
South Australian Fisheries Management Series

Ecological Assessment of the Lakes and Coorong Fishery

Reassessment Report

Prepared for the Department of Sustainability, Environment,
Water, Population and Communities (DSEWPaC)

For the purposes of Part 13 and Part 13A of the Environment Protection and
Biodiversity Conservation Act 1999

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Purpose

This report has been prepared by the Fisheries and Aquaculture Division of the Department of Primary Industries and Resources South Australia (PIRSA).

The purpose of this report is to provide a revised assessment of the management arrangements in place for the South Australian Lakes and Coorong Fishery, as set out in the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This report has been prepared in accordance with the *Guidelines for the Ecologically Sustainable Management of Fisheries*, 2nd Edition (2007) (the *Guidelines*) and particularly addresses the level of change that has occurred in the fishery since the May 2009 assessment. This report should be read in conjunction with that assessment.

1. Background

The Lakes and Coorong Fishery (LCF) is a multi-species, multi-method fishery, which is primarily managed using input controls. This report addresses key species taken in the fishery, which include Mulloway (*Argyrosomus japonicus*), Pipi (*Donax deltoides*), Yellow-eye Mullet (*Aldrichetta forsteri*), Golden Perch (*Macquaria ambigua*), Greenback Flounder (*Rhombosolea tapirina*), Black Bream (*Acanthopagrus butcheri*) and Bony Bream (*Nematasola erebi*). Commercially important exotic fish species taken by this fishery include European Carp (*Cyprinus carpio*) and Redfin (*Perca fluviatilis*).

The *Fisheries Management Act 2007* provides a broad statutory framework to ensure the ecologically sustainable management of South Australia's aquatic resources. The regulations that govern the management of the LCF are the *Fisheries Management (Lakes and Coorong Fishery) Regulations 2009* and the *Fisheries Management (General) Regulations 2007*.

A Management Plan for the South Australian LCF has been in operation since 2005 (Sloan, 2005). It provides a detailed outline of the strategic policy framework that has been established to provide for the ecologically sustainable management of the fishery. The Fisheries Council of South Australia is responsible for the preparation of management plans under the *Fisheries Management Act 2007*. The Minister for Agriculture, Food and Fisheries has called for the Fisheries Council to prepare a management plan for the LCF under the Act by 30 June 2013.

The management plan will set out a formal harvest strategy for the fishery and specify the share of aquatic resources allocated to each fishing sector. The management plan will also describe the biological, economic and social characteristics of the fishery; identify impacts of the fishery on ecosystems; assess risks to the fishery and strategies to address them; and set out methods for monitoring the performance of the fishery.

The development of the management plan will take into consideration a number of international legal instruments including the United Nations Convention on the Law of the Sea (UNCLOS) and the Ramsar Convention. The Ramsar site is outlined in the 2005 Ecological Character Description (ECD) (Phillips & Muller, 2006), and the fishery operates within this site. Additionally, the fishery operates within the boundaries of the Coorong National Park, which is deemed as a 'Living Murray Icon Site' and is an area recognised primarily for its wetland habitats and its importance for a variety of migratory waterbirds and threatened fish communities (Sloan, 2005; Phillips and Muller, 2006).

Key policy drivers for the fishery include:

- The National Strategy for Ecologically Sustainable Development
- The Australian Government Guidelines for the Ecologically Sustainable Management of Fisheries, which relate to the requirements of the *Environment Protection and Biodiversity Conservation Act 1999*
- The Native Fish Strategy for the Murray –Darling Basin 2003-2013
- The National Policy on Fisheries By-catch

The new management plan will also be informed by an ecologically sustainable development (ESD) risk assessment. An ESD risk assessment for the LCF was completed in January 2011. The ESD risk assessment process is detailed below.

1.1 Ecologically Sustainable Development (ESD) Risk Assessment

The *Fisheries Management Act 2007* requires that ecological impacts be identified and assessed as the first step in developing a South Australian fishery management plan. The primary goal of the plans is the management of aquatic resources as 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 impacts must be assessed to determine the most serious risks and strategies for addressing those risks must be developed.

The *National ESD Reporting Framework for Australian Fisheries* (Fletcher *et al*, 2002) is used to conduct the risk assessments. In accordance with the ESD objective in the Act, this approach is aimed at assisting PIRSA identify and prioritise the important ecological, social and economic factors affecting the management of a fishery.

Risks and important issues in the fishery are identified in consultation with stakeholders and are prioritised using risk ratings from negligible to extreme. Specific management strategies to minimise priority risks and associated performance indicators are developed for inclusion in the fishery management plan.

An ESD risk assessment was conducted for the LCF in January 2011. Risks that were identified during the risk assessment process as moderate, high or extreme will be included in the relevant sections of this reassessment report.

2. Level of Assessment

The LCF was last assessed as an approved Wildlife Trade Operation in May 2009. Since the last assessment there have been changes in some areas of interest as outlined in page 5 of the 'Guidelines for the Ecologically Sustainable Management of Fisheries' (see table 1). There have been varying levels of change to the management arrangements of the fishery, environmental issues outside of the fishery management agency control, interactions with protected species and to target stock status. There have been no known changes to ecosystem impacts or the status of by-product and by-catch species.

Table 1: Level of assessment required by the Lakes and Coorong Fishery

Issue	Area of Interest	Yes	No
Fishery	Has there been any change to management arrangements, and/ or fishing practices?	X	
External Influences	Has there been any change to an environmental issue/influence outside of the fishery management agencies control?	X	
Interaction with protected species	Has there been any change in the nature, scale, intensity of impact, and/or management response?	X	
Ecosystem impact	Has there been any change in nature, scale or intensity of impact and/or subsequent management response?		X
Target Stock Status	Has there been any change in the target stock status?	X	
By-product/ bycatch status.	Has there been any change in the by-product and/or by-catch stock status?		X

Based on the *Guidelines*, the assessment submission for the LCF is one that requires a 'comprehensive level of information'.

3. Fishery

The area of water encompassed by the LCF includes the waters of three separate, but closely linked, ecosystem components (see Figure 1) these are:

1. The lower River Murray lakes
2. The Coorong lagoons
3. The coastal marine water adjacent to the Sir Richard and Younghusband Peninsulas, out to three nautical miles from the low water mark

The boundaries of this fishery are described in detail in the *Fisheries Management (Lakes and Coorong Fishery) Regulations 2009*.

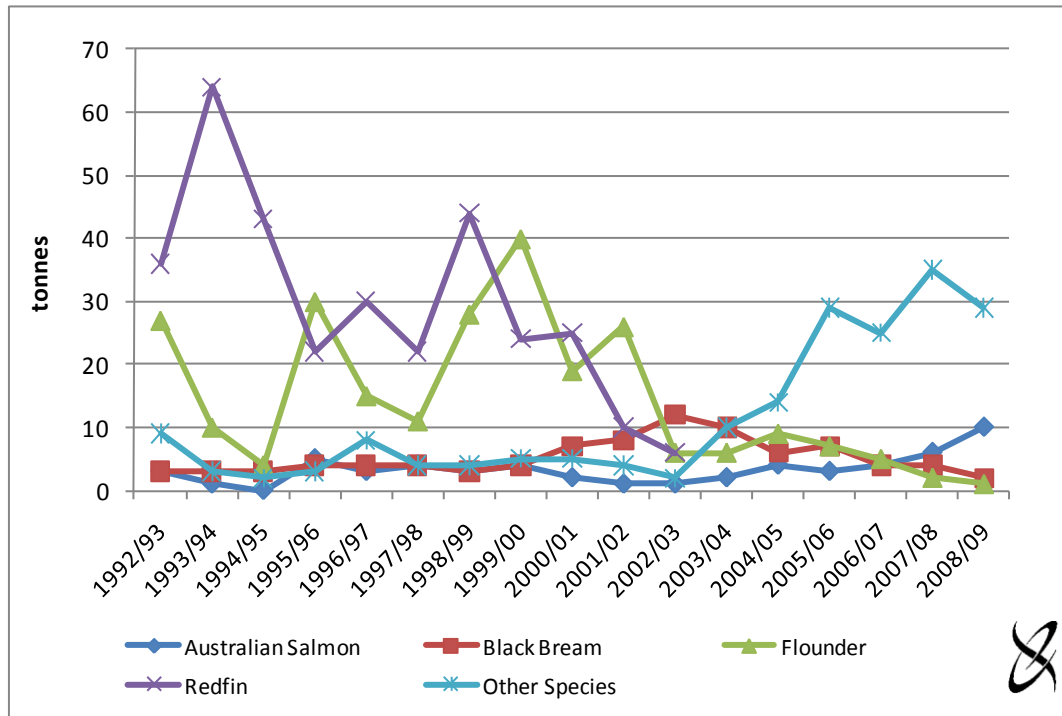
Figure 1: Management areas for the Lakes and Coorong Fishery



The commercial fishing sector of the LCF caught a total of 2,023 tonnes in 2008/09 (Econsearch, 2010). The make up of this catch from 1992/93 to 2008/09 is shown in Figures 2 and 3 below. Gross value of production for the LCF has increased steadily in recent years, from approximately \$4.5 million in 2002/03 to \$8.4 million in 2008/09 (in nominal terms). Figure 4 shows the gross value of production of major species in the LCF. This increase is largely due to the increasing value of the Pipi fishery, which has quadrupled in value from \$1.1 million to \$4.3 million over the last decade (see Figure 4). The Pipi fishery has become more valuable as an increasing proportion of the catch is sold for high-value human consumption, rather than as low-value bait. The

