likely the consequences are to occur. The combination of the level of consequence and the likelihood is used to produce an estimated level of risk associated with a particular issue. The risk assessment process helps to identify and prioritise issues requiring specific management actions, and therefore ongoing assessment of performance, from those issues that require only justification for low risk rating (Fletcher et al. 2002). Typically only issues of sufficient risk (ranked moderate to extreme) require specific management actions. Nonetheless, the rationale for classifying issues as low risk or even negligible risk needs to be documented. The documentation of the risk assessment process allows all stakeholders and interested parties to see why issues were accorded certain risk ratings.

This report provides an overview of the information pertaining to the SCF and presents the results of a comprehensive risk assessment against the ESD principles.

Several key documents were consulted for preparing the background information and should be referred to for additional knowledge including the *Western Australian Sea Cucumber*

*Resource Harvest Strategy* (Department of Primary Industries and Regional Development 2018), which outlines the operational objectives, performance indicators and reference levels used to assess the performance of commercial fisheries. The performance of the fishery against these objectives is reported in the annual *Status Reports of the Fisheries and Aquatic Resources of Western Australia: the State of the Fisheries*. For more detail on stock assessment of the target species, refer to the *Resource Assessment Report for the Western Australian Sea Cucumber Resource* (Hart et al. 2018).

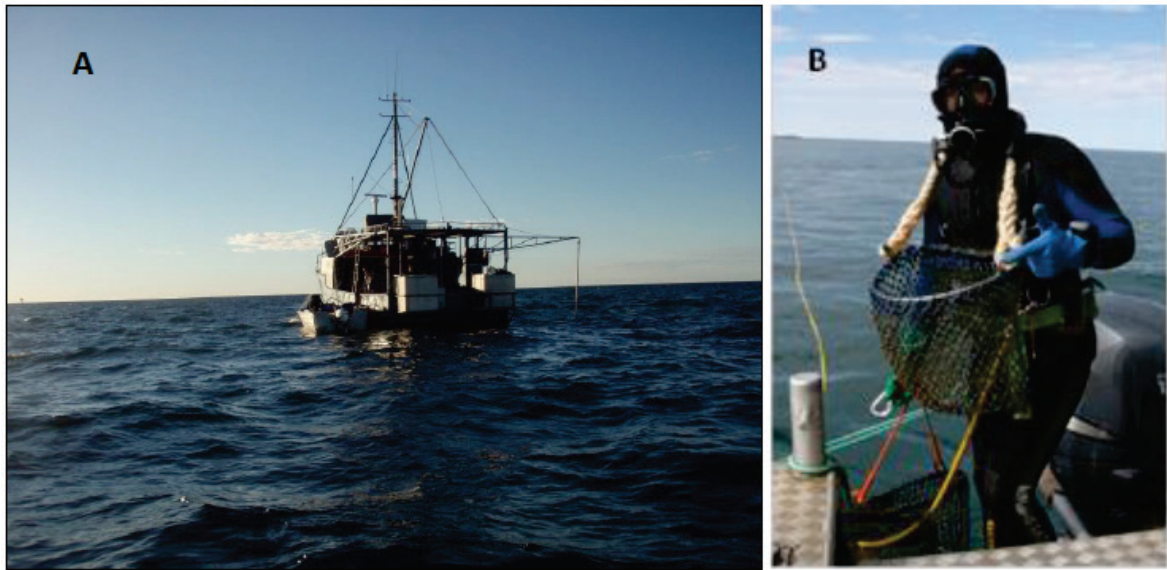
The scope of this Ecological Risk Assessment (ERA) is for the next five years of industry operations. It is envisioned that ERA's will be undertaken periodically (approximately every five years) to reassess any current or new issues that may arise in the industry; however, a risk assessment can also be triggered if there are significant changes identified in industry operations or management activities or controls that may change current risk levels. This cycle coincides with the review of the harvest strategy.

## 2 Description of SCF

Commercial fishing for sea cucumbers in WA dates back to the Houtman Abrolhos Islands during the mid-1800s, however, the modern day SCF began in 1995. The SCF primarily targets two key species, sandfish (*Holothuria scabra*) and redfish (*Actinopyga echinites*), through hand collection by diving and wading primarily in shallow waters. Until 2007 the fishery was primarily a single species fishery with 99% of the catch being sandfish. Management arrangements allow six other species to also be retained, however, records show that catches of these species is minimal (*H. atra*, *H. fuscogilva*, *H. whitmaei*, *Stichopus hermanni*, *S. vastus* and *Thelenota ananas*).

There are currently six fishing licences in the SCF, which through time have been purchased by a single company. This company also owns additional commercial fishing licences permitting the capture of sea cucumbers in the Northern Territory and in Queensland and uses the same vessel throughout these jurisdictions on a rotational basis.

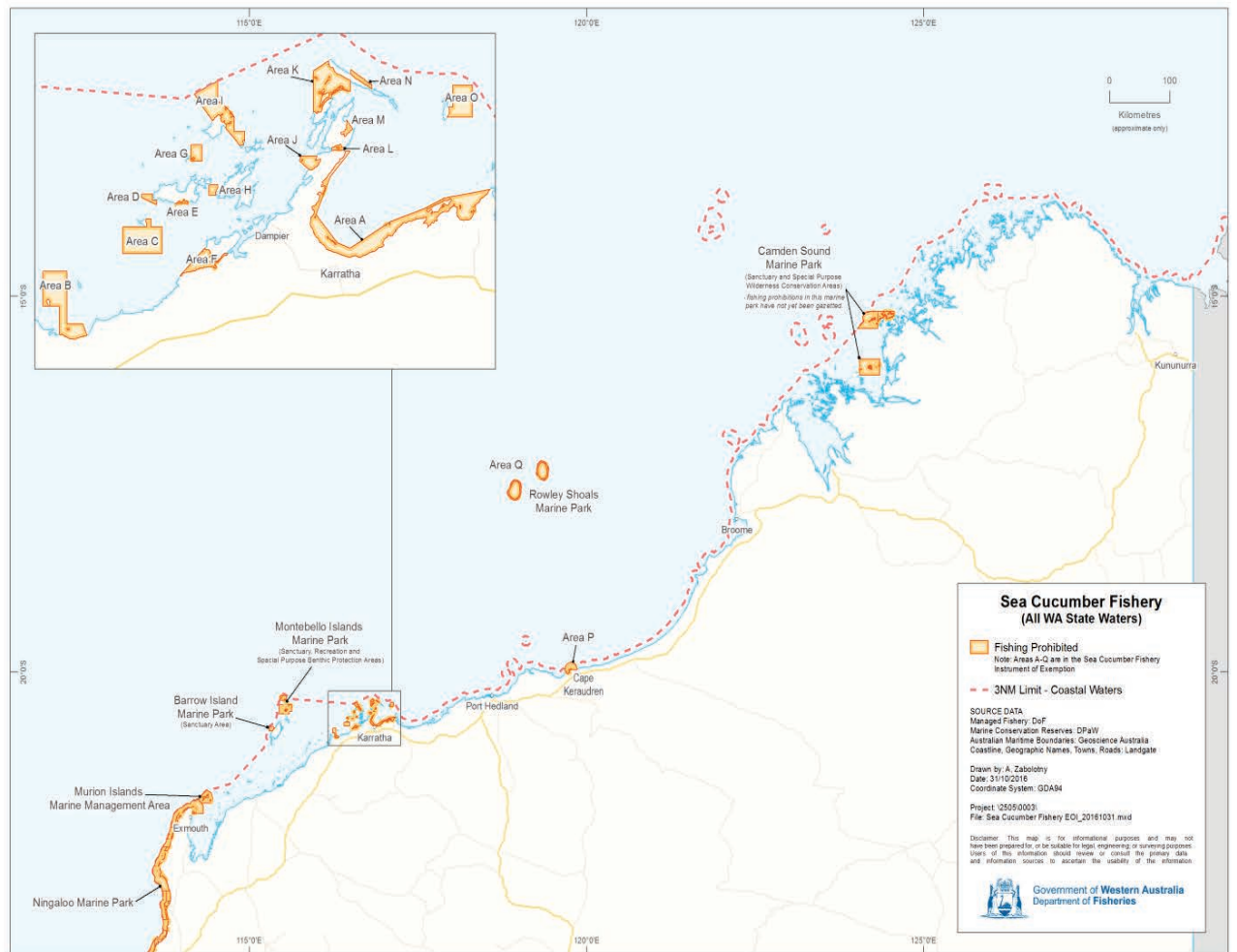
The method of fishing involves drift diving using hookah in small vessels <3m long known as dorys. Fishers operate using the one up one down method, one diver is in the water collecting sea cucumbers and the other remaining in the vessel steering its course. Diving is typically in water <5m deep. The divers and dorys return to the main vessel at the end of a day where the sea cucumbers undergo initial processing (Figure 2-1). This involves gutting, boiling and a short drying period before being frozen in blocks. Secondary processing occurs in Melbourne where sea cucumbers are dried and packaged before being exported as 'beche-de-mer' to Asian markets.



**Figure 2-1 Sea cucumber fishing vessel including tender (a) and diver (b).**

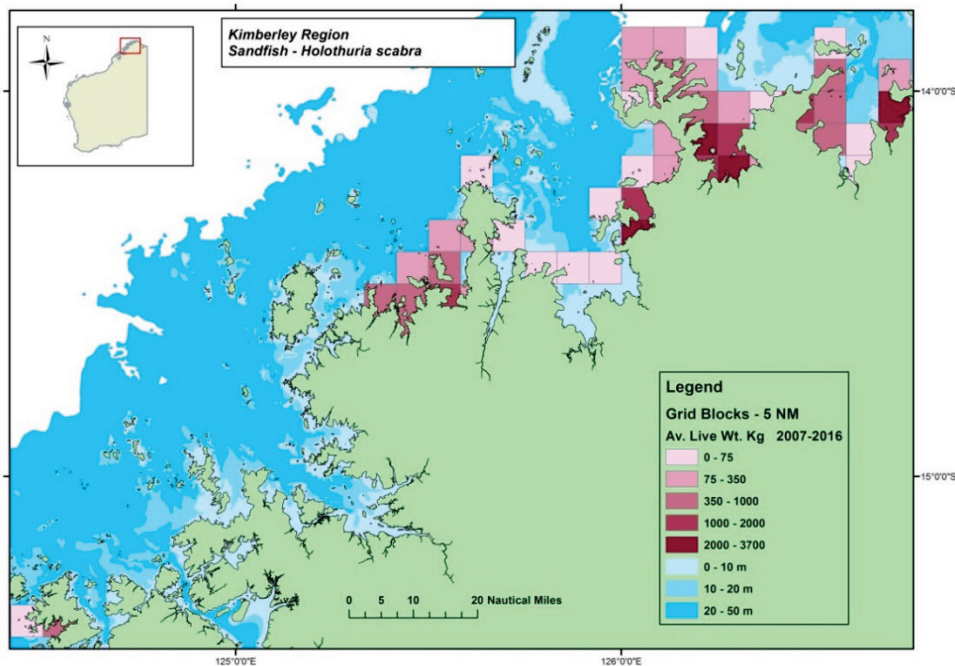
While the fishery is permitted to operate throughout WA waters, fishing only occurs in the North Coast Bioregion, from Exmouth Gulf to the Northern Territory border (Figure 2-2). Fishing generally takes place in shallow water during neap tides as strong currents and poor visibility outside of this timeframe render fishing impractical. The fishery is primarily a ‘pulse’ fishing operation whereby stocks are harvested periodically according to a rotational strategy. Sandfish aggregations are targeted at a number of specific locations in the Kimberley, on average for two to three trips of 14-20 days each per annum. Sandfish in Nickol Bay / Dampier Archipelago (Pilbara) have been targeted less frequently. Redfish, predominantly caught around Barrow / Lowendal / Montebello islands, is on average targeted for two months every third year (Figure 2-3 and Figure 2-4). These conditions have resulted in natural refuges for sea cucumbers and significant periods during which aggregations that are targeted by the fishery are left undisturbed.

Recreational and customary fishing on sea cucumbers is considered to be negligible (Henry and Lyle 2003).

