

# SOUTH COAST BIOREGION

## ABOUT THE BIOREGION

The continental shelf waters of the South Coast Bioregion are generally temperate but low in nutrients, due to the seasonal winter presence of the tail of the tropical Leeuwin Current and limited terrestrial run-off. Sea surface temperatures typically range from approximately 15°C to 21°C, which is warmer than would normally be expected in these latitudes due to the influence of the Leeuwin Current. The effect of the Leeuwin Current, particularly west of Albany, limits winter minimum temperatures (away from terrestrial effects along the beaches) to about 16 to 17°C. Summer water temperatures in 2012/13 were at a record high, which may affect the recruitment of some species.

Fish stocks in this region are predominantly temperate, with many species' distributions extending right across southern Australia. Tropical species are occasionally found, which are thought to be brought into the area as larvae as they are unlikely to form breeding populations.

The South Coast is a high-energy environment, heavily influenced by large swells generated in the Southern Ocean. The coastline from Cape Leeuwin to Israelite Bay is characterised by white sand beaches separated by high granite headlands. East of Israelite Bay, there are long sandy beaches backed by large sand dunes, until replaced by high limestone cliffs at the South Australian border. There are few large areas of protected water along the South Coast, the exceptions being around Albany and in the Recherche Archipelago off Esperance.

Along the western section of the coastline that receives significant winter rainfall, there are numerous estuaries fed by winter-flowing rivers. Several of these, such as Walpole/Nornalup Inlet and Oyster Harbour, are permanently open, but most are closed by sandbars and open only seasonally after heavy winter rains. The number of rivers and estuaries decreases to the east as the coastline becomes more arid. While these estuaries, influenced by terrestrial run-off, have higher nutrient levels (and some, such as Oyster Harbour and Wilson Inlet, are suffering eutrophication), their outflow to the ocean does not significantly influence the low nutrient status of coastal waters.

The marine habitats of the South Coast are similar to the coastline, having fine, clear sand sea floors interspersed with occasional granite outcrops and limestone shoreline platforms and sub-surface reefs.

A mixture of seagrass and kelp habitats occurs along the South Coast, with seagrass more abundant in protected waters and some of the more marine estuaries. The kelp habitats are diverse but dominated by the relatively small *Ecklonia radiata*, rather than the larger kelps expected in these latitudes where waters are typically colder and have higher nutrient levels.

## SUMMARY OF FISHING AND AQUACULTURE ACTIVITIES

The major commercial fisheries of the South Coast Bioregion are the abalone fishery, the purse seine fishery targeting pilchards and other small pelagics, and a demersal gillnet fishery for sharks. Other smaller commercial fisheries are the long-standing beach seine fishery for western Australian salmon and herring, a trap fishery targeting southern rock lobsters and deep-water crabs, and the intermittent scallop fishery. There is also a commercial net fishery for finfish operating in a number of South Coast estuaries. South Coast commercial fishing vessel operators often hold a number of licences to create a viable year-round fishing operation.

As much of the South Coast is remote or difficult to access, recreational beach and boat fishing tends to be concentrated around the main population and holiday centres. The major target species for beach and rock anglers are salmon, herring, whiting and trevally, while boat anglers target pink snapper, queen snapper, Bight redfish, a number of shark species, samson fish and King George whiting. The third major component of the recreational fishery is dinghy and shoreline fishing off estuaries and rivers, focused in the western half of the bioregion. Here the main angling targets are black bream and whiting (including King George whiting). Recreational netting, primarily targeting mullet, also occurs in these estuaries.

The predominant aquaculture activity undertaken on the south coast is the production of mussels and oysters from Oyster Harbour at Albany. This activity is restricted to this area where there are sufficient nutrient levels related to terrestrial run-off to provide the planktonic food necessary to promote growth of filter-feeding bivalves.

Other forms of aquaculture (e.g. sea cage farming) are restricted on the South Coast by the high-energy environment and the very limited availability of protected deep waters typically required by this sector. Most recent development activity in the invertebrate sector has focused on land-based 'raceway' culture of abalone, using pumped sea water. In addition, an offshore abalone farm near Augusta is achieving encouraging early results for abalone grown out using purpose-built concrete structures located on the sea bed (See Aquaculture Regional Research and Development Overview section in this chapter).

## ECOSYSTEM MANAGEMENT

The inshore marine habitats of the South Coast are largely unaffected by human activities. While there are few permanent closures to trawling in this region, the actual level of such activities is very small with about 98% of the region not affected by these activities.

The estuaries and near-shore marine embayments where there is restricted water exchange, for example Princess Royal and Oyster Harbours and Wilson Inlet, have experienced

eutrophication events associated with high nutrient loads from adjacent land-based activity.

The Walpole–Nornalup Marine Park was declared on the 8th May 2009 and is the first marine protected area on the South Coast. The Department of Fisheries Research Division’s Biodiversity and Biosecurity Branch undertakes research and monitoring within the Walpole-Nornalup Marine Park, based on the departments identified risks in conjunction with the marine park management plan priorities. This work includes the support and supervision (in collaboration with Murdoch University) of post-doctoral studies on the finfish community to assess current trends, movement ecology and development of a long term monitoring program for the finfish community within marine park. . Additional access restrictions in the bioregion include closures under s.43 of the Fish Resources Management Act 1994 surrounding the wreck of the ‘Perth’ (Albany), wreck of the ‘Sanko Harvest’ (east of Esperance), and Esperance Jetty.

The Commonwealth Government’s is undertaking a Marine Bioregional Planning process for Commonwealth waters between Kangaroo Island, South Australia and Shark Bay.

The Department of Fisheries continues to provide advice to the Environmental Protection Authority on development proposals, which if implemented, have the potential to impact on the aquatic environment. The Department also continues to actively engage with the natural resource management groups for the South Coast to promote sustainable use of the aquatic environment.

## ECOSYSTEM BASED FISHERIES MANAGEMENT

### Identification of Ecological Assets using the EBFM framework

Under the Integrated Marine and Coastal Regionalisation for Australia scheme, the South Coast Bioregion has been divided into 2 meso-scale regions: WA South Coast, Eucla (IMCRA, V 4.0, 2006). This sub-regional scale of management has now been adopted by the Department through the implementation of an Ecosystem Based Fisheries Management (EBFM) framework (Fletcher, *et al.*, 2010) see How to Use section for more details.