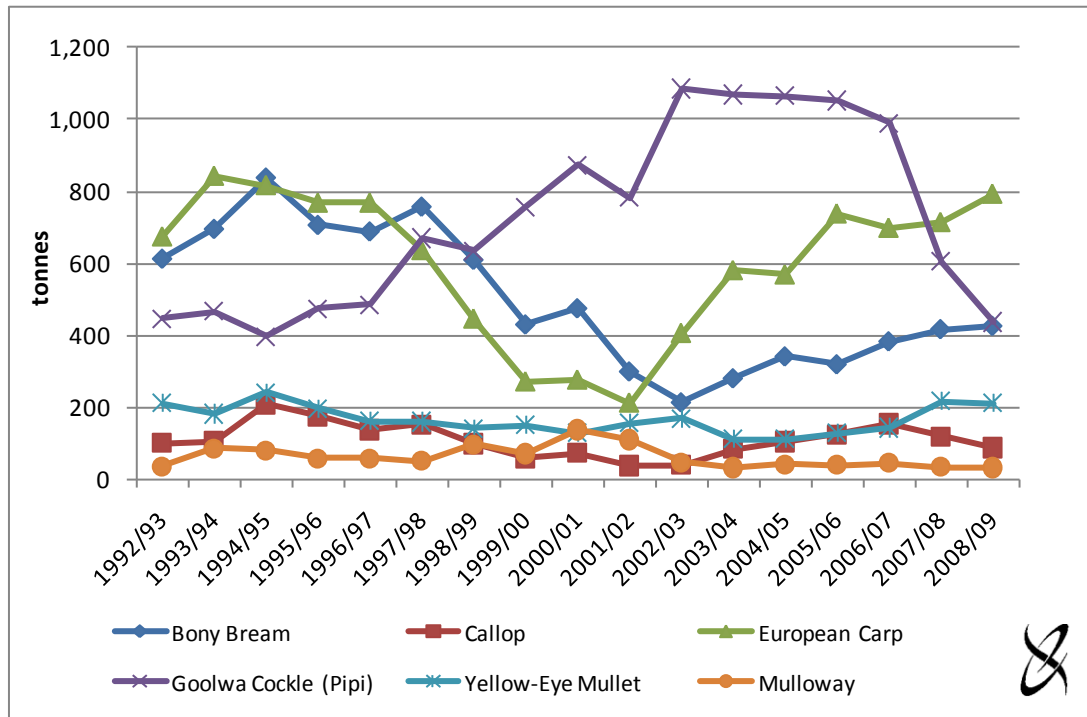
value of the fishery has increased since 2002/03, despite the catch of Pipi declining from over 1000 tonnes to just over 400 tonnes over this period.

Figure 2: Catch of lower volume species, Lakes and Coorong Fishery, 1992/93 to 2008/09^a



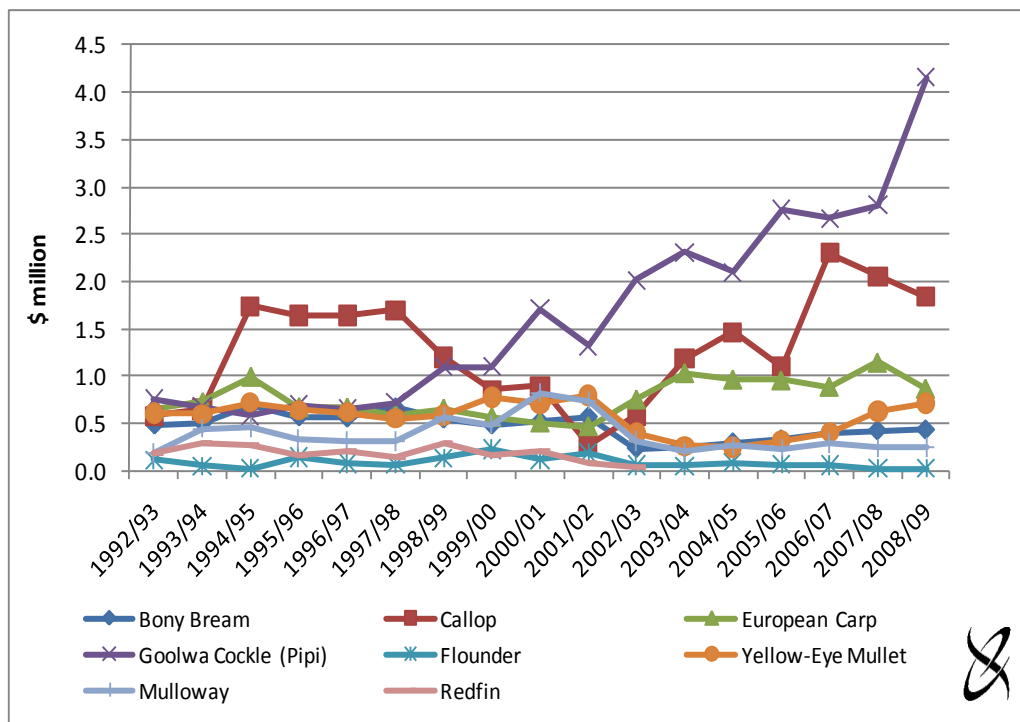
^a Note that Redfin catch was not published separately in 2003/04 to 2008/09 and has been included in the 'other species' category. Source: Econsearch 2010.

Figure 3: Catch of higher volume species, Lakes and Coorong Fishery, 1992/93 to 2008/09



Source: Econsearch 2010

Figure 4: Gross value of production of major species, Lakes and Coorong Fishery, 1992/93 to 2008/09^a



^a Redfin value of production was not published separately in 2003/04 to 2008/09 and has been included in the other species category (Figure 3.2). Source: Econsearch 2010.

3.1 Management Changes

The following three sections will outline key aspects of the Commercial, Recreational and Aboriginal traditional sectors of the LCF. It will provide information on changes to management arrangements within these sectors.

3.1.1 Commercial Fishery

The commercial fishery is managed using a complex mix of input and output controls aimed at matching harvesting capacity with resource availability and controlling growth in aggregate harvesting capacity. Existing controls include limitations on the number of licences, a wide range of gear restrictions, spatial and temporal closures, restrictions on the number of commercial agents permitted to undertake fishing operations and legal size limits for individual species.

Access to the fishery is limited to holders of one of 36 LCF licences, which have a variety of gear entitlements. All licences are renewed on an annual basis and are fully transferable. These gear entitlements provide access to various sectors within the fishery. The main target species for each commercial fishing device are listed below in Table 2. Detailed management arrangements for the commercial fishery are provided in Section 3 of the management plan (Sloan, 2005).

Table 2. Commercial fishing methods

Device	Main Target Species
mesh nets	Mulloway, Golden Perch, European Carp, Bream, Yellow-eye Mullet, Greenback Flounder and Western Australian Salmon
swinger nets	Mulloway
hauling nets	Mulloway, Western Australian Salmon, Yellow-eye Mullet, Bream and Greenback Flounder
bait net	Bait species collection
drop/hoop nets	Crabs
dab net	Garfish, other
drum net	Golden Perch and Murray Cod
cockle rake	Pipi
crab rake	Crabs
yabbie trap	Yabbies
shrimp trap	Shrimp
set line	Murray Cod, Mulloway
razor fish tongs	Razorfish
fish spear	Greenback Flounder
electro-fishing gear	European Carp

Size limits for key species in the LCF remain the same since the last assessment. Management changes were introduced in 2007 for commercial and recreational Murray Cod fishing (refer to section 6 – Interaction with Protected Species). Further changes were implemented in 2010.

In the Pipi (Goolwa Cockle) sector of the fishery, a quota management system was introduced in December 2007 with an initial Total Allowable Commercial Catch (TACC) set at 1,150 tonnes for the 2007/08 season. Licence holders were allocated individual transferable quota (ITQ) units that were endorsed on fishery licences. In conjunction with the introduction of the quota system, the number of agents permitted to be used for Pipi fishing activities was increased from two to four (two diggers, one grader and one bucket runner).

The regulations that established the quota management system for the Pipi fishery were disallowed in Parliament on 23 July 2008. PIRSA Fisheries subsequently introduced a total catch limit through licence conditions. The regulations that established the quota management system were reintroduced in Parliament on 28 October 2009.

In 2008, the LCF achieved certification to the Marine Stewardship Council standard for sustainable and well-managed fisheries. Four species were assessed and certified as meeting the MSC standard: Golden Perch, Pipi, Mulloway and Yellow-eye Mullet. Certification was awarded by independent certification body, Scientific Certification Systems, following scrutiny of the fishery's operation. Refer to www.msc.org for further information.

Recent Changes

Since the last assessment of May 2009, there have been two significant changes to the management arrangements in the LCF.

The first significant change occurred in the Pipi sector of the fishery where a number of management arrangements have been introduced to protect Pipi stocks against over-exploitation. This includes:

- the TACC has been monitored closely and was reduced from 600 tonnes in 2008/09 to 300 tonnes in 2009/10. It was increased to 330 tonnes in 2010/11;
- the recreational daily bag limit has also been reduced from 600 per person to 300 per person, and combined with spatial closures for recreational access. A small section of beach from Kingston to 28 Mile Beach has been re-opened to recreational fishers for the 2010/11 season; and
- the closure of the commercial Pipi fishery has been extended for an extra month from 31 October to 30 November for both 2009/10 and 2010/11. For the 2009/10 fishing season, a two-week closure was implemented from 1 January to 14 January 2010, while there were two separate one week closures from 1 March to 7 March 2010 and from 1 April to 7 April 2010.

Market trials were conducted during the winter closure of 2010 and will be conducted again in 2011. The trials collected biological and economic information on the Pipi fishery to improve harvest strategy development as part of the FRDC project 2008/008: "Harvesting strategy development for South Australia's Lakes and Coorong Fishery for pipi (*Donax deltoides*)".

Due to health concerns resulting from high *E.coli* levels, the commercial beach from the Murray mouth to 10 kilometres south has been closed to the take of Pipi for human consumption since mid January 2011. The no take zone for human consumption was extended to 30 km south of the Murray Mouth in mid March 2011. This beach is monitored on a weekly basis by PIRSA's South Australian Shellfish Quality Assurance Program (SASQAP).