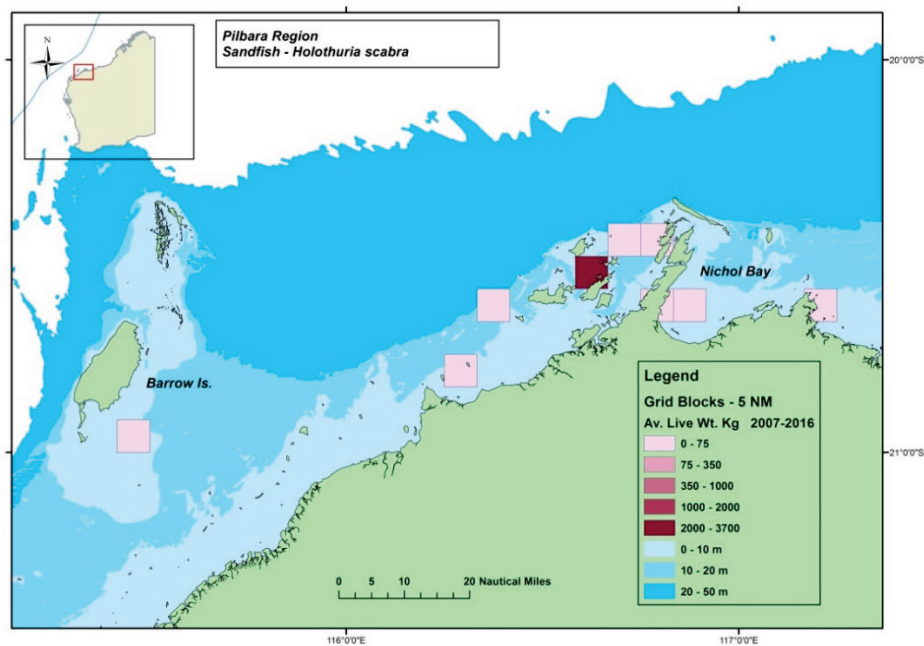


**Figure 2-2. Main fishing area with closures for the Western Australian Sea Cucumber Fishery**

a) Kimberley

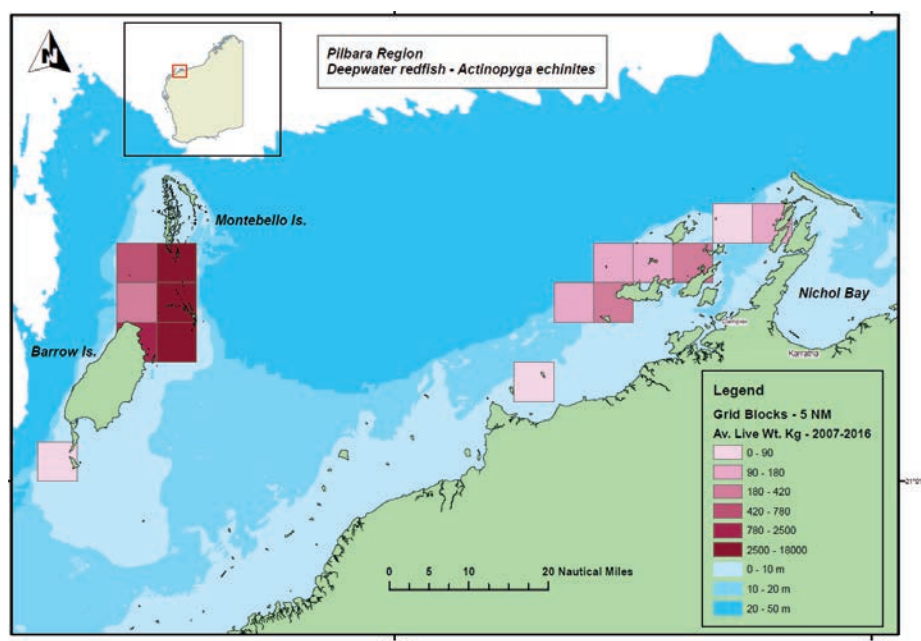


b) Pilbara



**Figure 2-3 Catch distribution for a) Kimberley and b) Pilbara sandfish depicted in 5 x 5 nm blocks for the 10 year period between 2007-2016**





**Figure 2-4 Catch distribution for Pilbara redfish depicted in 5 x 5 nm blocks for the 10 year period between 2007-2016**

## 2.1 Catches in the SCF

### 2.1.1 Retained species

The SCF primarily targets two species; sandfish and redfish which collectively compromise approximately 98% of the catch in the past five years (Table 2-1). The average landings of sandfish per is 36.3 t yr<sup>-1</sup> and redfish 12.7 t yr<sup>-1</sup> over the past five years. Catches of black teatfish was on average 0.9 t yr<sup>-1</sup> and catches of other species are negligible.

**Table 2-1 Retained catches of sea cucumber (live weight) reported in the SCF between 2012 and 2016.**

Common name	Species name	Retained catch (t)						
		2012	2013	2014	2015	2016	Average	% of total
Sandfish	<i>Holothuria scabra</i>	12.7	0.0	40.0	36.7	92.1	36.3	72.6
Redfish	<i>Actinopyga echinites</i>	0.0	0.0	61.7	0.0	1.6	12.7	25.3
Black teatfish	<i>Holothuria whitmaei</i>	0.0	0.0	4.7	0.0	0.0	0.9	1.9
Other species	-	0.0	0.0	0.4	0.0	0.0	0.1	0.1
<b>Total</b>		12.7	0.0	106.8	36.7	0.0	50.0	

## **2.2 Bycatch species**

The SCF is a highly selective fishery, with sea cucumbers collected by hand. Bycatch is extremely low and comprises undersize individuals or unwanted species. All bycatch is returned to the water immediately and survival is likely to be high.

## **2.3 Endangered, Threatened and Protected (ETP) species**

The SCF fishery operates in the same area as a number of ETP species including cetaceans, turtles, crocodiles, seabirds, and sea snakes. Fishers are required to report all ETP interactions through mandatory daily catch and effort log book returns. Logbook data are monitored monthly and analysed each year for annual reporting on the state of the fishery. There have been no reported interactions between ETP species and the SCF since the introduction of the current logbooks in 2007.

## **2.4 Habitat impacts**

The SCF has little interactions with the marine benthos. The vessels can potentially impact the benthos whilst anchoring, however, typically operators try to anchor in areas of sand. Operators in the fishery typically do not touch the bottom whilst diving, and wading occurs in sandy/muddy intertidal areas. Less than 5% of the catch is collected whilst wading.

## **2.5 Ecosystem impacts**

### **2.5.1 Role in sediments**

Sea cucumbers are deposit and detritus feeders, ingesting large amounts of sediment using their retractile tentacles from which they extract food. Gut contents are generally composed of bacteria, copepods, diatoms and other algae, molluscs, foraminiferans, sand and mud (Conand 1998).

Through their feeding activities sea cucumbers play an important ecological role in the upper sediment levels including nutrient cycling, bioturbation and oxygenation. These activities are known to increase the productivity of benthic micro-algae providing increased food resources for other species (Mangion et al. 2004, Purcell et al 2013, Uthicke 1999, Skewes et al. 2002, Uthicke and Klump 1998). In coral reef systems nutrient-recycling by sea cucumbers is likely to be a significant ecosystem function (Birkeland 1988).

### **2.5.2 Trophic role**

Whilst predation on adult sea cucumbers is rare, due to the presence of toxins, a number of sea cucumber species are consistently targeted by specialists, indicating that some predators depend on sea cucumbers for part of their dietary intake (Bakus 1968, 1973, see Francour 1997 for a review). It has also been suggested that juvenile sea cucumbers can be an important prey item in food webs (Purcell et al. 2013). For example, fish predators of juvenile *A. echinites* include scorpion fish, lion fish, groupers, lizard fish, trigger fish and puffer fishes (Wiedemeyer 1994).



### 2.5.3 Commercial impacts

The commercial collection of sea cucumbers may affect the ecosystem through interrupting the processes of sediment cycling and/or disrupting predator prey relationships. Assessments of the stock status for the key target species indicates that both are fished sustainably (Section 8.3) and it is therefore unlikely that commercial fishing disrupts ecosystem processes.

## 3 Other fisheries capturing sea cucumbers

### 3.1.1 Commercial fishing

#### 3.1.1.1 Marine Aquarium Fish Managed Fishery (MAFMF)

The MAFMF is permitted to collect Holothurians however catches are typically low (Table 3-1). Management arrangements specify that MAFMF is prohibited from taking six of the eight species which the SCF is legally permitted to catch, including sandfish and redfish.

**Table 3-1 Total number of sea cucumbers collected in the MAFMF between 2011 and 2015.**

Year	Total number sea cucumbers (all species)	Live weight estimate (assumption 0.5 kg)
2011	660	330
2012	351	175.5
2013	323	161.5
2014	469	234.5
2015	812	406.0

#### 3.1.1.2 Trawl fisheries

Sea cucumbers are caught as bycatch in WA's inshore trawl fisheries (e.g. Shark Bay, Exmouth Gulf, Onslow, Broome, Nickol Bay and Kimberly trawl fisheries). Data collected during trawl bycatch biodiversity programs conducted in Exmouth Gulf (2004) and Shark Bay (2002 and 2003) suggest that a number of sea cucumber species are caught as bycatch (Appendix 1), although in low numbers and typically species that are not retained by the SCF. The study also found no statistically significant differences for pooled data between trawled and un-trawled sites in Shark Bay, Exmouth Gulf and Onslow with respect to fish and invertebrate abundance, species richness, evenness or diversity (Kangas et al. 2007).

The Onslow, Kimberley and Nickol Bay trawl fisheries are much smaller than the Exmouth and Shark Bay trawl fisheries and little specific information is available on the bycatch composition of these fisheries. However, if a similar catch rate of sea cucumbers is assumed, the bycatch is likely to be between 500 and 2000 individuals per year for the Kimberley and Nickol Bay trawl fisheries and <500 individuals for the Onslow trawl fishery.

Sea cucumbers are discarded in all trawl fisheries and survival is likely to be high.

### **3.1.1.3 Indigenous commercial fishery**

Aboriginal communities have previously been granted a non-transferable exemption to fish for sea cucumbers for a commercial purpose. Instruments of Exemption are considered on a case by case basis. The current catch is considered negligible, however, the development of a policy (and ultimately Regulations) to provide for the grant of Aboriginal Body Corporate Licences for traditional species such as sea cucumbers is underway (Department of Primary Industries and Regional Development, in prep).

### **3.1.2 Recreational fishing**

Recreational take is capped by a daily bag limit of 10 individuals of ‘other [non-listed] molluscs and invertebrate species’. The recreational catch of sea cucumber in WA is negligible, the most recent estimate of the recreational annual harvest of ‘other taxa’ in WA (including sea cucumbers, sea urchins, cunjuvoi and ‘other non-fish’) was <1,000 animals (Henry and Lyle 2003). Note that this estimate is nominal and includes a range of organisms besides sea cucumbers.

### **3.1.3 Customary fishing**

Cultural take is uncapped and included under ‘allowances’ (as opposed to ‘allocations’) factored in when setting commercial and recreational allocations. The cultural take of sea cucumbers in WA is negligible – the total annual harvest for ‘non-fish – other’ (which includes sea cucumbers) in WA was estimated at 49 animals for the year surveyed (Henry and Lyle 2003).

## **4 Environmental context**

Sea cucumbers are widely dispersed within tropical WA and are commercially targeted mainly in shallow waters of the Kimberley and Pilbara regions of the North Coast Bioregion (NCB). The NCB has a unique combination of features that distinguish it from other marine regions around Australia, including a wide continental shelf, very high tidal regimes, high cyclone frequency, unique current systems, warm oligotrophic surface waters and unique geomorphological features (Brewer et al. 2007). Coastal waters are generally low-energy in terms of wave action, but are seasonally influenced by intense, tropical cyclones, storm surges and associated rainfall run-off. These cyclone events generate the bulk of the annual rainfall, although the Kimberley coast does receive limited monsoonal thunderstorm rainfall over summer.

The Kimberley coast is highly indented, with bays and estuaries backed by a hinterland of high relief. Broad tidal mudflats and soft sediments with fringing mangroves are typical of this area. The eastern Pilbara coast is more exposed than the Kimberley, with few islands and extensive intertidal sand flats. Western Pilbara is characterised by a series of significant, but low-relief islands, including the Dampier Archipelago, Barrow Island and the Montebello Islands. Nearshore coastal waters include rocky and coral reef systems, as well as areas of soft sediments, salt-marshes and mangrove communities. In addition to a diversity of corals, fish,

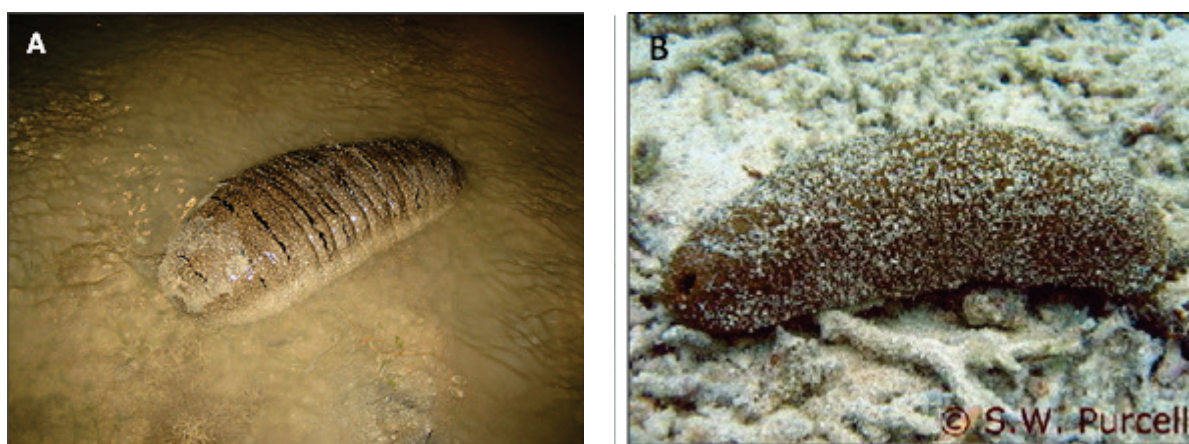
molluscs and other invertebrates, the nearshore waters of the NCB also have a number of ETP species, including cetaceans, dugong, marine turtles, sea snakes, crocodiles, syngnathids (seahorses and pipefish), sharks, rays and sea and shore birds.

## 5 Target species description

Sea cucumbers are soft-bodied, elongated animals of the Phylum Echinodermata (Class Holothuroidea) that grow to around 400 mm in length. They usually live with their ventral surface in contact with the benthic substrate or buried in the substrate and are classified as deposit and detritus feeders. The two main commercially retained species in WA, sandfish and redfish, are widely distributed on soft sediments throughout shallow waters of the Indo-Pacific region. In tropical WA, sandfish and redfish occur primarily within low energy environments behind fringing reefs or within protected bays (Figure 5-1).

The stock structures of the sandfish and redfish in WA have not yet been established, however, genetic studies of sandfish populations in Northern Territory and Queensland state waters have indicated genetically distinct stocks occur within these regions (Uthicke and Benzie 2001; Gardner and Fitch 2012). In view of these studies, and noting the existence of morphological differences between Pilbara and Kimberley sandfish, it is likely that genetically distinct stocks exist along the WA coast.

Sandfish can produce up to 18 million viable eggs and spawning can occur year round (Hamel et al. 2001), although the main spawning season occurs during September to November. In populations outside of WA, sexual maturity occurs at approximately 140 mm in length or two years of age. This species exhibits sexually dimorphic growth, with males maturing earlier than females (Hamel et al. 2001). Redfish can produce up to 25 million viable eggs and the size at maturity is approximately 120 mm (Conand 1993, Kohler et al. 2009).



