



# **MANAGEMENT PLAN FOR THE SOUTH AUSTRALIAN COMMERCIAL MARINE SCALEFISH FISHERY**

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Approved by the Minister for Agriculture, Food and Fisheries pursuant to section 44 of the *Fisheries Management Act 2007*.

Hon Gail Gago MLC  
Minister for Agriculture, Food and Fisheries  
1 October 2013

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## 1 FISHERY TO WHICH THIS PLAN APPLIES

This plan applies to the commercial Marine Scalefish Fishery (MSF), which is formally constituted by the *Fisheries Management (Marine Scalefish Fisheries) Regulations 2006* (the Regulations). The fishery includes both the Marine Scalefish Fishery and the Restricted Marine Scalefish Fishery. Some minor management and licensing arrangements differ for the two licence types, however for the purposes of this management plan these two fisheries will be collectively referred to as the Marine Scalefish Fishery unless otherwise specified. Further information on the regulatory arrangements is provided in Section 13.

The Regulations define the fishery as:

- a) the taking of aquatic resources specified in Schedule 1<sup>1</sup> in coastal waters; and
- b) the taking of Razorfish (*Pinna bicolor*) in coastal waters for the purpose of bait.

Coastal waters include all of South Australia's gulfs, bays and estuaries (excluding the Coorong) and extend from the Western Australian border (129° E longitude) to the Victorian border (140°58' E longitude).

Whilst the management of the commercial harvest of Australian Sardines (*Sardinops sagax*) using a sardine net is governed by the *Fisheries Management (Marine Scalefish Fisheries) Regulations 2006* and a MSF licence is required to take them, a separate management plan will be prepared for this fishery.

## 2 CONSISTENCY WITH OTHER MANAGEMENT PLANS

Access arrangements to the aquatic resources prescribed within the Marine Scalefish Fishery (MSF) are complex. Nine separate commercial fisheries have some level of access to marine scalefish species within the area of the fishery. This management plan has been developed to be consistent with other management plans. As a consequence of this management plan being prepared ahead of others, this plan has prescribed some processes that will be reflected within other management plans as they are prepared or amended in the future. In particular, the provisions relating to the allocation of access for many of the MSF resources has been addressed for the first time during the development of this plan. The shares prescribed in this plan will be reflected in other relevant management plans as they are prepared and/or amended.

This management plan has also been developed so that it can be integrated with any Aboriginal traditional fishing management plans that are made in the future that apply to the waters of this fishery.

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<sup>1</sup> Schedule 1 of the regulations is also included as Appendix 7 of this management plan.

### **3 TERM OF PLAN**

This management plan applies from 1 October 2013 for a period of 10 years.

Part 5 of the *Fisheries Management Act 2007* sets out the requirements for reviewing, replacing or extending this management plan upon expiry. Further detail on the process for reviewing the management plan is described in Section 14.

### **4 DESCRIPTION OF FISHERY**

#### **4.1 Introduction**

The commercial Marine Scalefish Fishery (MSF) is a multi-species, multi-gear fishery. The fishery provides for the commercial harvest of most commercially available aquatic resources, with the exception of Southern Rocklobster, prawns, abalone and freshwater fish species. The fishery includes all South Australian coastal waters including gulfs, bays and estuaries (excluding the Coorong estuary) from the Western Australian border (129°E longitude) to the Victorian border (140°58' E longitude) (Figure 1).

The MSF is a valuable social and economic contributor to South Australian communities. Commercially caught scalefish is a food source for South Australians and interstate consumers and the availability of fresh seafood contributes to regional tourism and provides health benefits to consumers. The fishery contributes to the economies of many South Australian coastal communities, through the generation of jobs, processing and retail of fresh fish, the purchase and maintenance of boats, marine engines, tackle, bait and equipment. The fishery is also an important part of South Australia's heritage and contemporary culture, particularly for regional coastal communities.

Access to the fishery is complex with nine separate commercial fisheries having some level of access to marine scalefish species within the area of the fishery. In addition to MSF licence holders, licence holders from the Miscellaneous Fishery, the Northern and Southern Zone Rock Lobster fisheries, the Lakes and Coorong Fishery, the three prawn fisheries and the Blue Crab Fishery all have some level of access. Access varies from the ability to retain some species taken as bycatch (prawn fisheries), to bait only (Blue Crab Fishery), to relatively open access for holders of a MSF licence. Species taken in the MSF also support a significant amount of recreational fishing activity both in terms of participation and catch.

With the exception of the Vongole (Mud Cockle) fishery and the Blue Crab Fishery, there are no zones to restrict where a licence holder can operate. A licence holder may choose to operate in any or all waters of the fishery, with the exception of area (spatial) closures. Vongole are managed under a quota management system and the quota fishery is divided into separate geographical zones including; the Port River, Coffin Bay, Smoky Bay, Streaky Bay and Venus Bay. Similarly the take of Blue Swimmer Crabs in Gulf St Vincent and Spencer Gulf, which is managed as a separate fishery, is limited to Blue Crab quota holders.

The fishery has a diverse range of gear types and fishing methods which have been developed to target the broad range of permitted species within the fishery. In all there are a total of 21 different gear types that have been registered on MSF licences, in addition to hand collection, handlines and rod and lines, which do not require



registration. Of these, the dominant gear types are handlines, longline, haul nets, mesh nets and jigs.

There are over 60 species of marine 'scalefish' taken commercially, however the majority of fishing effort is concentrated on four primary species; King George Whiting, Southern Garfish, Snapper and Southern Calamari. Together, these four species account for approximately 60% of the total fishery production (by weight) and 70% of the total fishery value. The majority of catches of these primary species comes from Spencer Gulf and Gulf St Vincent, with the exception of King George Whiting where areas west of Spencer Gulf have historically accounted for over 40% of the total commercial catch.



Figure 1. Area of the commercial Marine Scalefish Fishery

## 4.2 Historical overview

Fishing for marine scalefish species in South Australia preceded the establishment of the colony of South Australia. Aboriginal communities fished the coastal waters for at least 6,000 years before European settlement (Nance and Speight 1986). The types of fishing gear used included nets made from animal and vegetable fibres by the Kaurua community during summer months along the Adelaide coastline (Ellis 1976) and Encounter Bay (Whitelock 1985), fish spears, fish traps and snares by southern Eyre Peninsula communities (Mountford 1939; Berndt 1985); and the gathering of inter-tidal molluscs and gastropods (Turbo Shells) (Cann et al. 1991).

Commercial marine scalefish fishing commenced almost simultaneously with the arrival of European settlers, initially as means of providing food for the new colony. Fish became the first export of the new colony when three barrels of salted fish were shipped to Tasmania by the South Australian Company in 1836 (Noell et al. 2006). Fishing for scalefish increased with the demise of the whaling industry in the 1840s, with the nature of the fishery and the gear types being influenced by the arrival of

immigrants from the United Kingdom and Scandinavia, and during the 1870s and 1880s from Greece and Italy.

When licensing was first introduced in 1904, 476 people applied for and received licences. However during the Depression in the 1930s fishing licences were issued as a means of addressing rising unemployment, and in 1934 a total of 1463 licences were issued.

The capacity of the fishing fleet has not only been influenced by the number of licences issued, but also by technological advances in powered vessels (engines), refrigeration and processing. The introduction of engines began in the early 1900s and came into general use by the 1930s. Ice boxes were also an innovation that altered the way fish were kept and brought to market. Between the early to mid 1900s ice boxes replaced wells, carrying capacity increased and catches could be stored at sea for longer. The first fish cannery opened in the 1890s on Kangaroo Island, where King George Whiting was the main fish processed. Further canneries were opened in Port Lincoln and other West Coast towns during the mid 1900s for the purpose of preserving catches of Western Australian Salmon and Australian Herring (Tommy ruff). The Port Lincoln cannery was still in operation in the early 1960s, however production had switched from marine scalefish species to Southern Bluefin Tuna, a species that is managed by the Australian Government (Noell et al. 2006).

Modern day fisheries management began in the late 1970s when there was a freeze on issuing new licences, and entry into the fishery was capped. Since this time there have been continued increases in fishing capacity through technological advances, particularly in fish location through the use of sonar, echo sounders, global positioning systems (GPS) and computer software packages that integrate and store data from these devices. Managing this increase in effective effort is a key challenge of the MSF.

Since the late 1970s there have been continual management changes aimed at reducing overall effort in the fishery to counter this effort creep (Table 1). In some cases these management changes have resulted in the development of separately managed fisheries such as the Blue Crab Fishery, the Sardine fishery and more recently the Vongole fishery. The licence amalgamation scheme introduced in the early 1990's has achieved a significant and permanent reduction in the number of licences within the fishery (section 13.1.2). Although the number of licences in the fishery has declined to less than half the number of licences that existed in 1978, constraining effort remains a key challenge of the MSF.

Table 1. Summary of key historical management changes

Date	Management measure/change
1878	First Fisheries Act enacted, prohibiting the use of certain devices, limiting species that can be taken and other management controls.
1904	New Fisheries Act commenced, repealing the 1878 act. Licensing was first introduced, 476 people applied for and received Class A licences.
1917	The 1904 Act was repealed and replaced the <i>Fisheries Act 1917</i> , incorporating oyster fisheries legislation into the new act.
1930s	During the Depression fishing licences were issued as a means of addressing rising unemployment, and in 1934 a total of 1463 licences were issued.
1967	Amendments made to the <i>Fisheries Act 1917</i> making special provision for the regulation of a particular fishery.
1971	<i>Fisheries Act 1971</i> commences and arose out of the Select Committee of the House of Assembly appointed in 1966. Power to prescribe schemes of management made explicit.
Early 1970s	Minimum legal lengths in place prior to 1970s for most primary marine scalefish (MSF) species; State-wide ban on netting in water greater than 5 m water depth and mesh sizes for nets.
1977	Freeze on issue of new commercial licences (limited entry fishery); conversion call – B class licence holders able to convert to A class licences if they met certain criteria

1977-1982	Show cause provision – licence holders required to demonstrate a minimum level of involvement to qualify for licence renewal
1979-1980	Remote employee conversion call – some employees of MSF licence holders given opportunity to apply for licences
1980	Netting arrangements: • Limit on total net length to 600 m for A class licence holders and 400 m for B class licence holders • Net could not be joined with another net, with the exception of a drain-off shot • Net endorsements made non-transferable • Freeze on issue of additional permits for use of nets • B class licence holders no longer entitled to use nets other than bait nets • Restrictions on use of nets by Northern Zone Rock Lobster Fishery licence holders
1981	Experimental blue crab trawl fishery commences in upper Spencer Gulf
1982	<i>Fisheries Act 1982</i> approved but did not commence until operation until 1984. A and B class licences become Marine Scalefish and Restricted Marine Scalefish respectively. Separate schemes of management for each fishery.
1980	Restricted B class MSF licences became non-transferable; owner-operator policy announced; family transferability introduced for A class net and line licences
1982	Licences became transferable (any endorsement for the use of nets could not be retained with the transfer except in the case of family transfer)
1983	Inshore Fisheries Advisory Committee established; further Aquatic Reserves and restricted netting areas introduced
1983	Experimental blue crab trawl fishery ceased. Establishment of experimental Blue Swimmer Crab pot fishery with a call for expressions of interest from MSF licence holders.
1984	New Western Australian Salmon net fishing arrangements commenced with general quota and special quota for taking of Western Australian Salmon by net.
1986	Experimental Blue Swimmer Crab pot fishery ceases for West Coast.
1987	New management controls introduced for Snapper Offshore Constitutional Settlement (OCS) agreement signed between Commonwealth and South Australia for some species
1988	Policy introduced, no further longline endorsements. Limit on the number of hooks that can be used in Spencer Gulf, Gulf St Vincent and Investigator Strait introduced. Reduced limit of 1000 kg for Mulloway on West Coast.
1989	Introduction of new management arrangements for Ocean Jacket Fishery.
1990	Green paper for the review of the fishery released.
1990's	Rock lobster fishery licences able to choose level of access (A,B,C options) for marine scalefish species
1991	Supplementary Green Paper for the review of the fishery released.
1992	White Paper for a review of the fishery released. Freeze on transfers to allow a restructure of the fishery
1992	New management controls introduced for Snapper, King George Whiting and Southern Calamari
1993	Ban on net fishing for Snapper; introduction of a separately managed fishery for Blue Swimmer Crabs in Spencer Gulf and Gulf St Vincent.
1993	Initial access to Sardine (Pilchard) Fishery finalised (14 granted access through Ministerial Exemption)
1994	Licence amalgamation scheme introduced. Transfers of licence recommence under the amalgamation scheme. Requirements for attendance of longlines introduced with a restriction of 400 hooks on any set line. Minimum size of 10 cm introduced for Sand Crabs. Minimum size limits for Flounder increased to 25 cm and Sweep increased to 24 cm.
1995	First Sardine (Pilchard) total allowable catch determined.
1995	King George Whiting minimum legal length increased from 28 to 30 cm.
1995	Revised more permanent management arrangements introduced for Ocean Jacket Fishery
1995-1996	Net review conducted and further netting restrictions introduced.
1996	Blue Crab Fishery within the gulfs formally constituted. Amalgamation Scheme amended to require a 26 points, down from 29 points Daily bag limit for Razorfish introduced with restriction on use for bait only for commercial fishing
1997	Jurisdiction transferred to Australian Government for some species under Offshore Constitutional Settlement (OCS) agreement. Replaced 1987 OCS agreement
1997	Restrictions on the use of fish traps in water deeper than 60 m introduced
1998	First Cuttlefish closure of Spencer Gulf spawning aggregation area implemented
1999	Split Snapper closures implemented in August and November.
2000	Discussion Paper of Recommendations for fishery released for discussion by the Marine Scalefish Fishery Restructure Committee.

2000	OCS jurisdiction for School and Gummy Shark transferred to the Australian Government (AFMA). Trip limits introduced for SA MSF licence holders.
2000	Introduction of regulations for the management of Sardines (formerly Pilchards) and endorsement of quota on licences.
2001	Changes to legal minimum lengths and recreational bag and boat limits for several MSF species as recommended in the South Australian Recreational Fishing Management Strategy including Snook and Southern Garfish.
2002	Coffin Bay Sand Crab pot fishery approved by Minister; Scallop dredges prohibited. Maximum number of agents that can be used on a boat whilst fishing introduced.
2003	November closure for Snapper introduced.
2004	Change in legal minimum length to 31 cm for King George whiting taken east of 136°E longitude. Amendments to the licence amalgamation scheme from 26 to 24 points and Restricted MSF licences can be amalgamated under the amalgamation scheme.
2005	Voluntary net buyback scheme announced by the State Government – to reduce fishing effort using nets (gill nets <15 cm mesh and hauling nets). This buyback culminated in the removal of 24 licences and 61 net endorsements, and new areas closed to net fishing. Charter Boat Fishery commenced requiring participants to obtain licence under a separate scheme of management.
2007	Introduction of the Fisheries Management Act 2007.
2007	Fisheries Council of South Australia established. Fishery management committee's abolished.
2008	Quota management system introduced for Vongole with 3 zones: Port River (the Section Bank), Coffin Bay and the West Coast (including Smoky Bay, Venus Bay and Streaky Bay)
2008	Daily bag limit for Razorfish reduced to 50 razor fish for commercial fishers and 25 for recreational fishers.
2012	Seasonal Closure for the take on Southern Garfish introduced for Spencer Gulf and Gulf St Vincent.
2012	Extension of Snapper Closure and introduction of daily catch limits and restriction on the number of hooks to be used in the gulfs,

## 4.3 Biological and environmental characteristics

### 4.3.1 Ecosystem and habitat

South Australia's coastal regions support a diverse range of ecosystems, marine habitats and aquatic resources. An inventory of coastal fisheries habitats by Bryars (2003) identified 12 important habitats in South Australia: reef, surf beach, seagrass meadow, un-vegetated soft bottom, sheltered beach, tidal flat, tidal creek, estuarine river, coastal lagoon, mangrove forest, saltmarsh, and freshwater spring. Many of these habitats are found within two gulfs; Gulf St Vincent and Spencer Gulf, which is where the majority of commercial fishing is undertaken.

Both gulfs contain significant areas of seagrass meadows, saltmarshes and mangroves which are all recognised nursery areas for a key commercial fish species such as King George Whiting, Southern Garfish, Blue Swimmer Crabs and Western King Prawns. The range of habitats throughout South Australia's coastal regions provide important habitat for all life history stages of each of South Australia's primary marine scalefish species (Table 2).

The more southern waters of the gulfs are of oceanic character whilst salinity increases reaching 48 parts per thousand in the most northern reaches. This rising salinity is brought about by the decreasing water depth and higher summer water temperatures causing high evaporation rates (PIRSA 2007). These environmental conditions are optimal for some species of more tropical distribution (e.g. Blue Swimmer Crabs and prawns).

Primary production in the more sheltered parts of the gulfs, as well as embayment's off the west coast of Eyre Peninsula and the north coast of Kangaroo Island, is dominated by a number of seagrass species that occur at depths to about 20 m in clearer waters but about 10 m in the gulfs.

The natural and artificial reefs in the gulfs provide high quality habitats for a number of species including juvenile and adult Snapper, which form spawning aggregations during the summer spawning season between November and January each year.

Understanding ecosystem function and the potential impacts of the fishery on these functions is a key aspect of fisheries management. Managing the MSF as part of the broader ecosystem is a goal of this plan. A risk-based approach to managing ecosystem impacts has been undertaken and is considered in more detail in section 7.

Table 2. Key habitat types associated with life history stages of primary MSF species

<b>Life stage</b>	<b>King George Whiting</b> (Jackson and Jones 2000; McGarvey et al. 2003)	<b>Snapper</b> (Fowler 2002; Jones and Luscombe 1993)	<b>Southern Garfish</b> (Noell 2004)	<b>Southern Calamari</b> (Triantafillos 2001)
Early juveniles (0+ age group), i.e. nursery areas	Sheltered bays, tidal creeks, with seagrass patches	Fine mud substrate, deeper gulf waters	Sheltered bays, tidal creeks, seagrass beds of both gulfs	Bare sand substrate in deeper waters of both gulfs
Sub-adults	Seagrass beds (patchy to dense)	Natural and artificial reefs	Not applicable	Not applicable
Adults, i.e. spawning or feeding areas	Offshore low profile reefs, sponge/bare sand	Natural and artificial reefs, inshore mud substrate	Seagrass and algal beds	Seagrass and algal beds, low profile reefs

Source: Adapted from Noell et al. (2006)

#### 4.3.2 Biology of key species

As outlined previously, the production and value of the MSF is largely driven by the four primary species; King George Whiting, Snapper, Southern Garfish and Southern Calamari. Other species that make a significant contribution to the fishery include Vongole, Australian Herring, Western Australian Salmon, Yellowfin Whiting and a variety of shark species. The historical commercial catches of these key species are displayed in Figure 2.

The following descriptions provide background information on the biological characteristics of the four primary species. More detailed information on stock status is provided in stock assessment and stock status reports prepared by the South Australian Research and Development Institute (SARDI), Aquatic Sciences. All completed reports are available on the PIRSA and SARDI websites at [www.pir.sa.gov.au/fisheries](http://www.pir.sa.gov.au/fisheries) or [www.sardi.sa.gov.au](http://www.sardi.sa.gov.au).

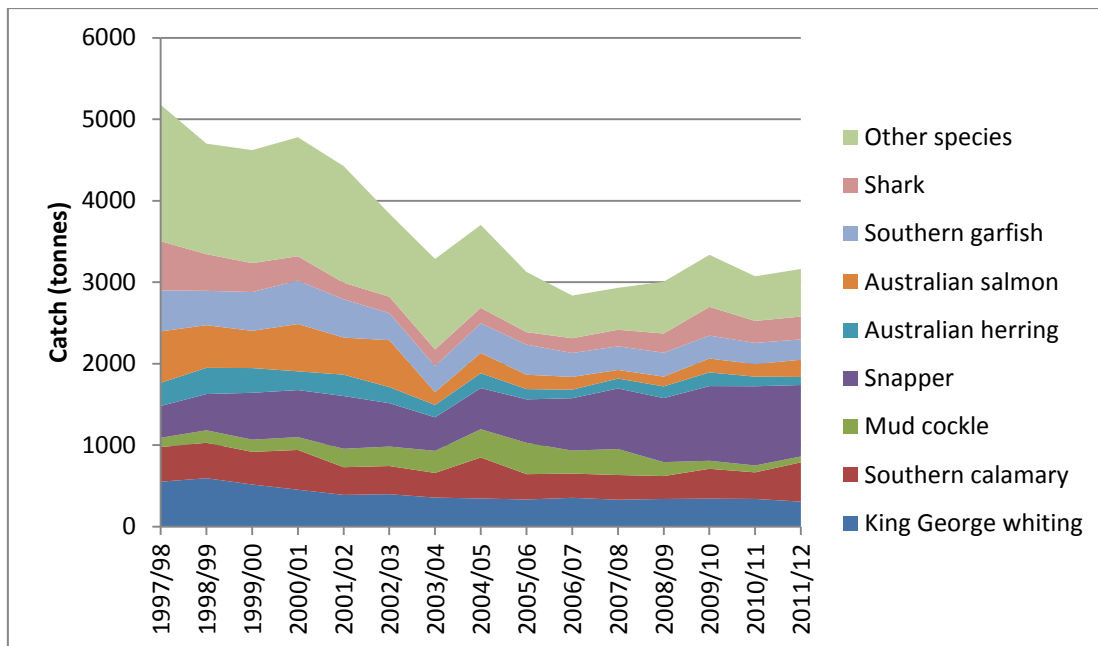


Figure 2. Marine Scalefish Fishery catch, 1997/98 to 2011/12  
Source: SARDI

### Snapper (*Pagrus auratus*)

Snapper are a member of the family Sparidae, occurring throughout the warm, temperate and sub-tropical waters of the Indo-Pacific region, including Japan, the Philippines, India, Indonesia, as well as Australia and New Zealand (Kailola et al. 1993). They are found in a broad range of habitats from shallow, coastal, demersal areas to the edge of the continental shelf across a depth range from 1 – 200 m. The broad distribution is thought to be divisible into a number of separate stocks, including a division between Victorian and South Australian stocks in the vicinity of the mouth of the River Murray. Snapper can also form separate stocks at spatial scales smaller than the regional geographic scale, however there is little evidence for any finer-scale genetic differentiation amongst Snapper captured from the remaining SA waters.

Spawning in northern Spencer Gulf commences in late November, peaking in December and declining in January before finishing in early February. The timing appears to be approximately one month later in the Southern Spencer Gulf (Fowler et al. 2010). Snapper are multiple batch spawners that spawn over several consecutive days. While spawning seems to occur widely through SA, the main nursery areas are believed to be in the northern parts of both gulfs, particularly Spencer Gulf (Fowler et al. 2010). Mature adults form large aggregations in preferred spawning areas. Spawning generally occurs in waters shallower than 50 m (Kailola et al. 1993).

Snapper eggs are pelagic and hatch after approximately 36 hours at ~21°C. The larvae are also pelagic and take 20-30 days to develop before they become demersal juveniles (Fowler et al. 2010). Studies on the distribution patterns of eggs are limited but they have patchy distribution patterns, which suggest distinct spawning hotspots. Recruitment of Snapper is highly variable (Fowler et al. 2010). The life history model for Snapper suggests that the majority of fish remain resident to their region whilst a lower proportion of fish are migrants (Fowler et al. 2010). There has been uncertainty whether the Snapper in South Australia are a single stock or consist of regional subpopulations (Fowler et al. 2010). At the time of writing this management plan a

movement study was in progress to better define the stock structure and movement of Snapper.

Snapper are long-lived and slow-growing fish; the oldest estimate of age obtained to date from SA is 36 years. The age structures of Snapper from different regions of SA show the presence of strong and weak year classes (Fowler et al. 2010). Age at first maturity also varies throughout their distribution. Snapper from New South Wales are, on average, three years old and 30 cm fork length at first maturity. Snapper in Port Philip Bay first breed when they are about four years old and 27 cm total length, while those from Southern Australian waters are about 28 cm total length at first maturity. In New Zealand, some juvenile Snapper change sex from female to male but all such changes are completed by the onset of maturity. There have been no investigations of sex reversal in Australian Snapper populations (Kailola et al. 1993).

Snapper in Victorian waters feed primarily on crustaceans, bivalve molluscs and small fish. Juveniles and small adults in South Australia feed on Western King Prawns (*Penaeus (Melicertus) latisulcatus*) while larger fish also feed on thick shelled animals such as Blue Swimmer Crabs (*Portunus armatus*) and Mussels (Mytilidae). Bronze Whaler Sharks (*Carcharhinus brachyurus*) are known to accompany spawning aggregations of Snapper but their significance as a predator is unknown (Kailola et al. 1993).

### **King George Whiting (*Sillaginodes punctata*)**

King George Whiting are a member of the family Sillaginidae and are endemic to the shelf waters of southern Australia ranging from Port Jackson on the east coast through Bass Strait and west to Jurien Bay on the west coast of Australia (Kailola et al. 1993). Juveniles occur in shallow waters to depths of 20 m, whilst adults are found in a range of habitats and depths from sandy patches in seagrass meadows to more exposed waters along coastal beaches and reef areas in the continental shelf waters to depths of 50 m and greater (Kailola et al. 1993). The nursery areas for King George Whiting are shallow, protected bays where the post-larvae arrive during the winter and spring each year (Fowler et al. 2008a).

Spawning in South Australia occurs at the offshore grounds to which fish migrate, including Investigator Strait along the north coast of Kangaroo Island and south-eastern Spencer Gulf around Corny Point and Wardang Island (Fowler et al. 2008a). Spawning typically occurs between March and May. King George Whiting are serial batch spawners, yet the number of spawning events in a season is unknown. Batch fecundity increases as the female fish grow; from an average of 100 000 eggs at 34 cm total length to 800 000 eggs at 45 cm (Kailola et al. 1993).

King George Whiting eggs are buoyant and the larvae are planktonic. The larvae move inshore to sheltered areas and settle out of the plankton between 60 and 150 days old and 15-18 mm long, depending on when they are spawned. Juveniles remain in protected waters for two to three years. King George Whiting greater than 25 cm total length generally move to deeper water, particularly during winter (Kailola et al. 1993) (Fowler & McGarvey 2000).

A maximum age of 22 years, a maximum size of 72 cm total length and 4.8 kg have been recorded for King George Whiting. Growth rates vary from region to region, depending on the water temperature. They grow rapidly in the summer months of December to March, typically reaching 31 cm in 3-4 years (Kailola et al. 1993).

Maturity is attained at three or four years of age when males are between 27 cm to 32 cm total length and females between 32 cm to 36 cm total length. The sex ratio at that time is even but among older fish (greater than 50 cm total length) females are four times more numerous than males (Kailola et al. 1993).

Juvenile King George Whiting feed on benthic amphipods and other crustaceans. As they grow larger their diet expands to include polychaete worms, molluscs and peanut worms (*Sipuncula*). Adult King George Whiting are preyed upon mostly by sharks, whilst juveniles are eaten by other fish such as flathead (*Platycephalidae*), Australian Salmon (*Arripis* species) and Barracouta (*Thyrsites atun*).

### **Southern Calamari (*Sepioteuthis australis*)**

Southern Calamari are from the family Loliginidae and is endemic to southern Australia and New Zealand waters (Steer et al. 2007). Their southern Australian range is from Dampier in Western Australia to Moreton Bay in Queensland, including Tasmania. Southern Calamari are found in coastal waters, usually in depths less than 70 m (Winstanley et al. 1983).

Southern Calamari is a short lived species, living for an estimated maximum of 280 days (Triantafillos 2001). There is considerable variability in growth during the short life span; with males generally growing faster and attaining larger sizes (Triantafillos 2001) and individuals spawned in spring growing faster than those spawned in autumn (Steer et al. 2007). Such variability in growth rates is common among cephalopods and is suggested to be governed by a combination of factors including temperature, prey availability, population density, sexual maturation and genetics (Steer et al. 2007).

Southern Calamari, like all cephalopods, have separate sexes. Their courtship and reproductive behaviour is complex and involves the transfer of mature spermatophores from the male to the female using a modified arm (hectocotylus). Females store sperm inside their buccal membrane (spermathecae) and are capable of mating multiple times with numerous males before fertilising the eggs and spawning (Steer et al. 2007). Females are serial spawners and spawning occurs throughout the year. Fertilised eggs are 'laid' in an egg mass attached to the substrate. The egg mass consists of numerous individual fingers that hold up to 10 longitudinally-aligned eggs (Steer et al. 2007). Evidence suggests that eggs are preferentially attached to seagrass (e.g. *Amphibolis* spp.) and macroalgae (e.g. *Cystophora* spp., *Sargassum* spp.) (Steer et al. 2007) however they are also known to lay eggs on low relief rocky reefs and on sand (Triantafillos 2001).

Once laid, the eggs undergo direct embryonic development to hatch as structurally and functionally adept 'paralarvae' (Steer et al. 2007). The embryos hatch at night and swim to the surface where they remain for an unknown period of time before they become benthic, at around eight millimetres in mantle length (Steer et al. 2007). Juveniles are generally found in the deeper offshore areas such as the middle of the gulfs, where they are vulnerable to capture by prawn trawlers. As they grow, the sub-adults move inshore where they reach maturity and aggregate to commence spawning on shallow seagrass habitats and low profile rocky reefs.

Southern Calamari populations are believed to follow a generalised anti-clockwise pattern of spawning behaviour within Gulf St Vincent (Steer et al. 2007). Spawning in late spring occurs in Kangaroo Island, continuing in a clockwise direction to Edithburgh where spawning occurs in late winter.



## **Southern Garfish (*Hyporhamphus melanochir*)**

Southern Garfish are from the family Hemiramphidae, which are characterised by having a distinct beak protruding from the lower jaw, hence the colloquial name 'halfbeaks'. Southern Garfish are a schooling species and found in shallow, inshore marine waters throughout southern Australia from Shark Bay in Western Australia to Eden in southern New South Wales, including Tasmania (Kailola et al. 1993). Southern Garfish are particularly abundant in the two gulf regions of South Australia.

The association with sheltered seagrass habitat is linked to a dietary basis, a hypothesis first proposed over 50 years ago (Ling 1958). This has been supported by several more recent studies in both Victoria and South Australia. The study undertaken in north eastern Gulf St Vincent confirmed that Zosteracean seagrasses were consumed in relatively large quantities during the day, followed by a switch to hyperbenthic invertebrates in lower volumes at night (McGarvey et al. 2009).

The estimated length at which 50% of the population is mature for female Southern Garfish in South Australia is 21.5cm (total length), equivalent to 17.5 months of age (Ye et al. 2002b), which is smaller than for fish in both Victoria and Western Australia. This, along with other evidence, suggests that the size and age of first maturity have decreased over time, possibly as a result of a high exploitation rate (McGarvey et al. 2009). Spawning throughout the South Australian gulfs extends from October to March and during the summer of 1997/98 there appeared to be two spawning peaks, one during November/December and the other in February (McGarvey et al. 2009).

Commercial catch samples taken during the 1990s were aged for a study on age and growth (Ye et al. 2002a). Seven age classes were present in the catch, from 0+ to 6+ age classes. However the catches were dominated by 1+ and 2+ fish which accounted for 88.8% of all fish sampled. Similar breakdowns in age classes were shown in recent ageing work from the northern parts of the two gulfs (Fowler et al. 2008b). This age structure demonstrates that a single year class dominates the fishery for approximately 12 months before it is fished down and replaced by the following year class. Under such circumstances fishery productivity is driven by inter-annual variation in recruitment (McGarvey et al. 2009).

The age structure described above has not altered in recent years but differs markedly from that recorded in the 1950s. This historical comparison suggests that the fished populations of the upper gulfs are now significantly truncated with respect to size and age, consistent with high, long-term exploitation rates that the Southern Garfish populations have been subject to (McGarvey et al. 2009).

## **4.4 Economic characteristics**

Detailed economic information for the MSF has been collected regularly since 1997/98, providing a valuable reference regarding the economic status and trends of the commercial MSF. These assessments are presented in an annual report *Economic Indicators of the SA Marine Scalefish Fishery* prepared by EconSearch Pty Ltd on behalf of PIRSA.

Information presented in the annual report includes gross value of production, financial performance (revenue, costs, and return on investment), costs of management and economic impact of the fishery. For reporting purposes, the fishery is divided into regions: West Coast, Spencer Gulf/Coffin Bay, Gulf St Vincent/Kangaroo Island, Victor Harbour/South East and Other. Indicators are presented on a regional basis, where possible, providing valuable information regarding the importance of the fishery to regional economies. Reporting for the fishery is also divided broadly by gear type: net licences and line licences. Completed reports are available on the PIRSA website at [www.pir.sa.gov.au/fisheries](http://www.pir.sa.gov.au/fisheries).

Given that the MSF is a multi-species and multi-gear fishery that operates throughout the entire range of South Australia's coastal regions there are significant differences between each individual's operations and economic 'performance'. As such caution should be used when evaluating the performance of an 'average' licence holder.

### **4.4.1 Gross value of production (GVP)**

The total catch in the MSF in 2010/11 was 3,045 tonnes with a total gross value of production (GVP) of over \$22.9 million (EconSearch 2012, Figure 3).

Since 1994/95 the total catch has steadily declined from over 6,000 tonnes per annum to just over 3,000 tonnes where it appears to have stabilised over the past few years. Despite the decline in catches, the GVP has been variable, but not shown any long-term trends, largely due to increased value of key target species (Figure 3).

The highest value species has historically been King George Whiting, however the recent increased catches of Snapper have resulted in this now being the highest valued species since 2007/08, with an estimated value of \$6.6 million in 2010/11. Southern Calamari and Southern Garfish, the third and fourth most valuable species were worth \$3.4 million and \$1.6 million respectively in 2010/11 (Table 3).