The second significant management change relates to a trial fish down of European Carp in Lake Albert. Due to bio-security concerns, a trial fish down was implemented in Lake Albert in 2010 to avoid a fish kill. Anticipated low water levels, poor water quality and high salinity, were expected to result in large-scale European Carp mortalities. The State Government approved the expenditure of up to \$1.038m to support a Fish Kill Contingency Plan for Lake Albert. Management arrangements for the lakes were altered to support the fish down.

3.1.2 Recreational Fishery

Mulloway, Yellow-eye Mullet and Pipi are the most sought after species by recreational fishers in the Lakes and Coorong region. Larger, sexually mature Mulloway are targeted by recreational fishers using rods on the ocean beaches of the Sir Richard and Younghusband Peninsulas, particularly adjacent to the Murray Mouth where Mulloway aggregate during the warmer months of spring and summer, particularly during periods of freshwater outflow. Smaller, immature Mulloway are targeted in the estuarine Coorong lagoons all year round using recreational nets. The recreational Mulloway catch accounted for 61.2% of the combined recreational-commercial harvest in 2007/08 (Jones, 2009).

Yellow-eye Mullet are targeted by recreational fishers all year round using rod and line and a limited number of small mesh nets. Pipi are harvested predominantly along the Sir Richard Peninsula (Goolwa beach) (Sloan, 2005). A small section of the beach from Kingston to 28 Mile beach has recently been re-opened for recreational Pipi fishing. Goolwa beach has been closed to recreational fishers since mid February 2011 due to elevated levels of *E.coli*.

The recreational sector is permitted to use a wide variety of methods to target the various species, which are provided in the *Fisheries Management (General) Regulations 2009*. The regulations pertinent to the recreational sector of the LCF are summarised in the *South Australian Recreational*

Fishing Guide, and are available at PIRSA's website: www.pir.sa.gov.au. The gear permitted varies with location.

There are 878 recreational mesh nets permitted for use by registration holders in the waters of the LCF, which are subject to specific conditions. These recreational net registrations are non-transferable and no new registrations can be issued.

Bag and boat limits provide output controls that limit catch in the recreational sector to ensure catch levels remain within sustainable limits as provided below in Table 3.

In the Coorong region, there are rules governing permitted devices. In addition to a rod and handline, a person can only use at any one time no more than:

- 1 mesh net (registered in their name), or
- 1 hand net, or
- 10 hoop nets, or
- 3 hoop nets and 1 mesh net, or
- 3 hoop nets and 1 hand net.

In Lakes Albert and Alexandrina, in addition to a rod and handline, a person can only use at any one time no more than:

- 1 mesh net (registered) and either 1 hand net or one shrimp trap, or
 - 1 hand net and 1 shrimp trap, or
 - 3 yabbie pots, or
 - 3 drop nets, or
 - 10 hoop nets, or
 - 3 hoop nets and 1 mesh net and either 1 hand net or 1 shrimp trap, or
 - 3 hoop nets and 1 hand net and 1 shrimp trap.

Table 3: Recreational daily bag and boat limits for key species in the Lakes and Coorong Fishery

Species	Daily bag limit	Daily boat limit
Bream (all spp)	10	30
Golden perch	5	15
Greenback Flounder	20	60
Mulloway 46–75 cm (within Coorong only)	10	–
Mulloway 75 cm or larger (all state waters)	2	6
Pipi	300	-
Yellow-eye Mullet	60	180

A recreational fishing management plan is due to be prepared by June 2012. A review of bag, boat and size limits for this fishery will be undertaken during the development of this plan.

Recent Changes

A decrease in the daily bag limit from 600 to 300 per person was implemented in the recreational Pipi fishery in 2009/10.

A Murray Cod options paper was released by PIRSA at the end of 2009. Four possible management options were proposed by PIRSA with three additional strategies that could be used in conjunction with any of them. The options and strategies are listed below:

- Option 1. Maintain existing management arrangements
- Option 2. Catch and release fishing only
- Option 3. Maintain closure of Murray Cod fishery
- Option 4. Place Murray Cod on the protected species list (permanent closure)

- Strategy A: Area closures
- Strategy B: Gear restrictions
- Strategy C: Stock enhancement

After a public consultation process and consideration of advice from the recreational fishing sector, it was decided to open up Murray Cod as a catch and release recreational fishery (Option 2). This option was combined with maintaining Strategy A: Closure to Chowilla, an important breeding area for Murray Cod; and Strategy B: Gear restrictions (ban on trolling in the closed season) for a period of 2 years during 2011 and 2012. For the 2011 fishing season, Murray Cod will be opened as a catch and release fishery from 1 January to 31 July. The annual seasonal closure will remain from 1 August to 31 December.

3.1.3 Aboriginal Traditional Fishing

Many Aboriginal communities have a long history of fishing in what are now known as South Australian waters. Each community's fishing activities and cultural practices are distinct. Fresh water and salt water fishing have been fundamental to the cultural economy of the Ngarrindjeri people who continue to depend on these resources for cultural and economical well being. Many of the species are totems for the Ngarthii culture, and have cultural values (Ngarrindjeri Nation, 2007). The *Fisheries Act 2007* now recognises Aboriginal traditional fishing as a separate sector from commercial or recreational fishing.

Further information about these activities and practices will be described in each Aboriginal Traditional Fishing management plan that is developed. These plans are currently being developed through the process of negotiating Indigenous Land Use Agreements (ILUAs) with native title claimants and will be available as those agreements are concluded.

4. External Influences

The lower lakes, Coorong and Murray mouth region is one of Australia's most important wetlands, as recognised by its designation as one of the Living Murray "icon sites" and a Ramsar wetland of international significance. The region is one of the top six sites in Australia for migratory waterbirds and hosts up to 20% of the world population for some of these species (Phillips & Muller, 2006).

The natural ecosystems supporting fisheries resources throughout the lower lakes, Coorong and Murray mouth region have been dramatically modified since early European settlement in South Australia. Most of these modifications have been directed at water flow control and water extraction (Sloan, 2005).

An extensive barrage network was constructed near the Murray mouth in 1940, which has, and continues to, influence the ecosystem significantly, in particular the habitat available for a range of estuarine dependant fish species, native plants and waterbirds (Sloan, 2005). The Coorong lagoons now comprise the remnant estuary of the River Murray.

Due to increased regulation, the Murray mouth closes more frequently than would have occurred naturally. Additionally, flow management can result in abrupt changes to salinity levels and overall water quality in the River Murray estuary, which disrupts the natural reproductive cycles and movement patterns of many fish species. The net result of these factors, and other external impacts, on the fishery is that there are varied and acute pressures placed on fish stocks and the ecosystem that supports them (Ferguson, 2008). Mulloway (*A. japonicus*) provide an example of an environmentally limited fish population associated with the River Murray estuary (Ferguson *et al* 2008a). Through their river discharge spawning relationship and requirement for protected juvenile habitat in the estuary, Mulloway may provide an environmental indicator for the system.

4.1 The current situation in the Murray-Darling Basin

After experiencing a number of years of drought where the condition of the Coorong and lower lakes in South Australia was very serious, flows into South Australia improved dramatically in 2010. Flows into South Australia were very high for most of December 2010 and early 2011 in response to heavy rainfall upstream of the South Australian border, high River Murray flows and inflows from the Darling and Murrumbidgee Rivers.

It is anticipated that the increased flow in the River Murray system will have a range of beneficial impacts on both the commercial and recreational sectors of the LCF. Some of the benefits of the improved flow include:

- Improvement in biological productivity of flow-dependent species, such as Black bream, Golden Perch, Murray Cod and Mulloway;

- Higher water levels and reduced salinities increase the amount of habitat available for many key species (except Yellow-eye Mullet which prefer increased salinity);
- Minimising the fishing pressure on target species that were forced to aggregate in reduced volumes of water that carried favourable environmental conditions, such as normal oxygen levels.

The 2011 ESD risk assessment identified a number of environmental factors as posing high risks to the LCF. Flow regulations, barrages and introduction of exotic species were thought to pose extreme risks to the fishery. Dredging posed a high risk to the fishery, while climate change, rainfall and associated flows, and biological diseases posed moderate short-term risks to the fishery.

Due to the several years of drought experienced in the Murray Darling Basin, freshwater flows into the Lakes and Coorong were approaching record low levels. As a result, much of the research in the LCF was focussed on the effects of hyper-salinity due to the lack of freshwater inflow. A number of reports on this subject were completed by South Australia Research and Development Institute (SARDI) Aquatic Sciences:

- *Baseline Surveys of the Marine Environment Adjacent to the Proposed High Salinity Water Discharge from the South Lagoon of the Coorong*, (Rowling, Wiltshire and Tanner, 2010), considered the localised effect of the proposed pumping of hyper-saline water from the Coorong South Lagoon into the adjacent marine environment.
- *Tolerances of Juveniles and Early Life Stages of the Pipi, Donax deltoides, to Elevated Salinity Produced by Mixing of Coorong and Sea Water*, (Wiltshire, Gluis and Tanner, 2009) considered the impacts of water from the Coorong South Lagoon on early life stages and juveniles of the pipi.
- *Inter-tidal infauna of the Youngusband Peninsula: Assessing the Potential Impacts of Discharge of Hypersaline Water*, (Gorman *et al*, 2010) provided an assessment of the relative abundance and composition of beach infauna at a site of proposed saline water discharge adjacent to the Coorong South lagoon.

Due to increased freshwater flows in December 2010 and early 2011, the environmental conditions that these reports considered have been neutralised.

4.2 Introduction of Marine Parks

In 2007, the South Australian Government introduced the *Marine Parks Act*. The legislation provides for the conservation of marine habitats and marine biodiversity through a comprehensive, adequate and representative system of marine parks. A network of 19 marine parks was established in 2009 under the legislation. Management plans with zoning for each of the 19 marine parks are being developed with assistance from local communities and stakeholders. The implementation of marine parks will be overseen by the Department of Environment and Natural Resources (DENR).