**Figure 5-1. Targeted species in the SCF a) sandfish b) redfish**

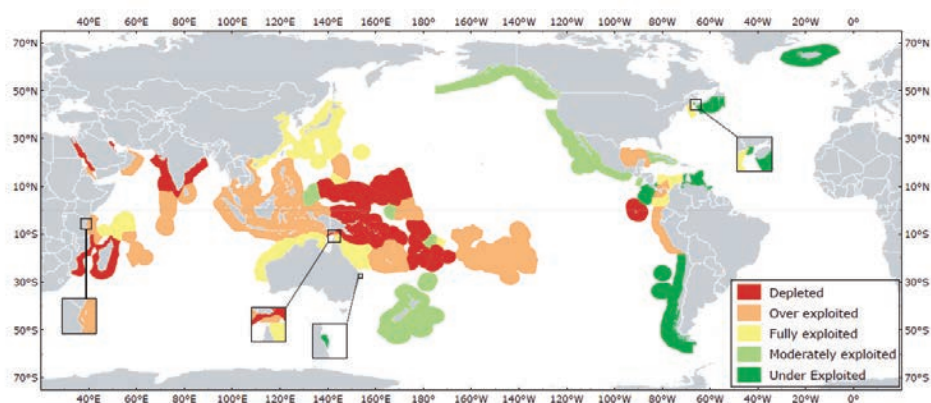
## 6 Conservation status of species caught in the SCF

Sea cucumbers are vulnerable to overfishing due to the following characteristics: slow growth; sessile nature; highly visible; shallow water habitation and patchy distribution. Many sea cucumber fisheries occur in developing countries where local communities depend on sea cucumbers for a source of protein and income, resulting in over exploitation. Furthermore, due to a lack of resources for effective management the problem of overfishing is further exacerbated (Kinch et al. 2008, Friedman et al. 2010, Purcell et al. 2013).

The Convention on International Trade in Endangered Species (CITES) is a multilateral treaty to protect endangered plants and animals. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of species in the wild and affords varying degrees of protection. Each protected species is included in one of three lists (called Appendices), which reflect the extent of the threat and controls that apply. Only one sea cucumber species (*Isostichopus fuscus*) is listed by CITES under Appendix III, for which there is no restriction on international trade (<https://www.cites.org/eng/app/appendices.php>). This species is not collected in the SCF.

The International Union for Nature Conservation (IUCN) Red List of Threatened Species is an international list providing information on species taxonomy, conservation status and distribution. In 2010, a comprehensive assessment of sea cucumbers was undertaken resulting in 16 species being classified as threatened. Six of the eight species which the SCF is licenced to collect, are listed on the IUCN Red List as either endangered or vulnerable (Table 6-1). The IUCN assessment is updated annually.

It is important to identify that IUCN classifications are based on the global status of species including developing countries where over exploitation is common. Sea cucumber populations on mainland Australia are not endangered or vulnerable and the IUCN assessments of these populations reflect this (Table 6-1). A recent independent assessment of sea cucumber fisheries on mainland Australia classified them as fully exploited, meaning that they were operating at or close to a maximum sustainable yield (Figure 6-1, Purcell et al. 2013). However, whilst sea cucumber populations on the mainland are considered stable, the Torres Strait Islands in far northern Australia are classified as over exploited (Conand et al. 2013a-g, Hamel et al. 2013, Purcell et al. 2013).



**Figure 6-1 Global status of sea cucumber fisheries in 2013 (Source Purcell et al. 2013)**

**Table 6-1 IUCN Conservation status of sea cucumbers in the SCF, with comments on Australian mainland populations as stated on the IUCN website**

Common name	IUCN conservation status	IUCN comments on mainland Australian populations
Sandfish	Endangered	Populations near mainland Australia are targeted but not considered to be overexploited (Hamel et al. 2013)
Redfish	Vulnerable	Populations of this species in Australia (10% of range) are collected but are mostly unknown (Conand et al. 2013d)
Black teatfish	Endangered	In the Great Barrier Reef, a fishing rate of 5% of the virgin biomass per year represented the depletion of breeding stocks. In Australia, this species is reduced by 80% in the Great Barrier Reef over the past few decades (Conand et al. 2013c)
White teatfish	Vulnerable	In Australia, this species is still fished and highly targeted, but the impact of fisheries on this species is not known (Conand et al. 2013e)
Prickly redfish	Endangered	No information published on website (Conand et al. 2013b)
Lollyfish	Least concern	No information published on website (Conand et al. 2013a)
Brown curryfish	Least Concern	No information published on website (Conand et al. 2013g)
Curryfish	Vulnerable	The status of populations in Australia (10% of range) are considered stable, as it is not collected here (Conand et al. 2013f)

## 7 Management

Sea cucumbers in Western Australia are currently targeted only by the commercial fishing sector. The recreational and customary harvest of this resource is considered to be negligible. These fishing sectors are managed by the Department under the following legislation:

- *Fish Resources Management Act 1994* (FRMA, will be replaced by Aquatic Resources Management Bill once enacted);
- *Fish Resources Management Regulations 1995* (FRMR);
- FRMA Section 43 Order No. 3 of 1999 – Prohibition on Fishing (Diving) Order;
- Notice No. 366 – Prohibition for commercial fishers to take fish of the classes *Gastropoda*, *Lamellibranchiata*, *Echinoidea*, *Asteroidea* and *Holothuroidea* unless the person has a licence authorising them to do so;
- FRMA Section 7 Exemption No 2920; and
- Commercial fishing and Fishing Boat Licences (and associated conditions).

Licence holders and fishers must also comply with the requirements of the:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC);
- *Western Australian Marine Act 1982*;
- Western Australian *Wildlife Conservation Act 1950*;
- Western Australian *Conservation and Land Management Act 1984*;
- Western Australian *Environmental Protection Act 1986*; and
- Any other legislation governing the use of the marine environment in which activities occur.

### 7.1 Management Measures

The FRMA provides the overarching legislative framework to implement the management arrangements for the WA SCF and any recreational catch. There are a number of management measures in place for the sea cucumber resource (Table 7-1) that help to achieve the management objectives.



**Table 7-1 Current management measures and instrument of implementation for the SCF**

Measure/Control	Description	Instrument
Limited Entry	Only six Fishing Boat Licence holders are permitted to take sea cucumbers for a commercial purpose (with each licenced fishing boat permitted to have no more than 4 dinghies)	<i>Section 7 Exemption from Notice 366 and Order No. 3 of 1999</i>
Species Restrictions	The SCF is limited to the collection of eight sea cucumber species.	<i>Section 7 Exemption</i>
Minimum size targets	Species-specific minimum target sizes have been established. 160 mm for sandfish ( <i>Holothuria scabra</i> ); 320 mm for white teat fish ( <i>Holothuria fuscogilva</i> ); 260 mm for black teat fish ( <i>Holothuria whitmaei</i> ); 300 mm for prickly red fish ( <i>Thelenota aranas</i> ); 120 mm for deep water red fish ( <i>Actinopyga echinitis</i> ); 150 mm for lolly fish ( <i>Holothuria atra</i> ); 280 mm for brown curry fish ( <i>Stichopus vastus</i> ) 280 mm for curry fish ( <i>Stichopus hermanni</i> ).	<i>Voluntary since March 2017</i>
Method Restrictions	Sea cucumbers can be taken by hand collection only.	<i>Section 7 Exemption</i>
Diver Restrictions	No more than 4 crew are permitted to dive for sea cucumbers at any one time on each Licenced Fishing Boat named on the Fishing Boat Licence.	<i>Section 7 Exemption</i>
Licence Requirements	Operators must hold a Commercial Fishing Licence and Fishing Boat Licence.	<i>FRMR 1995</i>
Spatial Restrictions	Fishing is prohibited within a 5 nm radius of Cape Keraudren, 2 nm radius of the Rowley Shoals and within the waters of the Abrolhos Islands Fish Habitat Protection Area. Fishing is not permitted in some zones of marine parks.	<i>Section 7 Exemption</i>
Notification prior to fishing	Fishers are required to advise the Department at least 6 hours prior to commencing fishing of details including the proposed place and time of landing fish <sup>1</sup>	<i>Section 7 Exemption</i>
Recreational bag limit	The daily bag limit for recreational catch is 10 sea cucumbers	<i>FRMR (Schedule 3, Part 6)</i>

<sup>1</sup> Note: This notification requirement will be replaced by the Vessel Monitoring System notification once the management plan is in force.

## 7.2 Harvest Strategy

The Department has developed a harvest strategy for the WA sea cucumber resource (Department of Primary Industries and Regional Development 2018). Harvest strategies establish the decision rules that seek to ensure appropriate levels of harvest to meet the ecological, economic and social objectives established for a resource (Department of Fisheries 2015). The development of a harvest strategy for the SCF is required under the new *Aquatic Resource Management Act* and also as a part of full assessment process for third party certification for sustainability under the Marine Stewardship Council (MSC) requirements.

Harvest strategies are based on performance indicators in relation to a set of reference levels that separates acceptable performance from unacceptable performance. For the SCF the reference levels are:

- a target level (where you want the indicator to be);
- a threshold level (where a review and/or adjustment to fishing arrangements is required); &
- a limit level (where you don't want the indicator to be)

Harvest strategies specifically articulate the values for the reference levels and the control rules define what management actions should occur in relation to the value of each indicator approaching or crossing the target, threshold or limit levels. Refer to the sea cucumber harvest strategy (Department of Primary Industries and Regional Development 2018) for more detail.

## 7.3 Compliance

The primary objective of the Department regarding compliance is to encourage voluntary compliance through education, awareness and consultation activities.

### 7.3.1 Operational Compliance Plans

Management arrangements are enforced under the Operational Compliance Plan (OCP) for the NCB. Each OCP is informed and underpinned by a compliance risk assessment conducted for each fishery. The OCPs have the following common objectives:

- To provide clear and un-ambiguous direction and guidance to Fisheries and Marine Officers for the yearly delivery of compliance in the fishery;
- To protect the fisheries' environmental values, while providing fair and sustainable access to the fishery's commercial and social values;
- To encourage voluntary compliance through education, awareness and consultation activities; and
- To provide processes which ensure that the fisheries are commercially viable in the international market yet environmentally sustainable in the local context.



### **7.3.2 Compliance Strategies for the SCF**

Compliance strategies and activities that are used in the fishery include:

- Land and sea patrols;
- Inspections of wholesale and retail outlets;
- Undertaking covert operations and observations;
- Inspections at fish processing facilities;
- Inspection in port;
- At-sea inspection of fishing boats;
- Aerial surveillance; and
- Intelligence gathering and investigations.

### **7.3.3 Industry Initiatives**

The SCF currently has an informal code of conduct involving rotation of fishing grounds to allow stock to rebuild after harvesting. This rotation is typically on three-year cycle.

## **8 Research and Monitoring**

### **8.1 Fishery-Dependent Information**

#### **8.1.1 Commercial Catch and Effort Reporting**

Monitoring of the fishery has occurred since the inception of the fishery in 1995, initially from mandatory monthly catch and effort returns, followed by daily reporting of catch and effort in fishers' "daily catch and effort logbooks" since 2007. The logbooks contain species-specific, fine-scale GPS location catch (number and weight) and effort (number of dives, duration or waded distance) data and appropriate environmental information, such as depth fished and protected species interactions. These commercial catch rates are used in assessments of the targeted sea cucumber stocks.

### **8.2 Fishery-Independent Information**

#### **8.2.1 Population Surveys**

Population surveys have been undertaken on a periodic basis over the history of the SCF. An experimental trial involving commercial fishers to evaluate abundance in two different areas was undertaken in 2004. It was found that the densities of sandfish recorded in Nickol Bay of the Pilbara region were five times greater than key fishing areas in the Kimberley region.

In addition, fishery-independent population surveys of redfish biomass were conducted in 2015 and will be repeated every five years to inform the biomass-based harvest strategy. The survey design is a stratified systematic survey design informed by fine scale GPS spatial information derived from the fishery logbooks.

## 8.3 Stock Assessments

### 8.3.1 Assessment Principles

The different methods used by the Department to assess the status of aquatic resources in WA have been categorised into five broad levels, ranging from relatively simple analysis of annual catches and catch rates, through to the application of more sophisticated analyses and models that involve estimation of fishing mortality and biomass (Fletcher and Santoro 2015). The level of assessment varies among resources and is determined based on the level of ecological risk, the biology and population dynamics of the relevant species, the characteristics of the fisheries exploiting the species, data availability and historical level of monitoring.

Irrespective of the types of assessment methodologies used, all stock assessments undertaken by the Department take a risk-based, weight-of-evidence approach (Fletcher 2015). This requires specifically the consideration of each available line of evidence, both individually and collectively, to generate the most appropriate overall assessment conclusion. The lines of evidence include the outputs that are generated from each available quantitative method, plus any qualitative lines of evidence such as biological and fishery information that describe the inherent vulnerability of the species to fishing.

#### 8.3.1.1 Assessment Overview

In overview, the assessment of the Kimberley sandfish, Pilbara sandfish and Pilbara redfish stocks are based on monitoring of catch, effort, catch distribution, trends in size-structure, fishery-dependent standardised catch rates (catch per unit effort, SCPUE) and fishery-independent biomass surveys. The key performance indicators (SCPUE for Kimberley sandfish and biomass estimates for Pilbara sandfish and redfish) are compared to the targets, thresholds, and limits as identified in the harvest strategy. If any of the reference points are breached the prescribed management action is implemented. Accompanying any management action is a review involving exploration of additional data including fine-scale fishing patterns and catch rates and trends in annual mean weights/size-frequency information.

Further details on stock assessments and the current status of target stocks are found in the *Resource Assessment Report for the WA Sea Cucumber Resource* (Hart et al. 2018).

## 8.4 Reports and Publications

The Department provides a comprehensive range of formal reports to stakeholders on annual fishery performance, including information on fishery outcomes, management, relevant findings and recommendations from research, monitoring, evaluation and review activities. This information is published and is publically available on the Department's website and includes:

- The *Annual Status Reports of the Fisheries and Aquatic Resources of Western Australia: The State of the Fisheries* (e.g. Fletcher and Santoro 2015).
- The Department's *Annual Report* to Parliament.

- The *Research, Monitoring, Assessment and Development Plan 2015 – 2020 Fisheries Occasional Publication No. 122.*

## 9 Risk Assessment Methodology

The Department has implemented an EBFM approach as the primary strategy to achieve the goal of ESD for fisheries in WA. EBFM deals with the aggregate management of all fisheries-related activities within an ecosystem or bioregion and takes into account the impacts of fishing on retained species, discarded bycatch species, protected species, habitats and the broader ecosystem — regarded as ‘ecological assets / components’ — and the social, economic and governance outcomes. In utilising a broad EBFM approach, managers are required to consider a wide and diverse set of issues.