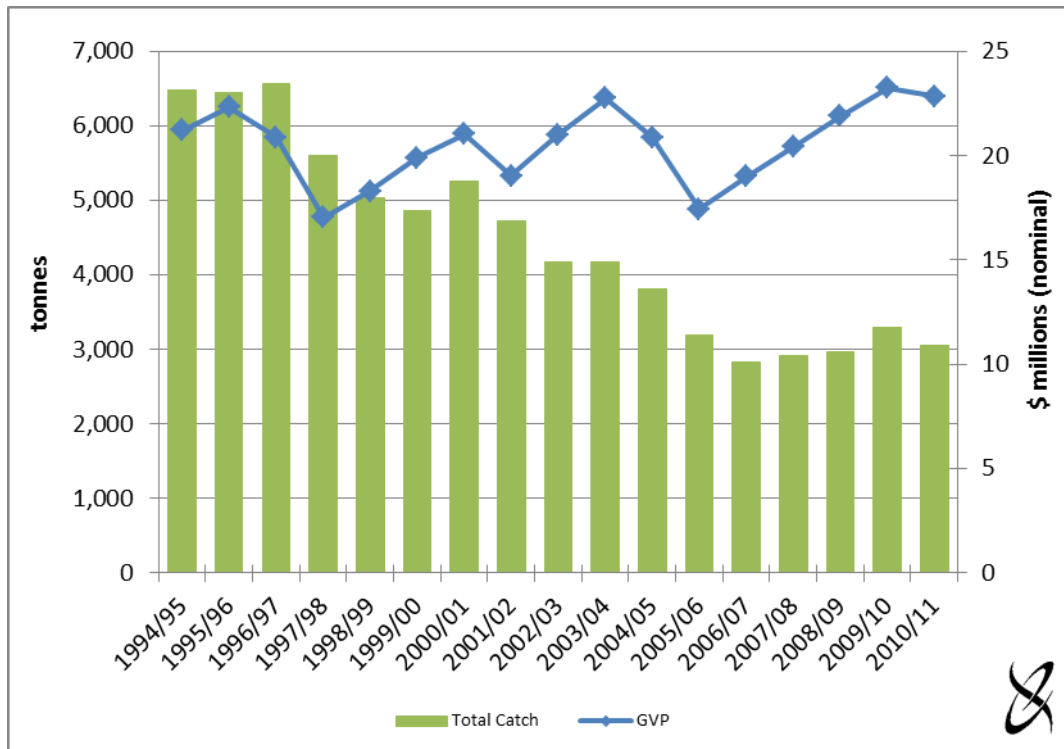


Figure 3. Catch and gross value of production of all marine scalefish species, South Australia, 1994/95 to 2010/11

Source: EconSearch (2012)

Table 3. Catch and gross value of production of the SA Marine Scalefish Fishery, 2005/06 to 2010/11

Species	2005/06			2006/07			2007/08			2008/09			2009/10			2010/11		
	catch	value	avg value	catch	value	avg value	catch	value	avg value	catch	value	avg value	catch	value	avg value	catch	value	avg value
	'000 kg	,\$000	\$/kg	'000 kg	,\$000	\$/kg	'000 kg	,\$000	\$/kg	'000 kg	,\$000	\$/kg	'000 kg	,\$000	\$/kg	'000 kg	,\$000	\$/kg
King George whiting	336	4,033	\$12.00	354	4,687	\$13.24	330	4,547	\$13.78	339	5,083	\$14.99	343	5,148	\$15.01	340	5,166	\$15.20
Snapper	529	3,376	\$6.38	643	4,338	\$6.75	743	5,264	\$7.09	786	5,771	\$7.34	916	6,594	\$7.20	972	6,643	\$6.83
Southern calamari	311	2,200	\$7.07	297	2,878	\$9.69	303	2,728	\$9.00	281	2,727	\$9.70	366	3,578	\$9.78	326	3,396	\$10.42
Garfish	369	2,139	\$5.80	293	1,933	\$6.60	290	2,137	\$7.37	294	2,019	\$6.87	281	1,744	\$6.20	261	1,578	\$6.04
Shark	152	585	\$3.85	182	684	\$3.76	203	927	\$4.57	236	917	\$3.89	353	1,320	\$3.74	270	1,031	\$3.82
Salmon	177	338	\$1.91	157	254	\$1.62	105	174	\$1.66	120	222	\$1.85	171	300	\$1.76	154	252	\$1.64
Sand crabs	142	539	\$3.80	83	395	\$4.76	63	275	\$4.37	98	400	\$4.08	71	343	\$4.83	72	318	\$4.42
Yellowfin whiting	130	805	\$6.19	85	622	\$7.32	82	722	\$8.81	111	904	\$8.14	104	827	\$7.95	98	768	\$7.84
Goolwa cockle	1	1	\$1.00	5	10	\$2.00	2	8	\$4.00	32	221	\$6.90	8	78	\$9.77	0	0	\$0.00
Australian herring (tommy ruff)	126	318	\$2.52	105	327	\$3.11	122	394	\$3.23	143	466	\$3.26	168	460	\$2.74	118	363	\$3.07
Mud cockle	385	1,250	\$3.25	282	1,378	\$4.89	320	1,673	\$5.23	171	1,389	\$8.12	99	1,097	\$11.08	85	1,139	\$13.40
Snook	61	171	\$2.80	64	222	\$3.47	82	266	\$3.24	70	253	\$3.61	65	230	\$3.54	62	213	\$3.44
Yelloweye mullet	38	100	\$2.63	36	102	\$2.84	29	90	\$3.11	30	105	\$3.50	23	95	\$4.14	28	109	\$3.91
Leatherjackets	na	na	na	68	104	2	46	77	\$1.67	33	72	\$2.18	155	358	\$2.31	88	266	\$3.02
Mulloway	5	28	\$5.60	5	39	\$7.80	6	45	\$7.50	4	31	\$7.75	na	na	na	na	na	na
Cuttlefish	7	21	\$3.00	11	21	\$1.91	6	14	\$2.33	4	19	\$4.75	na	na	na	na	na	na
King Crabs	na	na	na	18	233	12.9444	21	286	13.619	21	339	16.143	18	253	14.056	18	650	36.111
Octopus	na	na	na	11	67	\$6.09	22	122	\$5.55	30	203	\$6.77	8	49	\$6.13	12	81	\$6.75
Seaworms & fish roe	na	na	na	7	356	50.8571	7	397	56.7143	7	385	55	6	322	53.667	6	349	58.167
Other msf species	268	1,358	\$5.07	128	350	\$2.73	127	282	\$2.22	162	378	\$2.33	146	454	\$3.11	135	530	\$3.93
<b>TOTAL <sup>b</sup></b>	<b>3,186</b>	<b>17,446</b>	<b>\$5.48</b>	<b>2,834</b>	<b>18,999</b>	<b>\$6.70</b>	<b>2,909</b>	<b>20,430</b>	<b>\$7.02</b>	<b>2,972</b>	<b>21,904</b>	<b>\$7.37</b>	<b>3,301</b>	<b>23,251</b>	<b>\$7.04</b>	<b>3,045</b>	<b>22,852</b>	<b>\$7.50</b>

<sup>a</sup> SARDI estimates of GVP have been re-valued to reflect price differentials between Adelaide, interstate and local markets.

<sup>b</sup> Does not include sardines. Includes marine scalefish species harvested by all licence holders and catch taken by rock lobster fishery licence holders who have access to marine scalefish gear. To prevent double counting, estimates of catch do not include any Blue Crab catch.

Source: EconSearch 2012

#### **4.4.2 Cost of management**

PIRSA collects licence fees from commercial licence holders under the South Australian Government's cost recovery policy for the management of commercial fisheries. Licence fees contribute to the costs of management, compliance and research. More details on the recovery of the costs of management are provided in Section 15.2.

The total cost of management in 2010/11 was \$2 million, which was a 5% increase from the previous year. As a percentage of GVP, the total cost of management was 8.9 % in 2010/11 (EconSearch 2012).

Whilst the total cost of management has remained steady or declined in recent years, the average fee per licence has generally increased, as a direct result of the reduction in licence numbers through natural attrition within the Restricted Marine Scalefish Fishery and through licence amalgamations in the MSF.

#### **4.4.3 Financial performance**

The management plan sets out a number of economic indicators that are to be used as a measure of the economic performance of the fishery. These include; GVP, gross income, costs, cash operating surplus, return on investment and licence values.

Based on the results of surveys of licence holders conducted in 2007 and 2011 and values from 2006/07 and 2010/11, it was estimated that the average gross income per surveyed boat in the MSF in 2010/11 was approximately \$92,300. This has decreased when compared to 5 years prior in 2006/07 where it was estimated to be \$95,080. It was estimated that average total boat cash costs decreased by 8% between 2006/07 and 2010/11. However, the average gross income and average total boat cash costs fluctuate from year to year (EconSearch 2008, EconSearch 2012).

For the MSF as a whole, the average rate of return to total capital was 1.3% in 2010/11 (compared with -1.1% in 2006/07). For fishers with net and line entitlements the rate of return to total capital was 6.7% and for line only fishers it was -1.0% (compared with 12.4% and -6.9% in 2006/07, respectively) (EconSearch 2008, EconSearch 2012).

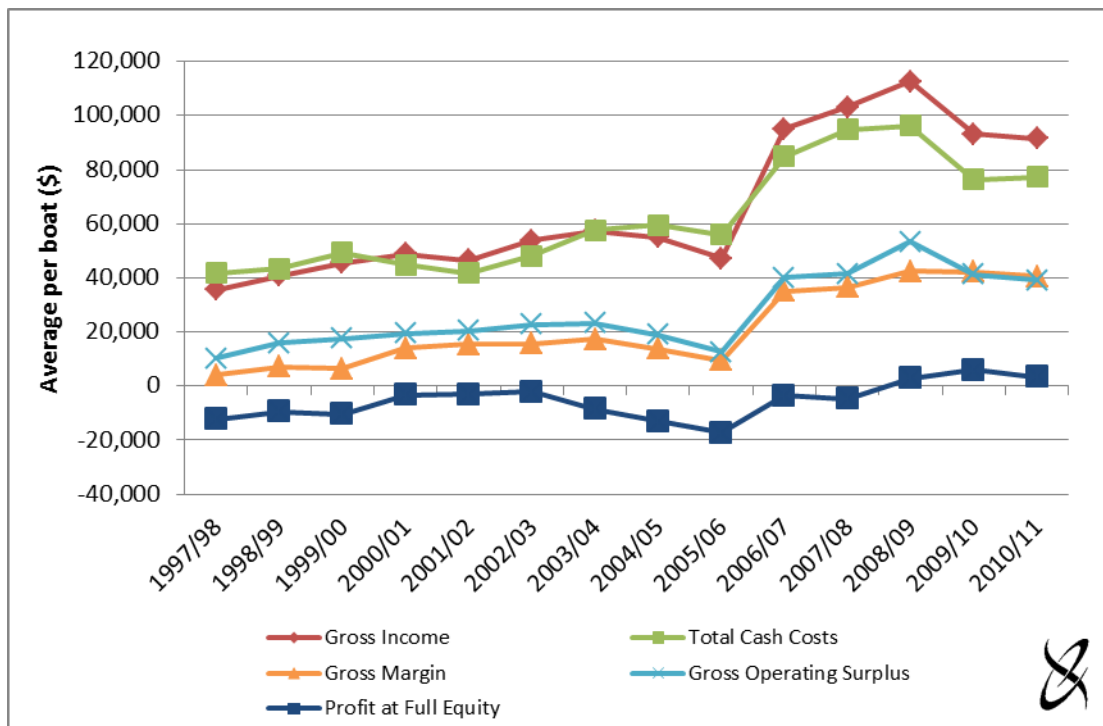


Figure 4. Average income and profit per boat in the Marine Scalefish Fishery, 1997/98 to 2010/11  
<sup>a</sup> Estimates of income and profitability measures are expressed in nominal terms.  
Source: EconSearch (2012)

#### 4.4.4 Employment

The MSF generates direct and indirect employment, contributes to regional development and supports significant small businesses through direct fishing enterprises and other support industries, primarily in regional South Australia.

The provision of employment is very important to the fishing industry and the broader community, particularly in regional areas. Table 3 shows that in 2010/11, the MSF was responsible for the direct employment of around 586 full-time equivalent jobs (fte) and downstream activities created employment of another 93 fte jobs state-wide. Flow-on business activity was estimated to generate a further 268 fte jobs state-wide.

Table 4. Economic impact of the SA Marine Scalefish Fishery on the South Australian economy, 2010/11

Sector	Output		Employment <sup>a</sup>		Household Income		Contribution to GSP	
	(\$m)	%	(fte jobs)	%	(\$m)	%	(\$m)	%
Direct effects								
Fishing	22.9	24.0%	586	61.9%	9.6	32.4%	9.6	21.7%
Processing	0.1	0.1%	0	0.0%	0.0	0.1%	0.0	0.1%
Transport	0.0	0.0%	0	0.0%	0.0	0.0%	0.0	0.0%
Retail	5.4	5.7%	57	6.0%	2.0	6.7%	2.8	6.3%
Food services	0.6	0.7%	4	0.4%	0.2	0.6%	0.3	0.6%
Capital expenditure <sup>b</sup>	7.3	7.7%	32	3.3%	1.7	5.8%	2.5	5.6%
<i>Total Direct</i> <sup>c</sup>	<b>36.4</b>	<b>30.5%</b>	<b>679</b>	<b>68.4%</b>	<b>13.5</b>	<b>39.7%</b>	<b>15.2</b>	<b>28.7%</b>
Flow-on effects								
Trade	9.2	9.7%	74	7.8%	3.0	10.3%	4.4	9.9%
Manufacturing	12.2	12.8%	48	5.1%	2.7	9.2%	4.0	8.9%
Business Services	8.1	8.5%	34	3.6%	2.8	9.5%	3.8	8.7%
Transport	3.0	3.1%	11	1.1%	0.7	2.4%	1.3	2.9%
Other Sectors	26.5	27.8%	102	10.7%	6.9	23.1%	15.6	35.2%
<i>Total Flow-on</i> <sup>c</sup>	<b>59.0</b>	<b>61.8%</b>	<b>268</b>	<b>28.3%</b>	<b>16.2</b>	<b>54.5%</b>	<b>29.0</b>	<b>65.7%</b>
<b>Total</b> <sup>c</sup>	<b>95.4</b>	<b>100.0%</b>	<b>947</b>	<b>100.0%</b>	<b>29.7</b>	<b>100.0%</b>	<b>44.2</b>	<b>100.0%</b>
Total/Direct	2.6	-	1.4	-	2.2	-	2.9	-
Total/Tonne	\$31,300	-	0.31	-	\$9,700	-	\$14,518	-

<sup>a</sup> Full-time equivalent jobs. Direct employment in the fishing sector was comprised of 360 full-time jobs and 393 part-time jobs, that is, 753 jobs in aggregate, which was estimated to be equal to 586 fte jobs.

<sup>b</sup> Capital expenditure includes expenditure on boats, fishing gear and equipment, sheds and buildings, motor vehicles and other equipment.

<sup>c</sup> Totals may not sum due to rounding.

Source: EconSearch (2012)

## 4.5 Social characteristics

The MSF is unique from many other Australian fisheries in that several social studies have been undertaken on the fishery. Reports for these projects were produced in 2005 and 2011 and a further national social indicators project (FRDC 2010/040), including a MSF survey, was nearing completion at the time of finalising this management plan. The social surveys in the fishery were undertaken in 2004, 2007 and 2011 respectively. It is acknowledged that the social aspects of the MSF have a symbiotic relationship with the ecological and economic aspects of the fishery and cannot always be neatly separated (Sullivan et al. 2011).

The MSF is a large and diverse fishery stretching across most of South Australia's coastline. Several hundred fishers work in the MSF, contributing significantly to the communities and economies of many coastal regions (Schirmer and Pickworth 2005). Many of the fishers live in small communities, return to their homes every night after a day on the water, purchase goods locally, socialise in the local pubs and clubs, support local football teams, and send their children to local schools. There are also a number of fishers that live in the South Australian capital, Adelaide (Hundloe and Sullivan 2011).

The commercial fishers' success or otherwise is intertwined with the desires and aspirations of all those who seek fish in South Australian coastal waters. Commercial, recreational and

charter operators and local Aboriginal groups all undertake fishing and target species that are managed within the fishery (Hundloe and Sullivan 2011).

Many members of the fishery are strongly connected to the industry. This is reflected in the length of time the fishers have remained in the fishery and have been involved in the industry generally, as well as the high level of involvement by family and friends in the fishing business. According to Brooks (2011), fishers have not historically had a depth of social structures in place through their relationship networks to provide them with ready access to new or different ideas, approaches or perspectives. Broader networks could provide further resources to improve their circumstances and obtain greater support from the broader community (Brooks 2011).

#### **4.5.1 Social profiles and fishing profile of those working in the MSF**

Table 5 provides a summary of the findings from the various social surveys that have been undertaken in the MSF fishery and an overview of the fishery in recent years. It is noted that the data have not always been collected in the same manner, which can make comparing/contrasting changes in the fishery over time somewhat difficult.

MSF participants are predominantly (but not solely) male; there is also a high number of women who undertake unpaid work involved in managing the fishing businesses. These unpaid workers are part of a significant unpaid workforce in the industry, with the average number of unpaid employees per business being 1.05 persons. Most fishers have achieved low levels of formal education, reflecting that their considerable fishing skills and knowledge have been gained through working in fishing rather than formal training. Respondents in a 2004 survey had worked in the fishery for long periods, on average over 20 years and up to 65 years. Contrary to common perception, only around half reported a family history of involvement in commercial fishing. Dependence on fishing for income is high, with most household income derived from fishing activities. (Schirmer and Pickworth 2005).



Table 5: Social profiles and fishing profile of those working in the MSF

Survey date	2004 <sup>@</sup>	2007 <sup>#</sup>	2011 <sup>*</sup>
Age	Average 50.7	Median age 48 years	Majority between 41-60 years (23% in 51-55 age bracket)
Gender	Almost all male	Male 97% Female 3%	
Marital status (Married or in de-facto relationship)	81.4%	91%	
Average number of dependents		1.3 persons	
Highest level of formal education	Primary school 23.7% Fourth year high school 39.6% High school certificate 20% TAFE/University 16.6%	Primary school 24% Fourth year high school 54% High school certificate 11% TAFE/University 11%	
Locations fishers live and fish		Where they live and fish: Port Pirie and environs 16% Port Wakefield 14% Yorke Peninsula 14% Port Adelaide 11% Greater Adelaide 11% Port Broughton 8% Cowell and environs 8% King Island 5% Port Lincoln 5% Whyalla 5% Port Augusta 3%	Where they fish: Spencer Gulf/Coffin bay 40% Gulf St Vincent/Kangaroo Island 32% West Coast 22% Other 6%
Expect to be living in the same location in 5 years		97%	
Expect to be working in the same industry in 5 years		89%	
Average years working in the commercial fishing industry	23	28.4	
Average years worked in the fishery	21.4	25.5	23
Average number of generations of same family in the fishing business	First generation 53.3% Two or more generations 46.7%	2.7	
Full time/Part time	76.9%/23.1%		

Sources: <sup>@</sup>Schirmer and Pickwoth 2005, <sup>#</sup>Brooks 2011 (noting this applies to net fishers), and <sup>\*</sup>EconSearch 2012

#### **4.5.2 Variability in size of MSF fishing businesses**

The economic indicator reports outline the variability in size of MSF fishing businesses. Generally fishers who had endorsements to fish using nets generally had larger business than fishers who had line only endorsements, particular those with Restricted Marine Scalefish Fishery (B-Class) licences (Schirmer and Pickworth 2005). This is also reflected in the economic data for the fishery.

Most MSF licences are restricted to fishing activities using a master and two agents (who assist the master in fishing operations) and restricted MSF licences are permitted to use a master and only 1 agent. This effort control also limits the size of the fishing business. In addition, not all licences employ the full complement of agents. The average number of agents employed had increased from 1.4 fishers in 1984 to 1.6 in 2007 (Steer 2009). The number and type of gear endorsements vary between licences; individual fisher fishing effort also varies. Some MSF licences have unique gear types, which allows the fishing business to diversify and some to exert more effort. All these factors influence the size of the fishing business.

MSF licence holders may fish on a part-time or full-time basis. Some fishers define their fishing operation as a 'lifestyle which has its own culture and customs' (PIRSA 1999).

#### **4.5.3 Quality of life**

Respondents to the 2004 survey reported being very satisfied with their life overall, while having lower overall satisfaction with their fishing work. Most reported feeling a strong or very strong attachment to their local community, and rated their local community as a good or very good place to live. Most fishers believed they were negatively perceived, which reduced their quality of life, as they felt less accepted as part of the broader community (Schirmer and Pickworth 2005).

While most MSF participants have a high quality of life, various pressures – including many related to their fishing work - are reducing this quality of life for many. Quality of life was highly related to work and financial satisfaction, and to the level of involvement fishers had in their local communities. Most fishers do not work in fishing with the goal of earning a high income, but for reasons including enjoyment of the types of tasks undertaken and environment worked in when fishing (Schirmer and Pickworth 2005).

Many respondents reported experiencing a range of health problems including headaches, stress and anxiety, excessive fatigue and difficulty sleeping. Most had not sought medical attention for these problems. However, a large majority (79%) reported experiencing back pain with many seeking medical assistance for this problem (Schirmer and Pickworth 2005).

Opportunities for interaction with other fishers tend to be fragmented, with fishers often interacting mainly via informal local networks of fishing acquaintances. Membership of fishing representative groups was low, as was attendance at meetings of these groups. This limits opportunities for transfer of knowledge and skills within the fishery, and the ability of the fishery to take actions on issues of concerns as a united group (Schirmer and Pickworth 2005).

#### **4.5.4 Impacts of the MSF on different South Australian regions**

Commercial fishing of marine scalefish species provides significant benefits to regional economies (PIRSA 1999). Key regions that the MSF has a high regional impact, in terms of economic spending, membership of community groups and historical links to the local area, are the West Coast (principally Ceduna, Thevenard and Streaky Bay), Port Lincoln, Yorke Peninsula and Kangaroo Island. In western Adelaide there is a high impact, primarily via delivery of catch to fish receivers, but also through a relatively high number of MSF participants residing in the region (Schirmer and Pickworth 2005).

The dynamics of the fishing fleet has changed over recent years, and appear to be stimulated by management changes (i.e. effort reductions from the amalgamation scheme and net buy back). There has been a large spatial contraction of effort across the state, with fishing intensity decreasing from most regional centres outside of the gulfs and the fishery becoming almost exclusively confined to gulf waters (Steer 2009).

#### **4.5.5 Social licence to operate**

Social licence to operate refers to the metaphorical moral licence that society provides to an industry to utilise a community owned/government managed natural resource (Sullivan et al. 2011). The MSF stocks are a common property resource, owned by the South Australian community, who have empowered the government of the day, to manage for them on their behalf (PIRSA 1999). South Australian commercial fishing licences are granted under the *Fisheries Management Act 2007*. The Act is amended and supported by the South Australian Government, which is democratically elected by the South Australian community.

The nature of the fishery being a community owned resource, can mean the fishing industry is subject to public scrutiny for a range of matters including fishing intensity, bycatch, fishing practices, interactions with protected species and resource sharing/access conflicts. An industry is better placed to counter adverse and uneducated criticism if it can demonstrate this understanding incorporating it into the fisheries management arrangements and monitoring, for biological, economic and social aspects. This is a social challenge for most fisheries (Sullivan et al. 2011).

The MSF contributes to the social, environmental, economic and heritage values of the various fishing regions around the state, through involvement in community-support activities and contribution to the provision, maintenance and expansion of local and regional services and businesses (Econsearch 2012).

While fish from the fishery is purchased by consumers, many fishers perceive that most consumers do not link where their fish comes from, or value the fishery service of providing fresh local fish. This may weaken the fishery's social licence.

## 5 CO-MANAGEMENT ARRANGEMENTS

The Fisheries Council of South Australia (Fisheries Council) was established under the *Fisheries Management Act 2007*. The functions of the Fisheries Council are set out in Section 16 of the Act and include preparing management plans under the Act, advising the Minister on allocation issues and promoting the co-management of fisheries.

Essentially, co-management is an arrangement whereby responsibilities and obligations for sustainable fisheries management are negotiated, shared or delegated at appropriate levels between government, the commercial fishing industry, recreational fishers, Aboriginal traditional fishers and other key stakeholders such as conservation groups (Neville 2008). Fisheries co-management operates across a wide spectrum, starting from centralised government regulation with no industry input at one end, to more autonomous management by industry groups and key stakeholders at the other, where government plays more of an audit role. It is designed to achieve efficient regulatory practice (among many other things) and is by no means a way of industry or other key stakeholders avoiding regulatory scrutiny and influence.

The Fisheries Council has prepared the *Policy for the Co-Management of Fisheries in South Australia* to provide an overarching framework to promote co-management of fisheries in South Australia and is designed to further the objective outlined in section 7(1)(e) of the *Fisheries Management Act 2007*, which states that “the participation of users of the aquatic resources of the State, and of the community more generally, in the management of fisheries is to be encouraged”. This policy is also consistent with the Fisheries Council function outlined under section 16(c) of the Act “to promote the co-management of fisheries”. The policy proposes that implementation of a preferred co-management model should be through a phased approach that allows industry and key stakeholders to build their capacity over time and allows for a government audit process to measure performance and success.

The Marine Fishers’ Association Inc. (MFA) has been recognised by PIRSA as the representative industry body for the commercial MSF.

A co-management committee known as the Marine Scalefish Fishery Management Advisory Group (MSFMAG) has been established by the MFA and its membership includes the MFA executive, PIRSA and SARDI. Whilst the Minister has oversight of the management of the fishery under this management plan, day to day management is conducted by PIRSA in association with the MFA both directly and through the MSFMAG. Consultative co-management arrangements have been established in the MSF, where PIRSA administers fisheries legislation and makes decisions on fisheries management through consultative processes with input from fishers and other key stakeholders. Fisheries management decisions are discussed and debated through stakeholder based fisheries management committees such as the MSFMAG, however the majority of management decisions are still made by the government management agency.

Under this management plan, the responsibility for reporting on and taking action in regard to issues such as breaches of harvest strategy rules and allocation triggers lies with the MSFMAG in association with PIRSA. On an annual basis PIRSA and the MFA will recognise the functions of the MSFMAG and set out a schedule of meetings to fulfil its obligations as well as including any agreements about addressing specific management issues. This agreement will follow on from agreements around co-management services and the cost recovery cycle.

Opportunities to improve the co-management arrangements for the MSF will continue to be pursued in accordance with the principles provided by the *Policy for the Co-Management of*

*Fisheries in South Australia*, in an effort to deliver sound management outcomes in an effective and efficient manner. This will include exploring opportunities for industry to take greater responsibility of the management of the fishery.

## **6 ALLOCATION OF ACCESS BETWEEN SECTORS**

The *Fisheries Management Act 2007* provides that a management plan must specify the share of the fishery to be allocated to each fishing sector under the plan (43(2)(h)).

The Act also provides that, in determining the share of aquatic resources to be allocated to a particular fishing sector under the first management plan for an existing fishery, the share of aquatic resources to which that fishing sector had access at the time the Minister requested the Council to prepare the plan (based on the most recent information available to the Minister) must be taken into account (43(3)).

The Minister formally requested that the Fisheries Council prepare this management plan on 17 June 2010. Therefore, this plan must take into account the share of aquatic resources that the commercial MSF, other commercial fisheries, the recreational sector and the Aboriginal traditional sector had access to at that time. The best available information regarding sector shares at this time is the catches from 2007/08, the year in which the most recent recreational catch information is available.

To guide the allocation process within management plans, the Minister for Agriculture, Food and Fisheries has issued a policy directive in the form of the Allocation Policy. The policy addresses issues related to the allocation of access between extractive used groups.

### **6.1 Sectors of the Marine Scalefish Fishery**

#### **6.1.1 Commercial Sector**

Commercial fishing sector licences providing some form of access to marine scalefish species include the Marine Scalefish Fishery (MSF), Southern Zone Rock Lobster Fishery (SZRL), Northern Zone Rock Lobster Fishery (NZRL), Miscellaneous Fishery (MISC), Lakes and Coorong Fishery (LCF), Gulf St Vincent Prawn Fishery (GSVP), Spencer Gulf Prawn Fishery (SGP), West Coast Prawn Fishery (WCP) and the Blue Crab Fishery (BCF). All fisheries with access have been included in the initial allocation process.

Whilst some marine scalefish species are taken by the Southern Eastern Scalefish and Shark Fishery (SESSF) managed by the (Australian Government) Australian Fisheries Management Authority (AFMA), these commercial fisheries are outside the jurisdiction of the South Australian Government and as such, an allocation has not been provided to these fisheries.

#### **6.1.2 Recreational Sector**

The recreational fishing sector accounts for a significant proportion of the total catch of a number of marine scalefish species, including high value species such as King George Whiting and Southern Calamari. Charter Boat Fishery catch is considered to be recreational catch and the allocation of shares of marine scalefish species for the Charter Boat Fishery is included as part of the broader recreational fishing sector. A discrete allocation of Snapper and King George Whiting has been recognised for the Charter Boat Fishery component of the recreational sector.

Marine scalefish species are taken by both South Australian resident and non-resident (inter-State and overseas visitors) recreational fishers. Information on the catch by non-residents is not routinely collected and there is currently no cost-effective method to capture this information. For this reason the allocation is based on recreational catch estimates from South Australian residents only. Future recreational fishing surveys will be undertaken in a manner so that the data can be compared to ensure allocations are managed consistently.

### **6.1.3 Aboriginal Traditional Sector**

Access to South Australia's fisheries resources by Aboriginal communities under the *Fisheries Management Act 2007* will be provided through Aboriginal traditional fishing management plans. These plans may be developed when an Indigenous Land Use Agreement (ILUA), agreed to resolve a native title claim, is in place in relation to a native title claim area. The State is currently engaged in ILUA negotiations with native title claimants and other stakeholder groups, including the fishing industry. The agreements arising from these negotiation processes will inform the way that access to fisheries resources by Aboriginal communities is defined and implemented. Aboriginal traditional fishing under the Act only relates to fishing agreed through the ILUA process. Aboriginal people are also recreational fishers outside of these arrangements.

Prior to implementation of the *Fisheries Management Act 2007* (and the development of this management plan), Aboriginal traditional fishing had not been distinguished from recreational fishing in relation to the collection of catch information. Subsequently, there are no estimates of catch taken by this fishing sector.

In this management plan, a share of access has been allocated and set aside for the purpose of resolving native title claims. A nominal share of 1% has been made to the Aboriginal traditional sector which has been deducted from the recreational share. This is because Aboriginal traditional fishing is non-commercial fishing. Where the estimate of the recreational share for a particular species is less than 1%, the Aboriginal traditional allocation has been set at half of the recreational share.

Fishery-related ILUAs will be negotiated over coming years. Therefore, at the appropriate review of this management plan, any difference between the nominal share put aside and the actual share agreed through the ILUA can be calculated. Any difference would then be re-allocated to or from the recreational sector.

## **6.2 Spatial scale of allocation**

When determining the shares of aquatic resources to be allocated, it is important to clarify the spatial extent of the fishery to which the allocation applies. Shares for a species may be allocated in a number of ways including fishery boundaries, management regions, biological or stock boundaries or a single allocation across the State.

In the first instance, shares have been allocated at the state-wide level providing a single allocation for each of the sectors for each species allocated. However in some cases the allocation has been determined at the fishery level to better reflect management arrangements and stock boundaries. That is, for some species two separate allocations have been made; one for the MSF and one for the Lakes and Coorong Fishery (LCF).

Allocating according to commercial fishery boundaries, in this case the boundary of the MSF, is likely to reduce the complexity of managing shares in the future, however it may also increase the complexity surrounding the recreational allocation, and managing those shares into the future.

For the purposes of the allocations provided in this management plan the MSF allocation includes the ocean beach area of the LCF. All commercial LCF catch in this region has been considered and allocated within this fishery allocation. The allocation within the inland waters component of the LCF (referred to as LCF inland) incorporates catches exclusively within the Lakes and Coorong Fishery inland area. Catches in this region will be from commercial Lakes and Coorong licence holders only.

### **6.3 Species allocated**

The list of permitted fish species and fish families for the commercial MSF is extensive (Schedule 1), with over 60 species recorded as landed in logbooks annually. There are also a significant number of 'scalefish' species taken by the recreational sector that cannot be taken for commercial purposes. Only those species permitted to be taken for commercial purposes have been considered for allocation within this management plan.

Not all eligible marine scalefish species will be allocated within this management plan. Only species for which there is an identified need have been allocated. In order to prioritise species for allocation a number of factors have been considered, including:

- Importance to the fishery (both commercial and recreational)
- Production (total catch)
- Commercial value
- Level of exploitation
- Inter-annual variability in catches
- Reliability of catch estimates

These same factors have been used to prioritise species for management and research also. Species have been classed as either primary, secondary, tertiary or other. Only primary and secondary species have been allocated.

Not all species allocated below are individual species, some include a number of similar species grouped together. This is because some species are difficult to identify and there may be misreporting, or non-differentiation by species by both commercial and recreational fishers. Where multiple species are included within a single species, the species name is followed by the abbreviation 'spp', e.g. Mullet spp.

### **6.4 Future allocations**

Future consideration will be given to determining allocations for those species yet to be allocated. For a species to be allocated, it will need to be elevated to either a secondary or primary species based on the criteria listed above. The review of species allocations will be undertaken in accordance with the review of the management plan and will be consistent with the Allocation Policy. The shares of the resource at the time the species is incorporated or requested to be incorporated into the allocation framework of the management plan, will be used in determining the initial allocation of shares between fishing sectors.

Furthermore, a need may arise to adjust the spatial scale of an allocation for a particular species. This may come about as a consequence of new information such as information regarding stock discrimination. In the event of a spatial allocation adjustment, the 'new' determination of shares needs to reflect the pre-existing shares, as well as taking into consideration the most recent information within the new spatial areas to which the allocation

applies. A spatial allocation adjustment should not be undertaken in such a manner that broadly re-allocates the resource from one sector to another. Any such re-allocation should be done explicitly in line with the Allocation Policy and the processes outlined within this management plan.

## 6.5 Sector allocations

### 6.5.1 Primary species

*King George Whiting, Snapper, Southern Garfish and Southern Calamari.*

These four species are the highest ranked commercial species in terms of total production and value. They are also significant target species of the recreational sector, with reliable catch estimates available for each species. Catches have been stable over time with smaller inter-annual fluctuations in commercial catches than for most other species. The allocations for these species are provided in Table 6.

Table 6. Allocated shares of primary species for the MSF

Species	Commercial		Recreational		Aboriginal traditional	Total
King George Whiting	MSF	49.5%	REC	45.5%	1%	
	SZRL	0.0%	CHARTER	3.0%		
	NZRL	1.0%				
Total	50.5%		48.5%		1%	100%
Snapper	MSF	79%	REC	8%	1%	
	SZRL	1.45%	CHARTER	10%		
	NZRL	0.55%				
	LCF	0.03%				
Total	81%		18%		1%	100%
Southern Garfish	MSF	79.33	19.5		1%	
	SZRL	0.13				
	NZRL	0.04				
Total	79.5%		19.5%		1%	100%
Southern Calamari	MSF	56%	37.4		1%	
	NZRL	0.45%				
	GSVP	0.45%				
	SGP	4.6%				
	WCP	0.1%				
Total	61.6%		37.4%		1%	100%

### 6.5.2 Secondary species

*Vongole sp., Yellowfin Whiting, Australian Herring, Snook, Mullet spp., Mulloway, Bronze and Dusky Whaler Shark, Sand Crab and Blue Swimmer Crab (outside the Gulfs).*

These species are medium-high value species and make a significant contribution to the total production value of the commercial MSF. Most species have a significant recreational component, with reliable catch estimates available for all species (excluding Vongole and Sand Crab). Secondary species generally exhibit larger inter-annual fluctuations in catch than primary species, which may be attributable to a number of factors including availability, market price and fishing effort. The allocations for these species are provided in Table 7.



Allocations have not been made between the different fisheries within the broader commercial sector for secondary species. This reflects the lower importance of maintaining the shares between the different commercial fisheries for these species, yet retains the allocation of resources between the commercial, recreational and Aboriginal/traditional fishing sectors.

Note that where an allocation is made for marine waters or Inland waters of L&C, the Inland waters of L&C allocation refers to the inland waters region of the Lakes and Coorong Fishery only. The marine waters allocation includes the commercial LCF catches from the ocean beach region of the fishery.

The Blue Swimmer Crab allocation provided in this management plan is for that part of the Blue Swimmer Crab fishery that occurs outside the gulfs. Effectively this fishery is confined to the West Coast and is considered separately to the quota managed Blue Crab Fishery of the gulfs.

Table 7. Allocated shares of secondary species for the MSF

Species		Commercial	Recreational	Aboriginal traditional	Total
Vongole (Mud Cockle) spp.		99.7%	0.15%	0.15%	100%
Yellowfin Whiting		78%	21%	1%	100%
Australian Herring		56.5%	42.5%	1%	100%
Snook		49.5%	49.5%	1%	100%
Mullet spp.	Marine waters	54.2%	44.8%	1%	100%
	Inland waters of L&C	98.9%	0.55%	0.55%	100%
Mulloway	Marine waters	19.9%	79.1%	1%	100%
	Inland waters of L&C	71.4%	27.6%	1%	100%
Bronze & Dusky Whaler Shark		73.7%	25.3%	1%	100%
Sand Crab		85%	14%	1%	100%
Blue Swimmer Crab MSF (Outside Gulfs)		81.7%	17.3%	1%	100%

### 6.5.3 Western Australian Salmon

Two types of commercial Western Australian Salmon quota were originally issued in 1984; 800 tonnes of transferable special quota and a non-transferable maximum catch limit of 20 tonnes per year on net licences with access to the MSF, which was issued as an aggregate catch limit of 300 tonnes. A portion of the special quota is held on a Miscellaneous Fishery licence.