In terms of ecological assets, the Department has recognised the following ecological values for the IMCRA regions within the South Coast Bioregion:

Ecosystem structure and biodiversity (on a meso-scale basis);  
 Captured fish species;  
 Listed species (direct impact – capture or interaction);  
 Benthic habitats; and  
 External impacts.

For some issues a finer level of division of the IMCRA ecosystems is used by the Department. This relates to recent management initiatives necessary to recognise different suites of exploited fish and invertebrates across the continental shelf. These sub-components are defined by depth contours (Estuarine, Nearshore 0-20m; Demersal 20-250m and Pelagic). The full set of ecological assets identified for ongoing monitoring are presented in South Coast Ecosystem Management Figure 1.

### Risk Assessment of Regional Ecological Assets

The EBFM process identifies the ecological assets in a hierarchical manner such that the assets outlined South Coast Ecosystem Management Figure 1 are often made up of individual components at species or stock level. The risks to each of the individual stock or lower level components are mostly detailed in the individual fishery reports presented in this document. The following table (South Coast Ecosystem Management Table 2) provides an overview and cumulative assessment of the current risks to the ecological assets of the South Coast Bioregion, at a bioregional level and provides a mechanism for reporting on their status and the fisheries management arrangements that are being applied. These bioregional level risks are now used by the Department as a key input into the Department’s Risk Register which, combined with an assessment of the economic and social values and risks associated with these assets, is integral for use in the annual planning cycle for assigning priorities for activities across all Divisions in this Bioregion.

The Marine Biosecurity Research and Monitoring Group implements a range of monitoring and research activities in the Bioregion focussed on detection of introduced marine pests (IMPs) at high risk locations and vessel risk analysis. Early detection of IMPs is vital if any attempt at eradication or other management strategies are to be successful. Further details for these projects may be found in the “Introduced Pests Status Report” at the end of this section and also in the Appendix section entitled “Activities of the Marine Biosecurity Research Group during 2014/15”.

**SOUTH COAST ECOSYSTEM MANAGEMENT TABLE 1**

The areas and proportions of the South Coast Bioregion making up State Waters and all continental shelf waters, out to 200 m depth, which are consistent with the IUCN criteria for classification as marine protected areas.

IUCN category or equivalent	State Waters only (17,116 km <sup>2</sup> )				All Waters (534,016 km <sup>2</sup> (including State waters))			
	Fisheries		Existing MPA		Fisheries		Existing MPA	
	km <sup>2</sup>	%	km <sup>2</sup>	%	km <sup>2</sup>	%	km <sup>2</sup>	%
I	0	0	0	0	0	0	0	0
II	1	< 1	0	0	1	< 1	0	0
III	0	0	0	0	0	0	0	0
IV	2,400	14	15	< 1	2,400	< 1	15	< 1
V	0	0	0	0	0	0	0	0
VI	14,700	86	0	0	531,600	99	0	0

**SOUTH COAST ECOSYSTEM MANAGEMENT TABLE 2****RISK LEVELS FOR EACH ASSET.**

Risk levels in this table are developed by combining the individual (lower level) elements that make up each of the higher level components. Low and Moderate values are both considered to be acceptable levels of risk. High and Significant risks indicate that the asset is no longer in a condition that is considered appropriate and additional management actions are required. Where the value is followed by (non-fishing) this indicates that all, or the majority of the risk value, was not generated by fishing activities.

**Ecosystem Structure and Biodiversity**

Ecosystem	Aquatic zone	Risk	Status and Current Activities
Estuarine	Marine	MODERATE (non fishing)	The most likely cause of changes to community structure in estuarine regions is changing rainfall levels and the manual opening or closing of bars at river mouths.
Marine	Marine	LOW	An assessment by Hall and Wise (2011) <sup>1</sup> of finfish community structure using commercial data for the past 30 years found no evidence of any concerning trend in mean trophic level, mean length or FIB. Few other species are captured in this region.
Eucla	Marine	NEGLIGIBLE	As above

**Captured fish species**

Fish species	Aquatic zone	Risk	Status and Current Activities
Finfish	Estuarine	MODERATE	The catch and catch rate of this suite has been reasonably stable for 10 years.
	Nearshore	HIGH	The capture of herring has been in decline for some years. A study (reported in detail elsewhere in this report) has recently confirmed that this is related to stock issues generated by reductions in recruitment
	Demersal	HIGH	Given the concerns that there could be an increase in targeting of demersal fishing on the south coast, an NRM funded project has begun to examine the stock status of this suite.
	Pelagic	LOW	While the spawning biomass of sardines has returned to appropriate levels, their capture levels and that of other pelagic fish has not returned to pre-virus levels due to market problems and changed fish behaviour.

<sup>1</sup> Hall, N.G. and Wise, B.S. 2011. Development of an ecosystem approach to the monitoring and management of Western Australian fisheries. FRDC Report – Project 2005/063. Fisheries Research Report No. 215. Department of Fisheries, Western Australia. 112pp.

Fish species	Aquatic zone	Risk	Status and Current Activities
Crustaceans	Shelf	MODERATE	The catch levels of lobsters and crabs remains at relatively low but consistent levels.
Molluscs	Nearshore	MODERATE	The stocks of abalone are maintained at appropriate levels
	Shelf	NEGLIGIBLE	The stocks of scallops varies annually and fishing only occurs when stocks are abundant