Based on interstate and overseas experiences, the marine parks are expected to deliver a range of benefits that will be good for the environment, including the ecosystems that support commercial and recreational fisheries. More information about South Australia's marine parks is available at: www.marineparks.sa.gov.au.

As part of the 2011 ESD risk assessment process stakeholders in the commercial fishing sector identified the introduction of Marine Parks, and the associated issues of potential restricted fishing access, as a risk to the operation of the fishery. The Government is committed to managing any unavoidable displaced commercial fishing effort that may arise from the implementation of marine parks. There is an obligation under the *Marine Parks Act 2007* to pay compensation where statutory rights are affected.

5. Interactions with Protected Species

The nature and extent of interactions with threatened, endangered or protected species (TEPS) within the LCF will be reported in the first TEPS logbook report to be completed in 2011. The report will be forwarded to DSEWPaC upon completion. The report will contain information reported by all South Australian commercial fishery licence holders on their interactions with TEPS and be produced annually from 2011. Reporting by commercial licence holders is undertaken through a TEPS logbook, developed by PIRSA in conjunction with the South Australian Research and Development Institute (SARDI) Aquatic Sciences and the fishing industry.

Murray Cod is listed nationally as a species vulnerable to extinction in 2003 under the *Environment Protection and Biodiversity Conservation Act 1999*. Catch and effort information shows that commercial fishers in the LCF have a low level of interaction with Murray Cod. Murray Cod is a permitted by-product species in the fishery, however there has been no commercial catch of Murray Cod reported for the last two years. Catch and release restrictions were placed on the recreational fishery and a closure on the commercial fishery for 2011/12. For 2011, Murray Cod has been opened as a catch and release recreational fishery from 1 January to 31 July. The annual seasonal closure will remain in place during the peak spawning period from 1 August to 31 December.

In 2009/10, PIRSA approved a “Native Fish Monitoring” project, which focused on the stock assessment of Murray Cod. The agreed funding level was \$100,000 per annum to conduct a minimum level of research/monitoring for large-bodied native fish in the Murray River. The project was critical to support policy/management decisions for Murray Cod. SARDI completed a comprehensive desktop review to identify the most suitable methods for quantitative/semi-quantitative assessments of the population status for Murray Cod. SARDI was also able to maintain a low level of ongoing field sampling.

Historical fishery data suggest a strong correlation between flow and Murray Cod recruitment (Ye and Zampatti 2007). The status report states that aside from some low level recruitment in 2000 (associated with flows in the River Murray of around 20,000 - 60,000 ML/day), there is little indication of strong recruitment of Murray Cod since 1994. Further to this, and given protracted years without significant high flows, particularly the critical drought conditions in the last six years in the Murray-Darling Basin, there is a high risk that the stock may decline further unless strong year classes can be added. Recent freshwater inflows into the Murray-Darling Basin in late 2010 and early 2011 present a much more positive outlook for Murray Cod stock compared to previous years. Since the benefits of the increased inflow into the South Australia section of the Murray River have yet to be seen, the existing precautionary management arrangements will remain in place.

New Zealand Fur Seal interactions have increased due to environmental conditions. Increased salinity in the estuarine waters of the Coorong has allowed Fur Seals to enter the Coorong Lagoons. Increased freshwater flows are expected to decrease interactions from current levels.

6. Target Stock Status

SARDI Aquatic Sciences collects, collates and validates catch and effort data from the LCF for stock assessment and stock status reporting. Stock assessments, which elaborate on the biology of the different species, have been completed for Mulloway (2003), Golden Perch (2004), Yellow-Eye Mullet (2005), Pipi (2003 and 2006), Greenback Flounder (2007), Murray Cod (2007) and Black Bream (2008). A second stock assessment for Mulloway will be published in June 2011, while a stock assessment for Golden Perch will be completed in 2012. Species to which a high priority has been assigned will have a full stock assessment report produced at least every four years. Lower priority species will have a full stock assessment report produced every five years.

The stock assessment reports provide a full literature review and comprehensively evaluate the status of fish stocks, as measured by performance against established management objectives and reference points (RP) outlined in the management plan. Stock status reports are produced each year for all key species in the fishery. Status reports provide a brief assessment of the performance of the fishery for each key species, as measured by biological performance indicators (PI) for established management objectives and RPs outlined in the management plan.

Stock assessments and stock status reports for the LCF rely heavily on fishery-dependent data. However, SARDI Aquatic Sciences has a significant focus on freshwater ecology and the Inland Waters Program conducts a number of research projects within the River Murray system. In addition to stock assessments reports, there is ongoing research into fish passage, ecology and larval recruitment of key species as part of the MDBC's and CSIRO's icon site activities. Additionally, these studies may provide baseline information on the population structure (age/size structure) of key species. Future research will potentially focus on the role of habitat and environmental factors in the life history of key species.

6.1 Stock Assessment

The report, *'Impacts of Drought, Flow Regime, and Fishing on the Fish Assemblage in Southern Australia's Largest Temperate Estuary: Fishery Stock Assessment Report for PIRSA'*, by Ferguson *et al*, 2010b provides the most recent information on trends for stock of the target species in the Lakes and Coorong Fishery. The report categorises LCF species as either periodic strategists or opportunistic strategists. Periodic strategists are usually larger, longer-lived species and are vulnerable to the combined impacts of reduced flows and fishing as they are periodic spawners (Ferguson, 2010b). Opportunistic strategists are often smaller in size, with early maturation and a reduced longevity, and continuous spawning habits (Ferguson, 2010b). The characteristics of opportunistic strategists allow a high resilience to adult

mortality and fishing pressure. In the LCF, European Carp, Bony Bream, and Yellow-eye Mullet exhibit characteristics of opportunistic strategists. Golden Perch, Mulloway, Murray Cod and Black Bream exhibit characteristics of periodic strategists (Ferguson, 2010b). Greenback Flounder is considered an intermediate strategist. This study found that periodic strategist species contributed <10% of the total annual catch for the fishery, whilst opportunistic strategists contributed >90% (Ferguson, 2010b).

Production levels in the LCF are affected by variation in natural environmental conditions, such as the frequency of flooding and the extent of drought periods. As such, the biological productivity of most major fish species and the economic productivity of the fishery will continue to fluctuate in line with variations in natural environmental conditions (Sloan, 2005). For many of the key species in the fishery, it appears that there has been no recruitment in recent years due to drought conditions (Ferguson *et al*, 2010).

The report also suggests that there has been “truncation of the age structures of four species of long-lived, large-bodied, native fishes suggesting environmentally-induced recruitment failure, longevity over-fishing and compromised egg production” (Ferguson, 2010b). These periodic strategists will require strong freshwater flows and protection of remnant populations to aid in the recovery of fish stocks (Ferguson, 2010b).

6.2 Stock Status

Information about the LCF's performance against performance indicators (PIs) and reference points (RPs) is provided in Stock Status reports. The most recent Stock Status report, '*The South Australian Lakes and Coorong Fishery: Fishery Stock Status Report for PIRSA* (Ferguson, 2011)', was published in March 2011 and provides catch and effort information for the 2009/10 season.

The 2011 Stock Status Report indicated that there were six PIs below the lower RPs and one above the upper RP. Additionally, one environmental PI was below the lower RP. For the 2009/10 season:

- Catch (t) for Black Bream was 63% below the lower RP
- Catch (t) for Greenback Flounder was 75% below the lower RP
- Catch (t) for Mulloway was 7% below the lower RP
- Catch (t) for Pipi was 62% below the lower RP
- CPUE (kg.day⁻¹) for Pipi was 56% below the lower RP
- 3-year total catch trend for Pipi was 5% below the lower RP
- CPUE (kg.fisher day⁻¹) of Yellow-eye Mullet was 23% above the upper RP
- Net annual freshwater flow was below the lower RP (Ferguson, 2011)

In 2009/10, Yellow-eye Mullet (51%) made the greatest contribution to the total catch while Pipi (35%) made the second largest contribution. From 2005/06 to 2009/10, the contribution of Pipi to the total catch dropped from

78% to 35%. During the same period, Yellow-eye Mullet increased its contribution from 9% to 51% (Ferguson, 2011).

Based on the assessment of PIs, the status of Pipi, Black Bream, Mulloway and Greenback Flounder are of most concern (Ferguson, 2011). Catches are being increasingly dominated by Yellow-eye Mullet due to its ability to tolerate a wide range of salinities, recruit successfully each year and reduced predation by Mulloway (Ferguson, 2010b).

As noted above, stock health is expected to improve across the sector because the LCF will benefit from increased flows in the River Murray system that will have positive consequences for a number of flow-dependent species. Detailed management responses to these 6 RP breaches for key species and proposed management actions are presently being developed in consultation with key stakeholder groups. Specifically, PIRSA will be considering new management arrangements for Mulloway once the next stock assessment report has been completed in 2011.

Supplementary information on distribution and relative abundance of Pipi stocks was collected during the 2008/09 season and will provide further information on how best to assess and manage these stocks in the future. Fishery-independent research showed an increase in catch per unit effort, which is viewed as a good indicator of relative stock abundance, especially when compared to fishery-dependent statistics of CPUE (Ward *et al*, 2010). As a result of the slight recovery in Pipi stocks, an increase in the commercial quota from 300t to 330t for the 2011 fishing season was seen as sustainable. A precautionary approach to the management of Pipi stocks will remain due to high levels of exploitation and changing environmental conditions.

The 2011 ESD risk assessment process highlighted concerns about stocks of Golden Perch, Black Bream, Greenback Flounder and Mulloway. Fishing of Papis posed a moderate risk to the fishery, while European Carp, Bony Bream, Yellow-eye Mullet and Yabbies presented only a low risk to the fishery.

Table 4 below details the current status and trends for key species in the Lakes and Coorong Fishery. The table provides the criteria on which classifications are made and also comments on the reliability of the assessments contained in the table. Definitions for the stock status classifications used in Table 4, as well as a reliability assessment rating are found in Appendix 2.