A number of historical netting closures were introduced from the late 1950s to 2000 for a range of fisheries management reasons and additional netting closures were introduced as part of the restructure of the MSF in 2005. Over time, netting closures have reduced the

availability of areas for the commercial harvest of Western Australian Salmon, as it is largely a net capture fishery. The catch data available for 2007/08 do not reflect the existing access arrangements between the commercial and recreational sectors of the fishery, or within the components of the commercial sector. The 2007/08 catches (kg) are provided in Table 7 below.

Table 8. 2007/08 catches (Kg) of Western Australian Salmon by sector and area.

	MSF	SZRL	NZRL	MISC	L&C (Marine waters)	L&C (inland waters of Lakes and Coorong )	REC (marine waters)	Rec (inland waters of Lakes and Coorong )
Western Australian Salmon	105,317	3	10	0.00	31	6269	83,395	7,907

The management arrangements in place for Western Australian Salmon were established some 30 years ago and as such, need to be reviewed to consider whether they are comprehensive enough to provide for the future sustainable management of the Western Australian Salmon fishery. Western Australian Salmon has therefore not been allocated in this management plan. A review of the management arrangements and allocation of resource shares between fishing sectors will be completed for Western Australian Salmon before the first major review of the management plan.

#### 6.5.4 Tertiary species and other species

**Tertiary:** Trevally, Ocean Jackets, Leatherjacket sp., Gummy Shark, School Shark, Wrasse, Black Bream, Redfish spp., Yellowtail Kingfish, Cuttlefish spp., Octopus spp., Scallop and Razorfish

**Other:** Flathead spp., Sea Sweep, School Whiting, Weedy Whiting, Bluespotted Goatfish, Southern Rock Cod, Barracouta, Flounder, Morwong spp., Blue Mackerel, Jack Mackerel, Goulds Squid, Mussels, Mako Shark, Sharks, Skates & Rays and Worm spp.

Tertiary and other species have not been allocated within this management plan. These species are of low-medium value and make a minor contribution to the total production value of the commercial MSF. Many of these species are considered by-product species taken when targeting other species, however specialised commercial fisheries have been developed for some. Commercial catches can vary significantly from year to year depending on a range of factors including availability, availability of other species, price and fishing effort. Recreational catch varies between species, with some catches dominated by the recreational sector. Reliable recreational catch estimates are not available for many of these species.

#### 6.6 Information used to allocate shares

In determining the share to be allocated to a particular fishing sector under the first management plan for an existing fishery, the share to which that sector had access at the time the Minister requested the Council to prepare the plan (based on the most recent information available to the Minister) must be taken into account.

Quantifying current shares was an estimate based on the best available information on the current level of use of all sectors.

The Allocation Policy requires that information about current use by sectors must be –

- Real – that is, data must be available – it must have been collected and published;
- Recent – data on which the information is based should be the most recent available, and in any case no more than five years old; and
- Reliable – the data on which the information is based should have been obtained, and the information or report collated or prepared, in a way that is verifiable. The process for obtaining the data and preparing the information should be properly documented.

The information used to allocate shares of aquatic resources in this management plan is derived from the following sources:

- 2007/08 South Australian Recreational Fishing Survey (Jones 2009)
- The South Australian Recreational Charter Boat Fishery Report 2009 (Knight 2010)
- South Australian Wild Fisheries Information and Statistics Report (Knight and Tsolos 2009)
- South Australian Wild Fisheries Information and Statistics Report 2008/09 (Knight and Tsolos 2010)
- SARDI Aquatic Sciences catch and effort database of licensed commercial fishers' logbook returns from 2007/08

## **6.7 Review of allocations**

Allocations between sectors will be reviewed in accordance with the Allocation Policy and under the following scenarios:

1. A review of the management plan, which will reassess the appropriateness of shares and may trigger an adjustment; or
2. One or more sectors exceed their allocation in accordance with the allocation triggers described in Section 6.9; or
3. A major change in the management of a species and or a sector that results in a shift of allocations to a sector(s).

The declaration of a marine protected area that would result in a reallocation of shares would be given effect through the *Marine Parks Act 2007* and policies applying under that Act. That Act provides that compensation may be paid to licensed fishers affected by the closure of an area or restrictions of activities within a marine park.

## **6.8 Review process**

The process to review allocations under the scenarios described above will be a two-staged approach. The first stage is an initial assessment to determine whether a full assessment is necessary or appropriate.

### **6.8.1 Initial assessment**

The initial assessment is a process that will be overseen by the Fisheries Council, with the exception of a breach in the 'commercial only shares' trigger. Commercial only shares will be reviewed on an annual basis by the MSFMAG and in the instance where a trigger is breached the initial review will be undertaken by this group (and where appropriate

representatives from other commercial fisheries' industry associations will be invited participate). A report on the assessment will be provided to the Fisheries Council with a recommendation to proceed to a full evaluation or not. The Fisheries Council will determine whether to move to a full evaluation, or may elect to refer a decision to the Minister.

Once an allocation trigger is breached or the need for a review has been recognised, an assessment committee is to be established and chaired by an independent person (either Fisheries Council member or external appointment). The committee is required to assess the need for a second-stage assessment based on the following:

1. Has there been a shift in the access value of the fishery? Or is new information available that suggests a reallocation of shares would bring additional social and economic benefits to the State?
2. If a trigger limit has been breached, can the breach be readily explained and justified?
3. Is the potential change in shares significant and considered long-term? A minor shift/anomaly may not require a full review.

A written report is to be prepared by the committee to the Fisheries Council, with a recommendation to proceed to a full evaluation or not. The Fisheries Council will determine whether to move to a full evaluation, or may elect to refer a decision to the Minister.

### **6.8.2 Full assessment**

As with the initial assessment, a full assessment of allocation is a process that will be overseen by the Fisheries Council. An evaluation panel is to be established with membership including an independent chair (either Fisheries Council member or external appointment), independent experts as required (e.g. economist, social scientist), representatives of each fishing sector and an independent appointment (with fisheries management and/or allocation experience).

The evaluation panel needs to evaluate how the value of one or more sectors is changing and the likely trends in the future. In the context of these changes, all options being considered should be evaluated against the option of maintaining the status quo and the potential flow on effects with regard to:

- Contribution to Gross State Product
- Contribution to employment
- Access for consumers to fresh seafood
- Maintenance, growth and wellbeing of regional communities
- Health impacts
- Sport and recreation opportunities
- Consistency with tourism policies
- Other criteria relevant to the fishery

### **6.8.3 Assessment outcomes**

Following the full assessment, the review panel may recommend to the Minister, either:

- a) Manage each sector within the existing allocated shares
- b) Proceed to adjust allocated shares

### **6.8.3.1 *Process for managing within existing shares***

If shares are to be maintained between all sectors it may be necessary, depending on the circumstances, to alter the catch of one or more sectors. To determine the appropriate mechanism to re-establish initial allocations, the existing co-management arrangements will be used to develop a preferred option.

Adjusting commercial shares within the MSF is likely to be achieved through a variety of controls consistent with current management arrangements such as; seasonal and area closures, gear restrictions, catch limits and size limits. Recreational adjustments are likely to be made through alterations to existing bag and boat limits, seasonal closures and size limits.

### **6.8.3.2 *Process for adjusting allocations***

In the event that an adjustment of shares is required, the Fisheries Council will be responsible for determining the most appropriate adjustment package. The following points are provided to guide an allocation adjustment process:

- Adjustments to the shares will, in the first instance, be implemented through a voluntary process and through direct negotiations between the relevant sectors.
- If agreement cannot be reached, a process of compulsory acquisition may occur in accordance with the Allocation Policy.
- Where possible, market mechanisms will be used to give effect to adjustments in share. Where there are no or limited market mechanisms available, adjustments to shares will be made in a similar manner used to manage shares within existing shares described in Section 6.8.3.1 above.
- Acquisition of entitlements will be compensated in accordance with the provisions of the Allocation Policy.
- Adjustments are to be finalised within 2 years.

The process that the Fisheries Council administers to make the determination of a share adjustment should include similar elements described in the review process (Section 6.8).

## **6.9 Allocation triggers**

An important component of the allocation of shares is monitoring to identify a change in the relative value of those shares over time. The value of shares can be measured in a variety of ways including catch and effort, economic value and social values. It is difficult to measure the economic values associated with a species within the MSF (both commercial and recreational) as they are only one species of a multi-species fishery. Measuring the social values of a fishery is an evolving area of natural resource management, and there are no clearly identifiable indicators of social value that can be readily incorporated into an assessment of share value at this point in time. For these reasons catch will be used as the indicator to measure changes in the value of shares, noting that catch has been used to determine the first shares in this management plan. Catch estimates are available annually for all commercial fisheries and good estimates of recreational catches for the primary and secondary species of the MSF will be available a minimum of once every five years.

Shares will be assessed either annually or when available (every five years in the case of recreational data). In order to detect a change in share value, thresholds have been determined for each sector's percentage allocation, exceeding this allocation will trigger a review of the allocation described in Section 6.8.

Without recreational catch data it is not possible to undertake an accurate assessment of all sector allocations in years when recreational survey data are available. Therefore comprehensive reviews of all sector allocations will only be undertaken in years for which recreational catch information is available. A trigger for a review of sector allocations at the time recreational catch data are available have been developed for primary and secondary species (Table 8 and Table 9).

Catch information for commercial sectors is available annually and provides the opportunity to review the allocations between the commercial sectors. An annual review of commercial sector allocations will only be undertaken for primary species, secondary species allocations have not been determined at the within-sector level.

Allocation triggers are specified for the commercial sectors, and only within the areas of the MSF. Commercial Lakes and Coorong Fishery and recreational triggers will be described within their respective management plans.

### **6.9.1 Primary Species**

Three trigger limits have been determined for primary species. These triggers have been designed to reflect the high importance of these species to the MSF and as such allow limited ability for sectors to exceed allocations without triggering a review. Trigger limits have also been set at a level that is commensurate with the initial allocation and allows for variability in catches. Where a sector has been allocated over 91%, no trigger limits (trigger 1) have been set as any shares greater than this amount are considered to be within normal fluctuation ranges. Similarly where a commercial sector has been allocated above 95% no commercial trigger limits (triggers 2 and 3) have been set. Please see Appendix 1 for more details on the trigger limit calculations.

**Primary Trigger 1:** Exceed fishery sector allocation by relevant percentage in the assessment year (the year following the availability of recreational data).

**Primary Trigger 2 (Commercial shares only):** Exceed commercial sector allocation by relevant percentage in three consecutive years or in four of the previous five years.

**Primary Trigger 3 (Commercial shares only):** Exceed commercial sector allocation by relevant percentage in any one year.

Table 9. Allocation triggers (percentages – portion of harvest) for primary species of the MSF

		MSF	SZRL	NZRL	MISC	LCF	GSVP	SGP	WCP	REC	CHTR	ABT
King George Whiting	Fishery Allocation	49.5	0.0	1.0	-	-	-	-	-	45.5	3.0	1.0
	Trigger 1	54.45	0.75	2.5								
	Commercial Allocation	98.1	0.0	1.9	-	-	-	-	-			
	Trigger 2	na	0.5	2.97								
	Trigger 3	na	0.75	3.96								
Snapper		MSF	SZRL	NZRL	MISC	LCF	GSVP	SGP	WCP	REC	CHTR	ABT
	Fishery Allocation	79.0	1.45	0.55	-	0.03	-	-	-	8.0	10.0	1.0
	Trigger 1	84.0	2.9	1.65		1.0						
	Commercial Allocation	97.5	1.78	0.68	-	0.04	-	-	-			
	Trigger 2	na	2.68	1.3		0.75						
	Trigger 3	na	3.58	2.0		1.0						
Southern Garfish		MSF	SZRL	NZRL	MISC	LCF	GSVP	SGP	WCP	REC	CHTR	ABT
	Fishery Allocation	79.3	0.13	0.04	-	-	-	-	-	19.5	-	1.0
	Trigger 1	84.0	1.0	1.0								
	Commercial Allocation	99.79	0.16	0.05	-	-	-	-	-			
	Trigger 2	na	0.75	0.75								
	Trigger 3	na	1.0	1.0								
Southern Calamari		MSF	SZRL	NZRL	MISC	LCF	GSVP	SGP	WCP	REC	CHTR	ABT
	Fishery Allocation	56.0	-	0.45	-	-	0.45	4.6	0.1	37.4	-	1.0
	Trigger 1	61.6		1.0			1.0	7.5	1.0			
	Commercial Allocation	90.91	-	0.73	-	-	0.73	7.47	0.16			
	Trigger 2	92.7		1.46			1.46	8.2	0.75			
	Trigger 3	95.4		2.19			2.19	11.2	1.0			

### 6.9.2 Secondary Species

Secondary species allocations will be assessed on a regular basis following the publication of recreational data. Secondary triggers have only been developed for catches outside of the Lakes and Coorong region of the Lakes and Coorong Fishery. These triggers have been designed to reflect the relative importance of these species to the MSF and as such allow greater fluctuations in sector allocations without triggering a review. Trigger limits have also been set at a level that is commensurate with the initial allocation and allows for inter-annual variability in catches. Where a sector has been allocated over 91%, no trigger limits have been set as any shares greater than this amount are considered to be within normal fluctuation ranges. Please see Appendix 1 for more details on the trigger limit calculations.

**Secondary Trigger:** Exceed sector allocation by relevant percentage in the assessment year.

Table 10. Allocation triggers for secondary species of the MSF

<b>Species</b>		<b>Commercial</b>	<b>Recreational</b>	<b>Aboriginal traditional</b>
Vongole (Mud Cockle) spp.	Allocation	98.7%	0.3%	1%
	Trigger limit (%)	na	-	-
Yellowfin Whiting	Allocation	78%	21%	1%
	Trigger limit (%)	88%	-	-
Australian Herring	Allocation	56.5%	42.5%	1%
	Trigger limit (%)	70.6%	-	-
Snook	Allocation	49.5%	49.5%	1%
	Trigger limit (%)	61.9%	-	-
Mullet spp.	Allocation	54.2%	44.8%	1%
	Trigger limit (%)	67.8%	-	-
Mulloway	Allocation	19.9%	79.1%	1%
	Trigger limit (%)	39.8%	-	-
Bronze & Dusky Whaler Shark	Allocation	73.7%	25.3%	1%
	Trigger limit (%)	88.%	-	-
Sand Crab	Allocation	85%	14%	1%
	Trigger limit (%)	93.5%	-	-
Blue Swimmer Crab (Outside Gulfs)	Allocation	81.7%	17.3%	1%
	Trigger limit (%)	89.9%	-	-



## **7 ECOLOGICALLY SUSTAINABLE DEVELOPMENT (ESD) RISK ASSESSMENT AND ECOSYSTEM IMPACTS**

The *Fisheries Management Act 2007* requires that ecological impacts or potential impacts be identified and assessed as the first step in developing a management plan. A goal of this plan is the management of the MSF resources as a part of the broader ecosystem, using an ecosystem-based fisheries management (EBFM) approach. The Act specifically requires that the following impacts are identified:

- Current known impacts of the fishery on the ecosystem
- Potential impacts of the fishery on the ecosystem
- Ecological factors that could have an impact on the performance of the fishery

These risks must be assessed to determine the most serious ones, whilst strategies for addressing them must be developed.

The ecological impacts associated with the fishery have been identified and assessed through the process of conducting an ecologically sustainable development (ESD) risk assessment for the fishery. The National ESD Reporting Framework for Australian Fisheries (Fletcher et al. 2002) was used to conduct the risk assessment.

In accordance with the ESD objective in the Act, this approach is aimed at assisting PIRSA to identify and prioritise all of the important ecological, social and economic factors that affect the management of the fishery. Risks and important issues in the fishery were identified in consultation with stakeholders and were prioritised using risk ratings from negligible to extreme. Risks identified as moderate, high or extreme have been summarised in Table 11 below. This table also includes references to specific management objectives and strategies that have been developed in an attempt to address these risks as part of the management of the fishery. A more detailed description of the management goals, objectives and strategies is provided in Section 8 and Table 12.

An overview of the ESD risk assessment for the MSF is provided at Appendix 2, however for more detailed information about the fishery and the outcomes of the ESD risk assessment refer to the report 'Ecologically Sustainable Development (ESD) Risk Assessment for the Commercial Marine Scalefish Fishery' (PIRSA 2012).

Table 11. Risk assessment of ecological components of fishery

Component	Risk/Issue	Description	Risk/Importance rating	Objective	Strategies
<b>Retained Species</b>	Snapper	Risk of fishery impacts on breeding population	High	1a; 1b; 2c; 4c	1a(i)(ii)(iii)(iv)(v)(vi); 1b(i)(ii)(iii)(iv)(v)(vi)(vii); 2c(i); 4d(i)(ii)(iii)(iv)(v)(vi)(vii)
	Southern Garfish	Risk of fishery impacts on breeding population	High	1a; 1b; 2c; 4c	1a(i)(ii)(iii)(iv)(v)(vi); 1b(i)(ii)(iii)(iv)(v)(vi)(vii); 2c(i); 4d(i)(ii)(iii)(iv)(v)(vi)(vii)
	Bronze & Dusky Whaler Shark	Risk of fishery impacts on breeding population	Moderate	1a; 1b; 2c; 4c	1a(i)(ii)(iii)(iv)(v)(vi); 1b(i)(ii)(iii)(iv)(v)(vi)(vii); 2c(i); 4d(i)(ii)(iii)(iv)(v)(vi)(vii)
	Vongole	Risk of fishery impacts on breeding population	Moderate	1a; 1b; 2c; 4c	1a(i)(ii)(iii)(iv)(v)(vi); 1b(i)(ii)(iii)(iv)(v)(vi)(vii); 2c(i); 4d(i)(ii)(iii)(iv)(v)(vi)(vii)
	Pipi (Gunyah Beach)	Risk of fishery impacts on breeding population	Moderate	1a; 1b; 2c; 4c	1a(i)(ii)(iii)(iv)(v)(vi); 1b(i)(ii)(iii)(iv)(v)(vi)(vii); 2c(i); 4d(i)(ii)(iii)(iv)(v)(vi)(vii)
	Razorfish	Risk of fishery impacts on breeding population	Moderate	1a; 1b; 2c; 4c	1a(i)(ii)(iii)(iv)(v)(vi); 1b(i)(ii)(iii)(iv)(v)(vi)(vii); 2c(i); 4d(i)(ii)(iii)(iv)(v)(vi)(vii)
<b>Non-retained Species</b>	Australian Sea Lion	Risk of fishery impacts on breeding population	Moderate	3a; 3d; 4c	3a(i); 3d(ii)(ii); 4d(i)(ii)(iii)(iv)(v)(vi)(vii)
	White shark	Risk of fishery impacts on breeding population	Moderate	3a; 3d; 4c	3a(i); 3d(ii)(ii); 4d(i)(ii)(iii)(iv)(v)(vi)(vii)
<b>General Ecosystem Impacts of Fishing</b>	Fishing – Marine	Risk of fishery impacts on the ecosystem	Moderate	1a; 1b; 3a	1a(i)(vi); 1b(iv)(v)(vi)(vii); 3a(i)(ii)(iii)(iv)(v)
	Introduced marine pests / aquatic diseases	Risk of fishery impacts on the ecosystem	Moderate	3a; 3c	3a(i)(iv)(v); 3c(i)
<b>Community</b>	Profit (fishing industry)	Importance of profit to the fishing industry	High	2c; 2d	2c(i); 2d(i)
	Employment	Importance of employment to the fishing industry	Moderate	2b; 2c; 2d	2b(i),(iv); 2c(i); 2d(i)

Component	Risk/Issue	Description	Risk/Importance rating	Objective	Strategies
	OHS&W	Importance of good OHS&W practices to the fishing industry	Moderate	2b	2b(iv)
	Relationship with community	Importance of positive relationships with the community to the fishing industry	High	2b; 2d	2b(i)(ii)(iii); 2d(i)(ii)
	Asset value	Importance of asset value to the fishing industry	High	2c; 2d	2c(i); 2d(i)
	Lifestyle	Importance of lifestyle to the fishing industry	High	2c; 2d	2c(i); 2d(i)(ii); 2f(i)(ii)
	Employment (regional centres)	Importance of fishing industry to regional employment	Moderate	2b; 2c; 2d	2b(iii); 2c(i); 2d(i)
	Re-Investment (regional)	Importance of fishing industry to regional re-investment	Moderate	2b; 2c; 2d	2b(i)(ii)(v); 2c(i); 2d(i)
	Social capital (regional)	Importance of the fishery to social capital of regional areas	Moderate	2b; 2d	2b(i)(ii); 2d(iii). 2f(i)(ii)
<b>Governance</b>	Minister	Importance of responsible governance of the fishery by the Minister	High	4a	4a(i)
	Management plan (Fish Council)	Importance of responsible governance (through management plan) by the Fisheries Council	High	4a; 4b	4a(i); 4b(i)(ii)
	Allocation (Fish Council)	Importance of responsible governance (through allocation) by the Fisheries Council	High	4a; 4b	4a(i); 4b(i)(ii); 2g(i)(ii)
	Consultation (Fish Council)	Importance of responsible governance (through consultation) by the Fisheries Council	Moderate	4b	4b(i)(ii)(iii)
	Management effectiveness (PIRSA)	Cost effective management that ensures resource is harvested within sustainable harvest	High	1a; 1b; 2d; 4a; 4b; 4c	1a(i)(ii)(iii)(iv)(v)(vi); 1b(i)(ii)(iii)(iv)(v)(vi)(vii); 2d(i)(ii)(iii); 2f(i)(ii); 2g(i)(ii); 4a(i); 4b(i)(ii); 4c(1)(ii)(iv); 4d(i)(ii)(iii)(iv)(v)(vi)(vii)
	Resources (PIRSA)	Sufficient resources for PIRSA to manage fishery	High	4a	4a(ii)(ii)
	Strategic policy (PIRSA)	Importance of adequate strategic policy by PIRSA	High	4a	4a(i)
	Research / information (PIRSA)	Sufficient information to inform management decisions	High	1b; 2d	1b(i)(ii)(iii)(iv)(v)(vi)(vii);

Component	Risk/Issue	Description	Risk/Importance rating	Objective	Strategies
					2d(i)(ii)(iii); 4c(ii)(iii)(iv)
	Compliance (PIRSA)	Importance of adequate compliance and enforcement	High	4c	4c(i)(ii)(iii)(iv)(v)(vi)(vii)
	Legal framework (PIRSA)	Importance of a sound legal framework for the management of the fishery	Moderate	4a; 4c	4a(ii)(iii); 4c(i); 4d(i)(ii)(iv)(v)
	Consultation (PIRSA)	Importance of consultation for achieving good management outcomes	High	4b	4b(i)(ii)(iii) 4c(ii)(iii)(iv)
	Reporting (PIRSA)	Importance of reporting for achieving good management outcomes	High	4b	4b(i)(ii)
	SA Govt: DENR	Importance of responsible governance by DENR	High	2e	2e(i)
	Aust Govt: SEWPaC	Importance of responsible governance by SEWPaC	Moderate	2e	2e(i)
	DTEI	Importance of responsible governance by DTEI	Moderate	2e	2e(i)
	Codes of Conduct (Industry)	Importance of Industry Codes of conduct for responsible governance	High	3b	3b(ii)
	Communication/participation (Industry)	Importance of industry participation in fishery management	High	4b	4b(i)(ii); 4c(ii)(iii)(iv)
	Industry association	Importance of recognised and functioning industry association	High	4b	4b(i)(ii)
	Access security	Importance of certainty of access for commercial fishing industry	High	2a; 2e	2a(i)(iii); 2e(i); 2g(i)(ii)
	Marine park issues	Potential impact of marine parks on fishery performance	High	2e	2e(i)
	Owner operator	Potential impact of owner/operator policy of fishery performance	Moderate	2c	2c(i); 2f(i)(ii)
	Conservation Organisations	Potential impact of conservation groups on future access to fishery	High	2e	2e(i)
	SARFAC	Potential impact of SARFAC on future access to fishery	Moderate	2a; 2e	2a(i); 2e(i)

Component	Risk/Issue	Description	Risk/Importance rating	Objective	Strategies
	Other NGO's	Potential impact of other NGO's on future access to fishery	Moderate	2e	2e(i)
External factors affecting performance of the fishery	Physical	Impact of human induced changes to water quality on resource and performance of fishery	Extreme	3c	3c(i)
	Diseases	Impact of externally sourced disease on performance of the fishery	High	3c	3c(i)
	Effluent	Impact of effluent on performance of the fishery	Moderate	3c	3c(i)
	Exotic species	Impact of exotic species on performance of the fishery	Moderate	3c	3c(i)
	Fuel price	Impact of high fuel on performance of the fishery	High	2e	2e(i)
	Other fisheries (market demand)	Impact of competing fishery products on performance of the fishery	Moderate	2e	2e(i)
	Marketing	Importance of good marketing on performance of the fishery	Moderate	2e	2e(i)
	Labour (availability/cost)	Impact of labour shortages and high costs on performance of the fishery	Moderate	2b; 2e	2b(ii)(iii); 2e(i)
	Other fishing costs	Impact of costs of fishing on performance of the fishery	Moderate	2e	2e(i)
	Interest rates	Impact of higher interest rates on performance of the fishery	Moderate	2e	2e(i)
	Illegal take	Impact of illegal catch on performance of fishery	High	4c	4d(i)(ii)(iv)(vi)(vii)
	Marine parks (access)	Impact of marine parks (access issues) on performance of fishery	High	2e	2e(i)
	Recreational fishers	Impact of recreational fishers (access issues) on performance of fishery	High	2e	2e(i)

## 8 GOALS AND OBJECTIVES

Section 7 of the *Fisheries Management Act 2007* sets out the objects of the Act. Ecologically sustainable development is established as the overall object of the Act and a number of biological, social and economic factors are identified that must be balanced when trying to achieve this. However in pursuing sustainable development, the principle of protecting resources from over-exploitation is deemed to take precedence over all other principles outlined in Section 7(1).

The goals and objectives for the commercial MSF are intended to capture all of the factors identified in the Act that must be balanced to pursue ecologically sustainable development, including securing the future of the commercial marine scalefish industry. The objectives are set out below and are organised under four broad goals.

The management strategies to achieve the goals and objectives are outlined in Table 12. This table also outlines the risks being addressed through each strategy and the indicators and trigger reference points used to measure the effectiveness of those strategies. The risks being addressed have been identified through the ESD risk assessment, a summary of these risks is provided in Table 11 and the methodology for the risk assessment process is described in Appendix 2.

### 8.1 Goal 1 – Ensure the Marine Scalefish Fishery resources are harvested within ecologically sustainable limits

Ensuring the sustainable harvest of all marine scalefish resources is a significant challenge given the complexities of the fishery. The current levels of catch and effort are considered to be at the upper levels of which the fishery can sustain for the majority of primary and secondary species.

The objectives of this management plan in relation to sustainability are:

- Manage total catch and effort across the commercial fishery to ensure species are harvested at sustainable levels
- Monitor the biological performance of the fishery against performance indicators and reference points and ensure the collection of biological and fishery information is undertaken to measure fishery performance

Prescribing performance indicators for the harvest of marine scalefish resources and measuring those indicators against operational objectives or trigger reference points is broadly referred to as a harvest strategy. Harvest strategies for the MSF fishery resources are described in detail in Section 9.

### 8.2 Goal 2 –Optimum utilisation and equitable distribution of the Marine Scalefish Fishery resources

This goal relates to the economic and social benefits derived from the fishery. The objectives of this management plan in relation to these benefits are:

- Allocate access to fishery resources and manage shares to achieve optimum utilisation and equitable distribution
- Increase the flow of economic benefit from the fishery to the broader community

- Improve economic efficiencies and financial returns within the constraints of sustainability imperatives
- Improve measures of economic and social value of the MSF
- Minimise external impacts on the ecologically sustainable development of the MSF

This management plan is the first plan to explicitly allocate shares of the MSF resources to the commercial, recreational and Aboriginal traditional fishing sectors. The methodology behind the allocation process and the mechanisms for managing and adjusting shares are outlined in Section 6.

The recreational sector takes a significant proportion of many marine scalefish species, and with over 230,000 recreational fishers in South Australia (Jones 2009) interactions between commercial and recreational fishers are inevitable. At times these interactions lead to conflict as access to a finite resource is highly valued. The allocation framework described in this plan will go some way to alleviating this conflict, however managing the fishery to provide fair and reasonable access for all is still a major challenge for the management of this fishery.

### **8.3 Goal 3 – Minimise impacts on the ecosystem**

This goal relates to the management of the fishery using an ecosystem-based fisheries management (EBFM) approach. The objectives of this management plan in relation to minimising the impacts of the fishery on the ecosystem are:

- Minimise fishery impacts on bycatch species and the ecosystem
- Minimise fishery impacts on fisheries habitat
- Participate in processes aimed at minimising external impacts on ecosystem
- Avoid the incidental mortality of endangered, threatened and protected species

Australian Government guidelines for the ecologically sustainable management of Australian fisheries acknowledge the need to minimise the impacts of fishing on the ecosystem. Three key objectives were identified to achieve this goal: ensure sustainability of bycatch and by-product species; minimise interactions with threatened, endangered and protected species (TEPS); and minimise impacts on benthic habitats and associated communities.

### **8.4 Goal 4 – Cost effective and participative management of the Marine Scalefish Fishery**

This goal relates to co-management of the fishery, planning of management activities and the recovery of the costs of management of the fishery. The objectives of this management plan in relation to co-management, planning and cost recovery are:

- Provide cost-effective and efficient management of the fishery, in line with Government's cost recovery policy
- Support industry body to participate and function within the co-management framework of the fishery
- Effective compliance program for the fishery

The key objectives of this goal are to ensure that representative industry body has involvement in the decision-making processes for developing and implementing management arrangements and to ensure that management arrangements are complied with. The cost effectiveness of management arrangements also needs to be taken into

account in the development process as the costs of management are recovered from fishers in accordance with the Government's cost recovery policy.



Table 12. Summary of management goals, objectives, strategies, performance indicators and reference points for the Marine Scalefish Fishery

Goal	Objective	Strategies	Addressing Risk	Performance Indicator	Description	Trigger Reference Point
Goal 1 <b>Ensure MSF resources are harvested within ecologically sustainable limits</b>	1a Manage total catch and effort across the fishery to ensure species are harvested at sustainable levels	1a(i) Regulate permitted fishing methods	Fishery impacts on breeding populations	Performance indicators described for selected species as detailed in the harvest strategy	Performance indicators relate to variables including fishable biomass, egg production, recruitment, exploitation rate and age structure, catch and effort information and CPUE	Trigger reference points are detailed in the harvest strategy
		1a(ii) Manage number of licences to achieve optimum levels of fishing effort and capacity. E.g. licence amalgamation scheme or other methods	Fishery impacts on ecosystem			
		1a(iii) Rationalise number of devices for each gear type endorsed and/or used on licences	Management effectiveness			
		1a(iv) Apply spatial and temporal restrictions to protect fish species during critical stage of life cycle				
		1a(v) Regulate size at which fish may be captured using minimum and/or maximum size limits				
		1a(vi) Maintain capacity for licence holders to transfer effort between species within sustainability constraints				
	1b Monitor the biological performance of the fishery and ensure the collection of fishery and biological data	1b(i) Obtain adequate and regular biological information for primary and selected secondary species, including fishery dependent catch sampling program	Fishery impacts on breeding populations	Stock assessment and stock status reports produced to a high standard and on schedule  Licence holders providing timely and accurate catch and effort information through logbook  Industry participation in research projects as required  Proposed research schedules and deliverables achieved	Good quality fishery data is essential to on-going monitoring of fishery status	Essential data for stock assessments not collected  Regular reviews of research programs not undertaken
		1b(ii) Undertake and further refine stock assessment models for primary species	Research/information			
		1b(iii) Review and refine trigger reference points as scheduled in harvest strategies	Management effectiveness			
		1b(iv) Review and update the research and monitoring plan regularly				
		1b(v) Periodically review and update information collected through commercial logbooks				
		1b(vi) Develop catch validation processes to improve integrity of fishery-dependant data				
		1b(vii) Explore opportunities for cost-effective fishery independent monitoring as required				

Goal	Objective	Strategies	Addressing Risk	Performance Indicator	Description	Reference Point
Goal 2 <b>Optimum utilisation and equitable distribution of Marine Scalefish Fishery resources</b>	2a Allocate access to fishery resources and manage shares to deliver optimum utilisation and equitable distribution	2a(i) Manage catches of each sector within allocated shares	Allocation	Catches managed within allocations and changes in shares detected and acted on appropriately		N/A
		2a(ii) Consider information relating to Aboriginal traditional fishing as it becomes available, including adjustment of shares accordingly	Access security			
		2a(iii) Where shares require adjustment, processes are implemented as per the Management Plan	Recreational access pressure Information			
	2b Increase the flow of economic and social benefit from the fishery to the broader community	2b(i) Positively influence fisheries related socioeconomic benefits for regional communities	Relationships with community	Contribution of fisheries to local economic activity (measured as trends in local and regional expenditure by fishers)  Proportion of direct and indirect employment in a regional dependent on fishing  Demonstrate availability of MSF information through website, correspondence, media releases, licence holder letters, Fishcare volunteer program, MFA publications and compliance officers  Level of community support activities	The Economic Indicators report provides detailed regional information on the economic performance including data on employment and expenditure  Community support activities include non-paid work such as attendance of meetings, conservation activities and community service volunteering  At the review of the plan, consider potential impacts the fishery may have on Aboriginal cultural practises (in particular Aboriginal cultural fishing) and traditional knowledge systems (specifically traditional fishing knowledge) and incorporated into the plan, where appropriate. This may include: <ul style="list-style-type: none"><li>Identifying 'sea country' relevant for this fishery</li><li>Support for cultural practices included in management considerations</li></ul>	Downward trends in employment, expenditure and community support activities
		2b(ii) Communicate information about ESD outcomes of the fishery to the broader community in a timely and publically assessable manner	Employment (regional)			
		2b(iii) Develop and maintain positive relationships with the regional communities in the area of the fishery	Re-investment (regional)			
		2b(iv) Industry to maintain adherence to existing occupational health, safety and welfare requirements and procedures	Social capital (regional)			
		2b(v) Consider potential impacts the fishery may have on Aboriginal cultural practices (in particular Aboriginal cultural fishing) and traditional knowledge systems (specifically traditional fishing knowledge) as information becomes available	OHS&W			
	2c Improve economic efficiencies and financial returns within the constraints of sustainability imperatives	2c(i) Develop and implement management arrangements that allow commercial operators to maximise operational flexibility, economic efficiency, value and returns	Profit	Key economic indicators: operating surplus, profit at full equity and rate of return on total boat capital  Licence value		Declining trends in economic indicators and licence value
		2c(ii) Provide opportunities for diversification and developmental fishing	Asset value Employment Lifestyle Fishing costs			
	2d Monitor the economic and social performance of the fishery and ensure the collection of	2d(i) Undertake periodic economic and social surveys of the commercial fishery to assess economic and social performance against a set of economic and social indicators	Management effectiveness Research/Information	Delivery of annual economic reports assessing economic performance of the	Economic indicator reports are currently prepared annually. Steps are being taken to provide indicators associated with key	N/A