**Listed species**

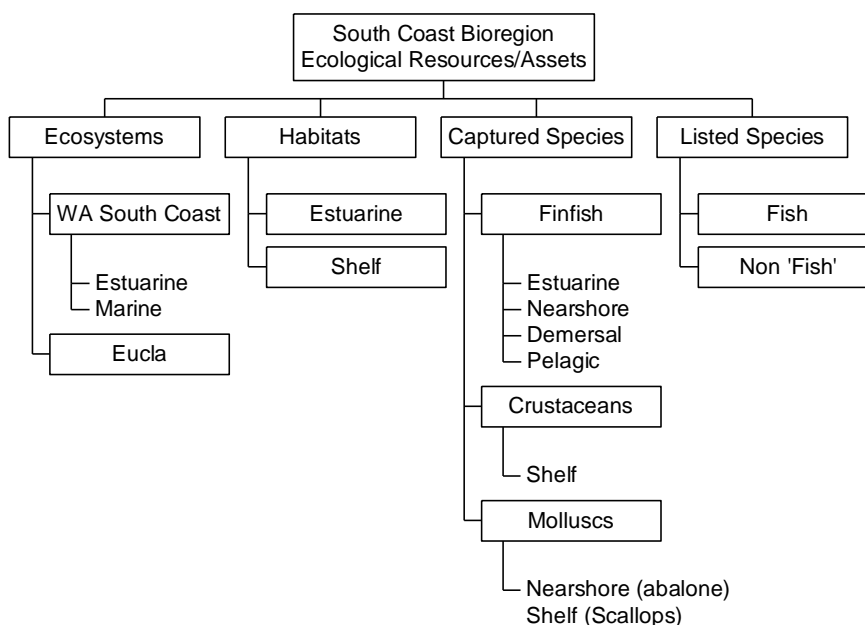
Listed fish species	Species	Risk	Status and Current Activities
Listed non 'Fish' species	Non fish (birds)	MODERATE	The capture of shearwaters in purse seine operations has been addressed by a code of conduct
	Mammals	MODERATE	The potential for the capture of sealions and seals by all fishing operations in this region, but especially gillnets has been the subject of a number of recent studies.
Listed 'Fish' Species	Fish	NEGLIGIBLE	There are few risks to the listed fish species in this region

**Benthic habitat**

Benthic Habitat	Risk	Status and Current Activities
Estuaries/ Nearshore	LOW (non fishing)	There are few fishing activities that would impact on nearshore or estuarine habitats. There may be risks at some locations due to coastal development activities.
Shelf	NEGLIGIBLE	The shelf region in this bioregion has very little habitat disturbance. Less than 3% of the area is trawled and there are no other activities that would materially impact on the habitats in these areas.

**External Drivers (Non Fishing)**

External Drivers	Risk	Status and Current Activities
Introduced Pests and Diseases	HIGH	The identification of the pest algae <i>Codium fragile fragile</i> in Albany highlights the issues that now face many ports in Australia
Climate	LOW	This area is unlikely to be impacted by climate change in the near future.



**SOUTH COAST ECOSYSTEM MANAGEMENT FIGURE 1**

Component tree showing the ecological assets identified and separately assessed for the South Coast Bioregion.

# Introduced Pests Status Report

## Regional Monitoring and Research Update

The introduction and spread of marine pests in WA waters poses a serious threat to native biodiversity and can have widespread effects on both our economy and health. There are two key vectors for marine pest translocation: ballast water and hull fouling. The Marine Biosecurity Research Group continue to implement a series of biosecurity related projects in the South Coast Bioregion ranging from early detection and control strategies for pests to vessel risk analyses.

The Marine Biosecurity Research Group, with financial and *in-kind* assistance from the Southern Ports Authority and the Department of Transport (Esperance) is running an Early Warning System program using *in-situ* settlement arrays to provide a mechanism for the early detection of marine pests in the ports of Albany and Esperance. Through this surveillance species detected to date in this region are reported in Introduced Pests Table 1.

From a biosecurity perspective the introduction of a marine pest to any region is based on multiple factors that can be grouped into two themes; the likelihood of inoculation and the likelihood of infection and establishment. Inoculation likelihood assumes that the greater the number of vessel visits from a source with introduced marine pests (IMP) the greater the risk of IMPs being brought into the recipient port i.e. a positive linear relationship. The number of commercial vessels entering the South Coast Bioregion has significantly

increased (~200%) over the past 12 years (2002 to 2014). As a result the group is analysing the change in numbers of commercial vessels as well as their visit and type profiles to better inform management processes of the domestic and international risks to the Bioregion.

The Marine Biosecurity Research Group is also examining the risk recreational vessels pose with respect to introducing, harbouring and translocating IMPs around the State. This project involves surveying marina-based vessel owners about their vessel management practices and their vessel use profiles. The research outputs are designed to be applicable to biosecurity management across the state.

The Marine Biosecurity Research Group is also running an ongoing *in-situ* control program for the management of the invasive alga *Codium fragile* ssp. *fragile*. So far this has involved diver's removing by hand the algae on two occasions, once in 2014 and again 2015. A third visit is planned for mid-late 2015. So far the group has seen a reduction in algae biomass over time, which gives some indication that the program of control is successful.

For further details on the above projects see the Appendix section entitled "Activities of the Marine Biosecurity Research Group during 2014/15".

### INTRODUCED PESTS TABLE 1

Introduced marine species detected in this bioregion.

Common name	Scientific name	Type of organism	IMS/IMP listing	Noxious Listing
	<i>Codium fragile</i> ssp. <i>fragile</i>	Algae	Introduced species	Yes
	<i>Didemnum perlucidum</i>	Ascidian	Introduced species - likely pest	Yes
	<i>Botrylloides giganteum</i>	Ascidian	Introduced species	No

## FISHERIES

### South Coast Crustacean Fisheries Status Report

J. How and R. Oliver

#### Main Features

Status		Current Landings	
Stock level	Adequate	Southern rock lobster	46 t
Fishing level	Acceptable	Deep sea crabs	24 t

## Fishery Description

The 'south coast crustacean fisheries' comprise four pot-based fisheries, which operate from Augusta to the South Australian border. They include the Windy Harbour-Augusta Rock Lobster Managed Fishery (WHARLMF), the Esperance Rock Lobster Managed Fishery (ERLMF), the Southern Rock Lobster Pot Regulation Fishery operating in the Albany and Great Australian Bight areas, and the South Coast Deep-Sea Crab Fishery (South Coast Crustacean Figure 1).

The fisheries are multi-species and take southern rock lobster (*Jasus edwardsii*) and western rock lobster (*Panulirus cygnus*) as well as deep-sea crab species including giant crab (*Pseudocarcinus gigas*), crystal crab (*Chaceon albus*) and champagne crab (*Hypothalassia acerba*).

Southern rock lobster comprises the majority of the catch in the eastern areas of the fishery, with crab species becoming more prevalent in the south-western region (South Coast Crustacean Figure 2). Western rock lobster is a significant component of the catch in the WHARLMF (not reported here due to confidentiality provisions relating to the small number of licensees).