Table 4: Current status and trends for key species in the Lakes and Coorong Fishery (trends over last five years (2005/06 to 2009/10) (LRP Lower Reference Point, URP Upper Reference Point defined in the Management Plan).

Species	Stock status	Criteria	Assessment reliability	Trend in annual catch (last 5 years)	Trend in annual effort (last 5 years)
Mulloway	Over fished	Total catch below LRP Truncation of age structures suggests over-exploitation Environmentally limited	Reliable (based on catch/effort, age structures, life-history)	Total catch declining. Large mesh gill net catch: historically low, stable Swinger net catch: declining	Large mesh gill net: historically low, stable Swinger net: historically low, declining
Pipi	Over fished	Catch below LRP CPUE below LRP Catch trend below LRP Recovery strategy in place, catch restrained by quota in 2009-10 CPUE increased in 2009-10	Reliable (based on catch/effort, fishery independent surveys)	Decreasing	Decreasing
Black Bream	Over fished	Catch below LRP Truncation of age structures suggests over-exploitation Environmentally limited	Reliable (based on catch/effort, age structures, no catch/effort reported in 2009-10)	Decreasing	Decreasing
Golden Perch	Over fished	Truncation of age structures suggests over-exploitation Environmentally limited	Reliable (based on catch/effort, age structures, life-history)	Decreasing	Decreasing
Greenback Flounder	Over fished	Catch below LRP Truncation of age structures suggests over-exploitation	Reliable (based on catch/effort, age structures)	Historically low (Decreasing over 10 years)	Historically low (Decreasing over 10 years)
Yellow-eye Mullet	Under fished	CPUE above URP Consistent increase in CPUE over 20 years	Reliable (based on catch/effort)	Increasing	Increasing
Bony Bream	Under fished	No Reference Points for this species	Indicative (based on catch/effort. Catch/effort reported for 3 of last 5 years)	Increasing	No clear trend

7. By-product and by-catch

There have been no changes in the status of by-product or by-catch species in the LCF.

The FRDC project titled, '*Gear Interaction of Non-Targeted Species in the Lakes and Coorong Commercial and Recreational Fisheries of South Australia*' (Ferguson, 2010c)', aimed at the characterisation of by-catch in the fishery was being undertaken at the time of the last reassessment. This report has now been completed and is attached to this report. This study provides baseline data on the use of gillnets in the Murray River estuary and Coorong lagoons. This report provides information on:

- Species composition of discarded and retained catches
- Catch rates of retained and discarded species
- Levels of usage of gillnets by registered recreational fishers and qualitative levels of interactions with non-target species
- Estimates of survival at net retrieval for key species and gear
- Identification of potential methods for mitigating levels of discarding

The report also developed a performance indicator for levels of discarding to be incorporated into the commercial catch and effort log book. According to the report, "the key issue concerning non-target species in commercial gill nets in the LCF is discarding of sub-legal sized Mulloway" (Ferguson, 2010c). The key factors that contributed to the concerns in discarding of undersized Mulloway were: levels of discarded Mulloway were higher than levels of retained catch, large mesh gill nets selected Mulloway over a wide range of lengths and year classes, and survival of discarded Mulloway was low (Ferguson, 2010c). This has the potential to impact on the sustainability of Mulloway stocks. The report suggests mitigation measures for levels of discarding including shorter soak times, attendance at nets and reduced drop of nets (Ferguson, 2010c).

As mentioned above, Murray Cod is caught as a by-product in the LCF. It is not a targeted species and there has been no commercial catch for Murray Cod recorded in the last two years. The ESD risk assessment process deemed that the by-product catch of Murray Cod only presented a low risk to the species within the fishery.

The ESD risk assessment did not assess any by-product or by-catch species as higher than a negligible or low risk.

8. Additional Information

A number of research reports have been completed since the last reassessment of the LCF. The key reports are attached to this report:

- The South Australian Lakes and Coorong Fishery. Fishery Stock Status Report for PIRSA Fisheries (Ferguson, 2011)
- The South Australian Lakes and Coorong Fishery. Fishery Stock Status Report for PIRSA Fisheries (Ferguson, 2010a)
- Impacts of drought, flow regime and fishing on the fish assemblage in southern Australia's largest temperate estuary. (Ferguson *et al*, 2010b)
- Gear Interaction of Non-Targeted Species in the Lakes and Coorong Commercial and Recreational Fisheries of South Australia (Ferguson, 2010c)
- Baseline Surveys of the Marine Environment Adjacent to the Proposed High Salinity Water Discharge from the South Lagoon of the Coorong, (Rowling, Wiltshire and Tanner, 2010)
- Tolerances of Juveniles and Early Life Stages of the Pipi, *Donax deltoides*, to Elevated Salinity Produced by Mixing of Coorong and Sea Water (Wiltshire, Gluis and Tanner, 2009)
- Inter-tidal infauna of the Younghusband Peninsula: Assessing the Potential Impacts of Discharge of Hypersaline Water (Gorman *et al*, 2010)
- Effectiveness of fishery-independent surveys for monitoring the stock status of pipi (*Donax deltoides*) on the Younghusband Peninsula, South Australia, (Ward *et al*, 2010)

Additional information specific to the LCF can be found in the following publications:

- Lakes and Coorong Yellow-eye Mullet (*Aldrichetta forsteri*) Fishery (2005)
- Monitoring of recreational catch and effort during /after the 2005 Tauwitchere fishway trial (2006).
- Mulloway (*Argyrosomus japonicus*) Fishery (2003)
- The South Australian Goolwa Cockle (*Donax deltoides*) Fishery (2006)
- The South Australian Greenback Flounder (*Rhombosolea tapirina*) Fishery (2007)
- Fisheries biology of the greenback flounder *Rhombosolea tapirina* (Günther 1862) (Teleostei: Pleuronectidae) in South Australia (2006)
- Economic Indicators for the South Australian Lakes and Coorong Fishery 2008/09
- Marine Stewardship Council – Final Assessment Report of the Lakes and Coorong Fishery (2008)
- South Australian wild fisheries information and statistics report 2008/09. (Knight and Tsohos, 2010)

Publications are available from PIRSA and SARDI websites:
www.pir.sa.gov.au and www.sardi.sa.gov.au.

9. Recommendations by DSEWPaC

The following table contains consolidated detailed information outlining progress in implementing recommendations and conditions resulting from DSEWPaC's previous accreditation of the fishery.

Recommendation 1:

PIRSA, within one year, to implement the outcomes of the FRDC research 2005/2061 and to investigate options to validate catch and effort data for by-product and by-catch species in the LCF and implement the validation system(s) identified.

Progress

Moderate – Target: 2012.

The report suggests mitigation measures for levels of discarding including shorter soak times, attendance at nets and reduced drop of nets (Ferguson, 2010c). The outcomes of the FRDC research project will be considered when preparing the new management plan in 2013.

PIRSA is currently considering the issue of catch and effort data validation for all South Australian fisheries as part of the Fisheries Council's "Rules Review" project, which is scheduled to be completed in 2012.

A modified logbook has been developed that requires fishery-wide reporting of by-catch species, which will be implemented in 2012 when new logbooks are scheduled to be printed. The new logbook will explicitly require reporting of by-catch for each net type.

Recommendation 2:

PIRSA to further refine stock assessment processes to provide more robust sustainable yield estimates for key species.

Progress

Substantial - Ongoing.

Stock assessments have been completed for all the major species caught in the LCF: Mulloway (2003), Golden Perch (2004), Yellow-Eye Mullet (2005), Pigi (2003 and 2006), Greenback Flounder (2007), Murray Cod (2007) and Black Bream (2008). A second stock assessment for Mulloway will be published in June 2011, and a stock assessment for Golden Perch will be completed in 2012. The assessments provide an evaluation against the established performance indicators and reference points.

In addition, a fishery independent survey was undertaken for the Pipi fishery (Ward *et al*, 2010). The data from this survey was found to better represent the abundance of Pipi than fisheries-dependent data. Annual fishery independent surveys will complement the fishery dependent catch and effort surveys that already take place by providing a more robust index of abundance to inform the stock assessment. The independent survey will be used to assess stocks in the future, whilst also providing a reference point for fishery dependent surveys. The fishery independent survey will improve the quality of data estimates for the Pipi fishery.

SARDI has begun to collect age structures for the key vulnerable species of Mulloway and Golden Perch to add to the catch and effort data that is currently collected. This increased biological knowledge of the status of the species will lead to improved estimates of stock status.

When preparing the new management plan for 2013, performance indicators for all species will be reviewed and refined.

Recommendation 3:

As part of the 2009/10 review of the LCF Management Plan, PIRSA to consider external proposed actions which may impact on the LCF, including but not limited to: the opening of the barrages that currently separate the freshwater of Lake Alexandrina and Lake Albert (the lower River Murray Lakes); the construction of the Wellington Weir and the Langhorne Creek Irrigator's pipeline; and where appropriate, develop suitable mechanisms that may be required to address the outcomes of these processes.

Progress

Moderate – Ongoing.

The Minister has requested that the Fisheries Council prepare a new management plan for the LCF by June 2013. The first step in the process of preparing a new management plan is to conduct an ESD risk assessment for the LCF. The ESD risk assessment process involves the development of seven component trees that contain component issues that impact on the fishery. These components are then assigned a risk rating based on the likelihood of the risk occurring, multiplied by the consequence of the risk occurring. Components that are rated as posing moderate, high or extreme risks require a full performance report of the impacts of that risk and will likely require management changes to be developed to mitigate that risk. Where a risk score is low or negligible, this suggests that the risk is being managed effectively through existing arrangements and is unlikely to be changed.