Goal	Objective	Strategies	Addressing Risk	Performance Indicator	Description	Reference Point
	economic and social fishery data	2d(ii) Review and update the research and monitoring plan regularly	Profit Asset value Employment	fishery from periodic economic surveys  Social fishery surveys undertaken periodically and reported when data is available.	target species  Social indicator data to be collected with the economic survey data (to minimise survey costs) and reported when data is available, in consultation with industry.	
		2d(iii) Undertake and further refine indicators and trigger reference points as more information becomes available	Social capital Relationships with community Lifestyle Fishing costs			
	2e Monitor and participate to, where possible, minimise external impacts on the ecologically sustainable development of the fishery	2e(i) Monitor, report on and influence other management processes that impact on the ecologically sustainable development of the fishery as appropriate	Marketing Other fisheries (market demand) Fuel price Other fishing costs Interest rates Marine park planning Conservation groups and NGOs DENR, SEWPaC and DTEI SARFAC & Recreational fishing	None measured	Participation in external processes to mitigate external impacts on sustainable development of the fishery	NA
	2f Provide flexible opportunities to ensure fishers can maintain or enhance their livelihood	2f(i) When implementing management changes, where possible ensure that the management framework does not unnecessarily reduce ability of fishers to successful run a business	Social capital Relationships with community Lifestyle	Provision of a livelihood opportunity: How is the ability of fishers to access livelihood changing		Cost of entry and of maintaining access have risen relative to returns from the fishery for more than one year  The proportion of fishers who think fisheries management is flexible enough is decreasing over time
		2f(ii) When implementing management changes where possible enable adequate and secure access to fish stocks that is flexible	Fishing costs	Perception of flexibility: fishers believe fisheries management processes are flexible enough to allow them to adapt to changing conditions (fisher survey)		
	2g Ensure equitable treatment and access for fishers	2g(i) Decision making processes develop and use clear principles, incorporating consideration of equity principles	Social capital Allocation	How equitable/fair fishers feel the processes and outcomes of fisheries management are (fishery survey)		>50% of fishers believe they are treated unfairly on more than one of the relevant survey questions.
		2g(ii) Consultation process designed and undertaken for input of different fishers and stakeholders	Access security			

Goal	Objective	Strategies	Addressing Risk	Performance Indicator	Description	Reference Point
Goal 3 <b>Minimise impacts on the ecosystem</b>	3a Minimise fishery impacts on bycatch species and the ecosystem	3a(i) Regulate gear types, construction material and mode of operation to minimise bycatch as appropriate	General ecosystem impacts of fishing Diseases Exotic species	Quantification of bycatch associated with key gear types and operations  Estimates of discard rates  Number of reported breaches of relevant regulations	Aim is to reduce unwanted or discarded bycatch to lowest possible levels	Increasing trend in discarded bycatch  Level of bycatch mortality is considered to adversely affect population dynamics of the species and ecosystem
		3a(ii) Quantify impact of fishing operations on discarded bycatch through targeted research and on-going monitoring				
		3a(iii) Conserve key habitats utilised by fishery resources				
		3a(iv) Promote the adoption of industry codes of conduct				
		3a(v) Adoption of national biofouling guidelines for commercial fishing vessels and other specific guidelines/protocols as relevant (e.g. <i>Caulerpa taxifolia</i> )				
	3b Minimise fishery impacts on fisheries habitat	3b(i) Maintain appropriate regulations regarding the use of commercial fishing gear	General ecosystem impacts of fishing Industry codes of conduct	Risk ratings from regular ecological risk assessment  Opportunistic fishery independent research  Number of codes of conduct in place		Increases in number of risks to ecosystem rated as moderate or higher during the risk assessment
		3b(ii) Promote the adoption of industry codes of conduct as required				
	3c Monitor and participate to, where possible, minimise external impacts on ecosystem	3c(i) Where appropriate, influence other management processes that impact on the ecosystem	Water quality Effluent Disease Exotic species	None measured	It is acknowledged that management of the risks identified is outside the scope of this management plan yet PIRSA and industry should endeavour to participate in external processes as appropriate	NA
	3d Avoid the incidental mortality of threatened, endangered and protected species.	3d(i) Continue and improve commercial data recording systems to capture fishing interactions with threatened, endangered and protected species (TEPS)	Fishery impacts on TEPS including White Sharks and Australian Sea Lions	Monitoring of TEPS logbook forms for rising trends  Number of protected species caught  Annual report on TEPS interactions available for stakeholders	Recording of TEPS interactions is mandatory and all licence holders have been issued with a specific logbook	Real trend of increasing frequency of TEPS mortalities taking account of recent improvements in reporting accuracy
		3d(ii) Develop management measures to avoid interactions with threatened, endangered and protected species as required				
Goal 4 <b>Cost-effective and participative management of</b>	4a Provide cost-effective and efficient management of the fishery, in line with	4a(i) Develop and implement management arrangements that are effective at achieving management objectives and optimising cost effectiveness	Management effectiveness Minister	Total cost of management, research and compliance for the fishery relative to GVP,		Costs for service programs increase above CPI.  Failure to derive sufficient resources to maintain core

Goal	Objective	Strategies	Addressing Risk	Performance Indicator	Description	Reference Point
the Marine Scalefish Fishery	government's cost recovery policy	4a(ii) Determine the real cost of management, research and compliance for the fishery on an annual basis	Fisheries Council (Management plan and allocation)  Sufficient management resources  Strategic policy  Industry profit	each licence holder and production (weight of fish)		management, research and compliance tasks
		4a(iii) Recover licence fees from commercial licence holders, sufficient to cover the attributed costs of fisheries management, research and compliance of the commercial fishery in accordance with the Government's cost recovery policy				
	4b Ensure appropriate mechanisms exist for fisher involvement in the development of management advice	4b(i) Support industry body to participate and function within the co-management framework of the fishery	Management effectiveness  Reporting (Fisheries Council and PIRSA)  Consultation  Industry communication & participation  Recognised and functioning industry association  Industry relationship with community	Deliver against communication protocol objectives  Proportion of fishers actively participate in fisheries management  Fishers have opportunity to be represented on fishery advisory groups  PIRSA have a formal documented processes for providing feedback to stakeholders about management decisions, and how stakeholder input was used in those decisions  Fishers are aware of the methods by which they can have input into fisheries management processes  Fishers know how to contact people who represent their interests in fisheries management/advisory process	Annual communications protocol between Industry body and PIRSA outlines a variety of roles and responsibilities	Failure to meet timelines within communication protocol and harvest strategies  Feedback to stakeholders is not given or infrequently given.  Information is not provided to licence holders on who represents their interests on the MAG and other working groups
		4b(ii) Promote stakeholder input to the management of the fishery, through co-management processes and communication strategies				
		4b(iii) Develop and implement communication protocol, with annual review				
	4c Maximise stewardship of fisheries resources	4c(i) Where possible simplify and standardise the regulatory rules, to ensure the rules are easier to comply with, easier to enforce and that fisheries management will be more efficient		The number of infringements changing overtime  Proportion of fishers who believe that, overall, most fishers comply with fishing rules (fisher	The purpose of the Rules Review is to simplify and standardise the regulatory rules imposed on fishing activities. The aim of the review is rules are easier to comply with, easier to enforce and that fisheries	Infringements increasing rapidly over time (noting the level of compliance resources applied)  There is an ongoing decline in the proportion of fishers who agree with the statement 'most
		4c(ii) Ensure any management changes (and reasoning) are communicated with fishers				

Goal	Objective	Strategies	Addressing Risk	Performance Indicator	Description	Reference Point
		4c(iii)    PIRSA/industry collaborating to promote fishery stewardship		survey)  Extent fishers accurately understand regulations (fisher survey)  Fishers find it easy to comply with fishing rules and regulations (fishery survey)  Number of reliable MSF offences reported to Fishwatch	management will be more efficient. In addition to the rules review, this will also be an aim for any new rules implemented for the fishery.	fishers comply with fishing rules’  There is an ongoing decline in the proportion of fishers who correctly identify rules and regulations over time.  There is an ongoing decline in the proportion of fishers who agree with the statement ‘Fishers find it easy to comply with fishing rules and regulations (survey)  Number of offences reported to Fishwatch are increasing rapidly over time (noting the level of compliance resources applied)
		4c(iv)    Strengthen links with licence holders through improved communication				
	4d    Effective compliance program for the fishery to maximise voluntary compliance and create effective deterrence	4d(i)    Undertake annual compliance risk assessment and deploy resources to address those risks.	Compliance Management effectiveness  Illegal take (including sale of recreationally caught fish)  Resources  Legal framework  Breeding population sustainable	Compliance risk assessment reviewed annually  Identified risks are minimised  Knowledge of requirements under a licence  Level of compliance with regulatory rules changing over time  Number of reliable MSF offences reported to Fishwatch	The compliance risk assessment provides the opportunity to assess compliance status in fishery and prioritise work functions on high risk areas to fishery	Risk assessments not undertaken  Insufficient resources to implement compliance plan
		4d(ii)    Review existing reporting and monitoring arrangements where necessary				
		4d(iii)    Undertake compliance induction meetings with new licence holders and/or registered masters				
		4d(iv)    Develop and implement management arrangements that are clear and uncomplicated so as to promote voluntary compliance and assist with successful enforcement				
		4d(v)    Where possible, develop and implement licensing, compliance and monitoring arrangements that are consistent with other fisheries to reduce administrative costs				
		4d(vi)    Encourage the community and industry to report fisheries offences to the Fishwatch number				
		4d(vii)    Develop formal relationships between industry and fisheries officers to improve effective compliance				

## 9 HARVEST STRATEGY

### 9.1 Introduction

The aim of the harvest strategies for the species in this management plan is to set a process for monitoring the performance of the various species and measuring the effectiveness of the management arrangements which govern their commercial harvest. Performance indicators, operational objectives and reference points are used to determine when fishery performance warrants a review and possible changes to management arrangements.

#### 9.1.1 Priority species

With over 60 marine scalefish species harvested annually, developing individual performance indicators and reference points would require significant resources (Noell et al. 2006). Rather the majority of management and monitoring resources will be targeted on the priority species in the fishery, similar to the previous management plan. Species have been classed as Primary, Secondary, Tertiary or 'Other' (Table 13), taking account of the following:

- Perceived importance to the fishery (both commercial and recreational)
- Production (total catch)
- Commercial value
- Inter-annual variability in catches
- Reliability of catch estimates (both commercial and recreational)
- Level of fishing pressure on target species

A review of these classifications will be undertaken at the review of the management plan. A species may be moved from one classification to another if there have been significant changes in any one of the factors described above. Any proposed changes will be consulted on during the review of the plan.

Table 13. Priority classification of commercially harvested marine scalefish species

Primary	Secondary	Tertiary	Other
King George Whiting Snapper Southern Garfish Southern Calamari	Vongole Yellowfin Whiting Australian Herring Western Australian Salmon Snook Mulloway Mullet spp. Bronze & Dusky Whaler Shark Sand Crab Blue Swimmer Crab (outside the Gulfs)	Trevally Ocean Jackets Leatherjacket spp. Wrasse Black Bream Redfish spp. Yellowtail Kingfish Cuttlefish spp. Octopus spp. Razorfish	Gummy Shark School Shark Flathead spp. Sea Sweep School Whiting Bluespotted Goatfish Southern Rock Cod Barracouta Flounder Morwong spp. Blue Mackerel Jack Mackerel Gould's Squid Mussels Mako Shark Sharks, Skates & Rays Worm spp.

Species-specific harvest strategies have been developed for each of the four primary species and also for Vongole. Harvest strategies for the remaining secondary and tertiary species have been developed to apply generally to all species. Commercial harvest strategies have not been developed for 'Other' species at this point in time, however specific performance measures may be developed within the recreational or other relevant fishery management plans if appropriate.

### **9.1.2 Performance indicators**

A range of performance indicators are used to measure the performance of a fishery depending on the level of information available. Fishery models have been developed for Snapper, King George Whiting and Southern Garfish. The models for these fisheries provide estimates of biological indicators such as egg production and fishable biomass. However for most other species this level of information is not available and indicators are limited to more empirical 'secondary' performance indicators derived from fishery dependent information such as catch and effort.

Due to the contrasting life-history characteristics of marine scalefish species, not all performance indicators available are suitable for assessing every species. The specific indicators used for a species will be outlined within the relevant harvest strategy. A summary of primary and secondary performance indicators and their associated trigger reference points are outlined in Appendix 4.

### **9.1.3 Operational objectives and trigger reference points**

Performance indicators are assessed against reference points to track performance and indicate when a fishery reaches a situation which requires a review to identify a possible problem. Trigger reference points are precautionary and are set relative to known levels of variation in catch and effort, changes to management, recording systems, environmental changes, and the behaviour of fishers. In some cases operational objectives may be developed in order to achieve the management objectives such as stock rebuilding or economic efficiency. In the case of a rebuilding strategy the operational objectives may be below the long-term trigger reference points.

Primary and secondary performance indicators are outlined in each of the relevant harvest strategies. In addition, trigger reference points and operational objectives have been developed for individual species to reflect the management objectives of the harvest strategy.

The need to determine management operational objectives for primary performance indicators has been identified during the development of this management plan. Consideration of targets for priority species will be given at the time of reviewing the relevant harvest strategy, or alternatively, will be undertaken as a single project, depending on funding opportunities and priorities.

### **9.1.4 Decision rules**

Specific decision rules are described for each harvest strategy. These decision rules step out the process and management actions to be taken when a trigger reference point has been breached or an operational objective has not been achieved.



### **9.1.5 Review of indicators, operational objectives and trigger reference points**

Performance indicators, operational objectives and trigger reference points may be revised over time and trigger reference points developed as our knowledge and understanding of the species and fishery dynamics improve. Revision of the indicators and reference points should occur at the time of the formal review of an individual harvest strategy or at the time of the management plan review, five years from commencement of the management plan. In addition, for those species for which a detailed stock assessment is undertaken, a review of the indicators and reference points shall be conducted during the consideration of the stock assessment report. Outside the review timeframes outlined above, there is the ability to review the harvest strategy at any time (i.e. to address emerging sustainability issues, knowledge of the resource is increased, or if industry raises concerns).

## **9.2 Harvest strategy for secondary and tertiary species**

This harvest strategy outlines the broad management objectives and the indicators that will be used to monitor the performance of secondary and tertiary species over time. In managing these species the objectives are to:

1. Ensure long-term sustainable harvest of secondary and tertiary species
2. Maintain catches within agreed allocations for each sector

It is important to note that this harvest strategy does not prescribe specific management responses to breaches of trigger reference points, as the appropriate response is difficult to predict given the complexities and multi-species nature of the fishery. However, possible management responses may include:

- Effort restrictions
- Gear restrictions (type and amount)
- Modifications to fishing gear (e.g. mesh size, gear configuration)
- Temporal or spatial closures
- Moratoria on the take of individual species
- Size limits for individual species

### **9.2.1 Performance indicators & trigger reference points**

Where suitable, all secondary performance indicators and associated trigger reference points will be used to provide measures of the status of secondary and tertiary species. For some species, performance indicators relating to targeted effort and targeted CPUE may not provide a meaningful indicator due to the nature of the commercial harvest of those species (e.g. species taken as by-product of other fishing operations). In this instance, total catch will be used as the sole performance indicator. The stock status report will outline which performance indicators will be used to monitor each species.

### **9.2.2 Decision rules and management action**

Specific decision rules have been developed to ensure adequate and timely management responses are implemented to ensure the long term sustainability of the fishery resources.

A review of the stock status report will be undertaken within the existing co-management framework (principally the MSF Management Advisory Group) within one month of its release. The review will consider all information in the report with particular emphasis on the secondary performance indicators and the performance against the trigger reference points and operational objectives outlined in this harvest strategy.

Within 21 days of meeting, the MSF Management Advisory Group in association with PIRSA is to provide a report to the Minister (or his/her delegate) which includes:

- the key findings of the stock status report;
- details of trigger reference point(s) that have been breached;
- recommended actions; and
- the report will also be accompanied by minutes from the meeting.

The MSF Management Advisory Group may recommend that either no further action is required, or to initiate a detailed review of a breach.

In the case of a trigger reference point has been breached and where the recommendation is for no further action, the report must also provide reasoning as to why no action is to be taken. In the case where the Management Advisory Group recommends a detailed review, that review needs to be completed within 6 months. The review must include a detailed examination of the causes and implications of the fishery status and must also include adequate consultation with all relevant sectors. The report is to be provided to the Minister summarising the findings of the review and make recommendations about future management actions to ensure the fishery performance is returned to acceptable levels within a specified timeframe.

The Minister will consider recommendations, endorse supported strategies, or otherwise. Management changes would then be implemented as appropriate.

### **9.2.3 Maintain catches within agreed allocations for each sector**

The allocations for all secondary species are outlined in Table 7. No allocations have been made for tertiary and other species. An objective of this harvest strategy is to maintain shares within the agreed allocations. The process for review and/or adjusting shares will be undertaken in accordance with the limits specified in Section 6.9. The catches by relevant sectors will be presented within the stock status report in years when available.

### 9.3 Southern Garfish harvest strategy

The aim of this harvest strategy is to outline the key objectives for managing the take of Southern Garfish within the commercial MSF. The management objectives are to:

1. ensure long-term sustainable harvest of Southern Garfish by rebuilding stocks during the specified timeframes;
2. maintain catches within agreed allocations for each sector;
3. improve economic efficiency and financial returns to the commercial fishery;
4. minimise impacts of fishing activity on the ecosystem; and
5. take account of the objectives of other sectors (e.g. the recreational sector).

This harvest strategy outlines the broad management objectives and the indicators that will be used to monitor the performance of the fishery over time. It is important to note that this harvest strategy will not prescribe specific management responses to breaches of trigger reference points, as the appropriate response is difficult to predict given the complexities and multi-species nature of the fishery. Whilst it is difficult to specify a precise management response, the key management tools available are outlined in Section 9.3.1.6.

This harvest strategy will commence from the inception of the management plan and finish on 30 June 2022. A ten year period has been adopted to ensure the objective of re-building stocks is achievable. Consideration will be given to reviewing the operational objectives and trigger reference points following each stock assessment report. Stock assessment reports are scheduled for release in July 2015, 2018 and 2021 (Figure 5).

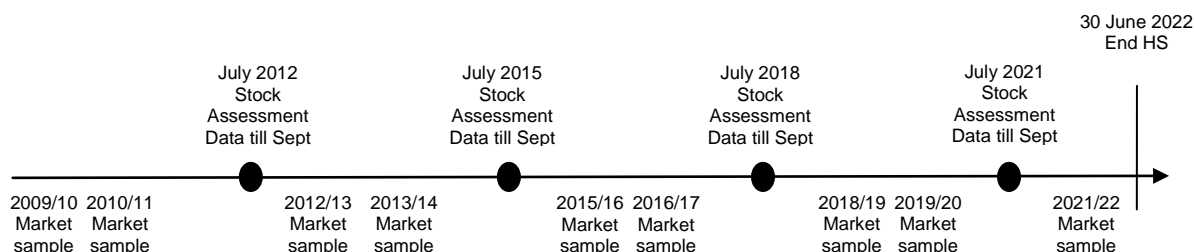


Figure 5. Key stock assessment dates during Southern Garfish harvest strategy

#### 9.3.1 Long term sustainable harvest of Southern Garfish

##### 9.3.1.1 Operational objective

The objective of achieving long term sustainability of the Southern Garfish fishery is translated into the following operational objectives to ensure the extent to which the objective is being achieved can be qualitatively measured:

- Reduce harvest fraction to  $\leq 60\%$  by 2014;
- Reduce harvest fraction to  $\leq 45\%$  by 2017;
- Reduce harvest fraction to  $\leq 30\%$  by 2020;
- Increase egg production to  $\geq 25\%$  of pristine population by 2017; and
- Increase egg production to  $\geq 30\%$  of pristine population by 2020.

### **9.3.1.2 Background**

The commercial MSF accounts for almost 80% of the total catch of Southern Garfish in South Australia. Approximately 90% of this catch is accounted for by hauling nets, with the remainder taken by dab nets. The recreational catch accounts for nearly 20% of the total catch and minor catches are taken by both rock lobster fisheries. The commercial hauling net fishery is concentrated in the upper regions of both Spencer Gulf and Gulf St Vincent.

It is the hauling net component of the fishery that operates in the northern parts of the gulf, on which the fishery assessment is primarily based on. For the purposes of stock assessment, the gulfs are considered to hold separate stocks.

A Garfish Working Group comprising representatives from industry, SARDI and PIRSA, was established to advise on the development of this harvest strategy and to provide recommendations for management arrangements for the commercial Garfish fishery to meet the operational objectives of the harvest strategy.

The Garfish Working Group developed and introduced seasonal closures in 2012 to introduce measures to meet the first operational objective of the harvest strategy. As a result, the commercial take of Southern Garfish was subject to agreed seasonal closures. For 2012, Spencer Gulf was closed between 12 and 31 May (20 days), and in Gulf St Vincent between 1 and 24 June (including an existing June long weekend closure that applies to all haul net fishing in State waters, additional 20 days).

The Garfish Working Group also made recommendations to increase the minimum mesh size of haul net pockets from 3 cm to either 3.2 cm standard knot or 3.4 cm knotless mesh, following the outcomes of the SARDI research report 'Promoting stock recovery through the standardisation of fishing gear: streamlining the hauling net sector of South Australia's Garfish Fishery' Steer et al. 2011. At the time of the plan development the changes to the minimum mesh size of haul net pockets were being implemented by amendments to the relevant regulations. The increase to the mesh size will contribute to reducing undersize Garfish captured by haul nets.

A continued co-operative approach with the industry through the Garfish Working Group is being undertaken to meet the operational objectives and associated timeframes (see Table 14); particularly achieving a reduction to the harvest fraction and increase in egg production. SARDI using 'GarEst' has modelled the required effort reduction needed to meet the operational objectives for harvest fraction. This has informed the Garfish Working Group in making their recommendations. The Garfish Working Group will continue to develop and recommend annual management changes as required to meet the operational objectives in this harvest strategy. A series of management changes will be implemented over 8 years to meet the final operational objective of greater than 30% by 2020. As part of this process, the Garfish Working Group will also consider stock assessment reports for Garfish (produced every 3 years, as per the timeline established in section 9.3) to ensure the management measures have been effective in meeting these operational objectives. In the case where they have not been effective additional measures will be put in place to meet next the operational objective.

### **Current Status**

There are concerns about the stock status for Southern Garfish. In 2005, a restructure of the net sector of the MSF removed 45% of the net fishing effort and introduced substantial spatial closures to the net fishery. The most recent stock assessment was

undertaken in 2009 and indicated few positive signs regarding the stock status of the species in the northern gulfs, where the majority of commercial effort is found. The size and age structures of the stocks are considered severely truncated as a result of high and sustained levels of exploitation. Commercial catches are largely comprised of only one and two year old fish. Harvest fraction is estimated at 69% of the fishable biomass in both gulfs. Egg production is estimated to be at 14% of that of the pristine population.

#### **9.3.1.3 Performance indicators**

Primary and secondary performance indicators will be used to monitor the performance of the Southern Garfish fishery.

A detailed stock assessment report is produced once every three years for Southern Garfish, providing a triennial reporting cycle upon which these indicators will be fully assessed. In addition, the stock status report will provide the opportunity to assess some indicators on an annual basis and provide an indication of stock status trends between assessment years.

The timing of these assessments is such that there will be three stock assessment reports during the life of this management plan, including an additional one following the commencement of the harvest strategy and the last in 2021. The intervening years provide the opportunity to implement management arrangements to achieve the rebuild operational objectives.

For the purposes of the stock assessment the Southern Garfish Fishery is separated into regions; Southern Spencer Gulf (SSG), Northern Spencer Gulf (NSG), Northern Gulf St Vincent (NGSV) and Southern Gulf St Vincent (SGSV). Estimates of the performance indicators will be presented at the regional level within each stock assessment report, however the annual stock status report will only measure performance indicators on a state-wide basis.

##### **9.3.1.3.1 Primary performance indicators**

The primary performance indicators that will be used to assess the performance of the fishery are harvest fraction and egg production. Estimates of both indicators are derived from the garfish stock assessment estimation model 'GarEst'. The GarEst model incorporates age and length samples, along with fishery dependent catch and effort information to estimate a range of biological output parameters.

Harvest fraction is calculated as the model-derived catch summed over the 2-time-step model year divided by the model-estimated fishable biomass (McGarvey et al. 2009). The current harvest fraction in both gulfs is well above international standards for a species with the life history characteristics of garfish. The previous management plan specified a trigger level of 32%, following which a review of management arrangements would be undertaken.

Egg production is determined by a range of factors including size and age structure, biomass and fecundity, and is expressed as a percentage of pristine (virgin) egg production. Current egg production is currently estimated to be 14% of pristine egg production levels in both gulfs. The acceptable range for egg production is between 20-35%.

#### *9.3.1.3.2 Secondary performance indicators*

The secondary performance indicators are age structure and effort. These indicators will not be used to trigger a formal management response however they provide an important measure of the stock-rebuilding strategy for this fishery.

The truncation of Southern Garfish populations, with respect to size and age structure has been identified as an indication of excessive and sustained exploitation rates (McGarvey et al. 2009, Hartmann and Lyle 2011). Size and age structure is measured directly through a commercial catch sampling program carried out by staff from SARDI Aquatic Sciences at the SAFCOL fish market. This market sampling program provides a reliable and cost-effective means for collecting representative data from across the main areas of the fishery. Catch sampling is currently undertaken in two of every three years, with data incorporated into the GarEst model. Age estimates will be calculated using a birth date of 1 January, which aligns with the middle of the spawning season, and is the current assumption of the GarEst model.

Effort reduction is considered an important component of the rebuilding strategy. Effort is a simple and effective measure of the impact and effectiveness of the harvest strategy and provides consistency with historical performance indicators. Effort is also reported on annually, providing a regular measure of the fishery performance. Effort reduction simulations were modelled using the GarEst model, which predicted significant increases in fishable biomass and egg production with effort reductions in the order of 15 – 45% (Steer et al. 2011).

#### *9.3.1.3.3 Other performance indicators and reference points*

Other performance indicators will continue to be reported and assessed against trigger reference points in both the annual stock status report and the stock assessment report and be used as supporting information for measuring the performance of the fishery. These indicators are:

- Total catch;
- Hauling net Catch per Unit of Effort (CPUE), expressed as kg/fisherday;
- Dab net CPUE, expressed as kg/fisherday;
- Fishable biomass (derived from GarEst); and
- Recruitment (derived from GarEst).

#### **9.3.1.4 Operational objective and trigger reference points**

Operational objective and trigger reference points have been established to measure the progress of rebuilding Southern Garfish stocks. These reference points have been designed to reflect stock levels that will support a sustainable and more profitable fishery.

Reference points have been established for primary, secondary and other performance indicators. Whilst 'other' performance indicators will not be used for explicit decision-making, they will provide continuity in the stock assessment and monitoring design.

Fishery operational objective and trigger reference points for performance indicators have been aligned with the stock assessment cycle. Operational objective dates are based on fishing years as opposed to the assessment date (Figure 5). Stock

assessment reports are generally available six to eight months after the last day of fishing activity.

#### 9.3.1.4.1 Primary performance indicators

The performance of the fishery will be rigorously assessed every three years with the first stock assessment due in July 2015. This stock assessment will report on two years of alternative management arrangements being in place, including two years of market sampling data, based on the first formal management response was in place 1 July 2012.

The operational objective and trigger reference points for the primary performance indicators are outlined in Table 14. Three sequential operational objectives have been set for reducing harvest fraction, whilst only two operational objectives have been set for egg production during the life of this management plan.

If a primary indicator trigger reference point is breached during the life of this harvest strategy, this will activate the decision rules and management actions outlined in Section 9.3.1.5.

Table 14. Primary performance indicators for Southern Garfish

Indicator	Operational objective	Trigger reference point	Assessment date	Comments
Harvest fraction	≤ 60% by 2014	Greater than 60% by 2014	July 2015	Current estimate 69% for both gulfs (McGarvey et al. 2009).
	≤ 45% by 2017	Greater than 45% by 2017	July 2018	
	≤ 30% by 2020	Greater than 30% by 2020	July 2021	
Egg Production	25% of pristine population by 2017	Less than 20% by 2017	July 2018	Current estimate 14% for both gulfs (McGarvey et al. 2009).
	30% of pristine population by 2020	Less than 30% by 2020	July 2021	

#### 9.3.1.4.2 Secondary performance indicators

The operational objective and trigger reference points for the secondary performance indicators are outlined in Table 15.

With the size and age structure of the fishery currently dominated by one and two year old fish, increasing the egg production and the overall fishable biomass of the fishery is dependent upon more fish reaching three years of age and older. The longer each fish can remain in the fishery and contribute to egg production, the quicker this stock will rebuild to desired levels. However, predicting the age composition required to rebuild stocks is difficult. For this reason, the operational objective for age composition is to have an increasing trend in the proportion of fish 3 years of age or older, averaged over the three-year stock assessment period. Using the average is preferred rather than using the value in one year, as a good year (or two) of recruitment may in fact reduce the proportion of older fish in the population simply because there are so many young fish. For this reason, recruitment levels will need to be considered when assessing this performance measure.

The levels of reduction in hauling net effort required to meet the rebuilding operational objectives are difficult to predict as they will change as egg production increases from the first management measures implemented. As such a range of management strategies are being developed in a stepwise manner and reviewed after each stock assessment report. An increase in mesh size would provide benefits to egg production and assist in reducing the harvest fraction (provided there is not a commensurate increase in fishing effort), but to what degree depends on the magnitude of the mesh size increase. An effort reduction operational objective is considered necessary to meet the operational objective reduction in harvest fraction; however an operational objective has only been set for the first triennium of this harvest strategy. Effort reduction operational objectives for the following years will be determined after the stock assessment report in July 2015 when a full evaluation of the performance indicators is undertaken.

Table 15. Secondary performance indicators for Southern Garfish

Indicator	Operational objective	Trigger Reference Point	Assessment date	Comments
Age composition	Increase the proportion of fish $\geq$ 3yrs of age between each stock assessment report	No change or reduced proportion of older fish	July 2015, July 2018 and July 2021.	Current estimate of fish $\geq$ 3yrs of age is 11.2% (McGarvey et al. 2009).
Total hauling net effort	$\geq$ 13% haul net effort reduction by June 2014	$<$ 10% haul net effort reduction by 2014	Annual Stock Status – November 2014	Required reduction will depend on other management strategies implemented

As detailed previously, a number of other performance indicators will continue to be reported on in the stock assessment reports and annual stock status reports. Trigger reference points for these indicators are outlined in Table 16; however no formal management responses are linked to these indicators.

Table 16. Other performance indicators for Southern Garfish

Indicator		Trigger Reference Point	Assessment date	Comments
Total catch		3 <sup>rd</sup> lowest/3 <sup>rd</sup> highest Greatest % inter-annual change (+/-) Greatest 5 year trend Decrease over 5 consecutive years	July 2015, July 2018 and July 2021	State-wide data available annually Regional data available stock assessment years
Hauling net CPUE and Dab net CPUE		3 <sup>rd</sup> lowest/3 <sup>rd</sup> highest Greatest % inter-annual change (+/-) Greatest 5 year trend Decrease over 5 consecutive years	July 2015, July 2018 and July 2021	State-wide data available annually Regional data available stock assessment years



Fishable biomass		3 yr average is +/- 10% of previous years	July 2015, July 2018 and July 2021	
Recruitment		Abundance of pre-recruits is 10% less or greater than the average abundance of the previous five years	July 2015, July 2018 and July 2021	

#### **9.3.1.5 Decision rules and management action**

Specific decision rules have been developed to ensure adequate and timely management responses are implemented to ensure the long term sustainability of the Southern Garfish fishery resources. Management decision rules have been built around the primary performance indicators and operational objectives which are assessed following the production of the stock assessment report.

A review of the stock assessment report will be undertaken within the existing co-management framework (principally the MSF Management Advisory Group via the Garfish Working Group) within one month of its release. The review will consider all information in the report with particular emphasis on the primary and secondary performance indicators and the performance against the reference points and operational objectives outlined in this harvest strategy.

Within 21 days of meeting, the MSF Management Advisory Group is to provide a report to the Minister (or his/her delegate) which includes:

- The key findings of the stock assessment report
- Details of trigger reference points that have been breached and progress on reaching the operational objectives
- Recommended management measures to meet the operational objectives
- Minutes of the meeting

The report is to be provided to the Minister (or his/her delegate) summarising the findings of the review and make recommendations about future management action.

The Minister (or his/her delegate) will consider recommendations, endorse supported strategies, or otherwise. Management changes would then be implemented as appropriate.

#### **9.3.1.6 Management options**

As previously stated, this harvest strategy does not prescribe specific management responses to breaches of trigger reference points. The appropriate response is difficult to determine given the complexities and multi-species nature of this fishery. There are a range of management tools available to achieve the operational objectives of the harvest strategy. Broadly the management options for Southern Garfish include:

- Gear modifications (mesh size increases, length reductions etc)
- Spatial or temporal closures (closure of specific areas for specific periods of time)
- Effort management (limit/quota the number of effort days in the fishery)

- Catch management (limit/quota the allowable catch in the fishery)

Management tools implemented may include one or more of these options. The preferred management response will be developed through the existing co-management framework for this fishery and must be consistent with the objectives of this harvest strategy.

### 9.3.2 Maintain catches within agreed allocations for each sector

Section 6 describes the allocation of shares between fishing sectors. An objective of this harvest strategy is to maintain shares within the agreed allocations. The process for review and/or adjusting shares will be undertaken in accordance with the limits specified in Section 6. The initial allocation of catch shares of the Southern Garfish fishery are outlined in Table 17.

Table 17. Allocation of Southern Garfish to all sectors

Species	Commercial		Recreational	Aboriginal traditional
Southern Garfish	MSF	79.33	19.5%	1%
	SZRL	0.13		
	NZRL	0.04		
<b>Total</b>	<b>79.5%</b>		<b>19.5%</b>	<b>1%</b>

### 9.3.3 Improve economic efficiency and financial returns to the commercial fishery

The objective of improving economic efficiency and financial returns to the commercial sector needs to be achieved within the bounds of sustainability imperatives and the existing management framework.

Improving economic efficiencies, and managing this fishery to achieve maximum economic yield (MEY) has been identified as a medium to long-term goal. Developing meaningful MEY performance indicators will require additional resources in order to integrate the current biological and economic information for the fishery.

In order to improve the suite of performance indicators currently available, future Marine Scalefish Fishery Economic Indicators Reports will aim to report on indicators specifically associated with the haul net fishery component of the MSF. These indicators include:

- Gross Operating Surplus
- Profit at full equity
- Rate of return on total boat capital

In addition, price per kilogram provides a simple yet effective indicator of economic performance. In a fishery with limited scope to increase production, the price received is an important factor for economic performance. In addition, the fishery has recently trialled the use of nets with a larger mesh size to allow smaller fish to escape whilst retaining larger fish (Steer et al. 2011). An increase in market price as a result of this change may partly offset any loss in catch as a result, and will be an important aspect for the harvest strategy to monitor.

Price information used will be derived from the annual EconSearch, Marine Scalefish Fishery Economic Indicators Report. No operational objectives or trigger reference points will be set for these economic indicators.

#### **9.3.4 Minimise impacts of fishing activity on ecosystem**

The current management arrangements are considered to adequately take account of ecosystem impacts. The specific issue of habitat disturbance by hauling nets was assessed in the Risk Assessment and found to be low. There are however potential impacts on the ecosystem through the capture of unwanted species (bycatch) and unintended mortality of non-target species.

A recent study by Fowler et al. (2009) provided a fishery-independent assessment and quantification of bycatch of hauling nets targeting Southern Garfish using a 3.0 cm mesh bunt or pocket. This study found that the retention rate of captured fish generally exceeded 65%, which is relatively high compared to similar net fisheries in south-east Australia. However, undersized and small legal size Southern Garfish made up over 30% of all teleost fish released in Gulf St Vincent (Fowler et al. 2009). This is concerning given that such fish are particularly fragile and prone to loss of scales, which results in most discarded fish being released in poor condition (Fowler et al. 2009).

More recent work has shown that a significant reduction in the capture of small and undersize Southern Garfish can be achieved by increasing the mesh size of the bunt/pocket (Steer et al. 2011).

Ecosystem impacts of management measures to re-build Southern Garfish stocks need to be considered. There are no specific indicators to assess performance against this objective. However a five-year review of the risk assessment will provide the opportunity for further consideration.