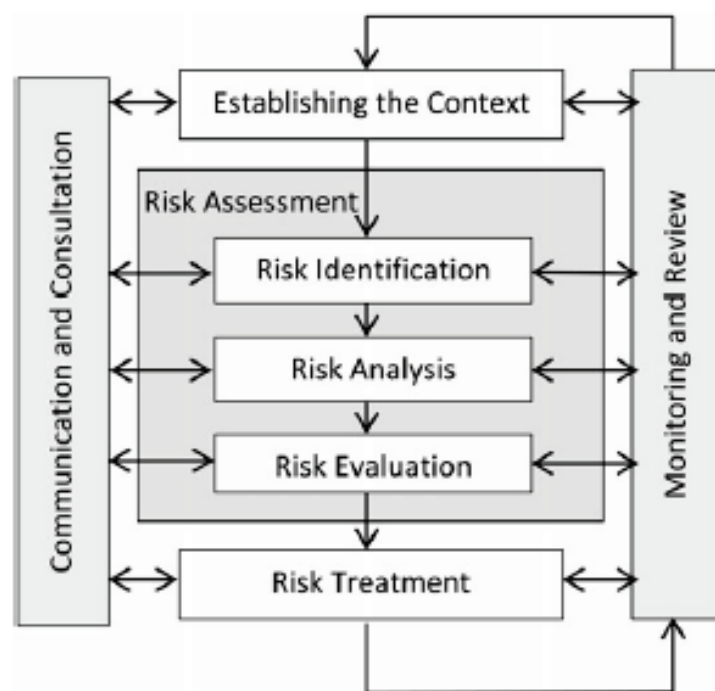
Risk assessments offer a means to filter and prioritise the various identified issues for management and have been used in fisheries management in Australia for over a decade (Fletcher et al. 2002). The risk analysis methodology utilised for the SCF risk assessment is based on the global standard for risk assessment and risk management (AS/NZS ISO 31000), which has been adopted for use in a fisheries context (see Fletcher et al. 2002, Fletcher 2005, 2015).

The risk assessment process which is an essential part of implementation of risk management is summarised in Figure 9-1. The first stage establishing the context or scope of the risk assessment – which includes which activities, stakeholders and geographical extent is covered, the objectives to be delivered, timeframe for the assessment and what is considered acceptable performance need to be established (Section 9.1).

Risk identification involves the process of recognising and describing risks, which involves the identification of risk sources and their causes (Section 9.2). Once the risks are identified they are scored by the risk analysis process. This process involves the examination of the sources of risk (issue identification), the potential consequences (impacts) associated with each issue and the likelihood (probability) of a particular level of consequence actually occurring (Section 9.3). The combination produces a risk score.

Risk evaluation is completed by comparing the risk score to established levels of risk. The risk evaluation step uses the risk levels to help make decisions about which risks need treatment.

Risk treatment involves addressing the issues with levels of risk which are considered undesirable. This involves identifying the likely monitoring and reporting requirements and associated management actions, which can either address and/or assist in reducing the risk to acceptable levels.



**Figure 9-1 Position of risk assessment within the risk management process (modified from SA 2012)**

## 9.1 Scope

This risk assessment covers commercial fishing for SCF. The geographical extent of the ERA is the management boundaries of the SCF (described in Section 1).

For the purpose of this assessment, risk was defined as *the uncertainty associated with achieving a specific management objective or outcome* (adapted from Fletcher 2015). The risk is different depending on the context. For a fisheries agency, ‘risk’ is the chance of something affecting the agency’s performance against the objectives laid out in their relevant legislation. In contrast for the commercial fishing industry, the term ‘risk’ generally relates to the potential impacts on their long term profitability. For the general community, ‘risk’ could relate to possible impact on their enjoyment<sup>2</sup> of the marine environment.

The aim for each of these groups is to ensure the ‘risk’ of an unacceptable impact is kept to an acceptable level.

The calculation of a risk in the context of a fishery is usually determined within a specified time frame, which, for the SCF the ERA is the next five years i.e. until November 2021.

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<sup>2</sup> Broader community values include non-extractive and non-direct uses

## 9.2 Issue identification (Component trees)

The first step in the ERA process is to identify the issues relevant to the fishery being assessed. This step is equivalent to the ‘hazard identification’ process used in most risk assessment procedures. Issues were identified using the assistance of the component tree approach (Fletcher et al. 2002).

Generic component trees have been established for of the main principles of ESD which include:

- Ecological sustainability — the impact of the SCF on ecological resources/assets;
- Community wellbeing — the contribution of the SCF to the fishing industry, local community and broader WA community in terms economic and social wellbeing;
- External factors — external environmental, social and economic drivers that impact the SCF performance; and
- Governance — management processes and arrangements that impact the SCF performance.

The identification of issues involves tailoring each of the trees to suite the individual circumstances of the fishery being examined, by adding/expanding some components and collapsing or removing others. For the SCF the development of the component trees with industry specific issues were based on:

- Previous risk assessments undertaken in the fisheries under the *EPBC Act 1999* to achieve approval for Wildlife Trade Operations.
- The Marine Stewardship Council (MSC) performance indicators (MSC 2014) and
- Consultation with industry and external stakeholders.

### 9.3 Risk Assessment Process and Reporting

The risk assessment process assists in separating minor acceptable risks from major, unacceptable risks and prioritising management actions. Once the components and issues were identified for the SCF, the process to prioritise each was undertaken using the ISO 31000-based qualitative risk assessment methodology. This methodology utilises a consequence-likelihood analysis, which involves the examination of the magnitude of potential consequences from fishing activities and the likelihood that those consequences will occur given current management controls (Fletcher 2015).

Consequence and likelihood analyses range in complexity; in this assessment used a 5 x 5 level system, with the consequence levels ranging from 1 (e.g. minor impact/consequence to fish stocks) to 5 (e.g. catastrophic consequences for fish stocks) and likelihood levels ranging from 1 ('remote', i.e. < 5 % probability) to 5 ('certain', i.e. > 90 % probability). Scoring involved an assessment of the likelihood that each level of consequence is actually occurring or is likely to occur within the next five years. Note that if an issue is not considered to have any measurable impact, it was considered to be a 0 consequence; however, this was only permitted where the likelihood of each other consequence level occurring was 0 (i.e. so remote that it is considered essentially impossible in the next five years). The scores for each of the consequence and likelihood levels was then be then multiplied to determine the risk score, i.e. Risk = the highest Consequence × Likelihood (Figure 9-2).

The ERA used a set of pre-defined consequence and likelihood levels (see Appendix 2). Different consequence tables were used in the risk analysis to accommodate for the variety of issues and potential outcomes. For example, the potential consequences of commercial fishing on ecological sustainability of retained species was be assessed using a Fish stocks consequence table where effects of the fishery on community well-being was be assessed using the Social consequence table.

The level of consequence was determined at the appropriate scale for the issue, e.g. for the retained species, the consequence of the SCF was be based at the stock / population level where as the ecosystem / environment was considered at a whole-of-system scale. In total 10 consequence tables were utilised in the assessment:

1. Fish stocks (retained/non-retained species) – measures at a stock level
2. ETP species measured at a population or regional level
3. Habitats – measured at a regional level
4. Ecosystem/Environment – measured at a regional level
5. Public reputation and image
6. Economic (measured at a regional or entire fishery level)
7. Safety and Health
8. Social
9. Community (Social Structures/Culture) – measured at a regional level
10. Operational Effectiveness

Appendix 3 identifies the different issues and consequences tables used to score each. The formal risk analysis was conducted by Departmental scientists and managers in internal workshop held in November 2016. The group at the workshop made a realistic estimate of the risk level for each issue, based on the combined judgement of the participants at the workshop, who collectively were considered to have appropriate expertise on the areas examined.

Based on the calculated score, each issue was assigned a Risk Assessment within one of five categories: Negligible, Low, Medium, High or Severe (Table 9-1). The rationale for classifying issues at each risk level was documented at the workshop and justification provided in this report. This allows all stakeholders and interested parties to see the rationale and Notes for the final Risk Assessments.

#### **9.4 Previous risk assessments**

In 2004 the SCF underwent a risk assessment as a part of the assessment for Wildlife Trade Operations under the *EPBC Act 1999*. A summary of the issues and risk scores from the previous risk assessment is provided in Appendix 4. The full report and risk assessment can be found on the DoE website at:

<http://www.environment.gov.au/topics/marine/fisheries/wa/beche-de-mer>.

		Likelihood				
		Remote (1)	Unlikely (2)	Possible (3)	Likely (4)	Certain (5)
Consequence	Minimal (1)	1	2	3	4	5
	Moderate (2)	2	4	6	8	10
	High (3)	3	6	9	12	15
	Major (4)	4	8	12	16	20
	Catastrophic (5)	5	10	15	20	25

**Figure 9-2 Standard Consequence — Likelihood Risk Matrix (based on AS 4360 / ISO 31000; adapted from Department of Fisheries 2015)**

**Table 9-1 Risk levels applied to all assets by the Department (modified from Fletcher 2005)**

Risk Category / Level	Description	Likely Reporting & Monitoring Requirements	Likely Management Action
1 Negligible	Acceptable; Not an issue	Brief Notes – no monitoring	Nil
2 Low	Acceptable; No specific control measures needed	Full Notes 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; Major changes required to management in immediate future	Recovery strategy and detailed monitoring	Increased management activities needed urgently



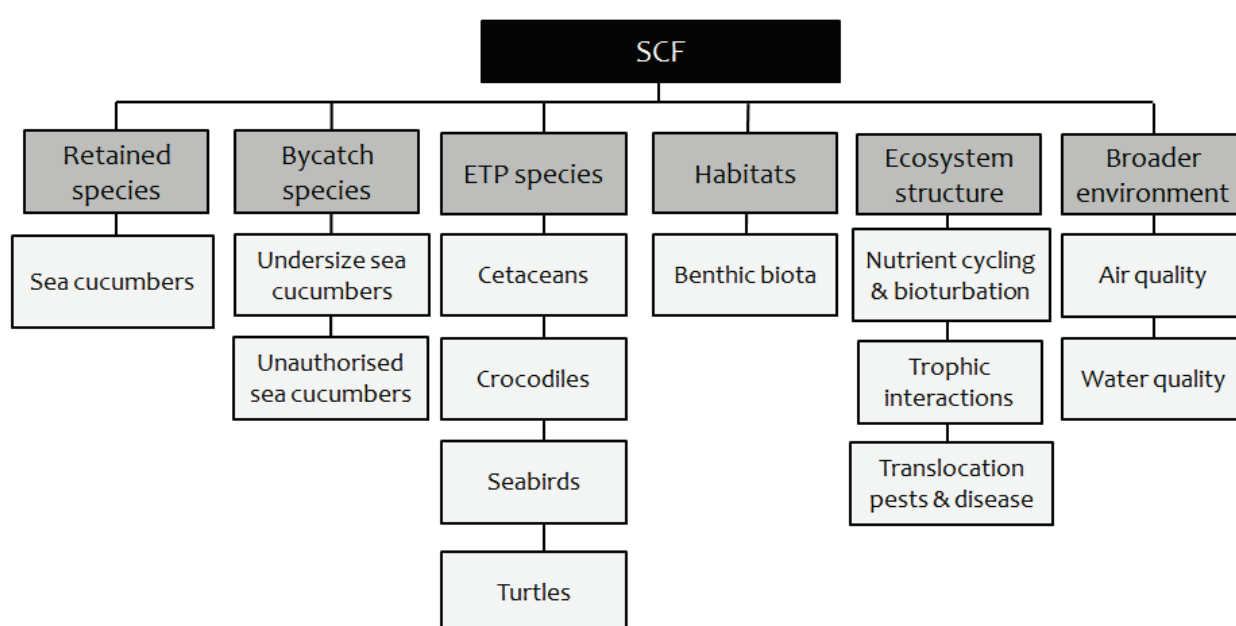
## 10 Risk Analysis

The risk analysis involved scoring each of the 54 identified issues in SCF across the four principles of ESD using the consequence x likelihood analysis.

### 10.1 Ecological sustainability

Six ecological components were identified as potentially impacted by SCF Figure 10-1 and Table 10-1.

There were 22 issues identified for how the SCF could impact on ecological processes. One issue was scored as medium risk with the remainder scored as either low or negligible risk (Table 10-1).



**Figure 10-1 Component tree for the ecological sustainability aspects of the SCF**

**Table 10-1 Overview table of Identified Issues, Objectives, Risk Scores and Assessed Risk rankings of the SCF may affect ecological sustainability**

Aspect	Fishery Objective	Component	Issues	Risk score	Risk rating
Retained Species	To maintain spawning stock biomass of <i>species</i> at a level where the main factor affecting recruitment is the environment	Sandfish (Kimberley)	Commercial fishing	See Hart et al. (2018)	MEDIUM
		Sandfish (Pilbara)	Commercial fishing		LOW
		Redfish (Pilbara)	Commercial fishing		LOW
		Black teat (Pilbara and Kimberley)	Commercial fishing	C4, L1 = 4	LOW
		Other sea cucumber species (Pilbara and Kimberley)	Commercial fishing	C1, L1 = 1	NEGLIGIBLE
Non retained species	To ensure fishing impacts do not result in serious or irreversible harm to bycatch (non-retained) species populations	Undersize sea cucumbers	Commercial fishing	C1, L1 = 1	NEGLIGIBLE
		Catches of unauthorised species	Commercial fishing	C1, L1 = 1	NEGLIGIBLE
ETP Species	To ensure fishing impacts do not result in serious or irreversible harm to ETP species' populations	Cetaceans	Boat strike	C1, L1 = 1	NEGLIGIBLE
			Entanglement in hookah lines	C1, L1 = 1	NEGLIGIBLE
		Crocodiles	Boat strike	C1, L1 = 1	NEGLIGIBLE
		Seabirds	Disturbance	C1, L1 = 1	NEGLIGIBLE
		Turtles	Boat strike	C1, L1 = 1	NEGLIGIBLE
			Entanglement in hookah lines	C1, L1 = 1	NEGLIGIBLE
Habitats	To ensure the effects of fishing do not result in serious or irreversible harm to habitat structure and function	Benthic biota	Anchor damage	C1, L1 = 1	NEGLIGIBLE
			Trampling from wading	C1, L1 = 1	NEGLIGIBLE
Ecosystem Structure	To ensure the effects of fishing do not result in serious or irreversible harm to ecological processes	Trophic Interactions	Nutrient cycling, bioturbation & oxygenation	C1, L1 = 1	NEGLIGIBLE
			Predator – prey interactions	C1, L1 = 1	NEGLIGIBLE
		Translocation of pests and/or disease	Vessel hulls	C5, L1 = 5	LOW
Broader Environment	To ensure the effects of fishing do not result in serious or irreversible harm to the broader environment	Air Quality	Exhaust	C1, L1 = 1	NEGLIGIBLE
		Water Quality	Debris/litter	C1, L1 = 1	NEGLIGIBLE
			Gut discards	C1, L1 = 1	NEGLIGIBLE

### 10.1.1 Retained Species

*Rationale for Inclusion:* Commercial fishing by the SCF may exert a significant impact on sea cucumber stocks.