An ESD risk assessment workshop was held for the LCF in January 2011 and identified external factors as a component tree. This workshop was attended by representatives from PIRSA, Industry, DSEWPaC and the Conservation

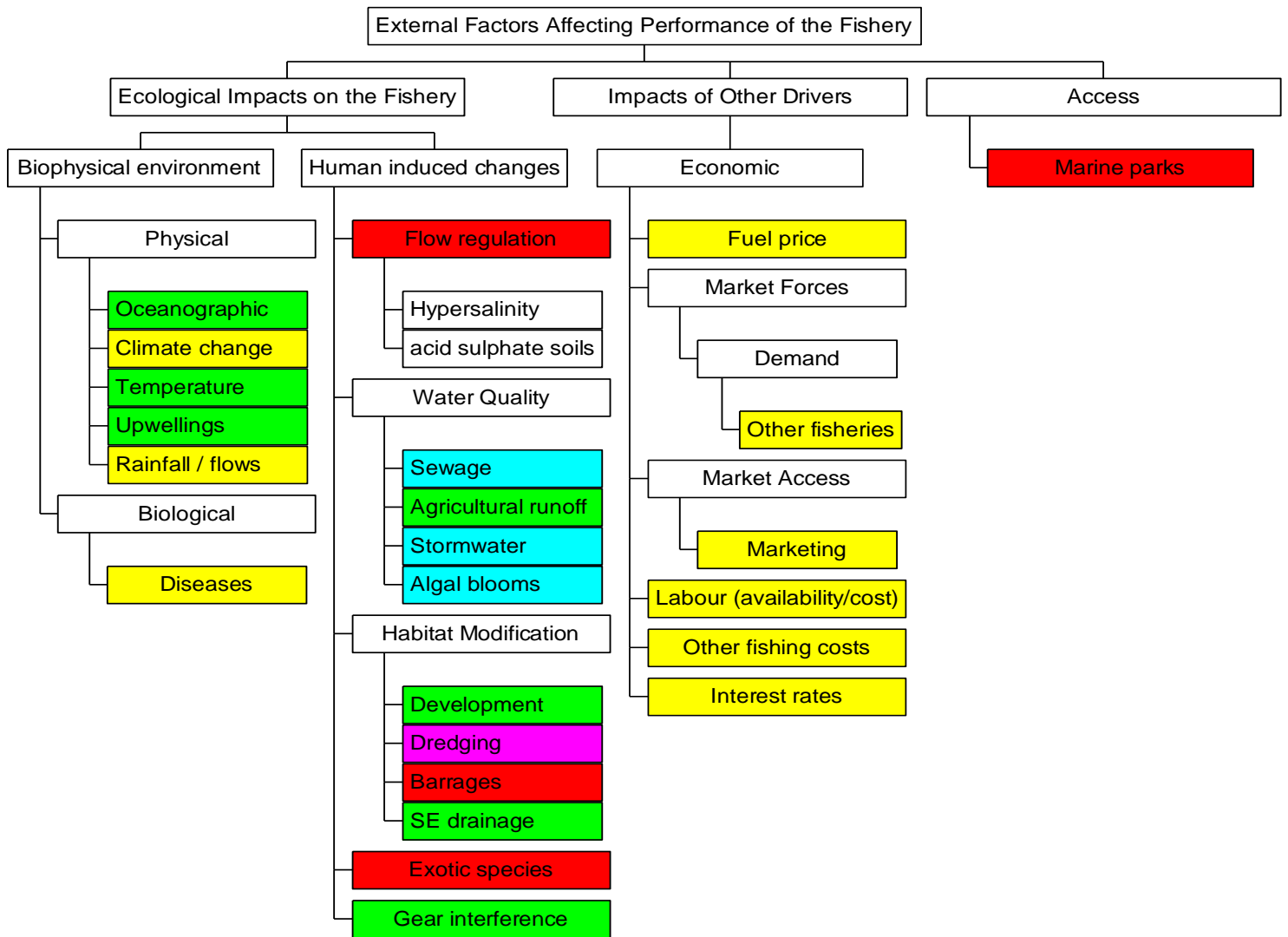
Council. The following external factor risks, rated moderate or higher, were identified for the LFC:

External Factors Risk Assessment	
<u>Risk</u>	<u>Risk Rating</u>
Flow regulation	Extreme
Barrages	Extreme
Exotic Species	Extreme
Marine Parks	Extreme
Dredging	High
Climate Change	Moderate
Rainfall/flows	Moderate
Diseases	Moderate
Fuel Price	Moderate
Other fisheries (competition)	Moderate
Marketing (market access)	Moderate
Labour (availability/cost)	Moderate
Other fishing costs	Moderate
Interest rates	Moderate

Following on from the identification and rating of risks, the next step in the ESD risk assessment process is to develop strategies to mitigate the risks, and introduce management changes where appropriate. Mitigation strategies and actions for these risks will be developed as part of the review and preparation of the new management plan for the LCF in June 2013.

The complete external factors component tree from the 2011 ESD risk assessment is found below at Figure 5. Components coloured red represent an extreme risk to the fishery, pink a high risk, yellow a moderate risk, green a low risk, and blue a negligible risk. Discussion on these risks is found in the 2011 ESD risk assessment report.

Figure 5. 2011 ESD Risk Assessment, External Factor Component Tree



Source: Bryars, S. (2011). Ecologically Sustainable Development (ESD) Risk Assessment of the South Australian Lakes and Coorong Fishery.

Condition 1:

Operation of the fishery will be carried out in accordance with the Lakes and Coorong Fishery (LCF) management regime in force under the SA Fisheries Management Act 2007, the Fisheries Management (General) Regulations 2009, and Fisheries Management (Lakes and Coorong Fishery) Regulations 2006.

Progress

Ongoing.

Operation of the LCF continues to be managed in accordance with this legislation, with the exception of the *Fisheries Management (General) Regulations 2009*, which have been updated since the last assessment.

Condition 2:

The Department of Primary Industries and Resources South Australia (PIRSA) to advise DEWHA of any intended amendments to the management arrangements that may affect the assessment of the fishery against the criteria on which the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) decisions are based.

Progress

Ongoing.

PIRSA has maintained communication with DSEWPAC through annual reports and has communicated management changes to DSEWPAC as they have arisen. PIRSA will continue to communicate management changes to DSEWPAC in the future. Refer to section 3 of this report for recent management changes.

Condition 3:

PIRSA to produce and present reports to DEWHA annually as per Appendix B to the Guidelines for the Ecologically Sustainable Management of Fisheries 2nd Edition.

Progress

Ongoing.

On-going annual reporting has been agreed upon. PIRSA has completed annual reports to present to DSEWPAC and this will continue to occur.

Condition 4:

PIRSA to:

(i) conduct an ecological risk assessment (ERA) of the impacts of the LCF, including any impacts on the listed ecological character and values of The Coorong, and Lakes Alexandrina and Albert Wetland Ramsar site (Site No. 25); and

(ii) develop and implement mitigation measures to address identified risks as appropriate.

Progress

Complete – Target: 2011.

As mentioned above under Recommendation 3, an ESD risk assessment was conducted for the LCF in January 2011 which included assessment of the fishery’s impact on the ecosystem. The risk assessment workshop identified the following risks as being moderate or higher. Therefore, they will require a full performance report and likely management changes to mitigate the risk.

General Ecosystem Impacts Risk Assessment	
Risk	Risk Rating
Freshwater fishing	High
Estuarine fishing	High
Marine fishing	Moderate
Introduction of marine pests and aquatic diseases	Moderate

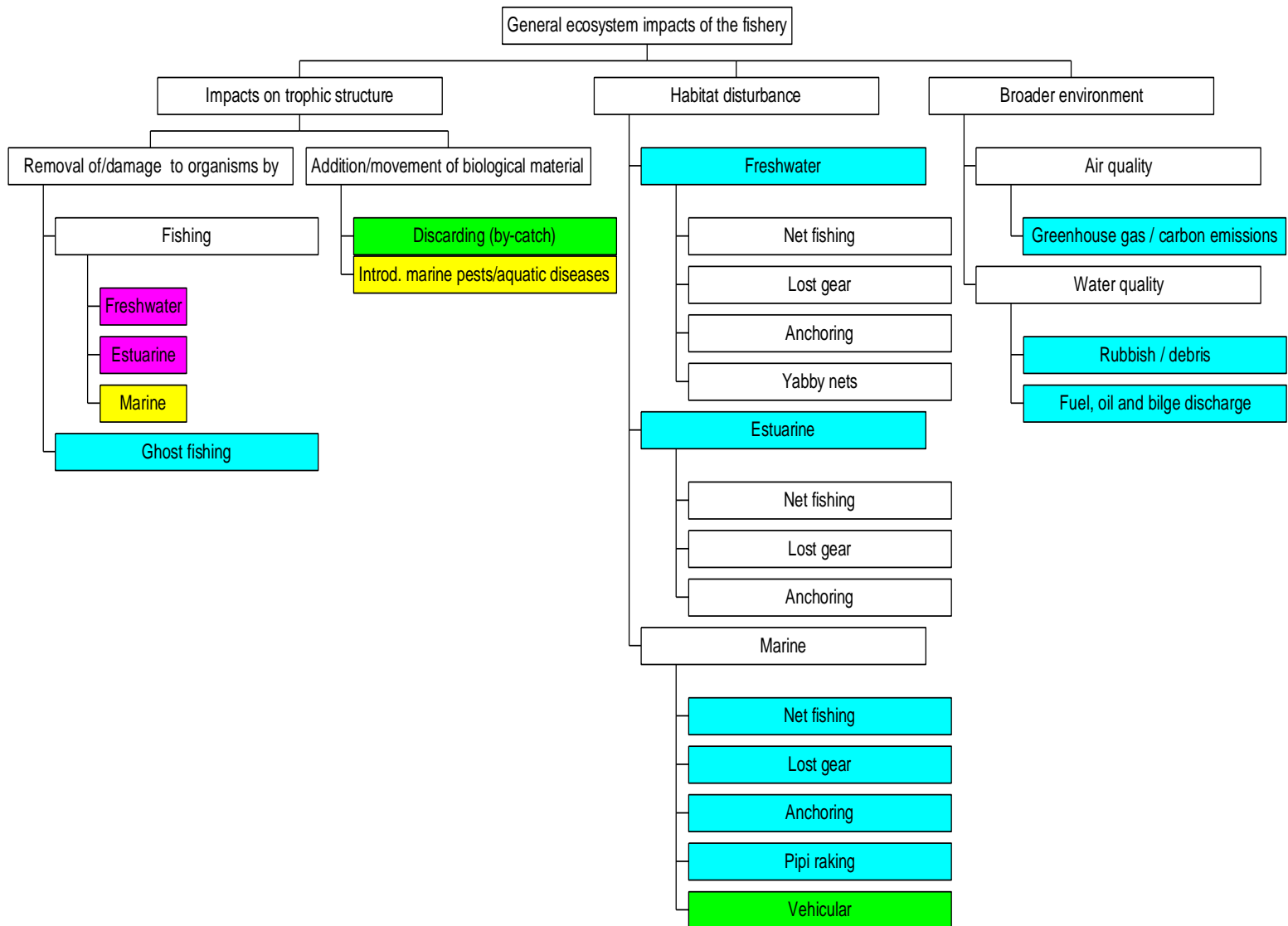
The process of developing and implementing mitigation measures will follow the completion of the risk assessment report. These strategies will be developed to respond to those risks identified as moderate or higher in the risk assessment process. All of the risks identified above will be dealt with in the review and preparation of the new management plan.