#### **9.3.5 Take account of the objectives of other sectors**

The current management arrangements are considered to adequately take account of the objectives of other sectors. Management of catches within agreed allocations will provide the necessary measurement of this objective into the future.

The use of hauling nets is prohibited in a significant proportion of waters in the MSF, including the two gulfs. Furthermore, hauling nets cannot be used in waters deeper than five metres. In addition to being a direct effort control, these spatial restrictions provide significant areas for recreational fishing access without competition from the commercial net sector. Similarly, hauling net closures in holiday periods provide a mechanism to reduce potential conflict between commercial and recreational fishers.

As there is a stock rebuilding strategy for Southern Garfish, management action will be directed across all major sectors, including the recreational sector. Management action targeted at this and other sectors will be addressed within the management plan for that sector.

## 9.4 Snapper harvest strategy

The aim of this harvest strategy is to outline the key objectives for managing the take of Snapper within the commercial MSF. The management objectives are to:

- 1) Ensure long-term sustainable harvest of Snapper
- 2) Maintain catches within agreed allocations for each sector
- 3) Improve economic efficiency and financial returns to the commercial fishery
- 4) Minimise impacts of fishing activity on ecosystem
- 5) Take account of the objectives of other sectors (e.g. the recreational sector)

This harvest strategy outlines the management objectives and the indicators that will be used to monitor the performance of the fishery over time. It is important to note that this harvest strategy does not prescribe specific management responses to breaches of trigger reference points. Significant management measures were implemented in 2012, and the fishery is likely to undergo a period of adjustment. Breaches of trigger reference points will be reviewed by the MSFMAG and reported to the Minister (or his/her delegate) as set out in section 9.4.1.1 below. If further action is required during the life of this harvest strategy then specific management responses will be developed through the existing co-management framework and will be consistent with the objectives of this harvest strategy.

This harvest strategy will commence from the inception of the management plan and will be in place until 30 June 2018, a period of five years. This period has been adopted to:

- Recognise the interruption to the time series of fishery dependant indicators from the introduction of new management arrangements
- Allow for the completion of the FRDC project 'The influence of fish movement on regional fishery production and stock structure for South Australia's Snapper (*Pagrus auratus*) fishery'
- Develop more explicit economic performance indicators for the Snapper fishery
- Develop a fishery independent performance indicator to improve monitoring of Snapper stock abundance and/or recruitment

The next Snapper harvest strategy will incorporate more prescriptive reference points and decisions rules, and consider the management and/or monitoring boundaries, as more information on stock structure and movement becomes available. A review of the performance indicators and trigger reference points is to be undertaken following consideration of each stock assessment report during this period (See Section 11 Stock Assessment and Research which details the process of data collection and reporting). Stock assessment reports for Snapper are scheduled for release in July 2013 and 2016 (Figure 6).

During the term of this harvest strategy, a key strategy is to build further scientific knowledge and improve the quality of fishery-dependent information and develop a fishery-independent index of fishable biomass. The purpose of building a suite of more robust fishery performance indicators is to be able to develop a future harvest strategy for the fishery that provides more confidence and certainty in the decision-making process. Part of this intent is to have the ability to set trigger reference points that are linked to explicit decision rules in the harvest strategy. Explicit decision rules in the future will provide greater certainty to the industry, fishery managers, other fishing sectors and the broader community on how the fishery will be sustainably managed.

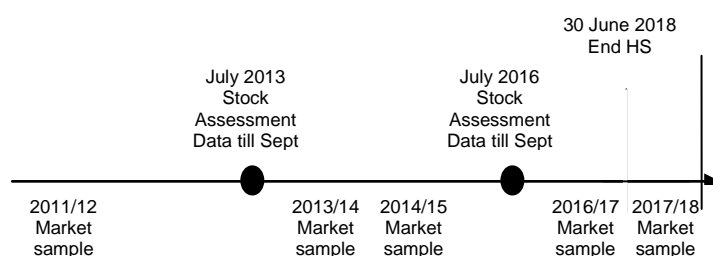


Figure 6. Key stock assessment dates during Snapper harvest strategy

## 9.4.1 Long term sustainable harvest of Snapper

### 9.4.1.1 Operational objective

The objective of achieving long term sustainability of the Snapper fishery is translated into the following operational objectives to ensure the extent to which the objective is being achieved can be qualitatively measured:

- Rebuilding Snapper stocks in Spencer Gulf to at or above sustainable levels
- Maintaining, at or above sustainable levels, the Snapper stocks in Gulf St Vincent and other regions of the fishery

### 9.4.1.2 Background

The commercial MSF accounts for almost 80% of the total Snapper catch. Snapper are taken with handlines and longlines, with longlines accounting for a greater proportion of the catch. Historically, the majority of catch has been taken within Spencer Gulf, however in recent years there has been a significant increase in catches from Gulf St Vincent and the South East. Recreational catch, including catch from charter boats, accounts for almost 20% of the total state-wide catch.

#### 9.4.1.2.1 Current status

##### 9.4.1.2.1.1 Southern Spencer Gulf Fishery

According to the recent Status of Key Australian Fish Stocks 2012 report (Jackson et al. 2012), from 2004/05, there was a substantial increase in commercial longline fishing effort for this biological stock, which related to the uptake of new longline fishing technology (Fowler et al. 2010). This resulted in a substantial increase in the effectiveness of fishers, culminating in dramatic increases in catches and CPUE. However, from 2008/09, CPUE declined dramatically, suggesting that the fishable biomass had become depleted (Fowler et al. 2010). This evidence indicates that the current level of fishing mortality is likely to cause the biological stock to become recruitment overfished.

Age-structure data indicate that no strong year-class has recruited to this biological stock since 1999. The stock assessment integrated this data and suggested that, between 2004 and 2009, fishable biomass fell from 4,200 to 3,600 tonnes (Fowler et al. 2010). Since recruitment for Snapper in South Australia is known to be highly variable and environmentally driven (Fowler et al. 2010), it is unclear if the poor recent recruitment is related to overfishing (Jackson et al. 2012).

On the basis of the evidence provided above, the biological stock is classified as a transitional–depleting stock.

A biological stock classified as ‘transitional-depleting’ means it is considered to be a deteriorating stock; that biomass is not yet recruitment overfished, but fishing pressure is too high and moving the stock in the direction of becoming recruitment overfished. If a stock becomes ‘recruitment overfished’, it means that the spawning stock biomass has been reduced by fishing so that average recruitment levels are significantly reduced.

#### 9.4.1.2.1.2 Northern Spencer Gulf Fishery

According to the recent Status of Key Australian Fish Stocks 2012 report (Jackson et al. 2012), the northern Spencer Gulf Fishery biological stock was traditionally the most important of the South Australian biological stocks, generally providing more than 50% of the state’s total catch. However, during the mid–late 2000s, its contribution declined to approximately 20%. These lower catches reflect declines in fishing effort, which are consistent with a decline in fishable biomass. The high levels of CPUE associated with these lower levels of catch and effort are thought to relate to hyperstability (i.e. where estimates of CPUE remain high despite declining biomass), reflecting the aggregative behaviour of Snapper and the experience and efficiency of the fishers in this region (Fowler and McGlennon 2011).

The suggestion of a decline in fishable biomass relative to the 1990s is supported by the lack of recruitment of any strong year classes to the population since 1999. It is not clear whether this lack of recruitment reflects the biological stock being recruitment overfished or an absence of environmental conditions conducive to spawning. In the absence of further recruitment, fishing mortality is likely to deplete the biological stock even further (Jackson et al. 2012).

On the basis of the evidence provided above, the biological stock is classified as a transitional–depleting stock.

#### 9.4.1.2.1.3 Gulf St Vincent Fishery

According to the Status of Key Australian Fish Stocks 2012 report (Jackson et al. 2012), commercial catches and catch rates for this biological stock have historically been consistently low. However, since 2008/09, there have been exponential increases in catch, effort and CPUE, to unprecedented levels. This is consistent with a substantial recent increase in biomass. Population age structures indicate that this relates to the recent recruitment of several strong year-classes to the population. As a consequence, the recent stock assessment suggests that, between 2000 and 2009, the stock biomass nearly doubled, to more than 2,900 t (Fowler et al. 2010). Therefore, the biomass of this biological stock is currently unlikely to be recruitment overfished.

As a result of the estimated increasing biomass, catch and effort have increased substantially. The current CPUE is at historically high levels and has been increasing since 2007. The catch in 2010 was 454 t, which is approximately 16% of the estimated biomass. This level of catch is unlikely to cause the biological stock to become recruitment overfished (Jackson et al. 2012).

On the basis of the evidence provided above, the biological stock is classified as a sustainable stock. This classification is given to a stock for which the biomass (or biomass proxy) is considered to be at a level sufficient to ensure that, on average, future levels of recruitment are adequate (i.e. not recruitment overfished) and for which fishing pressure is adequately controlled to avoid the stock becoming recruitment overfished.

#### *9.4.1.2.2 Snapper review and management changes*

At the time of the development of this plan a review of the management arrangements for the Snapper fishery was underway. PIRSA commenced a review of fisheries management arrangements for Snapper in 2011. The review was undertaken in response to concerns about the future sustainability of the fishery as a result of increasing commercial effort levels and a concentration of targeted fishing activity on breeding aggregations by all fishing sectors (commercial, recreational and charter sectors).

The aim of the review was to establish management arrangements that would effectively control the level of commercial impact on Snapper stocks, optimise Snapper spawning and recruitment, and support a sustainable Snapper fishery.

The longer-term management arrangements for the Snapper fishery were examined with input and advice from the Snapper Working Group. A paper with options for future management arrangements was released in November 2011 for public comment until 31 January 2012.

The Snapper Working Group identified that a reduction in catch and effort was required to manage the impact of fishing on the Snapper stocks. It was agreed by the Snapper working group that management measures should aim to reduce total commercial effort by 20%. It is expected the measures introduced in October 2012 will meet this operational objective.

Principles for the management of the Snapper fishery were developed with the working group so that there are clear objectives to guide decisions for long-term management of Snapper. The principles for management of the South Australian Snapper fishery are:

- Long-term sustainable harvest of Snapper
- Management arrangements must control catch or effort
- Maintain or improve the quality of recreational and charter fishing experience (recognising the importance of large fish in the population)
- Share the Snapper stock, in particular, maintain catches within the allocations for each sector
- Recognise the importance of Snapper to all stakeholders
- Simple and effective rules to ensure cost effective management (including research, licensing and compliance) that allow for flexibility in responding to changing conditions in the fishery for improved fishery performance
- Avoid creating unnecessary barriers to the supply of high quality product to the markets (including local markets)
- Profitable and economically efficient Snapper fishery

- Transparent decision making process which fosters trust between PIRSA and stakeholders
- Science is used to underpin management decisions where available
- Respect the social value of the fishery to regional communities

In 30 November 2011, in response to concerns raised by the commercial fishery regarding high levels of commercial fishing activity on Snapper stocks PIRSA implemented interim arrangements for Snapper; a commercial daily catch limit for Snapper of 800 kg within the Spencer Gulf and Gulf St Vincent.

Replacing the interim measure, in October 2012 the State Government introduced new fishing arrangements. The changes were aimed at controlling the level of commercial catch and minimising disturbance to spawning aggregations, so that opportunities for spawning and recruitment success could be maximised.

The Snapper management arrangements, in addition to the existing November closure, announced in October 2012 were:

- A 15-day extension to the annual state-wide Snapper fishing closure (midday 30 November – midday 15 December) was introduced in 2012 for commercial fishers and 2013 for recreational and charter fishers. In 2012, recreational and charter fishers were able to fish for Snapper during the 15-day extension period, with a reduced Snapper bag and boat limits. The extension was introduced to afford better protection for spawning aggregations from disturbance caused by fishing activity
- A daily commercial catch limit of 500kg across all South Australian waters from 15 December 2012, to control the level of commercial impact on Snapper stocks
- Commercial fishers are restricted to using 200 hooks on set lines (reduced from 400 hooks) when operating in Spencer Gulf and Gulf St Vincent from December 2012, to assist in restricting daily catches of Snapper to the 500 kg daily limit and avoid excess Snapper being discarded

At the time of finalising this management plan, PIRSA was undertaking additional work, including a regional socio-economic impact assessment and community consultation, on the development and implementation of Snapper spatial closures in 2013, to afford adequate protection to key Snapper spawning aggregation sites. The spatial (area) closures are proposed to restrict Snapper fishing in key aggregation areas for the remainder of the annual spawning period, to protect the long term sustainability of South Australian Snapper stocks. These spatial closures are considered to be important for minimising disturbance to spawning aggregations by all Snapper fishing activities (i.e. recreational, charter and commercial fishing). The closures are expected to maximize opportunities for spawning success throughout this critical reproductive period and promote future recruitment to the fishery.

It is noted that the introduced management arrangements (daily catch limit and reduction in the number of longline hooks) are likely to affect fisher behaviour and the commercial catchability of Snapper. This is likely to affect the interpretation of fisheries performance indicators, particularly the catch, effort and CPUE time series. As such, the need to investigate and develop a fishery independent indicator for abundance and/or recruitment has been identified to improve monitoring of the fishery. Fishery independent indicators will be investigated and incorporated into the next harvest strategy for the Snapper fishery.



#### **9.4.1.3 Performance indicators and reference points**

The primary objective of this harvest strategy is to maintain the fishery at a level regarded as stable and sustainable. This will include monitoring the fishery's response to the new management arrangements that were implemented in 2012. The status of the fishery will be monitored using primary performance indicators that are reported against operational objectives and trigger reference points in the triennial stock assessment report and the annual stock status report.

There will be two comprehensive stock assessment reports produced during the life of this harvest strategy, with the first to be presented in 2013 (Figure 6). These reports provide the opportunity for a detailed assessment of fishery performance and the consideration of management changes if required. In addition, annual stock status reports will be produced.

The stock assessment report breaks down the Snapper fishery into regions. The SnapEst derived indicators are presented for three regions i.e. Northern Spencer Gulf, Southern Spencer Gulf and Gulf St Vincent as well as for all three regions combined. The other 'secondary' performance indicators are presented at a finer scale; Northern Spencer Gulf, Southern Spencer Gulf, Northern Gulf St Vincent, Southern Gulf St Vincent, West Coast, South East and Statewide. Regional estimates of the primary performance indicators will be presented within each stock assessment report. The annual MSF stock status report will report on total catch, targeted effort and CPUE at a state-wide basis.

##### **9.4.1.3.1 Primary performance indicators and reference points**

The following primary performance indicators have been selected as the key determinants of fishery performance:

- Handline and longline effort, expressed as boatdays and hook sets (longline)
- Handline CPUE, expressed as kg/boatdays
- Yearly proportion of handline trips reaching 250kg (excluding November - January)
- Age composition
- Fishable biomass (derived from SnapEst)
- Exploitation rate (harvest fraction) (derived from the SnapEst model)

##### **Commercial CPUE**

Handline effort and CPUE are derived from commercial logbook data. Exploitation rates vary with effort. CPUE as catch divided by effort provides a measure of the relative abundance of the stock. Effort has historically been measured in boatdays however information relating to the number of hooks set per day when using longlines may provide a more accurate measure of effort for this gear type. Using this measure of effort will be trialed within this harvest strategy along with boatdays. The time series for this indicator will be disrupted with management changes (interim limits implemented in November 2011 and new ongoing arrangements October 2012).

It is usually assumed in fisheries that CPUE is proportional to abundance. In South Australian Snapper, both handline and longline CPUE (kg/boatdays) have been used as fishery-dependent indicators of relative abundance. The implementation of daily catch limits to control exploitation levels will disrupt these indices of abundance by reducing the catch on an average fishing day. For longlines, reduced hook numbers will

further reduce the catch on an average trip and because the Snapper fishery, especially handlines, targets a schooling spawning biomass during summer, this indicator needs to be used cautiously and with other indicators. In the future (July 2016 stock assessment), the SnapEst model can be used to estimate how much catchability is reduced by these management measures for both handlines and longlines, permitting CPUE to be corrected for years subsequent to the implementation of daily catch limits and the longline hook reduction. Given the reduced catchability and daily limit, it is expected that the CPUE will decline as a result of the management changes. However the extent of expected decline in CPUE is unknown.

#### Yearly proportion of handline trips reaching 250kg

The yearly proportion of handline trips reaching 250kg is a new indicator for the fishery. This index of abundance will be trialed within this harvest strategy. This indicator has been found to track the historical trend of handline CPUE. Because this indicator is not affected (or only indirectly affected) by the new handline management controls of daily catch limit, it will provide a useful replacement for CPUE as a measure of relative abundance which should not be disrupted. Because longlines will also be controlled by a reduction in permitted number of longline hooks, the proportion of longline trips reaching 250kg will be altered by this management control. The total of 250kg was selected so as to minimise any impacts from changes in fisher behavior as they approach 500kg daily catch limit. The fishery data for the months of November-January will be excluded from this indicator, so that the Snapper closures do not impact on the indicator.

#### Age composition

Age composition is examined to understand the population dynamics and compared over time to provide an indicator of the impact that fishing pressure has on the target species population and also on recruitment. Snapper ages structures are developed through the SARDI Aquatic Sciences commercial catch sampling program at the SAFCOL fish market. In considering the age structure of the population, key observations in the data are to ensure that younger fish are entering/recruiting into the fishery, cohorts move through the fishery over time and older fish remain in the fishery. Theoretically, when overfishing occurs it can be detected in the age frequency distributions by the gradual decrease in the numbers of older fish. This will be true if there are no major fluctuations in the abundance of individual year-classes and if the fishery draws equally upon all sizes of a fish population.

Having older fish in the fishery is an important objective for the recreational fishery (trophy fishing experience) and older fish are important contributors to spawning.

#### Fishable biomass and exploitation rate

Fishable biomass, exploitation rate and recruitment numbers are derived from the Snapper stock assessment estimation model 'SnapEst'. A combination of the fishery dependent catch and effort information, recreational surveys, and the size and age structure information are used by the model to determine the absolute population size (fishable biomass) and therefore determine what fraction of that population is being caught (exploitation rate).

The trigger reference points associated with the primary performance indicators are presented in Table 18.

Table 18. Primary performance indicators and reference points for Snapper

Indicator	Operational objective	Trigger reference Point	Assessment date	Comments
Handline & longline effort (fisher days and hook sets {longlines})		3 <sup>rd</sup> lowest/3 <sup>rd</sup> highest  Greatest % inter-annual change (+/-)  Greatest 5 year trend  Decrease over 5 consecutive years	State-wide-annually in MSF status report  Regionally in stock assessment report July 2013 and July 2016	
Handline CPUE	No target	3 <sup>rd</sup> lowest/3 <sup>rd</sup> highest  Greatest % inter-annual change (+/-)  Greatest 5 year trend  Decrease over 5 consecutive years	State-wide-annually in MSF status report  Regionally in stock assessment report July 2013 and July 2016	
Yearly proportion of handline trips reaching 250kg (excluding November-January)	No target	3 <sup>rd</sup> lowest/3 <sup>rd</sup> highest  Greatest % inter-annual change (+/-)  Greatest 5 year trend  Decrease over 5 consecutive years	Regionally in stock assessment report July 2013 and July 2016	November-January data removed to exclude any potential bias to the data from the spawning closures
Age composition (Annual population size and age classes)	Maintain proportion of fish older than 10, above 20% of the fished population	Proportion of fish older than 10 are less than 20% of the fished population	Regionally in stock assessment report July 2013 and July 2016	It should be noted for the target that a good recruitment may drive down the proportion of adult fish.  This indicator needs to be

				considered in conjunction with the secondary indicator for recruitment
Fishable biomass	No target	Most recent 3 yr average is +/- 10% of previous 3 year average	By region and state-wide in stock assessment report July 2013 and July 2016	
Harvest fraction (SnapEst)	≤ 32% (international standard)	Above international standard (above 32%)	By region and state-wide in stock assessment report July 2013 and July 2016	

#### 9.4.1.3.2 Secondary performance indicators and reference points

The following secondary performance indicators have been selected to be used as the supporting information for understanding the fishery performance:

- Total catch
- Longline CPUE, expressed as kg/boatdays and kg/hook
- Yearly proportion of longline trips reaching 250kg (excluding November and December)
- Recruitment Index
- Yearly egg production

Secondary performance indicators do not trigger a review in the fishery, however they provide supporting information as part of a weight of evidence approach for measuring the performance of the fishery. Secondary performance indicators will continue to be reported and assessed against trigger reference points in the annual MSF stock status report and the Snapper stock assessment report as indicated in the assessment date column in Table 18 below. These indicators and their associated trigger reference points are described in Table 19.

The trend in total catch is monitored to determine the fishing mortality and it can also be an indicator of abundance. However, total catch on its own needs to be treated cautiously as the same catch may come out of the fishery, with a higher level of effort being used to take it. Total catch is determined from fishery logbooks submitted by licence holders.

Longline CPUE (kg/boatdays and kg/hooks) in the Snapper fishery is used an indicator of Snapper relative abundance. It is noted that during summer the Snapper fishery targets spawning aggregations, as such the indicator needs to be used cautiously with other indicators. The longline CPUE time series is likely to be disrupted with the implementation of daily catch limits and the reduction in number of hooks for longlines. It is noted that after the next Snapest model run (July 2016 stock assessment) using

parameters derived in the model, the CPUE time series may be able to be adjusted or corrected for the management change affecting to catchability.

Yearly proportion of longline trips reaching 250kg (excluding November and January). This is a new indicator for the fishery. This index of abundance will be trialed within this harvest strategy. This indicator has been found to track the historical trend of longline CPUE. This measure is less reliable than the equivalent indicator for handlines because of a change to the permitted number of longline hooks which is likely alter the proportion of longline trips reaching 250kg, disrupting the data time series. 250kg was selected as the indicator so as to minimise any impacts from changes in fisher behavior as they approach 500kg daily limit and any changes to behavior from conducting multi day trips that end at midday. The fishery data for the months of November- January will be excluded from this indicator, so that the Snapper closures do not impact on the indicator.

Table 19. Secondary performance indicators and reference points for Snapper

Indicator		Trigger Reference Point	Assessment date	Comments
Total Catch		3 <sup>rd</sup> lowest/3 <sup>rd</sup> highest  Greatest % inter-annual change (+/-)  Greatest 5 year trend  Decrease over 5 consecutive years	State-wide - annually in MSF stock status report  Regionally in stock assessment report July 2013 and July 2016	State-wide data available annually
Longline CPUE (fisher days and hook sets {longlines})		3 <sup>rd</sup> lowest/3 <sup>rd</sup> highest  Greatest % inter-annual change (+/-)  Greatest 5 year trend  Decrease over 5 consecutive years	State-wide- annually in MSF status report  Regionally in stock assessment report July 2013 and July 2016	State-wide data available annually,  Regional data available in stock assessment report (every 3 years)  Time series will be disrupted with management changes October 2012
Yearly proportion of longline trips		3 <sup>rd</sup> lowest/3 <sup>rd</sup> highest  Greatest % inter-	Regionally in stock assessment	November-January data removed to

reaching 250kg (excluding November-January)		annual change (+/-)  Greatest 5 year trend  Decrease over 5 consecutive years	report July 2013 and July 2016	exclude any potential bias to the data from the spawning closures
Yearly egg production (SnapEst)		Lower than 20% of pristine population	By region and state-wide in stock assessment report July 2013 and July 2016	
Recruitment – number of Snapper reaching legal size {38cm} (SnapEst)		Most recent 3yr average is +/- 10% of the historical mean  Most recent 3yr average is +/- 10% of the previous 6 years average	By region and state-wide in stock assessment report July 2013 and July 2016	Snapper recruitment is variable from year to year

#### **9.4.1.4 Decision rules and management action**

Decision rules ensure adequate and timely management responses are implemented to ensure the long term sustainability of the Snapper fishery resources. Management decision rules have been built around the primary performance indicators which are considered following the production of the stock assessment report.

A review of the MSF status report and the Snapper stock assessment report will be undertaken within the existing co-management framework (principally the MSF Management Advisory Group) within one month of its release. The review will consider all information in the report with particular emphasis on the primary and secondary performance indicators and the performance against the trigger reference points and operational objectives outlined in this harvest strategy.

Within 21 days of this meeting the Management Advisory Group is to provide a report to the Minister (or his/her delegate) which includes:

- The key findings of the stock assessment report
- Details of trigger reference points that have been breached
- Recommended actions
- Minutes of the meeting

The MSF Management Advisory Group may recommend one of two actions where a trigger reference point is breached; either no further action or initiate a detailed review. In the case where the recommendation is for no further action, the report must also provide reasoning to not act. In the case where the recommendation is to conduct a detailed review, that review should be completed within six months. The review must include a detailed examination of the causes and implications of the fishery status and must also include adequate consultation with all relevant sectors. The report is to be provided to the Minister (or his/her delegate) summarising the findings of the review and making recommendations about future management action if required.

The Minister (or his/her delegate) will consider recommendations, endorse supported strategies, or otherwise. Management changes would then be implemented as appropriate.

#### **9.4.1.5 Management options**

In achieving the longer term objectives of this and future harvest strategies it is difficult to identify the appropriate management response to breaches of trigger reference points given the complexities and multi-species nature of this fishery. There is a range of management tools available to achieve the operational objectives of this harvest strategy, which include:

- Catch management (e.g. adjust Snapper daily catch limits)
- Gear modifications
- Closures (e.g. additional or adjustments to existing temporal or spatial closures)
- Spatial management (e.g. changes to daily limits in certain areas of the fishery)

#### **9.4.2 Maintain catches within agreed allocations for each sector**

Section 6 describes the allocation of shares between fishing sectors. An objective of this harvest strategy is to maintain shares within the agreed allocations. The process for review and/or adjusting shares will be undertaken in accordance with the limits specified in Section 6. The initial allocation of catch shares of the Snapper fishery are outlined in Table 20.

Table 20. Allocation of Snapper to all sectors

Species	Commercial		Recreational		Aboriginal traditional
Snapper	MSF	79	REC	8	1%
	SZRL	1.45	CHARTER	10	
	NZRL	0.55			
	LCF	0.03			
Total	81%		18%		1%

#### **9.4.3 Improve economic efficiency and financial returns to the commercial fishery**

The objective of improving economic efficiency and financial returns to the commercial sector needs to be achieved within the bounds of sustainability imperatives and the existing management framework.

In order to improve the suite of performance indicators currently available, future Marine Scalefish Fishery Economic Indicators Report will aim to report on indicators specifically associated with the Snapper fishery component of the MSF, if there are sufficient data. These indicators include:

- Gross operating surplus
- Profit at full equity
- Rate of return on total boat capital

#### **9.4.4 Minimise impacts of fishing activity on ecosystem**

The current management arrangements are thought to adequately take account of ecosystem impacts. Handlines and longlines are considered to pose a negligible risk to habitat disturbance and impacts. There are, however, potential impacts on the ecosystem through the capture of unwanted species (bycatch) and unintended mortality of non-target species. The capture and release of undersize Snapper poses a particular risk as a preliminary bycatch study by Fowler et al. (2009) found that these fish were often released in poor condition suffering from barotrauma. Hook size influenced species composition (including the size composition of Snapper), catch rates and condition of discarded fish. This issue needs to be considered when developing alternative management arrangements in the future.

#### **9.4.5 Take account of the objectives of other sectors**

The current management arrangements are considered to adequately take account of the objectives of other sectors. Management of catches within agreed allocations will provide the necessary measurement of this objective into the future.

The current management options being considered as part of the Snapper review are explicitly addressing the needs of all sectors.



## 9.5 King George Whiting harvest strategy

The aim of this harvest strategy is to outline the key objectives for managing the take of King George Whiting within the commercial MSF. The management objectives are to:

1. Ensure long-term sustainable harvest of King George Whiting
2. Maintain catches within agreed allocations for each sector
3. Improve economic efficiency and financial returns to the commercial fishery
4. Minimise impacts of fishing activity on ecosystem
5. Take account of the objectives of other sectors (e.g. the recreational sector)

This harvest strategy outlines the broad management objectives and the indicators that will be used to monitor the performance of the fishery over time. It is important to note that this harvest strategy will not prescribe specific management responses to breaches of trigger reference points. If management action is required during the life of this harvest strategy then responses will be developed through the existing co-management framework and will be consistent with the objectives of this harvest strategy.

This harvest strategy will commence from the inception of the management plan and will be in place for the life of the plan, a period of ten years. This period has been adopted to recognise the current stable status of the stocks. A review of the performance indicators and trigger reference points is to be undertaken following consideration of each stock assessment report during this period. Stock assessment reports are scheduled for release in July 2014, 2017 and 2020 (Figure 7).

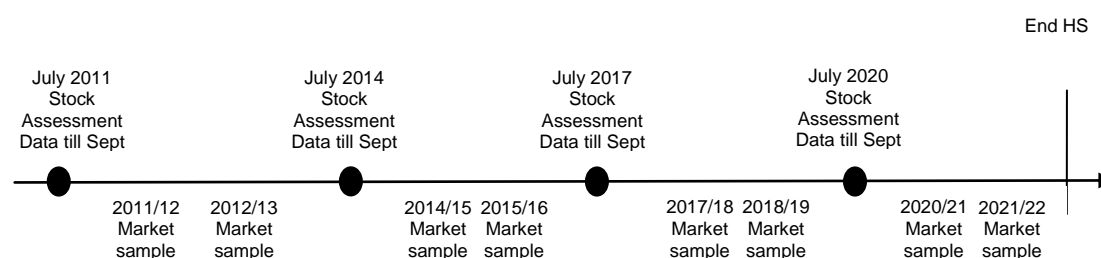


Figure 7. Key stock assessment dates during the King George Whiting harvest strategy

### 9.5.1 Long term sustainable harvest of King George Whiting

#### 9.5.1.1 Operational objective

The objective of achieving long term sustainability of the King George Whiting fishery is translated into the following operational objectives to ensure the extent to which the objective is being achieved can be qualitatively measured by:

- maintaining the primary performance indicators within acceptable trigger reference points described in Table 21.

#### 9.5.1.2 Background

Catches of King George Whiting are shared equally between commercial and recreational fishers. Approximately 80% of the commercial catch is taken by handline, with the remainder taken by hauling net and gillnet. The Far West Coast accounts for the highest catch by region, followed by Southern Spencer Gulf, and together these areas account for over 50% of the total commercial catch.

## **Current Status**

The King George Whiting fishery is considered to be sustainably fished. The most recent stock assessment report for King George Whiting (Fowler et al. 2011) considered that the fishery has been relatively stable for several years and that there is no immediate need to reconsider current management arrangements. A number of general limit reference points were breached in the 2011 stock assessment which relate to continued decline in effort across the fishery, and historically high catch rates, positive indicators for the fishery. The biological performance indicators were also generally positive with only two breaches one for recruitment in Spencer Gulf and the other exploitation rate in Gulf St Vincent. However these were minor breaches and not considered cause for immediate concern (Fowler et al. 2011).

### **9.5.1.3 Performance indicators and reference points**

The primary objective of this harvest strategy is to maintain the current performance of the fishery, which is regarded as stable and sustainable. The status of the fishery will be monitored using primary performance indicators that are reported against operational objectives and trigger reference points in the triennial stock assessment report and the annual stock status report.

There will be three stock assessment reports produced during the life of this harvest strategy, with the first to be presented in 2014 (Figure 7). These reports provide the opportunity for a detailed assessment of fishery performance and the consideration of management changes if required.

For the purposes of the stock assessment the King George Whiting Fishery is separated into regions; Far West Coast, mid West Coast, Coffin Bay, Southern Spencer Gulf, Northern Spencer Gulf, Gulf St Vincent and Kangaroo Island. Estimates of the primary performance indicators will be presented at the regional level within each stock assessment report; however the annual stock status report will report on a state-wide basis.

#### **9.5.1.3.1 Primary performance indicators and reference points**

The primary performance indicators are considered to be the best determinants of fishery performance. The primary biological performance indicators are:

- Handline effort (by region), expressed as boatdays
- Handline CPUE (by region), expressed as kg/boatday
- Age structure
- Fishable biomass (derived from WhitEst)
- Exploitation rate (harvest fraction) (derived from WhitEst)

Handline effort and CPUE are derived from commercial logbook data and provide a direct measure of the relative abundance of the stock. Future consideration will be given to determining a target CPUE range as an indicator of fishery performance.

Age structure, which is measured through the SARDI Aquatic Sciences commercial catch sampling program at the SAFCOL fish market, provides an indicator of the impact that fishing pressure has on the target species population. The other primary

indicators are derived from the King George Whiting stock assessment estimation model 'WhitEst'. A combination of fishery dependent catch and effort information and the size and age structure information are used to measure the absolute population (biomass) and therefore what fraction of that population is being caught (exploitation rate).

The trigger reference points associated with the primary performance indicators are presented in Table 21.

Table 21. Primary performance indicators and reference points for King George Whiting

Indicator	Operational objective	Trigger Reference Point	Assessment date	Comments
Handline effort	No target	3 <sup>rd</sup> lowest/3 <sup>rd</sup> highest Greatest % inter-annual change (+/-) Greatest 5 year trend Decrease over 5 consecutive years	July 2014 Annual (state-wide total only)	Targets to be considered for future monitoring
Handline CPUE	No target	3 <sup>rd</sup> lowest/3 <sup>rd</sup> highest Greatest % inter-annual change (+/-) Greatest 5 year trend Decrease over 5 consecutive years	July 2014 Annual (state-wide total only)	Targets to be considered for future monitoring
Age composition	No significant change	Significant change in long-term or previous 5 years	July 2014	
Fishable biomass	No target	3 yr average is +/- 10% of previous years	July 2014	Targets to be considered for future monitoring
Harvest fraction	≤ 28% (international standard)	>28% (international standard)	July 2014	

#### 9.5.1.3.2 Other performance indicators

Other performance indicators provide additional measures of fishery performance, but are considered to be of lower reliability. Other performance indicators will continue to be reported on and assessed against trigger reference points in both the annual stock status report and the stock assessment report and be used as supporting information for measuring the performance of the fishery. These indicators and associated reference points are described in Table 22.

Table 22. Other performance indicators and reference points for King George Whiting

Indicator		Limit Reference Point	Assessment date	Comments
Total catch		3 <sup>rd</sup> lowest/3 <sup>rd</sup> highest Greatest % inter-annual change (+/-)	July 2014 Annual (state-wide total only)	

		Greatest 5 year trend Decrease over 5 consecutive years		
Recruitment		Abundance of pre-recruits is 10% less or greater than the average abundance of the previous five years	July 2014	

#### **9.5.1.4 Decision rules and management action**

Specific decision rules have been developed to ensure adequate and timely management responses are implemented to ensure the long term sustainability of the King George Whiting fishery resources. Management decision rules have been built around the primary performance indicators which are assessed following the production of the stock assessment report.

A review of the stock assessment report will be undertaken within the existing co-management framework (principally the MSF Management Advisory Group) within one month of its release. The review will consider all information in the report with particular emphasis on the primary and secondary performance indicators and the performance against the reference points and operational objectives outlined in this harvest strategy.

Within 21 days of this meeting the Management Advisory Group is to provide a report to the Minister (or his/her delegate) which includes:

- The key findings of the stock assessment report
- Details of trigger reference points that have been breached
- Recommended actions
- Minutes of the meeting

The Management Advisory Group in association with PIRSA may recommend one of two actions, either no further action or initiate a detailed review. In the case where the recommendation is for no further action, the report must also provide reasoning to not act. In the case where the recommendation is to conduct a detailed review, that review should be completed within six months. The review must include a detailed examination of the causes and implications of the fishery status and must also include adequate consultation with all relevant sectors. The report is to be provided to the Minister (or his/her delegate) summarising the findings of the review and make recommendations about future management action if required.

The Minister (or his/her delegate) will consider recommendations, endorse supported strategies, or otherwise. Management changes would then be implemented as appropriate.