#### **Risk Rating: Impact of SCF on spawning stocks of:**

- **Sandfish – Kimberley stock (MEDIUM)**
- **Sandfish – Pilbara stock (LOW)**
- **Redfish – Pilbara stock (LOW)**
- **Black teat fish - Kimberley and Pilbara stocks (C4, L1 = 4, LOW)**
- **Other sea cucumbers - Kimberley and Pilbara stocks (C1, L1 = 1, NEGLIGIBLE)**

#### *Justification*

##### *General:*

- Commercial fishing tends to occur in a few concentrated areas, where there are higher densities of target species. There are large areas where sea cucumbers occur in low densities which are not viable for commercial fishing.
- The high tidal ranges (12 m in the Kimberley and 6 m in the Montebello islands) limit fishing time. In addition, the fishing season is limited due to seasonal weather patterns.
- In recent years the stocks have been very lightly fished and current economic conditions are not optimal for fully utilising the available resource.
- There are only six licences in the fishery which are owned by single operator. The presence of only one operator makes communication and co-operation with management agencies easier.
- There are also a number of large marine protected areas within the Kimberley and Pilbara regions of WA which provide full protection to large areas of stock, e.g. the Camden Sound Marine Park, the Barrow Island Marine Park, and the Montebello Islands Marine Park.

#### *Sandfish (Kimberley)*

- The risk status of Kimberley sandfish was assessed as medium in the Sea Cucumber Resource Assessment Report (Hart et al. 2018). Different consequence and likelihood risk tables were used in the Resource Assessment Report (which uses a 4 x 4 matrix) compared to this ERA (5 x 5 matrix). The justification for the risk rating is provided in the Weight of Evidence Risk Assessment (Section 9.4.1) of the Resource Assessment Report.

### *Sandfish (Pilbara)*

- The risk status of Pilbara sandfish was assessed as low in the Sea Cucumber Resource Assessment Report (Hart et al. 2018). Different consequence and likelihood risk tables were used in the Resource Assessment Report (which uses a 4 x 4 matrix). The justification for the risk rating is provided in the Weight of Evidence Risk Assessment (Section 9.4.2) of the Resource Assessment Report.

### *Redfish (Pilbara)*

- The risk status of Pilbara redfish was assessed as low in the Sea Cucumber Resource Assessment Report (Hart et al. 2018). Different consequence and likelihood risk tables were used in the Resource Assessment Report (which uses a 4 x 4 matrix). The justification for the risk rating is provided in the Weight of Evidence Risk Assessment (Section 9.4.3) of the Resource Assessment Report.

### *Non target species*

- Catches of non-target species are extremely low, or negligible. Most of these species scored a negligible risk. Black teat fish scored slightly higher than all of the other non-target species due to slightly higher harvest of these species.

## **10.1.2 Bycatch Species**

*Rationale for Inclusion:* On occasion undersize sea cucumbers or unwanted species may be collected by mistake and returned to the water.

**Risk Rating: Impact of collecting (and returning) undersize species on sea cucumber stocks (C1, L1 = 1, NEGLIGIBLE)**

**Risk rating: Impact of collecting (and returning) incorrect species on sea cucumber stocks (C1, L1 = 1, NEGLIGIBLE)**

### *Justification*

- The impact of the SCF on undersize and non-target species was scored as negligible.
- The SCF is a hand harvest only and fishers are highly selective which catching sea cucumbers. Smaller and undersize individuals are avoided and only certain species are targeted.
- Any undersize individuals observed on the vessel are immediately returned to the water and the chances of survival are high.
- Under the current management arrangements only eight species can be collected in the SCF. The collection of non-authorised species is extremely rare as the species are easily distinguishable underwater.

### 10.1.3 Endangered, Threatened and Protected (ETP) Species

#### 10.1.3.1.1 Cetaceans

*Rationale for Inclusion:* The SCF operates in regions where whales and dolphins are common and there is the potential for interaction.

**Risk Rating: Impact of SCF on whale and dolphin populations through:**

- **Boat strike (C1, L1 = 1, NEGLIGIBLE)**
- **Entanglement (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The impact of the SCF on ETP species was scored as negligible
- The low number of boats, restricted fishing season and highly selective nature of fishing in the SCF reduces the risk of ETP interactions. The boats typically move at a slow rate reducing the chances of boat strike. There have been no recorded interactions between the SCF and ETP species.

#### 10.1.3.1.2 Crocodiles

*Rationale for Inclusion:* The SCF operates in Kimberley regions where crocodiles are common and there is the potential for interaction.

**Risk Rating: Impact of the SCF on crocodile populations through boat strike (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The impact of the SCF on ETP species was scored as negligible
- The low number of boats, restricted fishing season and highly selective nature of fishing in the SCF reduces the risk of ETP interactions. The boats typically move at a slow rate reducing the chances of boat strike. There have been no recorded interactions between the SCF and ETP species.

#### 10.1.3.1.3 Seabirds

*Rationale for Inclusion:* The SCF operates in regions where migratory seabirds occur and there is the potential for disturbance.

**Risk Rating: Impact of the SCF on seabird populations through disturbance (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The impact of the SCF on ETP species was scored as negligible

- The low number of boats, restricted fishing season and highly selective nature of fishing in the SCF reduces the risk of ETP interactions. There have been no recorded interactions between the SCF and ETP species.

#### 10.1.3.1.4 Turtles

*Rationale for Inclusion:* The SCF operates in regions where turtles occur and there is the potential for interaction.

#### **Risk Rating: Impact of the SCF on turtle populations through**

- **Boat strike (C1, L1 = 1, NEGLIGIBLE)**
- **Entanglement (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The impact of the SCF on ETP species was scored as negligible
- The low number of boats, restricted fishing season and highly selective nature of fishing in the SCF reduces the risk of ETP interactions. The boats typically move at a slow rate reducing the chances of boat strike. There have been no recorded interactions between the SCF and ETP species.

### 10.1.4 Habitats

#### 10.1.4.1 Benthic biota

*Rationale for Inclusion:* The SCF may impact on the marine benthos through anchoring or wading.

#### **Risk Rating: Impact of the SCF on the benthic biota through:**

- **Anchoring (C1, L1 = 1, NEGLIGIBLE)**
- **Wading (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The impact of the SCF on habitats was assessed as negligible.
- There are currently only two vessels operating in the fishery. The fishery operates by drift diving, with vessels only anchoring at night.
- Sandfish and redfish tend to be found in less sensitive habitat types such as sand or rubble. Divers tend not to touch the benthos and wading occurs in intertidal, sandy areas. Less than 5% of the total catch is collected through wading.

## 10.1.5 Ecosystem Structure

### 10.1.5.1 Trophic Interactions

#### 10.1.5.1.1 Removal of target species

*Rationale for Inclusion:* The removal of a species from the environment may alter the key elements of the local ecosystem including nutrient cycling, water quality and predator – prey interactions.

**Risk Rating: Impact of SCF on nutrient cycling and bioturbation (C1, L1 = 1, NEGLIGIBLE)**

**Risk Rating: Impact of SCF on predator prey interactions in the ecosystem (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The impact of the SCF on the ecosystem was assessed as negligible
- Sea cucumbers play an important ecological role in the upper sediment levels through nutrient cycling, bioturbation and oxygenation (Purcell et al. 2013).
- The low number of sea cucumbers removed is unlikely to disrupt the ecosystem.
- Predation on adult sea cucumbers is low due to the toxins present in their body.

#### 10.1.5.2 Introduction of Diseases, Pests, Pathogens or Non-Native Species

*Rationale for Inclusion:* Vessels in the SCF move between different areas for fishing which have the potential to translocate marine pests and/or disease.

**Risk Rating: Impact of introducing diseases, pests, pathogens or non-native species from SCF vessels/equipment on the ecosystem (C5, L1 = 5, LOW)**

*Justification:*

- The chances of and SCF vessel introducing a marine pest, the pest becoming established and affecting sea cucumber stocks was scored as low risk.
- The SCF vessel which comes from Darwin does not dock in the Darwin Port. This vessel utilises the Frances Bay Mooring Basin, commonly known as the Duck Pond and is only present for as long as it takes to unload the catch and replenish supplies. The vessel never spends long periods of time in the Darwin Port (which is when pests have the opportunity to become established). Larger international vessels use a different part of the Darwin port and are required to undergo a hull pest inspection.
- The second vessel in the fishery is from Karratha.
- Both vessels in the fishery have their hulls cleaned regularly. Neither vessel uses ballast water.

### 10.1.5.3 Broader Environment

#### 10.1.5.3.1 Air quality

*Rationale for Inclusion:* Boats which operate in the SCF utilise fuel and emit exhaust fumes.

**Risk Rating: Impact of fuel use and/or exhaust from fishing vessels on regional air quality in the SCF (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The impact of the SCF on air quality was assessed as negligible
- The fishery currently only has two operating vessels, which operate for a few months per year.

#### 10.1.5.3.2 Water quality

*Rationale for Inclusion:* The operation of fishing vessels may reduce water quality through rubbish or debris. Sea cucumbers are processed onboard, with the gut discarded overboard.

**Risk Rating: Impact of rubbish from the SCF on water quality (C1, L1 = 1, NEGLIGIBLE)**

**Risk Rating: Impact of SCF on water quality through discarding gut content during processing (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

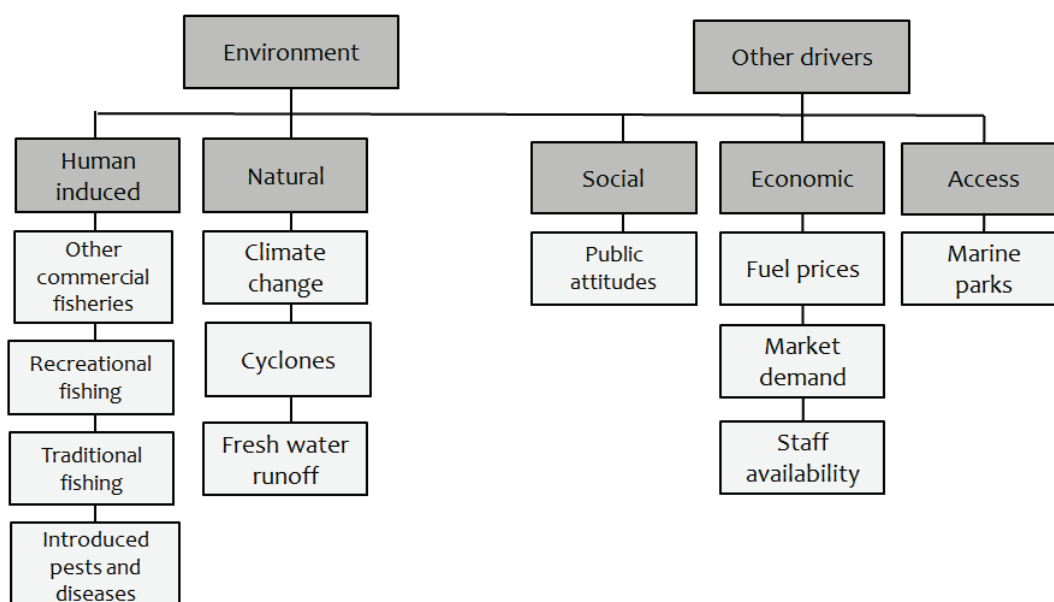
- The impact of the SCF on water quality was assessed as negligible
- All rubbish is stowed during fishing trips and disposed of on return to land with all vessels abiding by the International Convention for Prevention of Pollution from Ships (MARPOL).
- The vessel anchors at different locations each night, depending where fishing has occurred. The discarding of sea cucumber guts is not localised to one particular area.



## 10.2 External factors

Five external factor components were identified as potentially impacting the SCF industry performance (Figure 10-2).

There were fifteen external issues identified which may affect the SCF, the majority were scored as negligible or low risk, and three were scored as high risk Table 10-1.