The component tree for general ecosystem impacts from the 2011 ESD risk assessment is found below (see Figure 6). Components coloured red represent an extreme risk to the fishery, pink a high risk, yellow a moderate risk, green a low risk, and blue a negligible risk. Discussion on these risks is found in the 2011 ESD risk assessment report.

Immediate risks will be dealt with before the management plan is completed. For instance, a stock assessment for Mulloway is due in May 2011 and a review to consider any new management arrangements that may be required will be conducted in 2011/12.

The ongoing management of the fishery will take into account the current environmental conditions and the risks of poor environmental conditions in the future. A precautionary approach will be taken with the fishery until signs of recovery are clearly shown.

Figure 6. 2011 ESD Risk Assessment, General Ecosystem Impacts Component Tree



Source: Bryars, S. (2011). Ecologically Sustainable Development (ESD) Risk Assessment of the South Australian Lakes and Coorong Fishery.

Condition 5:

PIRSA to:

- (i) investigate the appropriateness of current management arrangements and/or identify new measures to ensure the ongoing protection of Murray Cod in the fishery, and report to DSEWPAC by 31 October 2009; and*
- (ii) implement identified measures, as appropriate, to ensure the ongoing protection of Murray Cod by 1 January 2010.*

Progress

Complete – Target: 2010.

PIRSA reviewed the management arrangements for Murray Cod in 2009. This review culminated in the production of an Options Paper on the future of the management of Murray Cod in December 2009. The Options Paper outlined four potential options, with an additional three strategies that could be combined with any of the options. The options and strategies are listed below:

- Option 1. Maintain existing management arrangements
- Option 2. Catch and release
- Option 3. Maintain closure of Murray Cod fishery
- Option 4. Place Murray Cod on the Protected Species list (Permanent Closure)

- Strategy A: Area closures
- Strategy B: Gear restrictions
- Strategy C: Stock enhancement

After a public consultation process and consideration of advice from the recreational fishing sector, it was decided to open up Murray Cod as a catch and release recreational fishery (Option 2). This option was combined with maintaining Strategy A: Closure to Chowilla, an important breeding area for Murray Cod; and Strategy B: Gear restrictions (ban on trolling in the closed season) for a period of 2 years during 2011 and 2012. For the 2011 fishing season, Murray Cod will be opened as a catch and release fishery from 1 January to 31 July. The annual seasonal closure will remain from 1 August to 31 December to protect spawning fish.

Catch and effort information shows that commercial fishers in the LCF have a low level of interaction with Murray Cod. Murray Cod is a permitted by-product species in the LCF, however there has been no commercial catch of Murray Cod reported for the last two years. Catch and release restrictions were placed on the recreational fishery and a closure on the commercial fishery for 2011/12. The annual seasonal closure will remain in place during the peak spawning period from 1 August to 31 December.

Condition 6:

PIRSA to:

- (i) identify risks relating to the sustainability of the LCF stock of Bony Bream through the ERA process; and*
- (ii) develop and implement mitigation measures to address identified risks as appropriate.*

Progress

Complete – Target: 2010.

Bony Bream is a native freshwater fish species which spawns every year regardless of environmental conditions. It has a high resilience and is not as vulnerable as other key species as it is only rarely targeted (there was no targeting of Bony Bream between 2006/07 and 2008/09). The catch per unit effort (CPUE) for Bony Bream has been consistent for the past 15 years (Ferguson *et al*, 2010b), indicating that stocks of Bony bream are healthy.

The 2011 ESD risk assessment process considered the risks relating to the sustainability of Bony Bream stock. The risk assessment identified that the current level of take of Bony Bream would be having only a minor consequence on the population, and that this was likely to continue into the future. Therefore, the risk was rated as low.

The ESD risk assessment framework instructs that where risks are identified as low, current management arrangements are sufficient to deal with the level of risk. The stock level of Bony Bream will continue to be monitored through stock status and stock assessment reports, and management changes will be made to mitigate risks if required.

Bony Bream has been included in recent stock status reports where catch and effort data is now monitored. PIRSA does not have any current sustainability concerns for Bony Bream stocks.

Condition 7:

PIRSA, within one year, to develop and implement management arrangements capable of controlling the level of take of Goolwa cockles at sustainable levels. Particular consideration should be directed at addressing the increases in effort and risk of overexploitation of cockle stocks.

Progress

Complete – Target: 2010.

A quota management system was introduced into the Pipi fishery in December 2007 with an initial Total Allowable Commercial Catch (TACC) set at 1,150 tonnes for the 2007/08 season. Licence holders were allocated individual transferable quota (ITQ) units that were endorsed on fishery licences. In conjunction with the introduction of the quota system, the number

of agents permitted to be used for Pipi fishing activities was increased from two to four (two diggers, one grader and one bucket runner). The regulations that established the quota management system and allowed for the allocation of quota units for the Pipi fishery were disallowed in Parliament on 23 July 2008. PIRSA subsequently introduced a total catch limit through licence conditions. The regulations that established the quota management system were reintroduced in Parliament on 28 October 2009.

To improve the quality of information informing management decisions, a fishery independent survey was undertaken for the Pipi fishery in 2010 (Ward *et al*, 2010). The fishery independent survey will add to the fishery dependent catch and effort surveys that already take place by providing a more robust index of abundance to inform the stock assessment. The independent survey will be used to assess stocks in the future, whilst also providing a reference point for fishery dependent surveys. The fishery independent survey will improve the quality of data estimates for the Pipi fishery.

A number of management decisions have been taken in the Pipi fishery to protect Pipi stocks against over-exploitation in recent years. This includes: (1) the TACC has been monitored closely and was reduced from 600 tonnes in 2008/09 to 300 tonnes in 2009/10. It was increased to 330 tonnes in 2010/11; (2) the recreational daily bag limit has also been reduced from 600 per person to 300 per person, and combined with spatial closures for recreational access. A small section of beach from Kingston to 28 Mile Beach has been re-opened to recreational fishers for the 2010/11 season; and (3) the closure of the commercial Pipi fishery has been extended for an extra month from 31 October to 30 November for both 2009/10 and 2010/11. For the 2009/10 fishing season, a two-week closure was implemented from 1 January to 14 January 2010, while there were two separate one week closures from 1 March to 7 March 2010 and from 1 April to 7 April 2010.

Market trials were conducted during the winter closure of 2010 and will be conducted again in 2011. The trials collected biological and economic information on the Pipi fishery to improve harvest strategy development as part of the FRDC project 2008/008: "Harvesting strategy development for South Australia's Lakes and Coorong Fishery for pipi (*Donax deltoides*)".

During the 2008/09 season, supplementary information on distribution and relative abundance of Pipi stocks was collected and will provide further information on how best to assess and manage these stocks in the future. Fishery-independent research showed an increase in catch per unit effort, which is viewed as a good indicator of relative stock abundance (Ward *et al*, 2010). This improvement of stock health is reflected in the increase of the TACC from 300 tonnes to 330 for the 2011 season. Pipi stocks will continue to be of concern due to high levels of exploitation and changing environmental conditions. Management decisions will continue to be informed by stock status and assessment reports and commercial catch and effort data.

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10. Attachments to Report

Attachment 1

Ferguson, G (2010) The South Australian Lakes and Coorong Fishery. Fishery Stock Status Report for PIRSA Fisheries. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, 15pp. SARDI Publication No. F2009/000669-1. SARDI Research Report Series No. 421.

Attachment 2

Ferguson GJ (2010) Gear interaction of non-targeted species in the Lakes and Coorong commercial and recreational fisheries of South Australia, Final Report to FRDC for Project No. 2005/061. South Australian research and Development Institute (Aquatic Sciences), Adelaide, F2010/000239-1, SARDI Research Report Series No. 436, 56 pp.

Attachment 3

Ferguson, G.J., Ward, T.M., Ye, Q., Geddes, M.C., and Gillanders, B.M (2010). Impacts of drought, flow regime and fishing on the fish assemblage in southern Australia's largest temperate estuary. Fishery Stock Assessment Report for PIRSA Fisheries. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2010/000709-1. SARDI Research Report Series No. 498. 32pp.

Attachment 4

PIRSA Fisheries (2009). Management Options for Murray Cod in South Australia.