### Governing legislation/fishing authority

#### Commercial

*Windy Harbour-Augusta Rock Lobster Managed Fishery Management Plan 1987*

Windy Harbour-Augusta Rock Lobster Managed Fishery Licence

*Esperance Rock Lobster Managed Fishery Management Plan 1987*

Esperance Rock Lobster Managed Fishery Licence

Southern Rock Lobster Pot Regulation Licence

Condition 105 on a Fishing Boat Licence

*Prohibition on Fishing for Rock Lobster Order 2013*

Commonwealth Government *Environment Protection and Biodiversity Conservation Act 1999* (Wildlife Trade Operation).

#### Recreational

*Fish Resources Management Act 1994; Fish Resources Management Regulations 1995* and other subsidiary legislation

### Consultation process

The Department undertakes consultation directly with licensees on operational issues and processes and is responsible for the statutory management plan consultation. Industry Annual Management Meetings are convened by the Western Australian Fishing Industry Council (WAFIC), who are also responsible for statutory management plan consultation under a Service Level Agreement with the Department.

### Boundaries

Management boundaries for the south coast crustacean fisheries are shown in South Coast Crustacean Figure 1. The 'boundaries' of the deep-sea crab component of the fishery (managed by Fishing Boat Licence Condition 105) include all the waters of these fisheries deeper than 200 metres, excluding those of the ERLMF, where crabs may only be taken by licensees in the ERLMF.

### Management arrangements

#### Commercial

These commercial fisheries are managed primarily through input controls in the form of limited entry, pot numbers, size limits and seasonal closures.

The fishing season for rock lobsters across all four south coast crustacean fisheries is 15 November to 30 June. Fishing for deep-sea crabs can currently occur all year, but during the rock lobster season operators fishing under the authority of a Southern Rock Lobster Pot Regulation Licence must only use the number of pots specified on their authorisation. There is currently no limit on the number of deep sea crab pots that can be used by holders of Fishing Boat Licence Condition 105. This is being addressed as part of the new management plan that will come into effect on 1 July 2015 and consolidate the four existing fisheries into the South Coast Crustacean Managed Fishery.

Catch statistics for the fisheries are based on the period from 1 November to 31 October inclusive. In 2013/14 there were two licences in the WHARLMF; eight licences in the ERLMF (five vessels reported catch); 28 licences in the Southern Rock Lobster Pot Regulation Fishery (13 vessels reported catch) and 23 holders of Fishing Boat Licence Condition 105 (seven vessels reported catch).

#### Recreational

Recreational fishers generally only target rock lobster. They are restricted to the use of 2 pots per person and divers are only permitted to take rock lobster by hand, or with the use of a loop or other device that is not capable of piercing the rock lobster.

Size limits, a bag limit of eight lobsters per licence and seasonal closures apply and all recreational fishers are required to hold a current Rock Lobster Recreational Fishing Licence. The recreational rock lobster season has previously been 15 November to 30 June, in line with the commercial rock lobster season. However as of 2014, the recreational season has been extended to 15 October to 30 June to create consistency with the recreational rock lobster fishing season on the west coast, and thereby across the state.

### Research summary

A recent pre-assessment of the fishery for Marine Stewardship Certification has been the focus of the research for this fishery. It has resulted in the development of standardised catch rates to evaluate the stock status and a proposed harvest strategy and control rules framework, based on the catch rates.

## Retained Species

### Commercial landings (season 2013/14):

<b>Southern rock lobster</b>	<b>46 tonnes</b>
<b>Deep sea crabs</b>	<b>24 tonnes</b>
<b>Western rock lobster</b>	<b>Not reported</b>

**due to confidentiality provisions**

In 2013/14, the south coast catch of southern rock lobster of 46.2 t was below the target catch range and slightly lower than last year's catch of 46.5 t (South Coast Crustacean Figure 2a). However, this target catch range is currently being reviewed as a part of the overall review of the management for this fishery. The catch records are based on monthly statutory (catch and effort) returns.

The deep-sea crab catch was similar to year's catch of 23.8 t, comprising of 1.0 tonne of champagne, 9.9 t of giant, and 12.9 t of crystal crab.

### Recreational

#### **Southern rock lobsters** **<5 tonnes**

Estimates from mail surveys sent to a randomly selected sample of Rock Lobster Recreational Fishing Licence holders (approx. 10%) suggests that the recreational catch of southern rock lobsters on the south coast is less than 5 t per year.

The number of Rock Lobster Recreational Fishing Licence holders that catch southern rock lobster is small and estimating the recreational catch more accurately would require a dedicated survey or at least a different sampling strategy to the current mail survey. The small quantities taken on the south coast, does not significantly affect the overall sustainability of the stock, and therefore a more detailed survey is not a priority.

### Fishing effort/access level

The effort figures are based on monthly statutory catch and effort (CAES) returns. There was a total of 227 599 potlifts recorded for all fishing in the south coast crustacean fisheries, with effort spread relatively evenly across the three eastern zones with 62 513, 75 211 and 57 335 potlifts in Albany, Esperance and the Bight areas respectively. Windy Harbour-Augusta recorded 32 540 potlifts in 2013-14

As effort from CAES does not specify the effort level for particular species, sub-setting of the data is required to determine the effort levels relating to specific catches. Therefore, fishers are assumed to be targeting a particular species if that species represents >90% of the catch in a CAES record. The associated effort for that trip and species is then ascribed 'targeted' effort. Targeted effort for southern rock lobster in south coast crustacean fisheries has declined by 8% this season to 113 918 potlifts, while the standardised total effort increased by 5% to 154 428 potlifts (South Coast Crustacean Figure 2b).

## Stock Assessment

**Assessment complete** **Yes**

**Assessment level and method:** **Level 2 - Catch rate**

**Breeding stock levels** **Adequate**

As part of a recent MSC pre-assessment process, a harvest strategy was developed for a number of species captured in the 'south coast crustacean fisheries'. A standardised catch rate assessment was undertaken and notional target, threshold and limit reference points were developed for the southern rock lobster. Similar measures were also established for the deep sea crabs (crystal, giant and champagne crabs) which are secondary target species for many of the south coast crustacean fishers. The assessments of these secondary target crab species are still being developed and will be presented in future assessments.