**Figure 10-2 Component tree for external drivers that may impact on the SCF industry performance**

**Table 10-2 Overview table of Identified Issues, Objectives, Risk Scores and Assessed Risk rankings for external factors affecting the SCF**

<b>Component</b>	<b>Sub-Component</b>	<b>Issues</b>	<b>Risk Score</b>	<b>Risk Rating</b>
Environment: Human-Induced Changes	Removal of fish by people outside of the SCF	Marine Aquarium Managed Fishery	C1, L1 = 1	NEGLIGIBLE
		Trawl Fisheries	C1, L1 = 1	NEGLIGIBLE
		Commercial indigenous fishing	C1, L1 = 1	NEGLIGIBLE
		Recreational fishing	C1, L1 = 1	NEGLIGIBLE
		Traditional fishing	C1, L1 = 1	NEGLIGIBLE
	Introduction / spread of diseases and pests	Commercial ships	C5, L1 = 5	LOW
		Recreational boats	C3, L1 = 3	LOW
Environment: Natural/Climate	Water temperatures	Water temperature	C2, L2, = 4	LOW
	Cyclones	Cyclones	C2, L2, = 4	LOW
	Fresh water run off	Fresh water runoff	C1, L1 = 1	NEGLIGIBLE
Social Drivers	Public Attitudes	Public attitude	C1, L1 = 1	NEGLIGIBLE
Economic Drivers	Fuel Prices	Fuel prices	C3, L4 = 12	HIGH
	Market Demand	Market Demand	C1, L1 = 1	LOW
	Staff availability	Staff availability	C3, L4 = 12	HIGH
Access	Marine Protected Areas	Marine Protected Areas	C5, L3 = 15	HIGH

## 10.2.1 Environment

### 10.2.1.1 Human-Induced Changes

#### 10.2.1.1.1 Marine Aquarium Fish Managed Fishery

*Rationale for Inclusion:* The commercial Marine Aquarium Fish Managed Fishery (MAFMF) may significantly affect the breeding stocks of targeted species in the SCF

**Risk Rating: Impact of MAF on the breeding stocks of targeted species in the SCF. (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The impact of the collections by the MAFMF on the stocks of sea cucumbers targeted by the SCF was classified as negligible.
- Management arrangements prohibit the MAFMF from collecting six of the eight species in the SCF, including the target species. The MAFMF is permitted to collect sea cucumbers, however collections are typically low and have been <800 annually over the past five years.

#### 10.2.1.1.2 Trawl fisheries

*Rationale for Inclusion:* Sea cucumbers caught as bycatch in trawl fisheries may significantly affect the breeding stocks of targeted species in the SCF

**Risk Rating: Impact of trawl fisheries on the breeding stocks of targeted species in the SCF. (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The impact of trawl fisheries on sea cucumbers as bycatch was assessed to be negligible.
- A bycatch study on WA's two biggest trawl fisheries, Shark Bay and Exmouth Gulf trawl found that none of the SCF species were captured. Furthermore, the study found no significant differences in the abundance or biodiversity of invertebrates between trawled and untrawled areas (Kangas et al. 2006).
- The Nickol Bay trawl fisheries, has low catches of sandfish (Kangas per comm 2016.)
- Bycatch is returned to the water almost immediately and survival of sea cucumbers is thought to be high (Kangas et al. 2006).

#### 10.2.1.1.3 Commercial indigenous fishing

*Rationale for Inclusion:* Commercial fishing by indigenous communities may significantly affect the breeding stocks of targeted species in the SCF

**Risk Rating: Impact of commercial indigenous fishing on the breeding stocks of targeted species in the SCF. (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The commercial fishing by indigenous groups is negligible.
- There are several applications for Aboriginal Body Corporate Licences currently lodged. Commercial catches by indigenous groups is likely to increase in the future.

10.2.1.1.1.4 Recreational fishing

*Rationale for Inclusion:* Recreational fishing may significantly affect the breeding stocks of targeted species in the SCF

**Risk Rating: Impact of recreational fishing on the breeding stocks of targeted species in the SCF. (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- Recreational fishing for sea cucumbers is negligible.

10.2.1.1.1.5 Traditional fishing

*Rationale for Inclusion:* Indigenous fishing from traditional owners boats may significantly affect the breeding stocks of targeted species.

**Risk Rating: Impact of traditional fishing on the breeding stocks of targeted species in the SCF (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- Customary fishing for sea cucumbers is negligible.

10.2.1.1.1.6 Introduction of pests and diseases

*Rationale for inclusion:* The movement of commercial ships and recreational vessels could result in the introduction of and spread of pests and diseases which has the potential to affect the breeding stocks of species targeted in the SCF.

**Risk Rating: Impact of introduction of pests and diseases on the breeding stocks of targeted species in the SCF from:**

- Commercial ships (C5, L1 = 5, LOW)
- Recreational vessels. (C3, L1 = 3, LOW)

*Justification:*

- The potential for commercial and recreational vessels introducing a pest, which becomes established and impacts upon sea cucumber stocks was assessed to be either low or negligible risk.
- The Department maintains an active surveillance program for pests and diseases in WA ports classified to be at high risk, which are Fremantle, Dampier and Port Headland. There is also a passive surveillance program throughout WA, actively investigating any reports of abnormal mortalities, which are backed up by emergency response capability in the areas of both aquatic pests and diseases.
- A Departmental incident response manual has been developed, which details protocol associated with emergency biosecurity response. The Department is equipped with state-of-the-art diagnostic laboratories and capability. It participates in nationally-coordinated proficiency testing programs and is accredited to ISO17025 for both pest identification and pathogen identification.

### **10.2.1.2 Natural Changes**

#### **10.2.1.2.1 Water Temperature**

*Rationale for Inclusion:* Water temperature significantly affects biology and survival of marine organisms including sea cucumbers.

**Risk Rating: Impact of increased water temperature on the breeding stocks of targeted species in the SCF. (C2, L2 = 4, LOW)**

*Justification:*

- Changes in water temperature have not been known to noticeably affect sea cucumber stocks in WA
- Sea cucumber species are tropical species and a warming trend is less likely to have negative impact.
- There is currently little data from which the likely impacts on sea cucumbers and preferred shallow water habitats in WA can be estimated, but there is some evidence to support the idea that sea cucumbers are not among the most susceptible of organisms to ocean acidification (e.g. Dupont et al. 2010) and increased water temperatures.

#### **10.2.1.2.2 Cyclones**

*Rationale for Inclusion:* The marine environment including the target species can be significantly affected by cyclones.

**Risk Rating: Impact of cyclones on the breeding stocks of targeted species in the SCF. (C2, L2 = 4, LOW)**

*Justification:*

- Cyclones regularly occur on the WA coast and have not been known to affect sea cucumber stocks.
- The occasional strong cyclone i.e. Category 5 also passes through the northern bioregion but has not been known to affect sea cucumber stocks.

#### 10.2.1.2.3 Freshwater runoff

*Rationale for Inclusion:* Low salinity i.e. fresh water runoff can cause high sea cucumber mortality.

**Risk Rating: Impact of freshwater runoff on the breeding stocks of targeted species in the SCF. (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- High sea cucumber mortalities have been observed in the Northern Territory associated with freshwater runoff. Whilst this has not been observed in WA, there is the potential for this to occur.

### 10.2.2 Social drivers

#### 10.2.2.1 Public attitudes

*Rationale for Inclusion:* Community attitudes and perceptions can have a significant influence on the SCF.

**Risk Rating: Impact of community attitude on fishery performance in the SCF. (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The SCF operates offshore and is not highly visible to the public. Most members of the public are not aware of the fishery and know little about sea cucumbers.

### 10.2.3 Economic drivers

#### 10.2.3.1 Fuel prices

*Rationale for Inclusion:* Changes in fuel prices can significantly affect the operating costs and profits of the fishery.

**Risk Rating: Impact of fuel prices on fishery performance in the SCF. (C3, L4 = 12, HIGH)**

*Justification:*

- The fishing grounds are remote and vessels travel large distances, especially those coming from Darwin. Fuel is one of the major costs of operations and any increases in the prices will affect profit margins.

### 10.2.3.2 Market demand

*Rationale for Inclusion:* Market demand for fish can be affected by a range of factors such as the global financial crisis and competition from other fish products.

**Risk Rating: Impact of market demand on fishery performance in the SCF. (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The market demand for sea cucumbers is very strong, with much greater demand than supply. It is unlikely that market demand will decrease in the next five years.

### 10.2.3.3 Staff availability

*Rationale for Inclusion:* The availability of staff can affect the operations of the SCF.

**Risk Rating: Impact of staff availability on fishery performance in the SCF. (C4, L3 = 12, HIGH)**

*Justification:*

- During the WA mining boom it was very difficult to find staff. The fishery had to stop operations for a period due to lack of staff.
- Due to the inherent dangers in diving for sea cucumbers (sharks, crocodiles and stingers) it can be difficult to find divers.

## 10.2.4 Access

### 10.2.4.1 Marine Protected Areas

*Rationale for Inclusion:* The SCF is not permitted to operate in certain management zones within state and Commonwealth marine parks.

**Risk Rating: Impacts of closed areas and marine parks on fishery performance in the SCF (C5, L3 = 15).**

*Justification:*

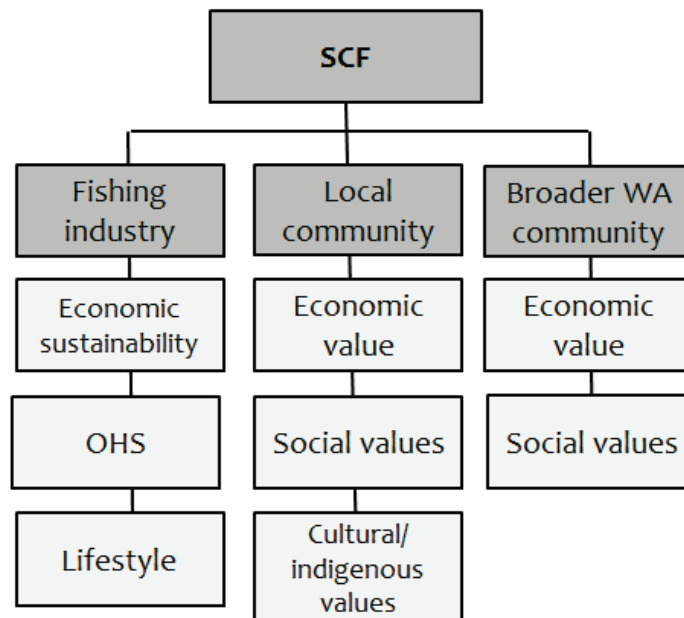
- The impact of restricted access in marine parks was ranked as high risk.
- Commercial and recreational fishing is prohibited in the sanctuary zones of the marine protected areas. There are a number of marine protected areas within the Kimberley and Pilbara regions of WA: the Camden Sound, Eighty Mile Beach, Roebuck Bay, Horizontal Waterfalls, North Kimberley, Barrow Island and the Montebello Islands Marine Parks.
- A significant proportion of the redfish (*A. echinites*) stock is contained within sanctuary zones of the Montebello Islands marine park and whilst fishers have expressed interest in accessing these stocks, but this has not been permitted.

- The Kimberley area which covers the entire northern end of the Kimberley. The zoning of this park has only recently been confirmed.
- While the SCF has preferred fishing grounds, there are still large areas of unexplored waters with the potential for commercial sea cucumber fishing. New fishing grounds are still being discovered and sanctuary zones maybe declared in potentially productive fishing grounds.

### 10.3 Community Wellbeing Aspects

The SCF could potentially affect the fishing, local and broader WA communities. Three components were identified as potentially impacted by SCF operations (Figure 10-3).

The effects of the SCF community wellbeing were assessed for risk under three broad categories. All of the issues scored were low or negligible risk (Table 10-3).



**Figure 10-3 Component Tree for community wellbeing aspects of the SCF**



**Table 10-3 Overview table of Identified Issues, Objectives, Risk Scores and Assessed Risk rankings of the GSDMF may affect community wellbeing**

Component	Fishery Objective	Sub-Component	Issues	Risk score	Risk rating
Fishing Industry	To provide flexible opportunities to ensure fishers can maintain or enhance their livelihood, within the constraints of ecological sustainability	Economic Sustainability	Fisher Income	C2, L2 = 4	LOW
			Fisher Employment	C2, L2 = 4	LOW
		Occupational Health and Safety	Working Environment	C2, L2 = 4	LOW
		Lifestyle Benefits	Lifestyle	C1, L1 = 1	NEGLIGIBLE
Local Community	To contribute to local community well-being, lifestyle and cultural needs	Economic Values	Economic value	C2, L3 = 6	LOW
		Social Values	Social value	C2, L2 = 4	LOW
		Cultural / Indigenous values	Cultural/indigenous values	C1, L1 = 1	NEGLIGIBLE
Broader WA Community		Economic Value	Economic value	C1, L1 = 1	NEGLIGIBLE
		Social Values	Social value	C1, L1 = 1	NEGLIGIBLE

## 10.3.1 Fishing Industry

### 10.3.1.1 Economic stability

#### 10.3.1.1.1 Fishing Industry

*Rationale for Inclusion:* The SCF provides a source of income to licence holders and fishers.

**Risk Rating: Contribution of the SCF as a source of income for licence holders and fishers (C2, L2 = 4, LOW)**

*Justification:*

- The fishery is well managed and sustainable and is unlikely to change in the next five years. Income from the fishery is likely to remain stable.
- The SCF currently only operates for a few months of the year, most fishers do not dependent on the SCF exclusively as a source of income.

#### 10.3.1.1.2 Fisher Employment

*Rationale for Inclusion:* The SCF provide a source of employment to licence holders and deck hands.

**Risk Rating: Contribution of the SCF source of employment to income for licence holders and deckhands (C2, L2 = 4, LOW)**

*Justification:*

- The fishery is well managed and sustainable and is unlikely to change in the next five years. Employment in the fishery is likely to remain stable.
- The SCF currently only operates for a few months of the year, most fishers do not dependent on the SCF exclusively as a source of employment.

### 10.3.1.2 Occupational Health and Safety

*Rationale for Inclusion:* Working in the SCF can result in injury.

**Risk Rating: Contribution of the SCF to a safe working environment (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- There are relatively few injuries in the SCF, with most resulting in minor first aid only.

### 10.3.1.3 Lifestyle benefits

*Rationale for Inclusion:* SCF affords certain lifestyle benefits such working at sea, living in regional areas and independence.

**Risk Rating: Contribution of the SCF to lifestyle benefits (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- Working on the SCF vessels can be challenging. The vessels are at sea for weeks at a time. The SCF does not offer significant lifestyle benefits and most fishers also have other employment.

### 10.3.2 Local Community

#### 10.3.2.1 Economic values

*Rationale for Inclusion:* The SCF contributes to the economic value of local communities.

**Risk Rating: Contribution of the SCF to the economic value of the local community (C2, L3 = 6, LOW)**

*Justification:*

- The SCF is a small fishery, with a low GVP. There is one WA based vessel, which employs local staff and procures supplies locally, providing some economic stimulus to local communities.

#### 10.3.2.2 Social values

*Rationale for Inclusion:* The SCF may impact on the local community.