#### **9.5.1.5 Management options**

As previously stated this harvest strategy will not prescribe specific management action in response to breaches of trigger reference points. The appropriate response is difficult to determine given the complexities and multi-species nature of this fishery. There are a range of management tools available to maintain fishery performance, broadly the management options for King George Whiting include:

- Area and seasonal closures
- Size limit changes
- Catch management (limit/quota the allowable catch in the fishery)
- Effort management (limit/quota the number of effort days in the fishery)

The preferred management response will be developed through the existing co-management framework for this fishery and must be consistent with the objectives of this harvest strategy

### 9.5.2 Maintain catches within agreed allocations for each sector

An objective of this harvest strategy is to maintain shares within the agreed allocations. The process for review and/or adjusting shares will be undertaken in accordance with the limits specified in Section 6. The initial allocation of catch shares of the King George Whiting fishery are outlined in Table 22.

Table 23. Allocation of King George Whiting to all sectors

Species	Commercial		Recreational		Aboriginal traditional
King George Whiting	MSF	49.5	REC	45.5	1%
	SZRL	0.0	CHARTER	3.0	
	NZRL	1.0			
Total	50.5%		48.5%		1%

### 9.5.3 Improve economic efficiency and financial returns to the commercial fishery

The objective of improving economic efficiency and financial returns to the commercial sector needs to be achieved within the bounds of sustainability imperatives and the existing management framework.

In order to improve the suite of performance indicators currently available, future Marine Scalefish Fishery Economic Indicators Report will aim to report on indicators specifically associated with the King George Whiting fishery component of the MSF, if there are sufficient data. These indicators include:

- Gross operating surplus
- Profit at full equity
- Rate of return on total boat capital

### 9.5.4 Minimise impacts of fishing activity on ecosystem.

The three different fishing methods used to take King George Whiting; handline, hauling nets and gillnets all pose different risks to ecosystem impacts. It is considered that these activities pose a low to negligible risk to habitat and ecosystem function.

There are potential impacts on the ecosystem through the capture of unwanted species (bycatch) and unintended mortality of non-target species with all gear types used. Of these gear types, hauling nets pose a higher risk to the capture of non-target species, with a large range of species being captured during fishing operations. A recent bycatch study by Fowler et al. (2009) demonstrated that hauling nets have the potential

to capture large numbers of bycatch species. However the risk to non-target species is somewhat mitigated through regulations that require haul net catches to be sorted in-water, which increases the likelihood that bycatch species are released alive. Handlines are more selective with over 80% of handline catches comprised of the target species (Fowler et al. 2009).

#### **9.5.5 Take account of the objectives of other sectors**

The current management arrangements are considered to adequately take account of the objectives of other sectors. This objective is particularly important for the management of King George Whiting given the almost equal allocation between commercial and recreational fishers. Management of catches within agreed allocations will provide the necessary measurement of this objective into the future.

## **9.6 Southern Calamari harvest strategy**

This harvest strategy outlines the broad management objectives and the indicators that will be used to monitor the performance of Southern Calamari over time. In managing these species the objectives are to:

1. Ensure long-term sustainable harvest of Southern Calamari
2. Maintain catches within agreed allocations for each sector
3. Improve economic efficiency and financial returns to the commercial fishery
4. Minimise impacts of fishing activity on ecosystem
5. Take account of the objectives of other sectors (e.g. the recreational sector)

It is important to note that this harvest strategy will not prescribe specific management responses to breaches of trigger reference points, as the appropriate response is difficult to predict given the complexities and multi-species nature of the fishery.

This harvest strategy will commence from the inception of the management plan and applies for the life of the plan, a period of ten years. This period has been adopted to recognise the stability of management arrangements for the fishery. Consideration will be given to reviewing the performance indicators and trigger reference points following the release of the stock status report which details the Southern Calamari fishery performance at a regional level. This detailed stock status report will be produced every three years commencing in November 2015.

### **9.6.1 Long term sustainable harvest of Southern Calamari**

#### **9.6.1.1 Operational objective**

The objective of achieving long term sustainability of the Southern Calamari fishery is translated into the following operational objectives to ensure the extent to which the objective is being achieved can be qualitatively measured by:

- Maintaining performance indicators within the trigger reference points described in Table 24.

#### **9.6.1.2 Background**

The commercial MSF accounts for over 50% of the total catch of Southern Calamari in South Australia. The majority of the MSF catch is taken by jigs with less than 10% of the catch taken by hauling nets. The other commercial catch of Southern Calamari is taken by the prawn fisheries where it is retained as bycatch from prawn trawling. Together the three prawn fisheries account for over 5% of the total catch, the majority coming from Spencer Gulf. Southern Calamari is a popular target species of the recreational sector which accounts for nearly 40% of the total catch. The majority of catches are taken within the gulfs.

The short life cycle and high natural variability in abundance of Southern Calamari makes it difficult to predict future trends and status of the fishery. This also makes the development of a fishery based model to provide biological estimates of performance unfeasible.

## Current Status

The most recent stock assessment for Southern Calamari (Steer et al. 2007) considered that the resource was being harvested within sustainable limits. No trigger reference points were breached in the most recent stock status report which. Catches have been relatively stable since a record high in 2004/05.

### 9.6.1.3 Performance indicators and reference points

All secondary performance indicators and associated trigger reference points will be used to provide a measure of the status of Southern Calamari. Effort and CPUE is measured for targeted jig and haul net operations. An assessment of the performance indicators against the trigger reference points will be undertaken annually within the stock status report. This report will present information at a regional level once every three years providing a more detailed assessment than the current state-wide assessments. The regional areas for this fishery are; far west coast, northern Spencer Gulf, south west Spencer Gulf, south east Spencer Gulf, north west Gulf St Vincent, south central Gulf St Vincent and Kangaroo Island. Future consideration will be given to determining a target jig CPUE range as an indicator of fishery performance.

These indicators will be assessed against the relevant trigger reference points described in Table 24.

Table 24. Performance indicators and reference points for Southern Calamari

Indicator	Operational objective	Trigger reference point	Assessment date	Comments
Total commercial catch	No target	3 <sup>rd</sup> lowest/3 <sup>rd</sup> highest Greatest % inter-annual change (+/-) Greatest 5 year trend Decrease over 5 consecutive years	Annual with regional assessment every 3 years from 2015	
Jig & haul net effort	No target	3 <sup>rd</sup> lowest/3 <sup>rd</sup> highest Greatest % inter-annual change (+/-) Greatest 5 year trend Decrease over 5 consecutive years	Annual with regional assessment every 3 years from 2015	Targets to be considered for future monitoring
Jig & haul net CPUE	No target	3 <sup>rd</sup> lowest/3 <sup>rd</sup> highest Greatest % inter-annual change (+/-) Greatest 5 year trend Decrease over 5 consecutive years	Annual with regional assessment every 3 years from 2015	Targets to be considered for future monitoring



#### **9.6.1.4 *Decision rules and management action***

Specific decision rules have been developed to ensure adequate and timely management responses are implemented to ensure the long term sustainability of the Southern Calamari fishery resources. Management decision rules have been built around the performance indicators which are assessed following the production of the stock status report

A regional analysis of performance indicators will be undertaken once every three years and will be presented within the stock status report. More detailed assessments may be undertaken during this harvest strategy depending on information needs and resources. That information will be used to support the annual assessment against trigger reference points.

A review of the stock status report will be undertaken within the existing co-management framework (principally the MSF Management Advisory Group) within one month of its release. The review will consider all information within the report with particular emphasis on the secondary performance indicators and assessment against the trigger reference points outlined in this harvest strategy.

Within 21 days of this meeting the MSF Management Advisory Group is to provide a report to the Minister (or his/her delegate) which includes:

- The key findings of the stock assessment report
- Details of trigger reference points that have been breached
- Recommended actions
- The report will also be accompanied by minutes from the meeting

The Management Advisory Group may recommend one of two actions, either no further action or initiate a detailed review. In the case where the recommendation is for no further action, the report must also provide reasoning to not act. In the case where the recommendation is to conduct a detailed review, that review should be completed within 6 months. The review must include a detailed examination of the causes and implications of the fishery status and must also include adequate consultation with all relevant sectors. The report is to be provided to the Minister (or his/her delegate) summarising the findings of the review and make recommendations about future management action if required.

The Minister (or his/her delegate) will consider recommendations, endorse supported strategies, or otherwise. Management changes would then be implemented as appropriate.

#### **9.6.2 *Maintain catches within agreed allocations for each sector***

The allocations for Southern Calamari are outlined in Table 25. An objective of this harvest strategy is to maintain shares within the agreed allocations. The process for review and/or adjusting shares will be undertaken in accordance with the limits specified in Section 6. The catches by relevant sectors will be presented within the stock status report.

Table 25. Allocation of Southern Calamari to all sectors

Species	Commercial		Recreational	Aboriginal traditional
Southern Calamari	MSF	56%	37.4%	1%
	NZRL	0.45%		
	GSVP	0.45%		
	SGP	4.6%		
	WCP	0.1%		
<b>Total</b>	<b>61.6%</b>		<b>37.4%</b>	<b>1%</b>

### 9.6.3 Improve economic efficiency and financial returns to the commercial fishery

The objective of improving economic efficiency and financial returns to the commercial sector needs to be achieved within the bounds of sustainability imperatives and the existing management framework.

The economic performance of the Southern Calamari fishery will be measured as part of the broader MSF. The Marine Scalefish Fishery Economic Indicators Report provides measures on a range of indicators. No specific indicators apply to measure the economic performance of the Southern Calamari fishery.

### 9.6.4 Minimise impacts of fishing activity on ecosystem.

There are two very different methods of capture used to target Southern Calamari, jigs and hauling nets. It is considered that these activities pose a low to negligible risk to habitat and ecosystem function.

Jigs are extremely selective fishing gears that have minimal interactions with bycatch species or marine habitats. There are potential ecosystem impacts associated with the taking of Southern Calamari on spawning grounds, however given the short life cycle this is the perhaps the only opportunity to effectively target this species for commercial purposes. The stock sustainability impacts are measured through the performance indicators described previously.

There are potential impacts on the ecosystem through the capture of bycatch species and unintended mortality of non-target species with all gear types used. Hauling nets pose a higher risk to the capture of non-target species, with a large range of species being captured during fishing operations. The bycatch risks associated with hauling nets when used to target Southern Calamari are not fully understood. A recent bycatch study by Fowler et al. (2009) demonstrated that hauling nets have the potential to capture large numbers of different bycatch species. The risk to such species is mitigated, to some extent, through regulations that require catches to be sorted in-water, which increases the likelihood that bycatch species are released alive.

### 9.6.5 Take account of the objectives of other sectors

The current management arrangements are considered to adequately take account of the objectives of other sectors. Management of catches within agreed allocations will provide the necessary measurement of this objective into the future.

## **9.7 Vongole (Mud Cockle) harvest strategy**

This harvest strategy outlines the broad management objectives and the indicators that will be used to monitor the performance of Vongole (Mud Cockles) over time. In managing this species the objectives are to:

1. Ensure long-term sustainable harvest of Vongole
2. Maintain catches within agreed allocations for each sector
3. Improve economic efficiency and financial returns to the commercial fishery
4. Minimise impacts of fishing activity on ecosystem
5. Take account of the objectives of other sectors (e.g. the recreational sector)

The Vongole fishery is managed quite separately from the other marine scalefish species. In October 2008 the fishery moved to an individual transferable quota (ITQ) management system. The total allowable commercial catch (TACC) is the primary tool used to ensure a long term sustainable harvest. This harvest strategy is built around setting the TACC. As such, the performance indicators, reference points and decision rules for the Vongole fishery are different to those described for other species of the MSF.

This harvest strategy will commence from the inception of the management plan and be in force for a period of 5 years, unless earlier reviewed. This five year period recognises the infancy of the fishery and associated harvest strategy and the potential to modify in the short term. As this is the first harvest strategy to be developed for the Vongole quota fishery, modification to performance indicators and/or reference points during the term of the harvest strategy may be necessary in light of further information as well as practical experience.

### **9.7.1 Long term sustainable harvest of Vongole**

#### **9.7.1.1 Operational objective**

The objective of achieving long term sustainability of the Vongole fishery will be measured by maintaining total commercial catches at or below 7.5% of the biomass estimate.

#### **9.7.1.2 Background**

The Vongole fishery supports the commercial harvest of three bivalve species of the genus *Katelysia*; *K. peroni*, *K. rhytiphora* and *K. scalarina*. Vongole were traditionally harvested for bait or berley when targeting King George Whiting and remained lightly exploited until 1995/96 when the commercial catch first exceeded 50 t. The fishery rapidly expanded as the demand for Vongole for human consumption grew with catches peaking at 375 t in 2005/06. Catches were predominantly taken within Coffin Bay and the Section Bank (Port River). Concerns for the sustainability of the resource prompted management changes in 2008 which saw the introduction of the quota management system.

The quota management system encompasses three zones; the Port River, Coffin Bay and the West Coast (consisting of Smoky Bay, Streaky Bay and Venus Bay collectively), in which licence holders with Vongole quota entitlements are restricted to the zone(s) in which they hold a quota entitlement. Licence holders with access to marine scalefish species, but without a quota entitlement, retain access to Vongole inside and outside quota zones for the purpose of bait collection. Given that the vast

majority of the total commercial harvest of Vongole is by quota holders, the harvest strategy only applies to the quota-managed Vongole fishery.

At the time the quota management system was implemented there was consensus among fishers and PIRSA that the recent levels of catch and effort were unsustainable, however no formal biomass estimates were available on which to determine the TACC. For the first year the TACC was set conservatively based on historical catches; however biomass estimates derived from surveys in 2009 resulted in significant TACC reductions for the 2009/10 fishing year, suggesting that some areas were being fished beyond sustainable limits.

### ***Current Status***

At the time of preparing this harvest strategy, the status of Vongole varied considerably between the three zones. The Port River Zone closed to all fishing in 2011/12 as biomass levels were considered too low to allow for a viable commercial harvest. The Coffin Bay and West Coast zones are considered to be fished within sustainable limits. The different status of Vongole in each zone reflects the different levels of historical exploitation as well as the geographical and environmental characteristics of the three zones. The most recent estimates of harvestable biomass across the commercial fishery are provided in Dent et al. (2012).

#### ***9.7.1.3 Performance indicators & reference points***

The main focus of the research and monitoring program for Vongole is determining the sustainable harvest levels within each of the three quota zones and setting the TACC accordingly. Harvest levels are based on biomass estimates, which are considered the best available performance indicator, no other measures of fishery performance have been established for the fishery at this stage, however fishery performance is implicitly considered when recommending the zonal TACCs.

Biannual fishery-independent estimates of harvestable biomass are the key performance indicator for determining the TACC. Harvestable biomass is that part of the total biomass which may be taken in accordance with minimum size limits, and is calculated as the combined biomass estimate for all *Katylsia* species in each zone. To reduce uncertainty in estimating the harvestable biomass for the purpose of setting the TACC, the value used is the minimum biomass that is calculated with 80% confidence.

The TACC is determined as a fraction of the biomass estimate (at 80% confidence), up to a maximum of 7.5%. The harvest fraction adopted in each of the zones varies considerably. This variation reflects the differences between the zones in historic levels of exploitation, status of the stocks, and environmental and geographical characteristics. The current harvest fractions are 2.8%, 6% and 0% for the West Coast, Coffin Bay and Port River zones respectively.

The maximum of 7.5% harvest fraction of the harvestable biomass is considered appropriately conservative, whilst optimising the return from the resource. Vongole are characterised by low level, sporadic recruitment and, as such, require conservative harvest strategies to maintain adequate spawning biomass during periods of low recruitment.

The TACC is recommended for two quota years (a quota year being 1 July – 30 June), however is determined annually following a review.

When determining the harvest fraction for each zone a range of factors is taken into consideration, including:

- Fishery status (e.g. recovering from overfishing)
- Environmental conditions
- Geographic attributes
- Biological evidence of pre-recruits
- Quota holder economics

There are no quantitative measures or decision rules associated with these factors, rather they are a qualitative assessment of the quota holders observations and experience. Provided the harvest fraction is equal to or below the 7.5% level of the harvestable biomass, the biological objectives should be maintained over the long-term.

### **TACC setting decision rules**

1. Undertake zone specific biomass estimates, determined with 80% confidence
2. TACC not to exceed 7.5% of biomass estimate
3. PIRSA, SARDI and quota holders (through the Marine Fishers Association) to meet annually and determine an agreed TACC
4. PIRSA to make formal recommendation to the Minister for Agriculture, Food and Fisheries

#### **9.7.1.4 Reporting**

Reporting on the performance of Vongole is primarily undertaken as part of the bi-annual fishery-independent stock assessment for each of the three zones.

A review of the biomass estimation report will be undertaken through consultation between PIRSA, licence holders and the Marine Fishers Association. A consensus view of the TACC for each zone will be developed. TACC's will be recommended for two years, but will be reviewed annually. New information may be available to warrant alteration of the TACC.

### **9.7.2 Maintain catches within agreed allocations for each sector**

The allocation for Vongole are outlined in Table 26. An objective of this harvest strategy is to maintain shares within the agreed allocations. The process for review and/or adjusting shares will be undertaken in accordance with the limits specified in Section 6. The catches by relevant sectors will be presented within the stock status report when data is available for each sector.

Table 26. Allocation of Vongole to all sectors

<b>Species</b>	<b>Commercial</b>	<b>Recreational</b>	<b>Aboriginal traditional</b>
Vongole	98.7%	0.3%	1%

### **9.7.3 Improve economic efficiency and financial returns to the commercial fishery**

The objective of improving economic efficiency and financial returns to the commercial sector needs to be achieved within the bounds of sustainability imperatives and the existing management framework.

The economic performance of the Vongole fishery will be measured as part of the broader MSF. The Marine Scalefish Fishery Economic Indicators Report provides measures on a range of indicators including price, gross operating surplus, profit at full equity and rate of return on total boat capital.

### **9.7.4 Minimise impacts of fishing activity on ecosystem.**

Vongole are harvested by hand or with the use of a cockle rake/net. Raking of the sea bed has the potential to impact on the ecosystem, however the risk of impacting on ecosystem function was assessed as part of the risk assessment and was considered low. This takes into consideration the localised activity of commercial Vongole harvesting.

### **9.7.5 Take account of the objectives of other sectors**

The current management arrangements are considered to adequately take account of the objectives of other sectors. Management of catches within agreed allocations will provide the necessary measurement of this objective into the future.

## **10 OTHER COMMERCIAL FISHING**

### **10.1 Research fishing**

Some research activities are undertaken as part of a commercial enterprise, where the fish caught as part of the research fishing are sold for the purposes of funding the research or for compensating the commercial operator for their time. Regulations under the *Fisheries Management Act 2007* have provisions to issue permits for research activities with a commercial element. Other non-commercial research activities are authorised by exemption.

### **10.2 Exploratory and developmental fishing**

Applications for exploratory and developmental fishing for species that are not part of this fishery are dealt with under the Exploratory and Developmental Fishing Policy. This policy will also deal with applications for exploratory and developmental fishing for species that are part of this fishery in the area of the MSF, but must do so in a manner that is consistent with this plan. All applications are considered on a case by case basis.

Broodstock and seedstock collection is the taking of aquatic resources or part of resources for the purposes of commercial aquaculture. Only low levels of this type of activity are permitted. Large scale collection must be done under a fishery licence by arrangement between a fishery licence holder and aquaculture licence holder on a commercial basis. If the species is part of an existing commercial fishery, broodstock and seedstock collection activities will be considered through a permit system under the Act.

## **11 RESEARCH AND MONITORING**

### **11.1 Stock assessment and biological monitoring**

PIRSA contracts research services for each of its managed fisheries. SARDI Aquatic Sciences is currently the primary research provider for core stock assessment and biological monitoring research for the MSF. Costs of the annual research program for the fishery are recovered through licence fees.

The cost-recovered funding through licence fees is not the only stream of funding from which research relevant to the management of the fishery is undertaken. External sources such as the Fisheries Research and Development Corporation (FRDC) and universities also provide opportunities. The fishery contributes to the FRDC through an annual levy base which is also collected through licence fees.

#### **11.1.1 Biological data collection and analysis**

A range of fishery-dependent and independent data is collected to assist in the monitoring of the MSF. Commercial catch and effort information provides the primary data on which the biological status of the fishery is assessed and on which the majority of fisheries management decisions are based. Commercial catch and effort are fishery dependent data collected through daily fishing logbooks and submitted by registered masters in accordance with the regulations. To simplify logbook reporting, the fishery is divided into a series of administrative fishery blocks, see Figure 8.

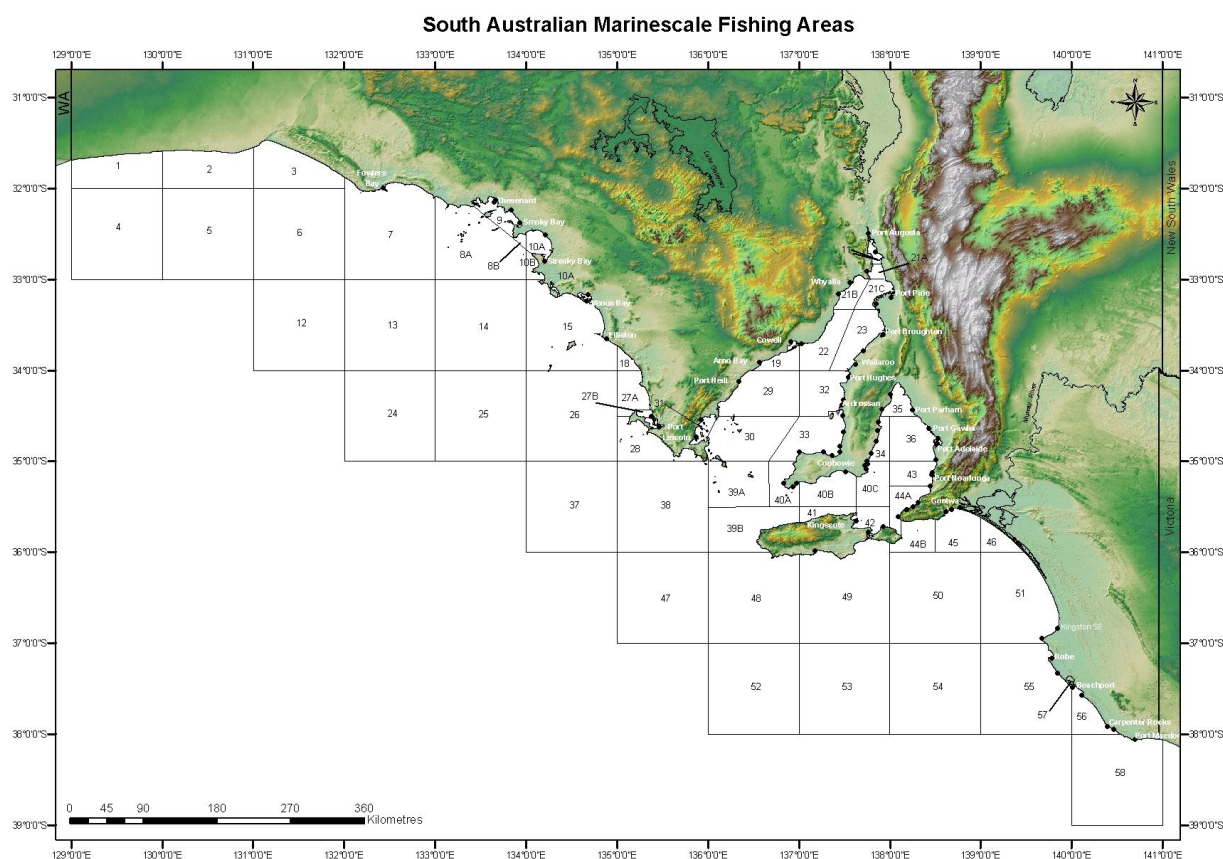


Figure 8: Marine scalefish fishing areas

The primary source of fishery-independent information is derived through market based sampling for Snapper, King George Whiting and Southern Garfish. This sampling provides biological information such as age and length data which is subsequently used in the fishery models to provide estimates on a range of performance indicators. Fishery-independent information is also collected in Vongole fishery to determine biomass estimates.

From 1 July 2007 a logbook was also introduced for commercial licence holders to report interactions with threatened, endangered and protected species.

#### **11.1.1.1 Commercial logbooks**

A logbook program, which requires all commercial fishers to compulsorily record daily information on catch and effort levels and other details on daily fishing operations. Information collected through the logbook program is periodically reviewed to accommodate changes in the fishery and ensure data collection meets management and research needs. Logbook returns are submitted monthly and are entered into the Marine Scalefish Fishery Information System database, which is maintained by SARDI Aquatic Sciences.

#### **11.1.1.2 Wildlife interactions logbook**

PIRSA implemented a data recording logbook in 2007 for wildlife interactions (including threatened, endangered and protected species – TEPS) for all South Australian commercial fisheries. SARDI Aquatic Sciences maintains the database of TEPS logbooks and summarises fishery interactions in an annual report.



### **11.1.2 Biological reporting**

As the primary research provider, SARDI Aquatic Sciences publish two key reports on the MSF annually. These reports provide the necessary biological information for the sustainable management of the fishery. Those reports are:

1. *Stock assessment report*. This is a major report that is published once every three years for Snapper, King George Whiting and Southern Garfish. The report provides a detailed analysis of the biological performance of the fishery and reports on the fishery performance against key indicators outlined within the relevant harvest strategy (Section 9).
2. *Stock status report*. Published annually following the collation of fishery catch and effort information from the previous financial year, this report provides a rapid assessment of the status of all primary, secondary and a number of tertiary species based on fishery derived catch and effort information. The status report reports on the fishery performance against key indicators outlined in the harvest strategy (Section 9).

The stock assessment report for each of the three species provides model-derived estimates of biological indicators such as recruitment, biomass and age structure as well as fishery dependent information such as commercial catch, effort and catch per unit effort (CPUE). Key information included in the fishery models are size, age and reproductive maturity information which is collected through market-based catch sampling undertaken in two of the three years between stock assessment reports.

For primary, secondary and most tertiary species an annual status report provides details on the status of the fishery at the State-wide level based on commercial fishing statistics. Catch, effort and CPUE for the most recent year are measured against trigger reference points in order to detect changes in fish abundance and fishing effort.

In addition to the species specific reports, SARDI Aquatic Sciences also publishes annual wild fisheries information and statistics report and a threatened, endangered and protected species interactions report.

### **11.1.3 Biological research plan**

The annual research priorities of the MSF are outlined in a five-year research plan. The plan is centred on the production of stock assessment reports, the stock status report as well as the collection of biological information and the maintenance of data to support the production of those reports.

Provision is also made to undertake a discretionary project annually, and is selected in consultation with the industry. This discretionary project is used to address key management issues and in the past has funded such projects as: examining the development of stock assessment and monitoring tools for Southern Calamari; examining fleet dynamics; management strategy evaluation for Snapper; providing fishery independent assessment and quantification of bycatch; and mesh selectivity analysis in the Southern Garfish fishery.

Table 27. Outline of the research plan for the MSF

	2012/13	2013/14	2014/15	2015/16	2016/17
Stock Assessment Report	Snapper	King George Whiting	Southern Garfish	Snapper	King George Whiting
Market sampling	King George Whiting & Southern Garfish	Southern Garfish & Snapper	Snapper & King George Whiting	King George Whiting & Southern Garfish	Southern Garfish & Snapper
Stock status Report	Primary, secondary and selected tertiary species	Primary, secondary and selected tertiary species	Primary, secondary and selected tertiary species	Primary, secondary and selected tertiary species	Primary, secondary and selected tertiary species
Collection of commercial catch and effort data	All species	All species	All species	All species	All species
Discretionary project	Further haul net mesh selectivity  Population structure of whaler shark (co-contribution only)	Snapper DPEM  Population structure of whaler shark (co-contribution only)	Snapper DPEM	Snapper DPEM	TBA

The Snapper harvest strategy is required to be reviewed within a 5 year timeframe. The next harvest strategy is to incorporate more explicit decision rules. Given this, further research may need to be conducted to inform the development of the harvest strategy. This will need to be considered when reviewing research priorities for the fishery.

## 11.2 Economic assessment and monitoring

Economic information for the MSF is reported in an annual economic indicators report, and includes the economic indicators set out in this plan (refer to Section 8 – Goals and Objectives table page 46).

The report relies heavily on the voluntary cooperation of fishing operators in providing data for the surveys. The most recent survey was undertaken in 2011, this was the fifth survey of licence holders. Surveys are undertaken every 3 years. In the interim years the data analysed is adjusted in the report to reflect the fishery's performance in that year, based on:

- SARDI catch and effort data - to reflect changes in catch size, catch value, changes in fishing effort (number of days fished)
- Price information from input suppliers- to adjust prices that had changed, for example, fuel
- The consumer price index (CPI) for Adelaide - to adjust the cost of inputs to reflect local levels of inflation

Within the report fishery specific data is reported at a whole fishery level as well as being aggregated or grouped based on characteristics of fishing business (gear, fishing regions, full time or part time licences, licence type etc.).

### **11.3 Social assessment and monitoring**

Ongoing and regular data collection and assessment of social data is new to the MSF (and most fisheries worldwide).

Previous social data on the fishery has been collected through discrete research projects. Data for assessing the social indicators will be derived by undertaking fisher surveys and collating existing PIRSA information, in consultation with the industry. Fisher surveys can be undertaken in conjunction with the economic surveys currently undertaken in the fishery, in order to minimise data collection costs. PIRSA will provide information to supplement fisher survey data in assessing the performance of the indicators. This is appropriate for some social indicator's performance measures which are related to available management agency (PIRSA) knowledge and records (e.g. demonstrate availability of MSF information through website, correspondence, media releases, licence holder letters, Fishcare volunteer program, MFA and Fisheries Officers).

## **12 COMPLIANCE AND MONITORING**

### **12.1 Objectives**

PIRSA administers a compliance program that has dual objectives:

- To maximise voluntary compliance with fisheries rules<sup>2</sup>
- To create effective deterrence to breaching fisheries rules

These objectives are consistent with the National Fisheries Compliance Policy.

Voluntary compliance is maximised through ensuring that fishers are aware of the rules that apply to their fishing activities, understand the rules and the purpose of those rules and operate in a culture of compliance.

Effective deterrence is created through the presence of Fisheries Officers and awareness of compliance operations, as well as through detection and prosecution of illegal activity<sup>3</sup>.

### **12.2 Cost recovery**

The costs of the compliance program are funded in two ways. The costs attributed to the commercial sector are recovered from licence holders through licence fees. This is done in accordance with the Government's cost recovery policy for fisheries. PIRSA and industry associations are involved in annual consultation in relation to the proposed compliance program and associated costs.

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<sup>2</sup> Rules include regulations, licence conditions, closure notices or any other enforceable instrument under the *Fisheries Management Act 2007*.

<sup>3</sup> Prosecution may include the issuing of a formal caution or an expiation notice, in addition to prosecution through the courts.

The costs attributed to non-commercial sectors are funded by government from consolidated revenue.

## **12.3 Planning**

PIRSA compliance programs are developed through a three-year planning cycle. This planning cycle is designed to ensure that compliance programs:

- Support the fisheries management objectives for each fishery
- Identify compliance risks in each fishery
- Respond to key risks within each three year period
- Have an appropriate mix of tools designed to maximise voluntary compliance and create effective deterrence
- Establish benchmarks against which to measure responses to risks

### **12.3.1 Risk assessment**

A compliance risk assessment is reviewed on an annual basis for each fishery. This assessment identifies and prioritises the compliance risks that exist in the fishery. Risks are ranked according to the likelihood and consequence of the risk occurring.

The MSF compliance risk assessment is scheduled to be conducted in October/November each year, to align with the cost recovery process (see Table 30), and inform the development and costs of the compliance program for the following financial year. The risk assessment process involves industry representatives and is designed to identify the key risks that the fishery is exposed to as a result of illegal activity. The risks are ranked based on a variety of factors including the current levels of non-compliance being observed or reported and the impact that this activity may have on the sustainability of the target species or the ecosystem. The key risks identified in the MSF at present are:

- Collusion between licensed and unlicensed fishers
- Fishing during closed seasons
- Using illegal gear
- Take undersize or over limit
- Catch validation

### **12.3.2 Responses and benchmarks**

Compliance activities are planned to respond to the risks identified for the MSF, with an emphasis on the most serious risks. Responses must include measures aimed at both maximising voluntary compliance and creating effective deterrence.

Benchmarks are established by which to measure compliance activities. These benchmarks are used to guide the allocation of resources in compliance planning.

### **12.3.3 Compliance plans**

Compliance plans are developed each financial year for the MSF and are implemented for the full financial year.

#### **12.3.4 Compliance status reports**

Each year a report is to be prepared assessing the compliance status of the fishery. This report will:

- Describe the compliance risks (and their attributes) impacting the fishery during the previous year
- Describe the actions undertaken to address each risk and the outcomes achieved
- Describe the mitigation strategy in place to address each risk
- Identify risk reduction options for future consideration

The report will be prepared and made available to the MSFMAG following completion of each financial year. PIRSA will meet with key representatives of the fishery and discuss the contents of the report, prior consulting with the MSFMAG on the proposed compliance risk assessment and associated compliance program for the following year.

### **13 REGULATORY ARRANGEMENTS**

The regulatory arrangements for the MSF are complex. This section aims to provide a general overview of the key licensing and management arrangements that are in place to regulate the fishery. For information relating to specific regulatory arrangements please refer to the relevant regulations. Regulatory arrangements for the MSF are contained within the *Fisheries Management (Marine Scalefish Fisheries) Regulations 2006* and the *Fisheries Management (General) Regulations 2007*. These regulations are subject to amendment which may then affect the regulatory arrangements outlined within this plan.

In relation to licences, the Minister reserves the right to amend licence conditions and entitlements for the MSF if required to meet the ESD objectives of the *Fisheries Management Act 2007* and/or in this plan through the term of the plan.

In addition, the Fisheries Council of South Australia is currently undertaking a review of the rules and regulations under the Act (the Rules Review) in order to standardise and simplify rules imposed across all fisheries. The Minister reserves the right to amend licence conditions and entitlements as a result of the outcomes of the Rules Review, including the gear review component.

#### **13.1 Licensing**

##### **13.1.1 Issue of licences**

Access to the commercial MSF is provided through a licence for the Marine Scalefish Fishery or the Restricted Marine Scalefish Fishery. The fishery is a limited entry fishery, which means that no new licences will be created. Licences are issued for a period of ten years under this management plan. The licensing arrangements for separately managed fisheries that have access to marine scalefish species will be detailed within the management plan for those fisheries.

Table 28. Commercial fishery licence holders with access to marine scalefish species as of 5 February 2013

Fishery Licence Type		Number of Licences
Marine Scalefish Fishery		327
Restricted Marine Scalefish Fishery		10
Southern Zone Rock Lobster Fishery	Option A	18
	Option B	10
	Option C	152
Northern Zone Rock Lobster Fishery	Option A	1
	Option B	2
	Option C	65
Lakes and Coorong Fishery		36
Miscellaneous Fishery		1 Western Australian Salmon, 7 Worm & 5 Scallop
Gulf St Vincent Prawn Fishery		10
Spencer Gulf Prawn Fishery		39
West Coast Prawn Fishery		3
Blue Crab Fishery		9

### 13.1.2 Transferability

MSF licences may be transferred provided the transfer is a family transfer or is an authorised transfer under the licence amalgamation scheme. All licence transfers are governed by the *Fisheries Management (Marine Scalefish Fisheries) Regulations 2006*.