The standardised catch rate for southern rock lobsters was near its threshold level in 2013/14, though was still within the target region (South Coast Crustacean Figure 2c). In 2013/14 the standardised catch rate for southern rock lobsters was 0.29 kg/potlift.

*The proposed performance measures for the fishery were established as part of the MSC pre-assessment and were:*

*a) the standardised catch rate of southern rock lobsters is acceptable (above the proposed threshold value with a degree of certainty).*

## Non-Retained Species

**Bycatch species impact** **Low**

The gear used in this fishery generates minimal bycatch and the design of the pots is such that their potential to 'ghost fish' if lost is negligible.

**Listed species interaction** **Negligible**

The pots and ropes used in crab longlines have limited capacity to interact with listed species in this fishing area. In the 2013/14 season there were no reported interactions with fishing gear of south coast crustacean fisheries.

## Ecosystem Effects

**Food chain effects** **Negligible**

The effects of the removal of lobster and deep sea crabs has been assessed for the West Coast Deep Sea Crustacean Fishery and Western Rock Lobster Managed Fishery on the state's west coast. Both of these fisheries have been assessed as having negligible food chain effects by the removal of crabs and lobsters respectively. Therefore, at current catch levels, it is unlikely that removal of lobster and crabs on the south coast are likely to result in food chain effects.

**Habitat effects** **Low**

Potting is considered to have a low impact on the habitat over which the fishery operates.

## Social Effects

This fishery is based on mobile vessels that employ a skipper and two or three crew. The product is landed live at ports between the South Australian / West Australian border and Augusta, generating some additional economic activity and benefits.

## Economic Effects

### Estimated annual value (to fishers) for 2013/14

**Level 2 - \$1 - 5 million (\$3.8 million)**

The beach value of the fishery was about \$3.8 million in 2013/14 with the majority of the catch sold live to Asian markets both locally and internationally.

## Fishery Governance

### Target commercial catch range:

**Southern rock lobsters 50 – 80 tonnes**

**Current fishing (or effort) level Acceptable**

In 2013/14, the south coast catch of 46.2 t was below the target catch range (South Coast Crustacean Figure 2a). This coincided with a reduction in the targeted effort for southern rock lobster, and as such the catch and fishing effort is considered acceptable. However, this target catch and associated effort range is currently being reviewed as a part of the overall review of the management for this fishery.

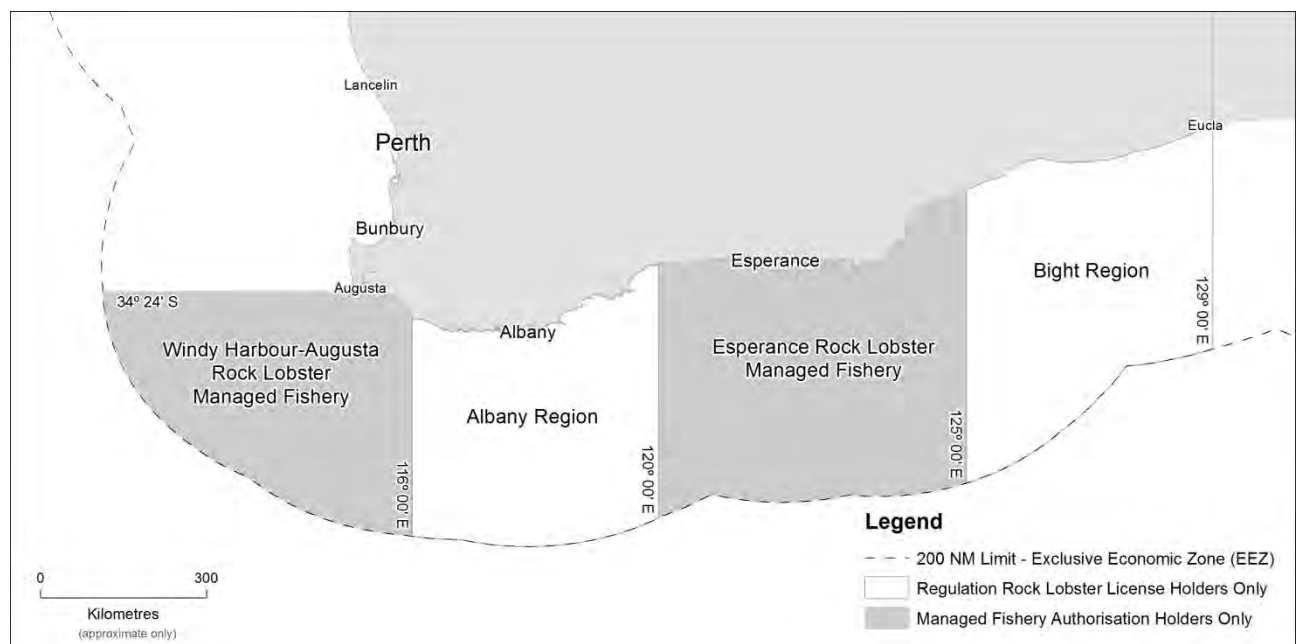
## New management initiatives (2015/16)

In 2013, the (then) Minister for Fisheries approved 'in principle' a suite of management proposals and access and allocation criteria for the proposed South Coast Crustacean Managed Fishery (Fishery). This included approval for a single management plan to be developed to amalgamate the management arrangements for the four existing south coast crustacean fisheries. As such, the *South Coast Crustacean Managed Fishery Management Plan 2015* (the Plan) has been developed and will supersede the two existing management plans, regulation licence and licence condition which currently regulate the four fisheries. The Plan will come into effect on 1 July 2015.

Under the Plan, the Fishery will be managed through limited entry, input controls (including limiting the number of pots that can be used), size limits and seasonal and spatial closures. All current authorisation holders will have access to the new Fishery but access will be limited to the zones in which operators currently hold an authorisation.