**Risk Rating: Contribution of the SCF to social values of the local community (C2, L2 = 4, LOW)**

*Justification:*

- The SCF is a small fishery which employs a few local staff. The SCF operates offshore and has low social value to the local community.

#### 10.3.2.3 Cultural/Indigenous values

**Risk Rating: Contribution of the SCF to cultural and indigenous values of the local community (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- Sea cucumbers do not have high cultural values to indigenous communities.
- Aboriginal communities have previously been granted a non-transferable exemption to fish for sea cucumbers for commercial purposes. The granting of these

authorisations is considered on a case by case basis. The current catch is considered negligible.

### **10.3.3 Broader WA**

#### **10.3.3.1 Economic Value**

**Risk Rating: Contribution of the SCF to economic value of the broader community (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The SCF is a small fishery, with a low GVP, with a negligible contribution to the state economy.

#### **10.3.3.2 Social Values**

**Risk Rating: Contribution of the SCF to social values of the broader community (C1, L1 = 1, NEGLIGIBLE)**

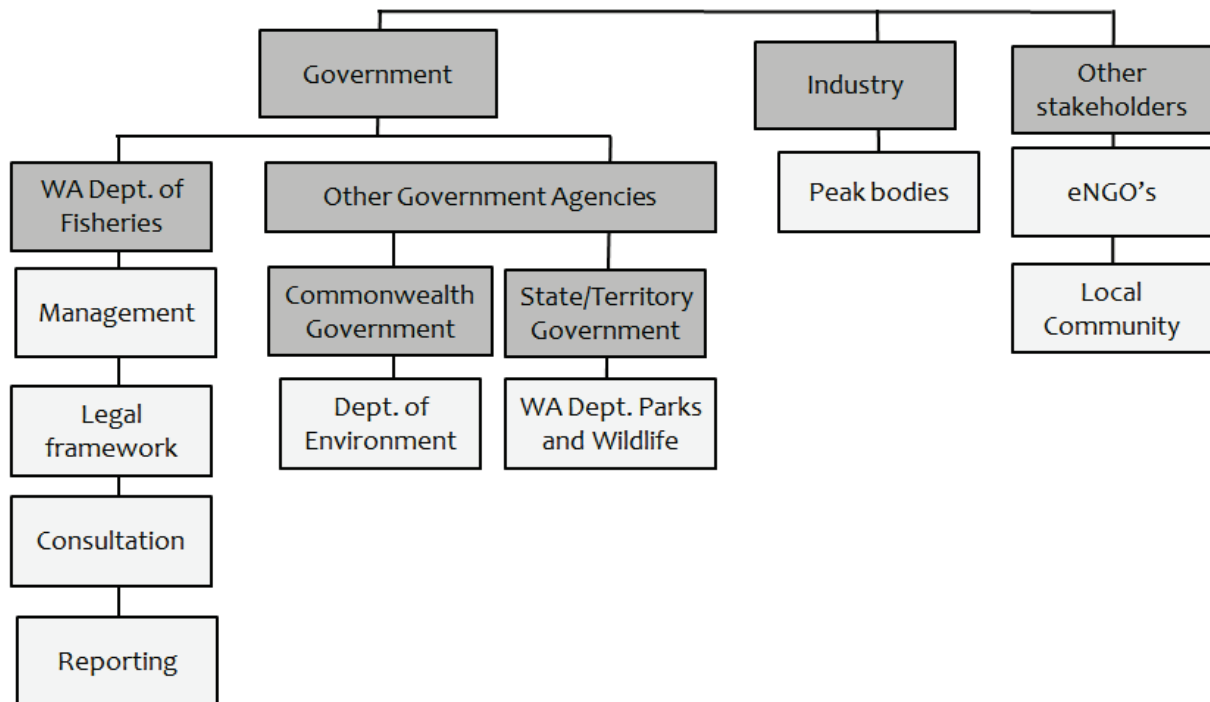
*Justification:*

- The SCF is a small fishery which operates offshore, with low social value to the state.

### **10.4 Governance**

Three main aspects of governance were identified as potentially impacting SCF performance: government agencies, industry and other stakeholders. A number of sub-components were identified within each of the three areas (Figure 10-4 and Table 10-4)

There were 10 issues assessed for how governance may affect the SCF; the majority were scored as negligible risk, with one scored as medium risk and three as high risk (Table 10-4).



**Figure 10-4 Component tree for governance aspects of the SCF**

**Table 10-4 Overview table of Identified Issues, Objectives, Risk Scores and Assessed Risk rankings for governance factors affecting the SCF**

Component	Fishery Objective	Sub-component	Issues	Risk score	Risk rating
Department of Fisheries	To ensure ESD principles are underpinned by legal, institutional, economic and policy frameworks capable of responding and taking appropriate peremptory and remedial actions.	Management	Effectiveness of management system	C3, L4 = 12	HIGH
		Legal Framework	Effectiveness of Fisheries Legal Framework	C3, L4 = 12	HIGH
		Consultation	Effectiveness of consultation	C1, L1 = 1	NEGLIGIBLE
		Reporting	Effectiveness of Reviews / Audits	C1, L1 = 1	NEGLIGIBLE
Other Government Agencies:	To ensure ESD principles are underpinned by legal, institutional, economic and policy frameworks capable of responding and taking appropriate peremptory and remedial actions.	DotE (Commonwealth)	Effectiveness of Consultation Processes	C1, L1 = 1	NEGLIGIBLE
		DPAW (State)	Effectiveness of Consultation Processes	C3, L4 = 12	HIGH
Peak bodies	To ensure ESD principles are underpinned by legal, institutional, economic and policy frameworks capable of responding and taking appropriate peremptory and remedial actions.	Peak bodies (WAFIC)	Effectiveness of Consultation Processes	C1, L1 = 1	NEGLIGIBLE
		Peak bodies (Recfishwest)	Effectiveness of Consultation Processes	C1, L1 = 1	NEGLIGIBLE
Other Stakeholders	To ensure ESD principles are underpinned by legal, institutional, economic and policy frameworks capable of responding and taking appropriate peremptory and remedial actions.	eNGOs	Effectiveness of Consultation Processes	C2, L4 = 8	MEDIUM
		Local Community	Effectiveness of Consultation Processes	C1, L1 = 1	NEGLIGIBLE

## 10.4.1 Government: WA Department of Fisheries

### 10.4.1.1 Management

*Rationale for Inclusion:* The *FRMA 1994* and the *FRMR 1995* are the primary instruments for the management of the SCF in WA. The Fisheries Management Act also provides for the creation of subsidiary legislation in the form of Regulations, Management Plans, Notices, leases and licences (with conditions).

**Risk Rating: Effectiveness of the management system on the SCF (C3, L4 = 12, HIGH)**

*Justification:*

- Whilst a management plan has been drafted for the SCF it has not been finalised and is still not in place.

### 10.4.1.2 Legal Framework

*Rationale for Inclusion:* The legal framework includes Fisheries legislation, access rights and quota allocation among users, as well as Offshore Constitutional Settlement (OCS) arrangements with the Commonwealth government.

In 2010, the (then) Minister for Fisheries directed the Department to review the existing legislation and scope the requirements for a new WA Act of Parliament to ensure the sustainable development and conservation of the state's aquatic resources into the future. As a result the Aquatic Resource Management Act (currently before parliament as the *Aquatic Resource Management Bill 2015*<sup>3</sup>) was drafted and provides an innovative legislative and administrative framework for the future management of the State's fish and aquatic resources, based on the principles of ESD and EBFM.

**Risk Rating: Effectiveness of Fisheries Legal Framework on the SCF (C3, L4 = 12, HIGH)**

*Justification:*

- The SCF management plan is still not in place. This can potentially impact on security of access rights, the ability to transfer licences, and the potential value of the fishery.
- The *FRMR 1994* and *FRMA 1995* will be replaced with the *Aquatic Resource Management Act* once enacted.

### 10.4.1.3 Consultation

*Rationale for Inclusion:* Consultation includes the participation of various stakeholder groups in management processes and the level of communication between the Department, industry

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<sup>3</sup> The Bill can be viewed on the Parliamentary website  
<http://www.parliament.wa.gov.au/parliament/bills.nsf/BillProgressPopup?openForm&ParentUNID=1D103914B411A4CF48257DF6001BBD6B>

and broader stakeholders. This is also dependent on the consultation requirements within the current legislative framework.

**Risk Rating: Effectiveness of consultation in the SCF (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- There is regular communication and consultation between the SCF and the Department.

#### **10.4.1.4 Reporting**

*Rationale for Inclusion:* Reporting takes into account the level of information published by the Department in relation to research results, the status of demersal stocks and management strategies and outcomes. It also takes into account internal and external reviews of the management system or audits of the industry, such as against the MSC standards

**Risk Rating: Effectiveness of reporting on the SCF (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The management system was externally reviewed as part of the process to export under the Wildlife Trade Operations by the Commonwealth Department of the Environment against the *Guidelines for the Ecologically Sustainable Management of Fisheries – V2* (CoA 2007c).
- The SCF has also undergone an independent pre-assessment against the MSC fishery standard (Intertek 2014) and is currently pursuing MSC certification.
- There is effective reporting in place. The SCF performance outcomes for target and retained non-target species, bycatch, ETP species, habitats and ecosystems are also made publically-available in the annual *Status Report of the Fisheries and Aquatic Resources of Western Australia: the state of the fisheries*.
- The Department prepares and releases detailed stock assessment reports to industry.

#### **10.4.2 Government: Other agencies**

*Rationale for Inclusion:* A number of other government agencies that influence industry activities were identified at the workshop including the Department of the Environment (DoE) and the WA Department of Parks and Wildlife (DPAW).

**Risk Rating: Effectiveness of Consultation Processes between the Commonwealth Department of the Environment (DoE) and the SCF (C1, L1 = 1, NEGLIGIBLE)**

**Risk Rating: Effectiveness of Consultation Processes between Department of Parks and Wildlife (DPaW) and the SCF (C3, L4 = 12, HIGH)**



### *Justification*

- The SCF submits the WTO applications to DotE and there have been no problems with the approval process.
- The Department is currently working to improve consultation process with the non-fishing sector and has recently introduced changes to provide more opportunities for public and stakeholder involvement in fisheries management processes. Key management documents such as Harvest Strategies are now posted on the Departmental webpage for stakeholder consultation and review. Other opportunities may include public forums, targeted consultation with key interest groups or a regional approach depending on the fishery or issues under consideration.
- The new proposed state marine park in the northern Kimberley could potentially impact upon the SCF. Effective consultation between the Department, DPaW and industry will be important.

## **10.4.3 Industry**

### **10.4.3.1 Peak bodies**

#### 10.4.3.1.1 Commercial sector

*Rationale for Inclusion:* The primary peak body for commercial fishing operations in WA is WAFIC.

**Risk Rating: Effectiveness of WAFIC representation and consultation with the SCF (C1, L1 =1, NEGLIGIBLE)**

#### *Justification:*

- WAFIC represent the SCF but on more broadscale issues such as potential removal of the fuel rebate. WAFIC have allocated an officer to the SCF. WAFIC and the SCF have little direct engagement.

#### 10.4.3.1.2 Recreational sector

*Rationale for Inclusion:* The primary peak body representing the recreational fishing sector in WA is Recfishwest

**Risk Rating: Effectiveness of Recfishwest consulting with the SCF (C1, L1= 1, NEGLIGIBLE)**

*Justification:*

- Currently there is little or no interest in recreational fishing for sea cucumber and therefore no requirement for consultation/representation by Recfishwest.

#### **10.4.4 Other stakeholders**

##### **10.4.4.1 Environmental organisations**

**Risk Rating: Effectiveness of Consultation Processes (C2, L4= 8, MEDIUM)**

- A university member has contacted the Department previously with concerns about localised depletion.
- The Department is currently working to improve consultation processes with the non-fishing sector. This may include public forums, targeted consultation with key interest groups or a regional approach depending on the fishery or issues under consideration.
- The Department publishes a range of documents online which can be accessed by the public and environmental organisations including: Annual State of Fisheries Report; Research Reports; Management Reports and Harvest Strategies (<http://www.fish.wa.gov.au/About-Us/Publications/Pages/default.aspx>).

##### **10.4.4.2 Local Community**

*Rationale for inclusion:* Local communities may have concerns about the operations of the SCF fishery

**Risk Rating: Effectiveness of Consultation Processes (C1, L1 = 1, NEGLIGIBLE)**

*Justification:*

- The SCF is a small fishery which operates offshore, with little interest to the local community.

## 11 Risk Evaluation

A total of 56 issues associated with the SCF (**Table 11-1**) were scored for risk across the four principles: ecological, external factors, community wellbeing and governance. The majority of issues were evaluated as low or negligible risks, which do not require specific control measures (as per Fletcher et al. 2002). Issues scored as medium risk or higher are further specified in Table 11-2.

**Table 11-1. Summary of risk scores across each aspect considered in the 2016 risk rating of the SCF**

	Component	Risk Score					Total
		Negligible	Low	Medium	High	Severe	
Ecological Sustainability	Retained Species	1	3	1			5
	Non-retained Species	2					2
	ETP species	6					5
	Habitats	2					2
	Ecosystem Structure	3	1				3
	Broader Environment	3					3
External Factors	Environment: Human-induced changes	5	2				7
	Environment: Natural Changes	1	2				3
	Social Drivers	1					1
	Economic Drivers	1			2		3
	Access				1		1
Comm. Well-being	Fishing Industry	1	3				4
	Local Community	1	2				3
	Broader Community	2					2
Governance	Government: Department of Fisheries	2			2		4
	Government: Other Agencies	1			1		2
	Industry	2					2
	Other Stakeholders	1		1			2
Total		33	13	2	6	0	56

**Table 11-2 Summary of issues identified as medium or higher risk in the 2016 risk assessment of the SCF**

Issue	Risk Score
<b>Ecological Factors</b>	
Sandfish (Kimberley)	MEDIUM
<b>External Factors</b>	
Fuel prices	HIGH
Staff availability	HIGH
Access	HIGH
<b>Community Wellbeing</b>	
None	-
<b>Governance</b>	
Department of Fisheries – Management	HIGH
Department of Fisheries – Legislation	HIGH
DPaW	HIGH
eNGO's	MEDIUM

## 12 Risk Treatment

This risk assessment has assisted in the identification and filtering of the different types of ecological risks associated with the SCF. Different levels of risk have different levels of acceptability, with different requirements for monitoring and reporting, and management actions (See Table 9-1 for a summary). Risks identified as negligible or low are considered acceptable, requiring either no or periodic monitoring, and no specific management actions. Risks identified as medium risk are considered acceptable providing there is specific monitoring, reporting, and management measures are implemented. Risks identified as high are considered ‘not desirable’, requiring strong management actions or new control measures to be introduced in the near future. Severe risks are considered ‘unacceptable’ with major changes to management required in the immediate future (Fletcher et al. 2002).