Attachment 5

Ward, T.M., Ferguson, G., Payne, N. and Gorman, D (2010). Effectiveness of fishery-independent surveys for monitoring the stock status of pipi (*Donax deltoides*) on the Youngusband Peninsula, South Australia. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2010/000824-1. SARDI Research Report Series No. 504. 35pp.

Attachment 6

Bryars, S. (2011). Ecologically Sustainable Development (ESD) Risk Assessment of the South Australian Lakes and Coorong Fishery.

Attachment 7

Ferguson, G (2011) The South Australian Lakes and Coorong Fishery. Fishery Stock Status Report for PIRSA Fisheries. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, 17pp. SARDI Publication No. F2009/000669-2. SARDI Research Report Series No. 527.

11. References

- Bryars, S. (2011). Ecologically Sustainable Development (ESD) Risk Assessment of the South Australian Lakes and Coorong Fishery.
- Commonwealth of Australia. (2007). *Guidelines for the Ecologically Sustainable Management of Fisheries* (2nd Edition).
- Econsearch, (2010). Economic Indicators for the Lakes and Coorong Fishery 2008/09. A Report prepared for Primary Industries and Resources South Australia.
- Econsearch, (2011). Preliminary Economic Indicators for the South Australian Lakes and Coorong Fishery, 2009/10.
- Ferguson. G (2011) The South Australian Lakes and Coorong Fishery. Fishery Stock Status Report for PIRSA Fisheries. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, 17pp. SARDI Publication No. F2009/000669-2. SARDI Research Report Series No. 527.
- Ferguson. G (2010a) The South Australian Lakes and Coorong Fishery. Fishery Stock Status Report for PIRSA Fisheries. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, 15pp. SARDI Publication No. F2009/000669-1. SARDI Research Report Series No. 421.
- Ferguson, G.J., Ward, T.M., Ye, Q., Geddes, M.C., and Gillanders, B.M (2010b). Impacts of drought, flow regime and fishing on the fish assemblage in southern Australia's largest temperate estuary. Fishery Stock Assessment Report for PIRSA Fisheries.. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2010/000709-1. SARDI Research Report Series No. 498.
- Ferguson GJ (2010c) Gear interaction of non-targeted species in the Lakes and Coorong commercial and recreational fisheries of South Australia, Final Report to FRDC for Project No. 2005/061. South Australian research and Development Institute (Aquatic Sciences), Adelaide, F2010/000239-1, SARDI Research Report Series No. 436.
- Ferguson, GJ, Ward, TM and Geddes, MC (2008). Do recent age structures and historical catches of mulloway, *Argyrosomus japonicus* (Sciaenidae), reflect freshwater inflows in the remnant estuary of the Murray River, South Australia? *Aquatic Living Resources*, 21: 145-52.
- Fletcher *et al.* (2002). National ESD Reporting Framework for Australian Fisheries.
- Gorman, D., Ferguson, G., Mathews, C. & Ward, T.M. (2010) Inter-tidal infauna of the Youngusband Peninsula: assessing the potential impacts of

discharge of hypersaline water. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2009/000699-1. SARDI Research Report Series No. 423.

Jones, K. (2009). 2007/08 South Australian Recreational Fishing Survey. PIRSA Fisheries, Adelaide, 84pp. South Australian Fisheries Management Series Paper No. 55.

Knight, M & Tsolos, A. (2010). South Australian wild fisheries information and statistics report 2008/09. SARDI Aquatic Sciences Publication No F2008/000804-2. SARDI Research Report Series No. 417. January 2010.

Ngarrindjeri Nation. (2007). Ngarrindjeri Nation Sea Country Plan, Caring for Ngarrindjeri Country and Culture. Meningie.

Phillips, W. and Muller, K. (2006). Ecological Character of the Coorong, Lakes Alexandrina and Albert Wetland of International Importance. South Australian Department for Environment and Heritage.

Rowling, K., Wiltshire K., and Tanner J. (2010). *Baseline Surveys of the Marine Environment Adjacent to the Proposed High Salinity Water Discharge from the South Lagoon of the Coorong*. SARDI Aquatic Sciences Publication No. F2009/000694-1. SARDI Research Report Series No. 422. January 2010.

Sloan, S. (2005). Management Plan for the South Australian Lakes and Coorong Fishery. Adelaide, Primary Industries and Resources South Australia: 122. Available online at http://www.pir.sa.gov.au/_data/assets/pdf_file/0016/12742/mgmt_plan_lakes_coorong_fishery.pdf.

Ward, T.M., Ferguson, G., Payne, N. and Gorman, D (2010). Effectiveness of fishery-independent surveys for monitoring the stock status of pipi (*Donax deltoides*) on the Younghusband Peninsula, South Australia. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2010/000824-1. SARDI Research Report Series No. 504. 35pp.

Wiltshire, K., Gluis, M., and Tanner J. (2009). Tolerances of Juveniles and Early Life Stages of the Pipi, *Donax deltoides*, to Elevated Salinity Produced by Mixing of Coorong and Sea Water. SARDI Aquatic Sciences Publication No. F2009/000678-1. SARDI Research Report Series No. 414. December 2009.

Ye, Q and Zampatti, B (2007) Murray Cod stock status: the Lower River Murray, South Australia. Stock Status Report to PIRSA Fisheries. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, 32pp. SARDI Publication Number F2007-000211-1.

Appendix 1: Total catch and value by species in the Lakes and Coorong Fishery 1996/97 – 2009/10

Table 5: Total catch for the Lakes and Coorong Fishery, 1996/97 to 2009/10 (tonnes) – (Econsearch, 2011)

Species	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10
Black Bream	4	4	3	4	7	8	12	10	6	7	4	4	2	1
Bony Bream	688	757	609	429	474	298	212	279	340	318	382	416	425	573
Callop	137	151	98	57	71	36	38	82	103	69	152	117	87	49
Pipi	485	669	635	756	873	783	1,086	1,070	1,066	1024	989	605	437	292
Flounder	15	11	28	40	19	26	6	6	9	7	5	2	1	1
Yellow eye mullet	161	158	139	150	127	155	167	111	110	126	141	216	210	207
Mulloway	56	50	95	69	136	109	45	31	39	38	44	32	30	26
Other Species	8	4	4	5	5	4	2	10	14	29	25	35	29	47
Total	1554	1804	1611	1510	1712	1419	1568	1599	1687	1618	1742	1427	1221	1196

Table 6: Total value for the Lakes and Coorong Fishery, 1996/97 to 2009/10 (\$000) – (Econsearch, 2011)

Species	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10
Black Bream	34	42	30	37	58	70	110	100	55	69	51	41	18	15
Bony Bream	553	661	542	479	512	564	227	234	286	318	382	416	425	235
Callop	1638	1691	1190	851	892	271	583	1176	1464	1094	2297	2055	1832	1040
Pipi	647	712	1098	1096	1710	1315	2013	2305	2092	2757	2662	2807	4157	3983
Flounder	74	62	132	219	113	183	53	49	78	62	51	20	16	12
Yellow eye mullet	612	544	581	773	704	195	392	257	245	310	401	621	705	895
Mulloway	310	303	570	482	824	736	306	192	256	231	286	239	240	187
Other Species	13	9	13	18	14	24	7	35	54	127	123	194	134	220
Total	3881	4024	4156	3955	4827	3358	3691	4348	4530	4968	6253	6393	7527	6587

Note: The River Fishery was closed from July 2003. A limited number of licences have access to the River and their production is included in this table. Therefore, statistics for some species from 2003 onwards will include the catch taken in the River Fishery as well as the Lakes and Coorong Fishery.

Appendix 2: Stock Status classifications and robustness and reliability assessment rating

Table 7. Stock status classifications.

Stock classification	Description
Uncertain	There is limited quantitative information available to provide a reliable assessment of stock status. A fish stock that may be under fished, fully fished or over fished.
Under fished	Is underutilised and has the potential to sustain harvest levels higher than those currently being taken.
Fully fished	Harvest levels are at, or close to, optimum sustainable levels. Current fishing pressure is considered sustainable. Any increase in catch or fishing pressure may lead to over fishing in the long term.
Over fished or depleted	Harvest levels are not sustainable and/or yields may be higher in the long term if catch or effort levels are reduced in the short term, or the stock may still be recovering from previous excessive fishing pressure. Classification of a stock as over fished or depleted may be due to recruitment or growth over fishing and/or as a result of habitat degradation. Recovery strategies will be developed for all over fished stocks to reduce fishing pressure and ensure that stocks recover to acceptable levels within agreed timeframes.
Environmentally limited	Has reduced productivity due to external impacts associated with habitat modifications or environmental factors. Reduced stock levels are not primarily due to fishing, although fishing may be a contributing factor to ongoing concerns regarding low stock levels.

Table 8. Assessment rating robustness and reliability.

Assessment rating	Robustness and reliability
Highly reliable	The assessment incorporates: (i) syntheses and analyses of fishery dependent and fishery independent data; (ii) best-practice quantitative numerical modelling; and (iii) risk analyses. Data underpinning the assessment are considered reliable. Uncertainty in the assessment is clearly identified and its implications understood. The assessment process is reviewed internally on an annual basis and externally reviewed within a three-year cycle.
Reliable	The assessment incorporates: (i) syntheses and analyses of fishery dependent data; and (ii) quantitative numerical modelling. Model outputs are preliminary and derived from a model undergoing refinement. Data underpinning the assessment are considered reliable. Uncertainty in the assessment is clearly identified and its implications understood. The assessment process is reviewed internally on an annual basis and externally reviewed within a five-year cycle.
Indicative	The assessment incorporates syntheses and analyses of fishery-dependent data. A quantitative numerical modelling approach is being developed or undergoing substantial refinement. Uncertainty in the assessment is clearly identified. The assessment process is reviewed internally on an annual basis and externally reviewed within a five-year cycle.
Uncertain	The assessment may be limited to a stock status report, or the assessment is still under development and has only been completed at an elementary level. The quality of data used in the assessment may be unknown and assumptions may be made for a number of inputs to the assessment.