## External Factors

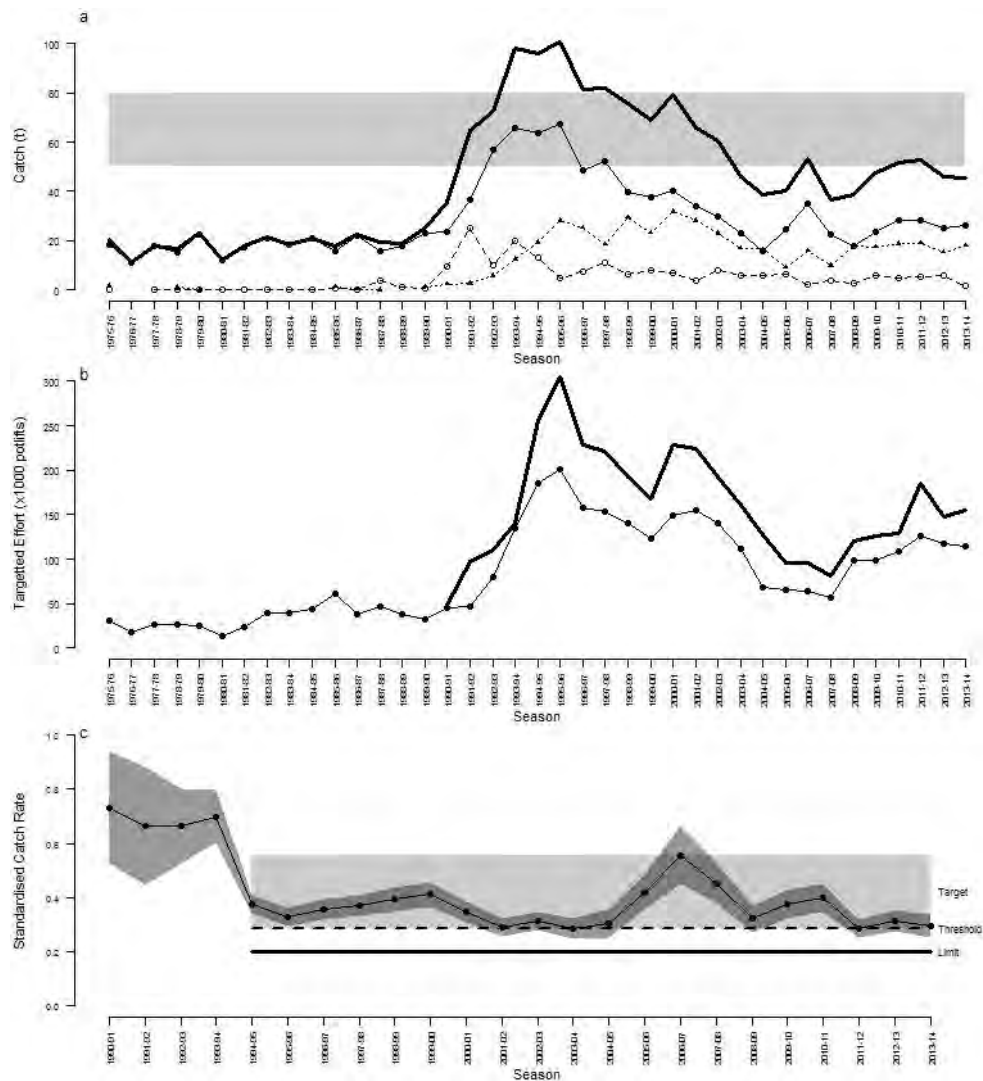
Given a large export market, fluctuation in the Australian dollar can have impacts on the economic performance of the fishery. The southern and western rock lobsters are near the edge of their distributional range and hence could be influenced by environmental conditions.



**SOUTH COAST CRUSTACEAN FIGURE 1**

Management boundaries in the south coast crustacean fisheries.





**SOUTH COAST CRUSTACEAN FIGURE 2**

Southern rock lobster seasonal a) catch for Esperance (line with solid circles), Albany (dashed line and open circles), Bight (solid triangles and dotted line) and all three zones combined (bold line) b) targeted effort (line with solid circles) and standardised total effort (bold line) for all fisheries and c) standardised catch rate for all fisheries with indicative target region (hashed area), threshold and limit reference points.

## Greenlip/Brownlip Abalone Fishery Status Report

A. Hart, F. Fabris and J. O'Malley

Main Features		
Status	Current Landings	
Stock level	Adequate	Commercial
Fishing level	Not Acceptable	Total
		193 t
		Greenlip
		159 t
		Brownlip
		34 t
	Recreational	3-4% of total catch

## Fishery Description

The Western Australian greenlip and brownlip abalone fishery is a dive fishery that operates in the shallow coastal waters off the south-west and south coasts of Western Australia. The fishery targets 2 large species of abalone: greenlip abalone (*Haliotis laevis*), and brownlip abalone (*H. conicopora*), both of which can grow to approximately 200 mm shell length.

Abalone divers operate from small vessels (generally less than 9 metres in length). The principal harvest method is a diver working off 'hookah' (surface supplied breathing apparatus) or SCUBA using an abalone 'iron' to prise the shellfish off rocks – both commercial and recreational divers employ this method.

### Governing legislation/fishing authority

#### Commercial

*Abalone Management Plan 1992*

Abalone Managed Fishery Licence

Commonwealth Government *Environment Protection and Biodiversity Conservation Act 1999* (Export Exemption)

#### Recreational

*Fish Resources Management Act 1994; Fish Resources Management Regulations 1995* and other subsidiary legislation.

Recreational Abalone Fishing Licence

### Consultation process

#### Commercial

The Department undertakes consultation directly with licensees on operational issues. Industry Annual Management Meetings are convened by the West Australian Fishing Industry Council (WAFIC), who are also responsible for statutory management plan consultation under a Service Level Agreement with the Department.

#### Recreational

Consultation processes are now facilitated by Recfishwest under a Service Level Agreement with the Department, although the Department undertakes direct consultation with the community on specific issues.

### Boundaries

#### Commercial

The Abalone Management Plan covers all Western Australian coastal waters, which are divided into eight management areas. Commercial fishing for greenlip/brownlip abalone is managed in three separate areas (Greenlip/Brownlip Abalone Figure 1).

#### Recreational

The recreational abalone fishery regulations relate to three zones: the Northern Zone (from Greenough River mouth to the Northern Territory border), the West Coast Zone (from Busselton Jetty to Greenough River mouth) and the Southern Zone (from Busselton Jetty to the South Australian border). Greenlip and brownlip abalone are only fished in the Southern Zone.