Family transfers allow a MSF licence (not including Restricted Marine Scalefish Fishery Licences) to be transferred to family members without being subject to the amalgamation scheme. For the purposes of family transfers, a licence holder (the licensee) may transfer the licence to:

- The spouse or domestic partner of the licensee
- A parent or grandparent of the licensee
- A brother or sister, or half-brother or half-sister, of the licensee
- a child or grandchild of the licensee
- a child or grandchild of the spouse or domestic partner of the licensee

The licence amalgamation scheme was introduced in 1994 as a method for reducing the number of licences, and therefore the maximum amount of fishing effort, within the fishery. At the time when the licence amalgamation scheme was introduced, all MSF licences were assigned a points value based on the level of historical catch. The amalgamation scheme requires at least two licences to be joined together, with one of those licences being removed from the fishery as a consequence. Provided the two (or more) licences being amalgamated have an aggregate points value above a pre-determined threshold, the licence will be transferred along with the appropriate gear entitlements from the licence being surrendered. The 'new' licence is re-assigned the aggregate points value which is above the threshold and can be freely transferred without having to be amalgamated with another licence, subject to all other conditions and regulations. The Restricted MSF licences were incorporated into the scheme in 2004 and awarded a value of 7 points. Prior to 2004, restricted licences were non-transferable and were slowly reducing by natural attrition.

It has been almost 20 years since the inception of the amalgamation scheme. During this time and with the assistance of the net fishery restructure in 2005, over 40% of licences have been permanently removed from the fishery (Figure 9).

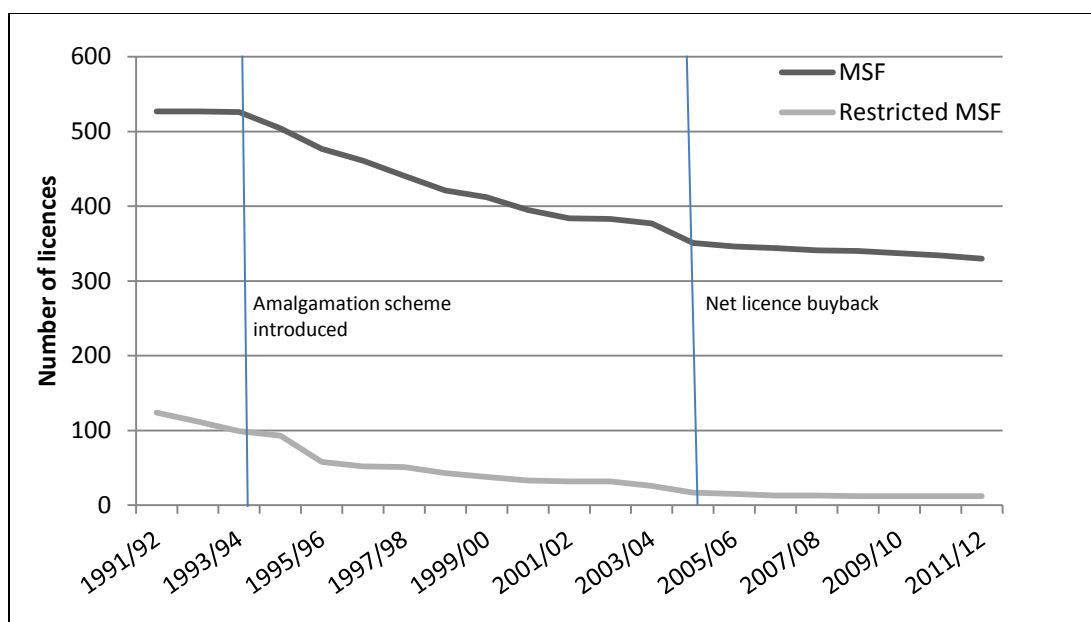


Figure 9. Numbers of MSF and Restricted MSF licences since 1991/92

### 13.1.3 Registered masters

The MSF is regarded as an owner operator fishery and as such the use of a registered master to operate the licence, in addition to the licence holder is not permitted, however there are some exceptions to this rule. The licence holder is not required to be the operator of that same licence under the following circumstances:

- The licence holder owns another MSF licence and is registered as the master of that licence<sup>4</sup> or
- The licence authorises the use of certain gear types (ocean jacket trap, sand crab pot or a sardine net), in which case a registered master can be endorsed on that licence for the purpose of operating that gear type only

### 13.1.4 Registered boats

The number of boats that may be registered on a MSF licence at any one time is not restricted; however only one boat may fish pursuant to a licence at any one time. Whilst the same vessel may be registered on multiple licences, multiple licences cannot be operated from one vessel at the same time.

### 13.1.5 Registered devices

All fishing gear, excluding hands (for the purpose of hand collection), rods, lines and hand lines, must be registered on a MSF licence before they can be used to take fish for trade or business. Current policy does not allow for additional fishing devices to be endorsed on a licence or transferred from one licence to another.

The gear types permitted to be used within the fishery, provided they are endorsed on a licence are provided in Table 29. Whilst gear types are not transferable, the licence amalgamation scheme allows for a licence holder to purchase an additional licence and

<sup>4</sup> Where a person holds multiple licences, that person is still required to be the owner/operator of one of those licences.

amalgamate the gear endorsed on both licences.

Table 29. Total numbers of devices endorsed on Marine Scalefish Fishery licences only as of 5 February 2013

Gear Type	No. of Licences	Total No. of Devices
Bait fork	16	33
Bait net	32	34
Bait pump	16	28
Bait spade	17	36
Brailing net	80	90
Cockle net	37	77
Cockle rake	142	299
Crab net	7	150
Crab rake	112	311
Dab net	284	773
Drop line	129	2741
Drop net	54	687
Fish spear	65	140
Fish trap	173	3079
Gill net (<15 cm)	48	187
Hauling net	52	145
Hoop net	198	2053
Large mesh net	32	140
Longline	291	2260
Mussel dredge	21	27
Oceanjacket trap	4	80
Octopus trap	43	26876
Purse seine net	2	2
Razorfish tongs	323	525
Sardine net	14	22
Sand crab pot	4	400
Squid jigging machine	3	18
Hand line/rod & line (not issued as endorsement)	All licences	Max 2 lines per person

## 13.2 Management arrangements

The management arrangements for the MSF are complex due to the multi-species and multi-gear nature of the fishery and are implemented through a variety of regulations, licence conditions and other legal instruments. Given the regulatory complexity of the fishery, this section will only provide a broad overview of the main regulations and licence conditions.

The fishery is largely managed through the use of input controls which aim to limit the total amount of effort that can be directed into the fishery to ensure the sustainability of the aquatic resources on which the fishery is based. Since the mid 1990s the main effort control has been the licence amalgamation scheme which has significantly reduced the total number of licences within the fishery. In addition the fishery has maintained the owner/operator policy which restricts the operation of the licence to the owner only, with some exceptions (section 13.1.3). This prevents the licence holder employing other people to work the licence in his/her absence and restricts the total effort expended to what the individual licence holder is willing or capable of undertaking.



Outside of limited entry, owner operator provisions and the licence amalgamation scheme, the main effort controls are centred on the use of gear types and gear amounts. Regulations and licence conditions restrict licence holders to using only gear that is endorsed on their licence and with that gear type come restrictions such as the number of devices, the dimensions, construction material, areas of operation, species that can be taken, and in the case of hauling nets, the method in which non-permitted species must be removed from within the gear. These restrictions are aimed at not only limiting effort but also limiting the impact on the marine ecosystem.

Output controls are also utilised within the MSF. Both Australian Sardines and Vongole are managed under an individual transferable quota (ITQ) management system which limits the number or amount of fish that can be taken from the water with less reliance on using effort controls to limit the catch. Other output controls such as size limits, daily catch limits and closed seasons are also used to manage the fishery.

There have been substantial and significant changes to the management of the MSF during its existence. These changes have occurred to keep up with increasing knowledge of the resource limitations and ecosystem requirements, as well as with the changing expectations of the South Australian community for whose benefit the resources are being managed for. As technology improves, so too does the efficiency of fishers, therefore management must adapt to ensure the resource is harvested within sustainable limits. In a fishery managed without limits on the total allowable catch this remains a key challenge. Table 1 outlines the more recent and significant changes to the management of the MSF.

### **13.2.1 Strategic review of management arrangements**

Whilst there have been significant changes to the management of the MSF over time, a number of underlying issues remain in the fishery today. The key issues include; licence transferability and the role of the amalgamation scheme, the owner operator arrangements and gear transferability. These issues are considered strategic issues for the fishery as they relate to the structure the MSF, its management framework and resource access arrangements.

There are a number of options for the future sustainable management of the fishery, depending on the values and aspirations of the industry. Future management of these fishery issues will be determined through the development of a long-term strategic direction for the management of the fishery. Undertaking such a review has been identified as an industry and management priority and will be addressed during the term of this management plan. PIRSA has commenced work with the Marine Fishers' Association on the development of a vision and strategic plan for the fishery, which will seek to assign priorities for addressing the key strategic issues.

### 13.2.2 Other commercial fisheries with marine scalefish access

A number of other separately managed fisheries maintain some level of access to marine scalefish species. The level of access and restrictions on access varies between each fishery and, as with the MSF these restrictions are implemented through a mix of regulations, licence conditions and other legal instruments. A brief outline of the level of access for these fisheries is provided below.

#### Rock Lobster Fisheries

The level of access to marine scalefish species by both the Southern and Northern Zone Rock Lobster fisheries is dependent upon one of three options fixed by licence condition to each rock lobster licence.

- Option A: Allows the take of Southern Rocklobster, Octopus and Giant Crab for trade and business. Incidental bycatch in the rock lobster pot of permitted species (MSF species) for bait purposes. All devices except rock lobster pots are removed from the licence when selecting this option, and only rock lobster pots are allowed onboard the vessel
- Option B: Allows the take of Southern Rocklobster, Octopus and Giant Crab for trade and business. Allows the take of permitted species (MSF Species) for bait purposes only i.e. means for use as bait in a licence holder's own fishing operations and does not involve selling or transferring those fish. All devices except rock lobster pots and bait nets are removed from the licence when selecting this option
- Option C: Allows the take of Southern Rocklobster, Octopus and Giant Crab for trade and business as well as the take of permitted species (MSF Species) for trade and business. Permitted to use all devices endorsed on licence subject regulations and conditions

A licence holder may 'downgrade' their marine scalefish option (i.e. shift from Option C to Option B), but cannot upgrade or increase their level of access.

The same owner operator provisions of the MSF do not apply to rock lobster licence holders. Registered masters may operate a rock lobster fishery licence to take marine scalefish on the licence holder's behalf without restriction during the rock lobster season. The level of access is different between the southern and northern zone fisheries and restrictions are in place for the northern zone fishery during the rock lobster closed season. There are also restrictions on rock lobster fishers using certain scalefish gear types when using rock lobster pots.

#### Lakes and Coorong Fishery

There are currently 36 Lakes and Coorong licence holders who have restricted access to some of the same fish species as MSF licence holders. These fishers operate in coastal waters between the seaward extensions of the Goolwa Beach Road to the jetty at Kingston, including the Goolwa channel, out to three nautical miles from the low water mark. Lakes and Coorong Fishery licences also operate under owner operator provisions apart from 28 relief days where a registered master other than the licence holder may operate the licence.

Lakes and Coorong licence holders are permitted to target similar species to the MSF, which are listed in Schedule 1 of the *Fisheries Management (Lakes and Coorong Fishery) Regulations 2009*. However the main species targeted by Lakes and Coorong

fishers in coastal waters are Mulloway (*Argyrosomus hololepidus*), Western Australian Salmon (*Arripis truttacea*), Black Bream (*Acanthopagrus butcheri*), Yellow-eye Mullet (*Aldrichetta forsteri*), Greenback Flounder (*Rhombosolea tapirina*) and Pipi (*Donax deltoides*).

### **Miscellaneous Fisheries**

There is one Miscellaneous Fishery licence holder, specifically licensed to take Western Australian Salmon (*Arripis truttaceus*), as well as seven licence holders licensed to harvest Beachworms, Bloodworms and Tubeworms. Scallops, which are a Schedule 1 species of the MSF, are managed within the Miscellaneous Fishery as a dedicated dive fishery. MSF licence holders are permitted to take Scallops for commercial purposes however taking by diving is prohibited.

Miscellaneous Fishery licences are non-transferable, however the *Fisheries Management (Miscellaneous Fishery) Regulations 2000* provide the Minister with the power to issue additional licences through a call for applications by way of a competitive tender process, provided that a licence within the fishery ceases to be held by a person or the Minister considers that it would not be detrimental to the aquatic resources of the State to issue an additional licence in respect of the fishery.

### **Prawn Fisheries**

All prawn fisheries (Gulf St Vincent, Spencer Gulf and West Coast) are permitted to retain some marine scalefish species that are incidentally taken during prawn fishing operations. All prawn fisheries are permitted to retain for a commercial purpose Southern Calamari (*Sepioteuthis australis*), in addition the West Coast Prawn Fishery licence holders are also permitted to retain Octopus (*Octopus spp.*) and Scallop (Family Pectinidae).

### **Australian Government (AFMA) Fisheries**

A number of fisheries managed by the Australian Government by the Australian Fisheries Management Authority (AFMA) operate in Commonwealth waters adjacent to South Australia. These fisheries have the authority to take some 'marine scalefish species' as unavoidable catch of their authorised fishing activities as agreed through an Offshore Constitutional Settlement (OCS) between the State of South Australia and the Australian Government. The OCS prescribes individual species possession limits as well as a combined possession limit for species managed by South Australia for commercial fisheries. The marine scalefish species managed under this arrangement, and their associated trip limits are provided in Appendix 5.

#### **13.2.3 MSF Licences with access to other fisheries**

##### **Sardine Fishery**

The Australian Sardine (*Sardinops sagax*) Fishery has evolved directly from within the MSF. The fishery developed following the establishment of tuna farming in the Port Lincoln region where Australian Sardines were sourced to feed farmed Southern Bluefin Tuna.

The management of this fishery is governed by the *Fisheries Management (Marine Scalefish Fisheries) Regulations 2006*, however the fishery is managed separately from the MSF under a quota management system. There are 14 marine scalefish fishers authorised to use sardine (purse seine) nets to harvest Australian Sardines. They may

also take other small pelagic species such as Anchovies. A separate management plan has been developed for this fishery.

### **Blue Crab Fishery**

The Blue Crab Fishery within Gulf St Vincent and Spencer Gulf historically formed part of the MSF where crabs were taken using hoop nets, drop nets and hauling nets. However the fishery evolved into a pot fishery and was formally constituted in 1996. At the time, MSF licence holders' maintained access to the fishery provided they held quota. This is still the case today, however MSF licence holders are restricted to using hoop nets or drop nets and are not permitted to use blue crab pots. The *Fisheries Management (Blue Crab Fishery) Regulations 1998* enable the Minister to issue additional blue crab pot fishery licences provided a MSF licence with blue crab quota entitlement is surrendered.

Blue Crab Fishery licence holders are also permitted to harvest a number of MSF Schedule 1 species, however the take of those species is restricted for personal bait use, and cannot be sold.

Since 1997/98, the total number of licences with blue crab quota has decreased from 40 to 12. In 2008/09 there were nine Blue Crab Fishery licences and three MSF licences with blue crab quota entitlements.

### **Access to Australian Government (AFMA) Fisheries**

In the same way that AFMA-managed fishery operators are entitled to possession limits for some South Australian managed species, South Australian fishery licence holders are permitted to land limited amounts of AFMA managed species under the OCS. These limits are provided to allow for the retention of limited amounts of unintended catch during normal fishing operations. The marine scalefish species managed under this arrangement, and their associated possession limits are provided in Appendix 6.

In addition, the management responsibility for School Shark and Gummy Shark was transferred from South Australia to AFMA in 2000 through a memorandum of understanding as a supplement to the OCS. This transfer of jurisdiction also occurred in Tasmanian and Victoria, recognising the overlapping stock boundaries of these species and the preference to manage them under a single authority. When this transfer occurred management of the species shifted to a quota management system. State-based licence holders eligible for quota through catches within coastal waters were issued with a South Australian Coastal Waters permit under the authority AFMA. These permits allow School Shark and Gummy Shark to be taken under quota within South Australian coastal waters (outside specified internal waters) provided the permit holder also holds a relevant South Australian licence and subject to any other AFMA regulations and permit conditions. All other MSF licence holders are entitled to a combined daily limit of five School Shark or Gummy Shark from specified internal waters and an additional combined daily limit of five from coastal waters (outside specified internal waters).

## **13.3 Fish processing**

The Act and the *Fisheries Management (Fish Processor) Regulations 2007* set out the requirements for registration as a fish processor.

## 14 REVIEW OF PLAN

A review of this management plan may be conducted at any time and a full review will be conducted after five years of its operation. The harvest strategies within this management plan will be reviewed in accordance with the timeframes set out for each species.

Under the *Fisheries Management Act 2007* management plans are subject to periodic review by the Fisheries Council. Section 49 of the Act outlines the process of reviewing a management plan:

### **Section 49—Review of management plans**

- (1) *The Council may review a management plan at any time.*
- (2) *The Council must, as soon as practicable after the fifth anniversary of the commencement of a management plan, conduct a comprehensive review of the plan for the purpose of determining whether the plan should be amended, replaced or reinstated without amendment.*
- (3) *The Council must submit a report on the outcome of a review under this section to the Minister within 12 months after the commencement of the review.*
- (4) *The Minister must, within 12 sitting days after receiving a report under this section, cause copies of the report to be laid before both Houses of Parliament.*
- (5) *If a report under this section recommends that a management plan should be reinstated without amendment on its expiry, the plan may be so reinstated without following the procedures set out in section 44.*
- (6) *If a plan is to be reinstated under this section, the Minister must—*
  - (a) *adopt the plan; and*
  - (b) *cause notice of that fact to be published in the Gazette; and*
  - (c) *in the Gazette notice adopting the plan, fix a date on which the plan will take effect.*

If new ideas and initiatives become available during the life of this plan, they will be considered for incorporation into the management plan in consultation with the MSF Management Advisory Group.

### **14.1 Key issues that may be considered in the review**

A number of issues have been highlighted within the plan for consideration during or before the review of the plan, where appropriate. These issues are highlighted below:

- Potential impacts of MSF management changes on Aboriginal fishing including outcomes of future Aboriginal traditional ESD risk assessments.
- Outcomes of any relevant ILUA processes
- Aboriginal traditional fishing management plans that are made in the future that apply to the waters of this fishery
- Improving economic efficiencies, and managing the fishery to achieve maximum economic yield (MEY) has been identified as a medium to long-term goal. Developing meaningful MEY performance indicators will require additional

resources in order to integrate the current biological and economic information for the fishery

- Outcomes of strategic review (see- Strategic review of management arrangements on page 105)
- Snapper harvest strategy
- Vongole harvest strategy
- Outcomes of the South Australian and national harvest strategy policy including consideration of further inclusion of social and economic indicators
- Other fisheries management plans which are relevant to the MSF
- Review of allocations (see Future allocations page 31)
- Consider the need to allocate species not yet allocated under the plan
- Outcomes of an Australian Salmon management review and suitable allocations
- Review the classification of MSF species (i.e. primary, secondary/other)

Note: this list is not all-inclusive and other fishery matters may be considered, in addition to those listed above.

## 15 RESOURCES REQUIRED TO IMPLEMENT THE PLAN

### 15.1 Cost recovery - overview

South Australian commercial fisheries operate in accordance with the Government's cost recovery policy, which provides that the costs attributed to the management of the commercial fishery are recovered from industry. Therefore, the costs of policy development, research and compliance programs are cost recovered through legislated licence fees. The commercial fishing industry, through its representative bodies, has a high level of involvement in structuring the relevant policy, compliance and research programs in partnership with PIRSA Fisheries and its service providers. This is an important facet of co-management in South Australia. The annual schedule for cost recovery in relation to commercial fisheries is outlined in Table 30.

Further details about the process for developing compliance and research programs are set out in sections 11 and 12 of this management plan.

Table 30. Cost recovery schedule for SA commercial fisheries.

Date	Activity	Parties
Sept/Oct	Review long term objectives for fishery and update if necessary Identify priority outcomes for upcoming financial year	PIRSA and industry association
Oct/Nov	Develop policy, research and compliance work programs in readiness for discussions (fisheries managers with industry) in November	PIRSA
Nov/Dec	Consult relevant industry associations in relation to proposed programs and reach agreement on these programs. Industry associations to consult with wider industry	PIRSA and industry association
February	Formal meetings with industry associations to finalise work programs and summarise costs	PIRSA and industry association
March	Submit proposed licence fees to Minister. Prepare Cabinet submission to amend regulations to prescribe new fees	PIRSA and government agencies
June	Invoices sent for licence fees	PIRSA

### 15.2 Management costs

Management costs of the commercial MSF are recovered through licence fees which are determined on an annual basis. The total costs of management include: biological and economic research, compliance, policy and management, licensing, legislation and co management consultative services. In addition a levy paid to the Fisheries Research and Development Corporation (FRDC) based on the GVP of the fishery is also included.

The costs for these services are shared among licence holders, with proportions attributed to all marine scalefish licence holders (base fee), marine scalefish licence holders with a net endorsement (net fee) and rock lobster licence holders with marine scalefish access. In recent years the costs have been split across these groups approximately 60:10:30 respectively, however these proportions are subject to change depending on the number of licence holders, net endorsements and any changes to fee structure that may be implemented over time.

Licences that are endorsed with Vongole, Blue Crab and Sardine quota are charged additional fees to cover the costs of the research, compliance and management costs specific to those fisheries.

Lakes and Coorong fishers with coastal nets pay a marine scalefish net fee but not a base fee. Other than rock lobster fishery licence holders and Lakes and Coorong fishers, no other commercial fisheries with access to marine scalefish species contribute directly to the management of the fishery. These licence holders pay licence fees which are calculated on the cost of managing the fishery in which they are licensed to operate.



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## 17 ACRONYMS

<b>AFMA</b>	Australian Fisheries Management Authority
<b>CPUE</b>	Catch per unit effort
<b>DEH</b>	Department of Environment and Heritage (South Australia)
<b>ESD</b>	Ecologically sustainable development
<b>EPBC Act</b>	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
<b>FRDC</b>	Fisheries Research and Development Corporation
<b>ILUA</b>	Indigenous Land Use Agreement
<b>MAG</b>	Management Advisory Group
<b>MFA</b>	Marine Fisheries Association
<b>MPA</b>	Marine Protected Area
<b>NRIFS</b>	National Recreational and Indigenous Fishing Survey
<b>PIRSA</b>	Department of Primary Industries and Regions, South Australia
<b>SABCPFA</b>	South Australian Blue Crab Pot Fishers Association Inc.
<b>SARDI</b>	South Australian Research and Development Institute
<b>TEPS</b>	Threatened, endangered and protected species

## 18 COMMON FISHERY MANAGEMENT TERMS

These terms are intended to be used for the purposes of this management plan only and are not intended to be inconsistent with fisheries legislation.

**Aboriginal traditional fishing** Fishing engaged in by an Aboriginal person for the purposes of satisfying personal, domestic or non-commercial communal needs, including ceremonial, spiritual and educational needs, and using fish and other natural marine and freshwater products according to relevant aboriginal custom.

**Adaptive management** Management involving active responses to new information or the deliberate manipulation of fishing intensity or other aspects in order to learn something of their effects. Within a stock, several sub-stocks can be regarded as experimental units in which alternative strategies are applied.

**Age structure** A breakdown of the different age groups within an individual population, or population sample.

**Allocation** Distribution of the opportunity to access fisheries resources, within and between fishing sectors.

**Aquatic plant** An aquatic plant of any species, including the reproductive products and parts of an aquatic plant.

**Aquatic reserve** An area of water, or land and water, established as an aquatic reserve by proclamation under the *Fisheries Management Act 2007*.

**Aquatic resource** Fish or aquatic plants.

**Bag limit** The maximum number of a species that can be legally taken by a recreational fisher per day or per fishing trip, as specified.

**Barotrauma** Physical damage to a fishes body or organs caused by rapid retrieval from deep water to the surface. Damage is often irreparable.

**Beach price** Price received by commercial fishers at the "port level" for their catch, and is generally expressed in terms of \$/kg. Processing costs are not included in the beach price, as processing operations are assumed to occur further along the value chain. The use of beach prices also removes the effect of transfer pricing by the firm if it is vertically integrated into the value chain.

**Benthic** Describes animals that live on, in or near the substrate.

**Biodiversity** The variability among living organisms from all sources (including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part) and includes: (a) diversity within species and between species; and (b) diversity of ecosystems.

**Biological reference point** An indicator of the status of an exploited stock and a standard for comparison between years. Two types are often used when sufficient biological data are available: those based on fishing mortality and those based on the sustainability of recruitment. In data poor fisheries, other BPIs related to estimates of relative biomass may be used (i.e. total catch and catch per unit effort). Reference

points can be either desirable targets (target reference points) or minimum biologically acceptable limits (limit reference points).

**Biomass** The total weight or volume of individuals in a fish stock.

**Boat Business Profit** Defined as *Gross Operating Surplus* less *Depreciation* less *Owner-operator and Unpaid Family Labour*. Boat Business Profit represents a more complete picture of the actual financial status of an individual firm, compared with GOS, which represents the cash in-cash out situation only.

**Boat Capital** Capital items that are required by the licence holder to earn the boat income. It includes boat hull, engine, electronics and other permanent fixtures and tender boats. Other capital items such as motor vehicles, sheds, cold-rooms, and jetty/moorings can be included to the extent that they are used in the fishing business. The fishing licence/permit value is included in total boat capital.

**Boat Cash Income** Defined as *Gross Operating Surplus* less *imputed wages for owner- operator and unpaid family labour*.

**Boat Gross Margin** *Total Boat Income* less *Total Boat Variable Costs*. This is a basic measure of profit which assumes that capital has no alternative use and that as fishing activity (days fished) varies there is no change in capital or fixed costs.

**Boat limit** The maximum number of a species that can be legally taken by recreational fishers on a boat per day or per fishing trip, as specified.

**Bycatch** At a broad level, fisheries bycatch includes all material, living and non-living, other than targeted species which is caught while fishing. It includes discards (that part of the catch returned to the water) and also that part of the catch that is not landed but is killed as a result of interaction with fishing gear.

**By-product** Non-targeted catch that is commercially valuable and retained by fishers.

**Catch** The total amount (weight or number) of a species captured from within a specified area over a given period of time. The catch includes any animals that are released or returned to the water.

**Catch per unit effort (CPUE)** The weight or number of a species caught by a specified amount of effort. Typically, effort units are defined using a combination of the following factors: gear type; gear size; the amount of gear; the amount of time the gear is used; and the number of people operating the gear. CPUE is often used as an index of relative abundance in fisheries stock assessment. In modern assessments, CPUE is standardised to account for the diverse range of factors that can affect CPUE.

**Closures** Prohibition of fishing during particular times or seasons (temporal closures) or in particular areas (spatial closures), or a combination of both.

**Cohort** A group of fish spawned during a specified period, usually within a year. A cohort is also referred to as an age class.

**Co-management** Arrangements between governments and stakeholder groups to allow joint responsibility for managing fisheries resources on a cooperative basis. Co-management arrangements can range from a consultative model, where stakeholders have an advisory role to government, to an informative model where co-managers have decision-making powers.

**Commercial fishing** Fishing undertaken for the purpose of trade or business.

**Common property resource** A resource that is determined to be owned by the community, or by the State on behalf of the community, and to which no individuals or user groups have exclusive access rights.

**Cost of management services** Commercial fishery management services will generally include biological monitoring and reporting; policy, regulation and legislation development; compliance and enforcement services; licensing services; and research. Where a commercial fishery operates under full cost recovery, licence fees will be set to cover the cost of managing the fishery or at least the commercial sector's share of the resource. In fisheries where there is full cost recovery, it can be assumed that the cost of providing these management services to the commercial sector will be equal to the gross receipts from licence fees in the fishery. With information on licence fee receipts, GVP, catch and the number of commercial fishers in the fishery, the following indicators can be readily calculated:

- aggregate licence fee receipts for the fishery (\$)
- licence fee/GVP (%)
- licence fee/catch (\$/kg)
- licence fee/licence holder (\$/licence holder)

**Critical habitats** Habitats that are crucial in at least part of the life cycle of a species, which typically includes nurseries such as estuaries, mangroves, seagrass beds, reefs and defined spawning areas.

**Data poor fishery** A fishery where limited data are available to inform management. For example, fisheries for species where baseline biological data such as size at maturity, fishing mortality and growth rates are unknown.

**Depreciation** Depreciation refers to the annual reduction in the value of boat capital due to general wear and tear or the reduction in value of an item over time.

**Ecologically sustainable development** 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.

**Economic efficiency** The maximisation of the value of the net benefits derived from fishery resources.

**Ecosystem** A dynamic complex of plant, animal, fungal, and micro-organism communities and the associated non-living environment interacting as an ecological unit.

**Effort** Amount of fishing taking place, usually described in terms of gear type and frequency or period during which the gear is in use; for example, 'hook-sets', 'trawl-hours', 'searching hours'.

**Effective fishing effort** Measures of fishing effort (such as hooks per day of fishing) that have been standardised so that the measure is proportional to the fishing mortality rate that the gear(s) impose on the stock of fish. Management measures to limit effective effort imply that the fishing mortality rate is to be limited.

**Fecundity** Number of eggs an animal produces each reproductive cycle; the potential reproductive capacity of an organism or population.



**Fish** An aquatic animal other than an aquatic bird, an aquatic mammal, a reptile or an amphibian.

**Fishery** A term used to describe the collective enterprise of taking fish. A fishery is usually defined by a combination of the species caught (one or several), the gear and/or fishing methods used, and the area of operation.

**Fishery dependent data** Information collected about a fishery or fish stock by the participants of a fishery, eg. catch and effort information from fishery log sheets.

**Fishery independent data** Information collected about a fishery or fish stock by researchers, independent of the fishery, eg. scientific surveys, observer reports.

**Fishing capacity** The amount of fishing effort that a fishing boat, or a fleet of fishing boats, could exert if utilised to its/their full potential.

**Fishing mortality** The rate of deaths of fish due to fishing.

**Fully exploited** This describes a fish stock for which current catches and fishing pressure are close to optimum (the definition of which may vary between fisheries; for example, catches are close to maximum sustainable yield). Categorising a species as 'fully fished' suggests that increasing fishing pressure or catches above optimum (allowing for annual variability) may lead to overfishing.

**Gear restriction** A type of input control used as a management tool to restrict the amount and/or type of fishing gear that can be used by fishers in a particular fishery.

**Gross Operating Surplus (GOS)** is defined as *Total Boat Income* less *Total Boat Cash Costs* and is expressed in current dollar terms. GOS may be used interchangeably with the term Gross Boat Profit. A GOS value of zero represents a breakeven position for the business, where *Total Boat Cash Costs* equals *Total Boat Income*. If GOS is a negative value the firm is operating at a cash loss and if positive the firm is making a cash profit. GOS does not include a value for owner/operator wages, unpaid family work, or depreciation.

**Gross value of production (GVP)** Value of the total annual catch for individual fisheries, fishing sectors or the fishing industry as a whole, and is measured in dollar terms. GVP, generally reported on an annual basis, is the quantity of catch for the year multiplied by the average monthly landed beach prices.

**Growth overfishing** A level of fishing pressure beyond that required to maximise the yield (or value) per recruit; a level of fishing where young recruits entering the fishery are caught before they reach an optimum marketable size.

**Habitat** The place or type of site in which an organism naturally occurs.

**Harvest** The total number or weight of fish caught and kept from an area over a period of time.

**Indicator species** A species whose presence or absence is indicative of a particular habitat, community or set of environmental conditions.

**Individually transferable quota** A management tool by which portions of the total allowable catch are allocated among licence holders (individual fishers or companies)

as units of quota. Quota entitlements can be made to be temporarily or permanently transferable between these licence holders.

**Input controls** Limitations on the amount of fishing effort; restrictions on the number, type, and size of fishing vessels or fishing gear, or on the fishing areas or fishing times in a fishery.

**Latent effort** The potential for effective effort within a fishery to increase over time (i.e. inactive fishing licences that may be used in the future).

**Length Frequency** An arrangement of recorded lengths of a species of fish, which indicates the number of times each length or length interval occurs in a population or sample.

**Limited entry** Fishing effort is controlled by restricting the number of operators. It usually requires controlling the number of licences in a fishery. It can also include restrictions on the number and size of vessels, the transfer of fishing rights, and the replacement of vessels

**Logbook** An official record (statutory declaration) of catch and effort data made by commercial fishers.

**Marine park** In South Australia, marine parks are a type of marine protected area proclaimed under the *Marine Parks Act 2007* with the primary aim of protecting and conserving marine biodiversity. South Australia's marine parks are zoned and managed for multiple use to protect and conserve marine biodiversity while providing for the ecologically sustainable use of suitable areas.

**Minimum mesh size** The smallest size of mesh permitted in nets and traps; imposed on the basis that smaller individuals will escape unharmed.

**Mortality** Rate of deaths (usually in terms of proportion of the stock dying annually) from various causes. Comprises (i) Natural Mortality - deaths in a fish stock caused by predation, pollution, senility, etc., but not fishing and (ii) Fishing Mortality - deaths in a fish stock caused by fishing.

**Nominal fishing effort** 'Nominal' means quantities as they are reported, before any analyses or transformations. Nominal effort refers to measures of fishing effort or vessel carrying capacity that have not been standardised.

**Non-target species** Any part of the catch, except the target species, and including bycatch and by-product.

**Non-retained species** Species that are taken as part of the catch but are subsequently discarded, usually because they have low market value or because regulations preclude them being retained.

**Offshore Constitutional Settlement (OCS)** An agreement between the State(s) and the Commonwealth whereby the State or the Commonwealth (or in some cases a Joint Authority) is given jurisdiction for a particular fishery occurring in both coastal waters and the Australian Fishing Zone. When no OCS agreement has been reached, the fishery remains under the jurisdiction of the State out to 3 nm, and the Commonwealth from 3 to 200 nm.

**Output controls** Limitations on the weight of the catch (quota), or the allowable size, sex or reproductive condition of individuals in the catch.

**Over-exploited or overfished** A fish stock in which the amount of fishing is excessive or for which the catch depletes the biomass too much; or a stock that still reflects the effects of previous excessive fishing.

**Owner-operator and Unpaid Family Labour** In many fishing businesses there is a component of labour that does not draw a direct wage or salary from the business. This will generally include owner/operator labour and often also include some unpaid family labour. The value of this labour needs to be accounted which involves imputing a labour cost based on the amount of time and equivalent wages rate. In the above calculations this labour cost can be included simply as another cost so that Gross Operating Surplus takes account of this cost. Alternatively, it can be deducted from GOS to give a separate indicator called Boat Cash Income. Owner-operator and unpaid family labour is separated into variable labour (fishing and repairs and maintenance) and overhead labour (management and administration).

**Parameter** A 'constant' or numerical description of some property of a population.

**Parental stock** The weight of the adult population of a species.

**Population** A group of individuals of the same species, forming a breeding unit and sharing a habitat.

**Possession limit** A possession limit under the *Fisheries Management Act 2007* is the maximum number of fish that a person is allowed to have in their possession in certain circumstances. Possession limits can provide a useful tool to constrain recreational fishers from taking and stockpiling large quantities of fish.

**Precautionary principle** This concept asserts that where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decision-making should be guided by: (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and (ii) an assessment of the risk-weighted consequences of various options.

**Profit at Full Equity** Calculated as *Boat Business Profit* plus *rent, interest and lease* payments. Profit at Full Equity represents the profitability of an individual licence holder, assuming the licence holder has full equity in the operation, i.e. there is no outstanding associated with the investment in boat capital. Profit at Full Equity is a useful absolute measure of the economic performance of fishing firms.

**Quota** A limit on the weight or number of fish that may be caught of a particular stock or from specified waters.

**Quota entitlement** The proportion of a quota that is allocated to a particular licence, which limits the total amount of a species that is permitted to be taken pursuant to that licence.

**Rate of Return to Capital** Calculated as *Profit at Full Equity* divided by *Boat Capital* multiplied by 100. This measure is expressed in percentage terms and is calculated for an individual licence holder. It refers to the economic return to the total investment in capital items, and is a useful relative measure of the performance of individual firms.

Rate of return to capital is useful to compare the performance of various licence holders, and to compare the performance of other types of operators, and with other industries.