A summary of issues identified as medium risk or higher with associated monitoring, reporting, and management actions are provided in Table 12-1. Note that whilst risks identified as medium are considered acceptable and not requiring additional treatment, they are documented in Table 12-1 to provide clarity in relation to current reporting and management arrangements.

Some of the issues identified in the ERA as medium or high risk (seismic operations and consultation with other government departments) are outside of the Department's direct influence or jurisdiction. However, whilst the Department cannot directly influence these issues, the risks can be mitigated by ensuring that fish stocks are sustainably managed through regular monitoring, targeted research and best management practices.

**Table 12-1 Risk Treatment: Specification of likely reporting and monitoring requirements and management actions for issues scored medium risk or higher.**

Issue	Risk Score	Likely reporting and monitoring requirements	Likely management action
<b>Ecological Factors</b>			
Sandfish (Kimberley)	MEDIUM	Continue current fisheries dependent and independent monitoring (See section 8). Continue with regular reporting (See Section 8.5)	Finalise and implement the Sea Cucumber Management Plan. Finalise and implement the harvest strategy which is responsive to stock status (7.2)
<b>External Factors</b>			
Fuel prices	HIGH	Influenced by factors outside of the Department. Continue with current monitoring and reporting on sea cucumber stocks (Sections 8.3 and 8.5).	Ensure sustainable management of sea cucumber stocks to assist in the mitigation of external impacts.
Staff availability	HIGH	Influenced by factors outside of the Department. Continue with current monitoring and reporting on sea cucumber stocks (Sections 8.3 and 8.5).	Ensure sustainable management of sea cucumber stocks to assist in the mitigation of external impacts.
Access	HIGH	Outside of the Departments jurisdiction. DPaW is responsible for marine park gazettal and management. Provide scientific advice to DPaW regarding the gazettal and impacts of marine parks. Continue with current monitoring and reporting on sea cucumber stocks (Sections 8.3 and 8.5).	Ensure sustainable management of sea cucumber stocks to assist in the mitigation of external impacts.

**Table 12-2 (cont.) Risk Treatment: Specification of likely reporting and monitoring requirements and management actions for issues scored medium risk or higher.**

<b>Governance</b>			
Department Fisheries	HIGH	Management - Finalise the management plan.	Ensure that the management plan is gazetted in 2017
	HIGH	Legal Framework - Finalise the management plan.	Ensure that the management plan is gazetted in 2017
DPaW	HIGH	Outside of the Departments jurisdiction. DPaW is responsible for marine park gazettal and management. Continue with current monitoring and reporting on sea cucumber stocks (Sections 8.3 and 8.5).	Provide scientific advice to DPaW regarding the gazettal and impacts of marine parks.
eNGO's/Other stakeholders	MEDIUM	Continue with current management arrangements, consultation and reporting	Ensure that the management plan is gazetted in 2017.

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## 14 Appendices

### 14.1 Appendix 1. Results of the Shark Bay and Exmouth Gulf Bycatch surveys

Table 14-1. Shark Bay holothurian species recorded from four survey trips in 2002 and 2003 (source Kangas et al. 2006)

Order	Class	Species
Or. Aspidochirotida	Holothuriidae	<i>Holothuria (Metriatyla) cf. albiventer</i>
	Holothuriidae	<i>Holothuria (Stauropora) aff. pervicax</i>
	Holothuriidae	<i>Holothuria (Theelothuria) michaelsoni</i>
	Holothuriidae	<i>Holothuria (Thymiosycia) impatiens</i>
	Stichopodidae	<i>Stichopus cf. chloronotus</i>
	Stichopodidae	<i>Stichopus cf. hermanni</i>
	Stichopodidae	<i>Stichopus</i> sp.
Or. Dendrochirotida	Cucumariidae	<i>Actinocucumis typica</i>
	Cucumariidae	<i>Cercodemus anceps</i>
	Cucumariidae	<i>Colochirus crassus</i>
	Cucumariidae	<i>Colochirus quadrangularis</i>
	Cucumariidae	<i>Loisettea amphictena</i>
	Cucumariidae	<i>Mensamaria intercedens</i>
Or. Molpadiida	Cucumariidae	<i>Plesiocolochirus challengerii</i>
Or. Apodidae	Phyllophoridae	<i>Staurothyra rosacea</i>
	Phyllophoridae	<i>Havelockia versicolor</i>
	Phyllophoridae	<i>Phyllophorus (Urodemella) brocki</i>
	Phyllophoridae	cf. <i>Phyllophorus</i> sp.
	Phyllophoridae	<i>Phyrella trapeza</i>
	Phyllophoridae	<i>Stolus buccalis</i>
	Phyllophoridae	<i>Thyone cf. okeni</i>
	Phyllophoridae	<i>Thyone</i> sp.
	Caudinidae	<i>Paracaudina chilensis</i>
	Synaptidae	<i>Synaptula recta</i>

**Table 14-2. Exmouth Gulf and Onslow holothurian species recorded from three survey trips in 2004 (source Kangas et al. 2006)**

Order	Class	Species
Aspidochirotida	Holothuriidae	<i>Bohadschia marmorata</i>
	Holothuriidae	<i>Holothuria modesta</i>
	Holothuriidae	<i>Holothuria ocellata</i>
	Stichopodidae	<i>Stichopus monotuberculatus</i>
	Stichopodidae	<i>Stichopus</i> sp.
Dendrochirotida	Cucumariidae	<i>Actinocucumis typica</i>
	Cucumariidae	<i>Cercodemus anceps</i>
	Cucumariidae	<i>Colochirus crassus</i>
	Cucumariidae	<i>Loisettea amphictena</i>
	Cucumariidae	<i>Mensamaria intercedens</i>
	Cucumariidae	<i>Plesiocolochirus challengeri</i>
	Cucumariidae	<i>Pseudocolochirus violaceus</i>
	Phyllophoridae	<i>Stolus buccalis</i>
Molpadida	Caudinidae	<i>Acaudina leucoprocta</i>
Apodida	Synaptidae	<i>Synaptula recta</i>
	Synaptidae	<i>Synaptula</i> cf <i>reticulata</i>

## 14.2 Appendix 2. Likelihood and Consequence tables

### LIKELIHOOD LEVELS

**(Note: If not measurable, Likelihood Level is essentially 0)**

1. Remote – Never heard of but not impossible here (< 5 % probability)
2. Unlikely – May occur here but only in exceptional circumstances (> 5 %)
3. Possible – Clear evidence to suggest this is possible in this situation (> 30 %)
4. Likely – It is likely, but not certain, to occur here (> 50 %)
5. Certain – It is almost certain to occur here (> 90 %)

### CONSEQUENCE LEVELS

**Note: if not measurable Consequence Level is essentially 0**

#### **FISH STOCKS (retained / non-retained species) – measured at a stock level**

1. Measurable but minor levels of depletion of fish stock
2. Maximum acceptable level of depletion of stock
3. Level of depletion of stock unacceptable but still not affecting recruitment level of the stock
4. Level of depletion of stock are already (or will definitely) affect future recruitment potential / level of the stock
5. Permanent or widespread and long-term depletion of key fish stock, close to extinction levels

#### **ETP SPECIES – measured at a population or regional level**

1. Level of capture is common but will not further impact on stock and is well below that which will generate public concern
2. Level of capture is the maximum that will not impact on recovery or cause unacceptable public concern
3. Recovery may be being affected and/or some clear, but short-term public concern will be generated
4. Recover times are clearly being impacted and/or public concern is widespread
5. Further declines in ETP species stocks are occurring or major public concern is ongoing

### **HABITATS – measured at a regional level**

1. Measurable impacts to habitats but still not considered to impact on habitat dynamics or system
2. Maximum acceptable level of impact to habitat with no long-term impacts on region-wide habitat dynamics
3. Above acceptable level of loss / impact with region-wide dynamics or related systems may begin to be impacted
4. Level of habitat loss clearly generating region-wide effects on dynamics and related systems
5. Total region-wide loss of habitat and associated systems

### **ECOSYSTEM / ENVIRONMENT – measured at a regional level**

1. Measurable but minor change in the environment or ecosystem structure but no measurable change to function
2. Maximum acceptable level of change in the environment / ecosystem structure with no material change in function
3. Ecosystem function altered to an unacceptable level with some function or major components now missing and/or new species are prevalent
4. 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
5. Permanent or widespread long-term damage to the environment; total collapse or complete shift in ecosystem processes

### **PUBLIC REPUTATION and IMAGE**

1. Negligible negative impact and news profile
2. Low negative impact, low news profile
3. Some public embarrassment, moderate impact and news profile, minor Ministerial involvement
4. High public embarrassment, high impact and news profile, third-party actions, public and significant Ministerial involvement
5. Extreme public embarrassment, very high multiple impacts, high widespread news profile, third-party actions, public and prolonged Ministerial involvement, Government censure, Upper House enquiry

### **ECONOMIC – measured at a regional or entire fishery level**

1. A small, measurable but temporary impact on economic sustainability of some fishers in relevant fisheries
2. A minor, ongoing impact on economic sustainability of all / most fishers in relevant fisheries
3. Temporary significant impact on economic sustainability or ongoing moderate impact on economic performance of the fishery
4. Long-term, major reduction in economic sustainability for relevant fisheries and their related industries
5. Permanent and widespread complete cessation of economic sustainability for the relevant fisheries and their related industries

### **SAFETY AND HEALTH**

1. First Aid Only
2. Some minor medical treatment required, eg visit to doctor's surgery. Less than a week off work.
3. Hospitalisation and/or intensive and extended treatment period required.
4. Serious or extensive injuries / disease. Hospitalisation and extended recuperation period > 1 month
5. Death or multiple severe permanent disabilities.

### **SOCIAL**

1. Temporary and minor additional stakeholder restrictions or expectations (< 1 year)
2. Some minor ongoing restrictions or loss of expectations
3. Some important expectations suspended or severely restricted in the medium term (> 2 years)
4. Long-term suspension or restriction of expectation in some key activities
5. Permanent loss of all key expectations for activities on this asset



**COMMUNITY (Social Structures / Culture) – measured at a regional level**

1. Some minor impacts may be measurable but minimal concerns
2. Clear impacts but no local communities threatened or social dislocations
3. Major impacts at least at local level, disruptions now evident
4. Impacts occurring at broader level or severe local impacts
5. Complete alteration to social structures across a region

**OPERATIONAL EFFECTIVENESS**

1. Minor delay in achievement of a key deliverable
2. Minor element of one key deliverable unable to be achieved on time
3. Significant delay in achievement of key deliverable
4. Non-achievement of more than one key deliverable or major delay to entire strategic directive
5. Non-achievement of an entire strategic directive

### 14.3 Appendix 3. Consequence Tables used in the Risk Scoring Process

Component	Sub component	Sub component	Issues	Consequence table
Ecological sustainability	Retained Species	Species name e.g. Pink snapper	e.g. Commercial fishing	Fish stocks
	Non retained species	e.g. Unmarketable scalefish	e.g. Capture by commercial fishery	Fish stocks
	ETP Species	e.g. ETP group e.g. Whales and dolphins	e.g. Capture by lines	ETP species
	Habitats	e.g. Benthic biota	e.g. Anchor damage	Habitats
	Ecosystem Structure	e.g. Trophic Interactions	e.g. Predator – prey interactions	Ecosystem/Env
	Broader Environment	e.g. Air Quality	e.g. Exhaust	Ecosystem/Env
External	Environment: Human-Induced Changes	e.g. Commercial fisheries	e.g. Removal of target species	Fish stocks
	Environment: Natural/Climate	e.g. Changes in water temperature	e.g. Effect on target fish stocks	Fish stocks
	Social Drivers	e.g. Public attitude	e.g. Effect on SCF	Public Reputation & Image
	Economic Drivers	Fuel prices	e.g. Effect on SCF	Economic
Community Wellbeing	Fishing Industry	Economic Sustainability	Fisher Income	Economic
		Occupational Health and Safety	Working Environment	Safety and Health
		Lifestyle Benefits	Lifestyle	Social consequence
	Local Community	Economic Values	Economic value	Economic
		Social Values	Social value	Community
		Cultural / Indigenous values	Cultural/indigenous values	Community
	Broader WA Community	Economic Value	Economic value	Economic
Governance	Dept. of Fisheries	Management/Legal framework/Consultation/Reporting	Effectiveness	Operational effectiveness
	Other Govt. Agencies	e.g. DPaW	Effectiveness of consultation	Operational effectiveness
	Peak bodies	e.g. WAFIC, Recfishwest	Effectiveness of consultation	Operational effectiveness
	Other stakeholders	e.g. eNGO's, Local community	Effectiveness of consultation	Operational effectiveness

## 14.4 Appendix 4. Risk ratings in previous risk assessments

Table 14-3. Summary of outcomes and risk ratings from the 2004 ERA for the SCF

Component and Sub/component	Issue	Risk Rating 2004
<b>Retained species</b>		
Beche de mer species	Impact on Breeding stock	C3 L3 – MODERATE
<b>Trophic Interactions</b>		
Impact of removing/damage or organisms	Removal of beche de mer species on the ecosystem	C0, L3 - NEGLIGIBLE
Discarding of undersize beche de mer	Impact on environment from discards	C0, L1 - NEGLIGIBLE
Damage to habitats	Impact on habitats from diver activities	C0, L2 - NEGLIGIBLE
	Impact on habitats from anchoring	C0, L1 - NEGLIGIBLE
	Impact on habitats from wading	C0, L1 - NEGLIGIBLE