### Management arrangements

#### Commercial

The commercial greenlip/brownlip abalone fishery is part of the overall Abalone Managed Fishery which is managed primarily through output controls in the form of Total Allowable Commercial Catches (TACCs), set annually for each species in each area and allocated to licence holders as Individually Transferable Quotas (ITQs).

The overall TACC for 2014 was 202 t (whole weight). The TACC is administered through 16,100 ITQ units, with a minimum unit holding of 450 units. The licence period runs from 1 April to 31 March the following year.

The legal minimum length for greenlip and brownlip abalone is 140 mm shell length, although the commercial industry fishes to self-imposed size limits of 145 mm, 150 mm and 153 mm in various parts of the main stocks. In 'stunted stocks' areas, greenlip can be fished from 120 mm under special exemptions with such fishing strictly controlled to pre-arranged levels of catch and effort.

#### Recreational

The recreational component of the fishery for greenlip and brownlip abalone is managed under a mix of input and output controls and occurs primarily on the south and south-west coasts. Recreational fishers must purchase an Abalone Recreational Fishing Licence. Licences are not restricted in number, but the recreational fishing season is limited to 7.5 months – from 1 October to 15 May.

The combined daily bag limit for greenlip and brownlip abalone is five per fisher, and the household possession limit (the maximum number that may be stored at a person's permanent place of residence) is 20.

#### General

A comprehensive ESD assessment of this fishery has been undertaken to identify any potential sustainability risks requiring direct management. The only issues identified through this process were the breeding stock levels of greenlip and brownlip abalone. Boxed text in this status report provides the annual assessment of performance for these issues.

### Research summary

Current research is focused on stock assessment using catch and effort statistics, meat weight indices, and length-frequency sampling. Commercial abalone divers are required to provide daily catch information on the weight and number of abalone collected, the hours fished, the date and location of harvest and the name of the person(s) harvesting. The divers also supply a random selection of abalone shells from each fishing day, and these are measured and used to estimate fishing mortality.

An annual standardized catch per unit effort (SCPUE) index was developed that takes into account diver, sub-area and month of fishing as well as technological improvements that aid fishing efficiency. This index forms the basis of the harvest strategy for the quota setting in each area of the fishery.

Current research initiatives include fishery-independent survey data collected from 220 sites across the fishery, and

mark-recapture analysis of growth and mortality in brownlip abalone.

The telephone diary surveys have previously estimated the statewide catch of greenlip and brownlip abalone. For the last survey, in 2007, around 500 licence holders were randomly selected from the licence database. The licence holders were sent a diary to record their fishing activity and were contacted every 3 months by telephone for the duration of the abalone season.

Research on brownlip abalone continued in 2014/15, under the externally funded FRDC project titled “*Demographic Performance of Brownlip Abalone: Exploration of Wild and Cultured Harvest Potential*”. Results from this project will inform industry and management about the development of harvest control rules and sustainable catch levels for this species.

## Retained Species

**Commercial landings (season 2014): 193 tonnes**

In 2014 the greenlip/brownlip catch was 193 tonnes whole weight (Greenlip Brownlip Abalone Table 1), which was 4% lower than the 2013 catch. The Area 1 (Nullarbor fishery) exploratory quota of 1.2 t has not been fished since 2010.

The greenlip catch of 158.9 t whole weight which is 96% of the total quota of 165.3 t, was lower than the preceding three years catch of greenlip due to a quota reduction in the Area 3 commercial management area. The brownlip catch of 33.8 t whole weight for the 2014 season was similar to the preceding two years catch and represents 93% of the quota of 36.2 t (Greenlip Brownlip Abalone Table 1).

**Recreational catch (2004 - 2007): 8 tonnes**

**Recreational catch: 3 – 4% of total catch**

The estimate of recreational catch of greenlip and brownlip abalone, based on the telephone diary survey of recreational licence holders in 2007, was 8 t (range: 0 – 16 t), which is similar to the 2006 estimate of 7 t. Given the catch estimates from 2004, 2006 and 2007, the recreational catch corresponds to approximately 3 – 4% of the total (commercial and recreational) catch (Greenlip Brownlip Abalone Table 2). More recent estimates are available from some sectors (e.g. statewide survey of boat-based licences), however are not considered as comprehensive as the telephone diary estimates.

### Fishing effort/access level

#### Commercial

Total fishing effort on the main stocks in 2014 was 1,578 days. This was similar to 2013 (1,558 days).

#### Recreational

For the 2014 season, 16,315 Abalone Recreational Fishing Licences were issued allowing abalone fishing. This is 2.3% higher than 2013 and similar to the number of licences that have been obtained since the “umbrella” Recreational Fishing Licences, which allowed for the catch of multiple species including abalone, were phased out in 2010 (Greenlip/Brownlip Abalone Figure 2).

Effort estimates for recreational abalone fishing on the west coast (excluding the Perth metropolitan area), from the 2007 telephone diary survey, was 6,300 days (3,800 – 8,800 days), while the estimated effort on the south coast was 4,900 days (1,700 – 8,000 days) (Greenlip Brownlip Abalone Table 2).

## Stock Assessment

**Assessment complete: Yes**

**Assessment level and method: Level 3**

**Standardised catch rates / Fishing mortality**

**Breeding stock levels: Adequate**

A stock assessment of the greenlip/brownlip abalone fishery was undertaken for the 2014 fishing season, based on commercial catch and effort statistics, biological growth studies and fishery-independent surveys.

**Standardised catch per unit effort (SCPUE):** As a result of a review of performance measures<sup>1</sup>, the SCPUE for the greenlip fishery is used as the principal indicator of the abundance of legal-sized abalone and the basis for the control-rule framework. Raw CPUE data (kg whole wt per diver per day) is also presented for comparative purposes.

In 2014, the SCPUE for the combined greenlip stocks was 29 kg whole weight per hour. This was the same as the 2013 value and a decrease from the 2011 and 2012 values of 31 kg per hour (Greenlip Brownlip Abalone Table 1).

The fishing effort in 2014 was 1,578 days (main stocks), which is above the governance range. The range was exceeded due to lowered abundance in both fisheries, operational changes in the fishery such as the use of 2 divers per day on some vessels and new divers with lower catching efficiency which are all incorporated within the calculation of the standardised catch rates (see above). As a consequence of lowered abundance, a 30% and 10% TACC reduction were implemented in the Area 2 and Area 3 fisheries, respectively for the 2015 season as the abundance was lower than the limit and threshold levels, respectively, of the harvest strategy for these areas.