**Recreational fishing** Fishing other than commercial fishing or Aboriginal traditional fishing, where the catch is released or used for personal consumption or taken for sport.

**Recruitment** The addition of new individuals to a stock.

**Recruitment overfishing** Occurs when excessive fishing effort or catch reduces recruitment to the extent that the stock biomass falls below the pre-defined limit reference point.

**Relative abundance** An index of fish population abundance used to compare fish populations from year to year. This does not measure the actual numbers of fish, but shows changes in the population over time.

**Retained species** The species within the catch that are not discarded.

**Sample** A proportion or a segment of a fish stock which is removed for study, and is assumed to be representative of the whole. The greater the effort, in terms of both numbers and magnitude of the samples, the greater the confidence that the information obtained is a true reflection of the status of a stock (level of abundance in terms of numbers or weight, age composition, etc.).

**Seasonal closure** The closure of a fishing ground for a defined period of time, usually used to protect a stock during a spawning season.

**Selectivity** The ability of a type of gear to target and catch a certain size or species of fish.

**Socio-economic** Relating to both social and economic considerations.

**Spatial** Of or relating to space.

**Species** A group of organisms capable of interbreeding freely with each other but not with members of other species.

**Size limits** A minimum or maximum size limit determines the legal size at which a given species can be retained.

**Size of maturity** Length or weight of the fish when it attains reproductive maturity.

**Slot size limit** Refers to a situation where both a minimum and maximum size limit has been determined for a given species.

**Stakeholder** An individual or a group with an interest in the conservation, management and use of a resource.

**Stock** A group of individuals of a species occupying a well defined spatial range independent of other groups of the same species, which can be regarded as an entity for management or assessment purposes.

**Stock assessment** A detailed analysis of stock status (abundance, distribution, age structure, etc.) to support the management of the species/fishery.

**Target species** The most highly sought component of the catch taken by fishers.

**Target effort** Effort that is directed at a particular species.

**Teleost** term used to describe fishes with bony skeletons, teleosts are distinct from the cartilaginous fishes such as sharks, rays, and skates.

**Total Boat Cash Costs (TBCC)** Defined as *Total Boat Variable Costs* plus *Total Boat Fixed Costs*.

**Total Boat Fixed Costs** Costs that remain fixed regardless of the level of catch or the amount of time spent fishing. As such these costs, measured in current dollar terms, are likely to remain relatively constant from one year to the next. Examples of fixed cost include:

- insurance
- licence and industry fees
- office and business administration (communication, stationery, accountancy fees)
- interest on loan repayments and overdraft
- leasing

**Total Boat Income (TBI)** Term refers to the cash receipts received by an individual firm and is expressed in dollar terms. Total boat income is calculated as catch (kg) multiplied by 'beach price' (\$/kg). Total boat income is the contribution of an individual licence holder to the GVP of a fishing sector or fishery.

**Total Boat Variable Costs** Costs which are dependent upon the level of catch or, more commonly, the amount of time spent fishing. As catch or fishing time increases, variable costs also increase. Variable costs are measured in current dollar terms and include the following individual cost items:

- fuel, oil and grease for the boat (net of diesel fuel rebate)
- bait
- ice
- provisions
- crew payments
- fishing equipment, purchase and repairs (nets, pots, lines, etc)
- repairs and maintenance: ongoing (slipping, painting, overhaul motor)

**Traditional fishing** Fishing for the purposes of satisfying personal, domestic or non-commercial communal needs, including ceremonial, spiritual and educational needs and utilising fish and other natural marine and freshwater products according to relevant indigenous custom.

**Temporal** Of or relating to time.

**Threatened** A species or community that is vulnerable, endangered or presumed extinct.

**Total allowable catch (TAC)** For a fishery, a catch limit set as an output control on fishing. The total amount of a species that may be taken during a specified time period.

**Total allowable commercial catch (TACC)** For a fishery, a catch limit set as an output control specifically on commercial fishing. The total amount of species that may be taken by commercial fishing during a specified time period.

**Trigger points** Events or measures that, if they occur or if they reach specified levels, are used to determine when a response should be made. Not usually used as a criterion for overfishing, but to indicate the need for review of management.

**Uncertain** A fish stock that may be underfished, fully fished or overfished, but for which there is inadequate or inappropriate information to make a reliable assessment of its status.

**Under-exploited or underfished** A fish stock that has potential to sustain catches higher than those currently taken.

**Vulnerable species** Under endangered species protection legislation, a species that within 25 years will become endangered unless mitigating action is taken.

**Yield** Total weight of fish harvested from a fishery.

**Yield per recruit** Analysis of how growth and natural mortality interact to determine the best size of animals for harvest.

## 19 APPENDICES

### 19.1 Appendix 1 – Calculation of allocation triggers

Trigger limits have been set based on an allowable percentage increase in allocation. The percentage increases have been determined for allocation ranges, with a total of seven ranges. As a consequence of the use of ranges, without adjustment, the upper allowable increase of one range may be higher than the allowable increases of the next range. To counter this, lower and upper limits have been determined for some ranges.

In specifying the allowable percentage increases for a range, the lower the original allocation, the higher the allowable percentage increase and vice versa, this recognises that catches associated with low percentage allocations are generally highly variable and this needs to be accounted for.

Percentage increases have not been determined for 0 and 0.01 – 0.49 allocations, rather an absolute increase has been specified for each of these.

Different percentage allowances have been determined for the primary and secondary species. The different allowances account for the variability in catches and the management need to minimise variability in sector shares. The tables below outline the allowable increases, absolute increases and the upper and lower limits for the different triggers:

Table 1. Allocation trigger calculation table for triggers 1 and 3 for primary species.

Allocation range	Allowable % Increase	Absolute increase	Lower limit	Upper limit
0	-	0.75	-	-
0.01 - 0.49	-	1	-	-
0.5 - 0.99	150	-	-	2.5
1.0 - 4.99	100	-	2.5	-
5.0 - 39.99	50	-	-	7.5
40 - 79.99	10	-	60	84
80 - 99.99	5	-	-	-

Table 2. Allocation trigger calculation table for trigger 2 for primary species.

Allocation range	Allowable % Increase	Absolute increase	Lower limit	Upper limit
0	-	0.5	-	-
0.01 - 0.49	-	0.75	-	-
0.5 - 0.99	100	-	-	-
1.0 - 4.99	50	-	2	-
5.0 - 39.99	10	-	7.5	-
40 - 79.99	5	-	44	-
80 - 99.99	2	-	84	-

Table 3. Allocation trigger calculation table for secondary species.

Allocation range	Allowable % Increase	Absolute increase	Lower limit	Upper limit
0	-	0.75	-	-
0.01 - 0.49	-	1	-	-
0.5 - 0.99	200	-	-	3
1.0 - 4.99	150	-	-	9
5.0 - 39.99	100	-	-	50
40 - 79.99	25	-	-	88
80 - 99.99	10	-	-	-

## 19.2 Appendix 2 - Methodology for ESD risk assessment

The current series of PIRSA ESD performance reports have been prepared to ensure that South Australian fisheries management is both effective and efficient in the context of achieving ESD outcomes. In addition to meeting the statutory requirements of the *Fisheries Management Act 2007*, and national environmental legislation, this approach will also provide the fishing industry, key stakeholders, and the broader community with an ongoing opportunity to contribute to, and influence, fisheries management outcomes.

The reports will also provide the basis for the development of statutory management plans required under the *Fisheries Management Act 2007*. On behalf of the Fisheries Council of SA, PIRSA Fisheries and Aquaculture has used the comprehensive issue identification and subsequent risk assessment and priority setting process to collaboratively develop more effective management arrangements under the new Act. Where necessary this may include development of fishery-specific harvest strategies, and related research and monitoring programs for each fishery assessed.

The issue identification, risk assessment, and reporting process described in detail below, as well as the final report format, is closely based on the National ESD Framework *How To Guide* (see [www.fisheries-esd.com](http://www.fisheries-esd.com)), as well as the Department of Fisheries Western Australia ESD performance reports pioneered by Dr Rick Fletcher and other WA Fisheries staff.

### Scope

The present ESD report describes “the contribution of the South Australian commercial Marine Scalefish Fishery to ESD” in the context of South Australian Fisheries legislation and policy. The report is based on preliminary scoping and issue identification work by PIRSA Fisheries and Aquaculture staff in conjunction with Marine Scalefish Fishery industry representatives. This initial scoping was then refined and validated through a broader stakeholder workshop on 18 April 2011.

The scope of the assessment was contained to issues relevant to the commercial Marine Scalefish Fishery. The recreational catch will be assessed separately through an ESD assessment of South Australian recreational fishing.

The assessment process examined an extensive range of issues, risks and opportunities identified by stakeholders. The identification of issues was informed by the generic ESD component tree approach with each fishery component tree refined specifically for the Marine Scalefish Fishery. Each major component tree reflects the primary components of ESD, and the ESD report assesses the performance of the fishery for each of the relevant ecological, economic, social and governance issues facing the fishery. The process also identifies where additional (or reduced) management or research attention is needed, and identifies strategies and performance criteria to achieve management objectives to the required standard.



Table 1. Primary ESD Components

Retained Species	<i>Ecological Wellbeing</i>
Non-Retained Species	
General Ecosystem	
Community Wellbeing	<i>Human Wellbeing</i>
Aboriginal Community	
Governance	
External Factors Affecting	<i>Ability to Achieve</i>
Fishery Performance	

## Overview

The steps followed to complete this report were:

1. A set of “Generic ESD Component Trees” were modified through an iterative process with stakeholders into a set of trees specific to the fishery. This process identified the issues relevant to ESD performance of the fishery under the categories described in above.
2. A risk assessment of the identified issues (or components) was completed based on the likelihood and consequence of identified events that may undermine or alternatively contribute to ESD objectives. This was an iterative process involving managers, scientists, industry, and key stakeholders.
3. Risks were then prioritised according to their severity. For higher level risks, where an increase in management or research attention was considered necessary, a detailed analysis of the issue, associated risks, and preferred risk management strategies was completed. For low risk issues, the reasons for assigning low risk and/or priority were recorded.
4. For higher level risks, a full ESD performance report was prepared (Section 4 of the current report). This was completed in the context of specific management objectives and includes operational objectives, indicators and performance measures.
5. A background report providing context and necessary supporting information about the fishery was also prepared to guide the identification of issues, risks and management strategies. The current report includes the history of the fishery and its management, the areas of operation and their biological and physical characteristics, target species and by-product and bycatch species, and other relevant information.

The process is illustrated in Figure 1 below.

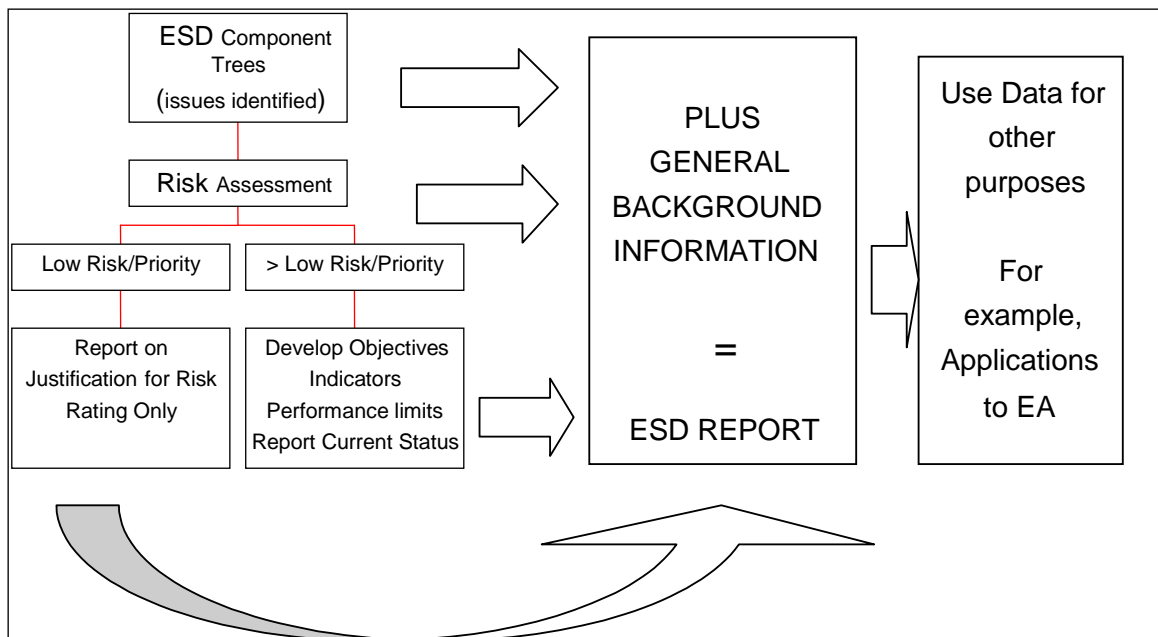


Figure 1. Summary of the ESD reporting framework processes  
Source: ESD Reporting *How To Guide*; Fletcher et al. (2002)

### Issue Identification (component trees)

The Marine Scalefish Fishery ESD reporting component trees are a refined version of the generic trees suggested in the National ESD Reporting Framework (Table 1). The generic trees and the issues that they encompass were the result of extensive consideration and refinement during the initial development of the National Fisheries ESD approach. The trees were designed to be very comprehensive to ensure that all conceivable issues facing a fishery would be considered during the workshop process. The fishery-specific component trees developed after expert and stakeholder consideration provide a more realistic and practical illustration of the issues facing a particular fishery.

The generic component trees have been used as the starting point to ensure thorough, consistent, and rigorous identification and evaluation of ESD issues across all of the South Australian Fisheries being assessed. When developing each of the major fishery-specific component trees, each primary component is broken down into more specific sub-components for which operational objectives can then be developed.

For example, the component tree identifying 'retained species' during the MSF risk assessment workshop is shown below (Figure 2).



Figure 2. Example of a component tree specific to the Marine Scalefish Fishery.

### Risk Assessment and Prioritisation of Issues

Once the fishery-specific component trees were developed and reviewed by stakeholders, the focus moved to the assessment and prioritisation of risks and opportunities facing the fishery. These have been considered in the context of the specific management objectives for each fishery being assessed. The higher level management objectives and desired ESD outcomes are those described in the

*Fisheries Management Act 2007*. Risks and opportunities are also evaluated against more detailed fishery-specific objectives, such as those articulated in the fishery's management plan.

The risk assessment of issues identified for the MSF has been done on the basis of existing management of risks to the fishery. Hence the risk assessment conducted during the stakeholder workshop considered the residual risk after the existing risk treatments were taken into account. For example, PIRSA's current compliance program for the Marine Scalefish Fishery is itself based on a separate compliance risk assessment process. This process identifies compliance risks in the context of the fishery's management objectives, and then develops and applies strategies to mitigate those risks. The ESD assessment and reporting process works across the full suite of fishery ESD objectives in a similar way.

Risk assessment applied under the national ESD framework has been designed to be consistent with the Australian and New Zealand Standard AS/NZS 4360:1999 for Risk Management. Subject matter experts and key fishery stakeholders consider the range of potential consequences of an issue, activity, or event (identified during the component tree development process) and how likely those consequences are to occur. The estimated consequence of an event is multiplied by the likelihood of that event occurring to produce an estimated level of risk.

#### What is Risk Analysis?

*“Risk analysis involves consideration of the sources of risk, their consequences and the likelihood that those consequences may occur.”*

Australian and New Zealand Standard (AS/NZS) 4360 – 1999

(NB. AS/NZS 4360-1999 has since been superseded by AS/NZS 4360:2004, which was then superseded by AS/NZS ISO 31000:2009)

ESD workshop participants worked methodically through each component tree from the top down and conducted a qualitative risk assessment of each issue. An estimate of the consequence level for each issue was made and scored from 0–5, with 0 being negligible and 5 being catastrophic/irreversible (see Appendix 1 for details of the risk consequence tables). The consequence estimate was based upon the combined judgement of workshop participants who had considerable expertise in the issues being assessed.

The level of consequence was estimated at the appropriate scale and context for the issue in question. For the target species the consequence assessment was based at the population not the individual level. Killing one fish is catastrophic for the individual but not for the population. Similarly, when assessing possible ecosystem impacts this was done at the level of the whole ecosystem or at least in terms of the entire extent of the habitat, not at the level of an individual patch or individuals of non-target species<sup>5</sup>.

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<sup>5</sup> These descriptions and detailed guidance about developing consequence and likelihood scores for fishery issues are provided in the ESD *How To Guide* at [www.fisheries-esd.com](http://www.fisheries-esd.com).

The likelihood of that consequence occurring was assigned to one of six levels from remote (1) to likely (6). This was based on a judgement about the probability of the events - or chain of events - occurring that could result in a particular adverse consequence. This judgement about conditional probability was again based on the collective experience and knowledge of workshop participants. See Appendix 1 for details of the likelihood table.

From the consequence and likelihood scores, the overall risk value (Risk = Consequence x Likelihood), was calculated. On the basis of this risk value each issue was assigned a Risk Ranking within one of five categories (see Table 2).

Table 2. Risk ranking definitions

RISK	Rank	Likely Management Response	Reporting
Negligible	0	Nil	Short Justification Only
Low	1	None Specific	Full Justification needed
Moderate	2	Specific Management Needed	Full Performance Report
High	3	Possible increases to management activities needed	Full Performance Report
Extreme	4	Likely additional management activities needed	Full Performance Report

Where a more detailed and/or quantitative risk assessment and management process was in place for the fishery - such as a robust quantitative stock assessment for a target species - the resultant risk score could be expected to be moderate to low. The risk score in this example reflects the fact that the risk is being managed effectively through existing arrangements.

The national ESD reporting framework suggests that only those issues scored at moderate, high and extreme risk, which require additional management attention, need to have full ESD performance reports completed. This is the approach that has been used in the current ESD report. The rationale for scoring other issues as low or negligible risk has also been documented and forms part of the current report. This approach encourages transparency and should help stakeholders to understand the basis for risk scores and the justification for no further management, or for additional management action if necessary. The process is summarised earlier in this section (Table 1).

### 19.3 Appendix 3 - Overview of the ESD Risk Assessment

Overview of the ESD Risk Assessment for the Marine Scalefish Fishery

N = Negligible; L = Low; M = Moderate; H = High; E = Extreme; N/A = Not applicable; \* = Review under new Management Plan; \*\* = Review at next major ESD assessment, \*\*\* = Review currently underway. Coloured cells reflect final risk ratings from the ESD risk assessment workshop.

Issue	Risk / Priority	Objective Developed	Indicator Measured	Performance Measure	Current Performance	Robustness	Actions
<b>Retained Species</b>							
Snapper	H	Yes	Yes	Yes	Uncertain	High	***
King George Whiting	L	Yes	Yes	Yes	Acceptable	High	**
Southern Calamari	L	Yes	Yes	Yes	Acceptable	High	**
Southern Garfish	H	Yes	Yes	Yes	Not acceptable	High	***
Yellowfin Whiting	L	Yes	Yes	Yes	Acceptable	Medium	**
Australian Herring	L	Yes	Yes	Yes	Acceptable	Medium	**
Bronze & Dusky Whaler Shark	M	Yes	Yes	Yes	Uncertain	Medium	*
Sand Crab	L	Yes	Yes	Yes	Acceptable	Medium	**
Blue swimmer crab (West coast)	L	Yes	No	No	Acceptable	Low	**
Ocean jackets	L	Yes	Yes	Yes	Acceptable	Low	**
Vongole	M	Yes	Yes	Yes	Acceptable	High	***
Western Australian Salmon	L	Yes	Yes	Yes	Acceptable	Medium	**
Snook	L	Yes	Yes	Yes	Acceptable	Medium	**
Yellow-eye Mullet	L	Yes	Yes	Yes	Acceptable	Low	**
Wrasse spp (parrotfish)	L	Yes	Yes	Yes	Acceptable	Low	**
Octopus	L	Yes	Yes	Yes	Acceptable	Low	**
Cuttlefish	L	Yes	Yes	Yes	Acceptable	Low	**
Bloodworms	L	Yes	Yes	No	Acceptable	Low	**
Pipi (Gunyah beach)	M	Yes	Yes	No	Not acceptable	Low	***
Razorfish	M	Yes	Yes	No	N/A	N/A	**
Gummy Shark	L	Yes	Yes	Yes	N/A	N/A	**
School Shark	L	Yes	No	No	N/A	N/A	**
Whiskery Shark	L	Yes	No	No	N/A	N/A	**
Broadnose Shark	L	Yes	No	No	N/A	N/A	**
Red Mullet	N	Yes	No	No	N/A	N/A	**
Western Striped Grunter	N	Yes	Yes	Yes	Acceptable	Low	**
Trevally	N	Yes	Yes	Yes	Acceptable	Low	**

Issue	Risk / Priority	Objective Developed	Indicator Measured	Performance Measure	Current Performance	Robustness	Actions
Leatherjacket spp	N	Yes	Yes	Yes	Acceptable	Low	**
Flathead	N	Yes	No	No	N/A	N/A	**
Mulloway	N	Yes	No	No	N/A	N/A	**
Other schedule 1 spp	N	Yes	No	No	N/A	N/A	**
Non-schedule 1 spp	N	Yes	No	No	N/A	N/A	**
<b>Non-Retained Species</b>							
Cormorants	N	Yes	Yes	No	Acceptable	Medium	**
Little penguin	N	Yes	Yes	No	Acceptable	Medium	**
Pacific gull	N	Yes	Yes	No	Acceptable	Medium	**
Shearwater	N	Yes	Yes	No	Acceptable	Medium	**
Silver gull	N	Yes	Yes	No	Acceptable	Medium	**
Australian fur seal	N	Yes	Yes	No	Acceptable	Medium	**
New Zealand fur seal	N	Yes	Yes	No	Acceptable	Medium	**
Dolphins	N	Yes	Yes	No	Acceptable	Medium	**
Australian sea lion	M	Yes	Yes	No	Uncertain	Medium	***
White Shark	M	Yes	Yes	No	Acceptable	Medium	**
Turtles	N	Yes	Yes	No	Acceptable	Medium	**
Western Blue Groper	L	Yes	No	No	N/A	N/A	**
Blue Swimmer Crab (gulf waters)	N	Yes	No	No	N/A	N/A	**
Other crab spp	N	Yes	No	No	N/A	N/A	**
Port Jackson Shark	N	Yes	No	No	N/A	N/A	**
Other shark spp	N	Yes	No	No	N/A	N/A	**
Other scalefish spp	N	Yes	No	No	N/A	N/A	**
Other sea birds	N	Yes	Yes	No	N/A	N/A	**
Whales	L	Yes	Yes	No	Acceptable	High	**
Sygnathids	N	Yes	Yes	No	Acceptable	Medium	**
<b>General Ecosystem Impacts of Fishing</b>							
Fishing – Marine	M	Yes	No	N/A	N/A	N/A	**
Ghost fishing	N	Yes	No	N/A	N/A	N/A	**
Discarding (bycatch)	N	Yes	No	N/A	N/A	N/A	**
Introduced marine pests / aquatic diseases	M	Yes	No	N/A	N/A	N/A	**
Habitat disturbance – Haul netting, cockle raking, bait fork/spade, razorfish tongs	L	Yes	No	N/A	N/A	N/A	**

Issue	Risk / Priority	Objective Developed	Indicator Measured	Performance Measure	Current Performance	Robustness	Actions
Habitat disturbance – gill netting, purse seining, hooking/jigging, longline & drop lining, cockle raking (pipi), fish traps, octopus traps, crab, hoop & drop nets, mussel dredge	N	Yes	No	N/A	N/A	N/A	**
Habitat disturbance – lost gear	N	Yes	No	N/A	N/A		**
Habitat disturbance – vehicular	L	Yes	No	N/A	N/A	N/A	**
Habitat disturbance – anchoring	L	Yes	No	N/A	N/A		**
Air quality – Greenhouse gas / carbon emissions	N	Yes	No	N/A	N/A	N/A	**
Water quality – Rubbish / debris	N	Yes	No	N/A	N/A	N/A	**
Water quality – Fuel, oil and bilge discharge	N	Yes	No	N/A	N/A	N/A	**
<b>Community</b>							
Profit (fishing industry)	H	Yes	Yes	Yes	Acceptable	Medium	**
Employment	M	Yes	Yes	Yes	Acceptable	Medium	**
OHS&W	M	Yes	Yes	Yes	Acceptable	Medium	**
Relationship with community	H	Yes	Yes	Yes	Acceptable	Low	**
Asset value	H	Yes	Yes	Yes	Acceptable	Medium	**
Lifestyle	M	Yes	No	No	N/A	N/A	**
Employment (regional centres)	M	Yes	No	No	N/A	N/A	**
GRP and GSP	L	Yes	No	No	N/A	N/A	**
Re-Investment (regional)	M	Yes	No	No	N/A	N/A	**
Social capital (regional)	M	Yes	No	No	N/A	N/A	**
Tourism (regional)	L	Yes	No	No	N/A	N/A	**
Infrastructure (regional)	L	Yes	No	No	N/A	N/A	**
Economic value (city)	N	Yes	No	No	N/A	N/A	**
Health / food (city)	L	Yes	No	No	N/A	N/A	**
Social capital (city)	L	Yes	No	No	N/A	N/A	**
Infrastructure (city)	N	Yes	No	No	N/A	N/A	**
<b>Governance</b>							
Minister	H	Yes	No	No	N/A	N/A	**
Management plan (Fish Council)	H	Yes	No	No	N/A	N/A	**
Allocation (Fish Council)	H	Yes	No	No	N/A	N/A	**



Issue	Risk / Priority	Objective Developed	Indicator Measured	Performance Measure	Current Performance	Robustness	Actions
Consultation (Fish Council)	M	Yes	No	No	N/A	N/A	**
Management effectiveness (PIRSA)	H	Yes	No	No	N/A	N/A	**
Resources (PIRSA)	H	Yes	No	No	N/A	N/A	**
Strategic policy (PIRSA)	H	Yes	No	No	N/A	N/A	**
Research / information (PIRSA)	H	Yes	No	No	N/A	N/A	**
Compliance (PIRSA)	H	Yes	No	No	N/A	N/A	**
Legal framework (PIRSA)	M	Yes	No	No	N/A	N/A	**
Consultation (PIRSA)	H	Yes	No	No	N/A	N/A	**
Reporting (PIRSA)	H	Yes	No	No	N/A	N/A	**
SA Govt: DENR	H	Yes	No	No	N/A	N/A	**
Aust Govt: SEWPaC	M	Yes	No	No	N/A	N/A	**
AFMA/DAFF	L	Yes	No	No	N/A	N/A	**
DTEI	M	Yes	No	No	N/A	N/A	**
FRDC	L	Yes	No	No	N/A	N/A	**
Codes of Conduct (Industry)	H	Yes	No	No	N/A	N/A	**
Communication/participation (Industry)	H	Yes	No	No	N/A	N/A	**
Industry association	H	Yes	No	No	N/A	N/A	**
Access security	H	Yes	No	No	N/A	N/A	**
Marine park issues	H	Yes	No	No	N/A	N/A	**
Owner operator	M	Yes	No	No	N/A	N/A	**
Conservation Organisations	H	Yes	No	No	N/A	N/A	**
SARFAC	M	Yes	No	No	N/A	N/A	**
Other NGO's	M	Yes	No	No	N/A	N/A	**
<b>External factors affecting performance of the fishery</b>							
Physical	E	Yes	No	No	N/A	N/A	**
Climate change	N	Yes	No	No	N/A	N/A	**
Diseases	H	Yes	No	No	N/A	N/A	**
Effluent	M	Yes	No	No	N/A	N/A	**
Agricultural runoff	L	Yes	No	No	N/A	N/A	**
Stormwater	L	Yes	No	No	N/A	N/A	**
Hyper salinity (desalination)	L	Yes	No	No	N/A	N/A	**
Illegal artificial reef	L	Yes	No	No	N/A	N/A	**
Illegal dumping	L	Yes	No	No	N/A	N/A	**

Issue	Risk / Priority	Objective Developed	Indicator Measured	Performance Measure	Current Performance	Robustness	Actions
Development	L	Yes	No	No	N/A	N/A	**
Dredging	L	Yes	No	No	N/A	N/A	**
Recreational boating	L	Yes	No	No	N/A	N/A	**
Commercial shipping	L	Yes	No	No	N/A	N/A	**
Exotic species	M	Yes	No	No	N/A	N/A	**
Fuel price	H	Yes	No	No	N/A	N/A	**
Other fisheries (market demand)	M	Yes	No	No	N/A	N/A	**
Marketing	M	Yes	No	No	N/A	N/A	**
Labour (availability/cost)	M	Yes	No	No	N/A	N/A	**
Other fishing costs	M	Yes	No	No	N/A	N/A	**
Interest rates	M	Yes	No	No	N/A	N/A	**
Illegal take	H	Yes	No	No	N/A	N/A	**
Marine parks (access)	H	Yes	No	No	N/A	N/A	**
Recreational fishers	H	Yes	No	No	N/A	N/A	**
Aquaculture	L	Yes	No	No	N/A	N/A	**
Eco-tourism	N	Yes	No	No	N/A	N/A	**
Non-extractive users	N	Yes	No	No	N/A	N/A	**
Shipping	L	Yes	No	No	N/A	N/A	**
Artificial reefs	N	Yes	No	No	N/A	N/A	**
<b>Aboriginal community</b>							
Yet to be undertaken							

## 19.4 Appendix 4 – Summary table of performance indicators and trigger reference points to monitor fishery performance

Performance Indicator		Unit of Measure	Limit Reference Point
Biological (model derived)	Egg production	Average of the last three years estimated by model	<ul style="list-style-type: none"> <li>• Lower than 20-35% of pristine population for any species</li> </ul>
	Fishable biomass	Average of the last three years estimated by model	<ul style="list-style-type: none"> <li>• 10% less or greater than the average biomass of the previous three-year time periods for any species</li> </ul>
	Exploitation rate (harvest fraction)	Average of the last three years estimated by model	<ul style="list-style-type: none"> <li>• Exceeds the international standard for any species (standard value reflected in species specific harvest strategy)</li> </ul>
	Recruitment	Average of the last three years estimated by model	<ul style="list-style-type: none"> <li>• Abundance of pre-recruits is 10% less or greater than the average abundance of the previous five years for any species</li> </ul>
	Age structure	Number of fish CPUE by age  Qualitative assessment of the market sampling data	<ul style="list-style-type: none"> <li>• Significant change of age structure over the previous five years for any species</li> <li>• Significant change in the long-term age structure</li> </ul>
General	Total commercial catch estimate from previous financial year	Data derived from MSFIS and reported by appropriate regional scale.  Reference period for trigger reference points from 1983/84 till present.	<ul style="list-style-type: none"> <li>• 3<sup>rd</sup> highest and 3<sup>rd</sup> lowest values over the reference period.</li> <li>• Greatest (%) inter-annual variation (+ &amp; -) over the reference period</li> <li>• The greatest rate of change (trend) over periods of three or five years (+&amp; -) through the reference period</li> <li>• Decrease over five consecutive years</li> </ul>
	Targeted effort estimate from previous financial year (selected gear types only)	Data derived from MSFIS and reported by appropriate regional scale.  Reference period for trigger reference points from 1983/84 till present.	<ul style="list-style-type: none"> <li>• 3<sup>rd</sup> highest value over the reference period.</li> <li>• Greatest (%) inter-annual variation (+&amp; -) over the reference period</li> <li>• The greatest rate of change (trend) over periods of three or five years (+&amp; -) through the reference period</li> <li>• Decrease over five consecutive years</li> </ul>
	Targeted CPUE estimate from previous financial year (selected gear types only)	Data derived from MSFIS and reported by appropriate regional scale.  Reference period for trigger reference points from 1983/84 till present.	<ul style="list-style-type: none"> <li>• 3<sup>rd</sup> highest and 3<sup>rd</sup> lowest values over the reference period.</li> <li>• Greatest (%) inter-annual variation (+&amp; -) over the reference period</li> <li>• The greatest rate of change (trend) over periods of three or five years (+&amp; -) through the reference period</li> <li>• Decrease over five consecutive years</li> </ul>

**19.5 Appendix 5 – Commercial MSF possession limits for selected Commonwealth-managed marine scalefish species**

Common Name	Species Name	Possession Limit
Blue-eye Trevalla	<i>Hyperoglyphe antarctica</i>	50 kg
Jackass Morwong	<i>Nemadactylus macropterus</i>	100 kg
Deepwater Flathead	<i>Neoplatycephalus conatus</i>	0 kg
Sand Flathead	<i>Platycephalus basensis</i>	0 kg
Tiger Flathead	<i>Neoplatycephalus richardsoni</i>	0 kg
Pink Ling	<i>Genypterus blacoides</i>	50 kg
Redfish	<i>Centroberyx affinis</i>	0 kg
Silver Trevally	<i>Pseudocaranx dentex</i>	100 kg
Combined limit (species listed above plus some additional, non-Schedule 1 species)		200 kg

**19.6 Appendix 6 – AFMA fishery possession limits for SA-managed marine scalefish species**

Common Name	Species Name	Possession Limit*
Red snapper	<i>Centroberyx gerrardi</i>	50 kg
Snapper	<i>Pagrus auratus</i>	50 kg
Combined limit (species listed above plus some additional, non-Schedule 1 species).		200 kg

\*Species for which a zero possession limit applies are not shown

## **19.7 Appendix 7 - Schedule 1 - Aquatic resources prescribed for the MSF under Schedule 1 of the Regulations**

### **Annelids**

Beachworm (Class Polychaeta)

Bloodworm (Class Polychaeta)

Tubeworm (Class Polychaeta)

### **Crustaceans**

Blue Swimmer Crab (*Portunus armatus*)

Sand Crab (*Ovalipes* spp)

Velvet Crab (*Nectocarcinus tuberculosus*)

### **Molluscs**

Southern Calamari (*Sepioteuthis australis*)

Cockle (Suborder Teledonta)

Cuttlefish (*Sepia* spp)

Mussel (*Mytilus* spp)

Octopus (Octopus spp)

Oyster (Family Ostreidae)

Scallop (Family Pectinidae)

Gould's Squid (*Notodarus gouldi*)

### **Scalefish**

Australian Anchovy (*Engraulis australis*)

Barracouta (*Thyrsites atun*)

Black Bream (*Acanthopagrus butcheri*)

Cod of all marine species (Family Moridae)

Dory (Family Zeidae)

Flathead (Family Platycephalidae)

Flounder (Family Bothidae or Pleuronectidae)

Southern Garfish (*Hyporhamphus melanochir*)

Bluespotted Goatfish (*Upeneichthys vlamingii*)

Australian Herring (*Arripis georgianus*)

Yellowtail Kingfish (*Seriola lalandi*)

Leatherjacket (Family Monacanthidae)

Pink Ling (*Genypterus blacodes*)

Blue Mackerel (*Scomber australasicus*)

Common Jack Mackerel (*Trachurus declivis*)

Morwong (Family Cheilodactylidae)

Mullet of all species (Family Mugilidae)

Mulloy (*Argyrosomus hololepidotus*)

Redfish (*Centroberyx affinis*)

Bight Redfish (*Centroberyx gerrardi*)

West Australian Salmon (*Arripis truttaceus*)

Australian Sardine (*Sardinops sagax*)

Snapper (*Pagrus auratus*)

Snook (*Sphyraena novaehollandiae*)

Southern Sole (*Aseraggodes haackeanus*)

Sea Sweep (*Scorpius aequipinnis*)

Swallowtail (*Centroberyx lineatus*)

Blue eye Trevalla (*Hyperoglyphe antarctica*)

Trevally (*Caranginae* spp)

Whiting (Family Sillaginidae)

Bluethroat Wrasse (*Notolabrus tetricus*)

### **Sharks**

Rays of all species (Class Elasmobranchii)

Shark of all species (Class Elasmobranchii) other than White Shark (*Carcharodon carcharias*)

Skate of all species (Class Elasmobranchii)