**Fishing mortality (F):** This analysis determines the proportion of the available abalone stock that is being harvested.

Fishing mortality of greenlip abalone in Augusta (West coast) increased from 2012 (no data available for 2013) to 2014 and also increased from 2012 to 2014 (no data available for 2013) for the South Coast of Area 3 (Greenlip Brownlip Abalone Figure 3a). Average F, based on a 2012/2014 was 0.52 (Area 3 Augusta), 0.41 (Area 3 South Coast) and 0.46 (Area 2). Increases in F at Augusta was caused by a combination of lowering of the minimum size of fishing, and a hypothesised slowing of growth due to sub-optimal water temperatures.

Fishing mortality of brownlip abalone in Area 3 increased for 2014 following a stable period between 2011 and 2012, (no data available for 2013). Fishing mortality of brownlip abalone in Area 2 also increased for 2014 from 2011 but no data was available for 2012 and 2013 (Greenlip Brownlip

<sup>1</sup> Hart, A., Fabris, F., Caputi, N. (2009). Performance indicators, biological reference points and decision rules for Western Australian abalone fisheries (*Haliotis* sp.): (1) Standardised catch per unit effort. Fisheries Research Report No. 185. Department of Fisheries, Western Australia. 32 pp.

Abalone Figure 3b). Average F, based on (2012/2014) was 0.35 (Area 3) and 0.37 (Area 2).

**Breeding stock:** Greenlip abalone mature between 80 and 110 mm shell length, and brownlip abalone mature between 90 and 130 mm shell length. These are both below the legal minimum size limit set across the fishery (140 mm shell length) with individual abalone expected to have spawned at least twice before reaching legal size.

Industry-imposed length limits, that are larger than the minimum legal limits, have been set in areas of fast-growing stocks. In Area 2, there is a general 145 mm minimum length across the fishing grounds. In Area 3, fishers have imposed a minimum size limit of 153 mm shell length for the faster-growing portions of the fishing grounds, 150 mm for the average growing portions and 140 mm for the slower growing portions of the fishing grounds.

In 2014, the average sizes of greenlip and brownlip caught were 175 g and 236 g respectively which are both well above the minimum breeding sizes of 140 g for greenlip and 160 g for brownlip.

For brownlip, the assessment showed that the TACC was being caught at a lower average meat weight i.e. declined from 282 g in 2006 to 243 g in 2011. The TACC was therefore reduced to 36.2 t in 2012 (Greenlip Brownlip Abalone Table 1) and the brownlip average meat weight has stabilised at 238 g and 236 g in 2013 and 2014 respectively.

*The main performance measures for the fishery relate to the maintenance of adequate breeding stocks in each area of the fishery. This is assessed using a combination of measures that reflect the average size of breeding individuals and the overall biomass of breeding stock.*

In 2014, the average sizes of greenlip and brownlip caught were 175 g and 236 g respectively. These were well above the minimum breeding sizes of 140 g for greenlip and 160 g for brownlip. The effort (days fished) required to take the quota (1,578 days) was above the set range that indicates sufficient biomass of breeding stock for the fishery overall (907 – 1,339 days – see ‘Fishery Governance’ section).

## Non-Retained Species

**Bycatch species impact:** **Negligible**

Divers have the ability to target abalone of choice (species, sizes and quality of abalone) and do not inadvertently harvest bycatch in their normal fishing activities.

**Listed species interaction:** **Negligible**

The only listed species interaction occurring in this fishery is with the white shark (*Carcharodon carcharias*), which has been known to attack divers. Most divers now use diving cages or electronic shark deterrent devices for their personal protection. Divers are now recording their encounters with white sharks and these will be documented in future reports.

## Ecosystem Effects

**Food chain effects:** **Negligible**

Commercial abalone diving occurs over a small proportion of the total abalone habitat of the Western Australian coastline. In view of the relatively low exploitation rates and consequent maintenance of a high proportion of the natural biomass of abalone, it is considered unlikely that the fishery has any significant effect on the food chain in the region. As abalone are drift algae feeders, their removal is considered to result in little change in algal growth cover and therefore the ecosystems within the areas fished.

**Habitat effects:** **Negligible**

The fishing activity makes minimal contact with the habitat, which typically consists of hard rock surfaces in a high wave-energy environment.

## Social Effects

There are 14 vessels operating in the greenlip/brownlip commercial fishery, employing approximately 35 divers and deckhands. The dispersed nature of the greenlip and brownlip abalone fishery means that small coastal towns from Busselton to the South Australian border receive income from the activity of divers.

Recreational diving for greenlip and brownlip abalone is a small but active sector, with dive shops and vessel manufacturers’ benefiting from this activity. The recreational fishery provides a major social benefit to those community members that appreciate abalone as a delicacy. There were 16,315 licences issued that would have allowed fishers to participate in the recreational abalone fishery, although most of these would have targeted the Roe’s abalone fishery in the Perth metropolitan area.

## Economic Effects

**Estimated annual value (to fishers) for 2014:**

**Level 3 - \$5 - 10 million (\$7.2 million)**

The estimated average price received by commercial fishers was \$101/kg meat weight (\$38/kg whole weight) for greenlip and \$83/kg meat weight (\$33/kg whole weight) for brownlip abalone, resulting in a fishery valued at \$7.2 million, similar to \$7.8 million in 2013.

Greenlip prices in 2014 were similar to prices in 2013 (\$105/kg) and are still considerably lower compared to 10 years ago e.g. \$126/kg meat weight in 2004.

## Fishery Governance

**Target effort range (days):** **907 – 1,339 days**

**Current effort level:** **Not Acceptable**

To assess whether the catch quota set is appropriate (sustainable) relative to the stock available, the effort required to take a full season’s quota (202 t in 2014) from the main stocks should fall within the effort range (907 – 1,339

diver days) derived from the 5-year period 1994 – 1998. This range reflects the acceptable variation in catch rates for the main stocks due to weather and natural recruitment cycles.

The fishing effort in 2014 was 1,578 days (main stocks), which is above the governance range. Based on the harvest strategy, a 30% and 10% TACC reduction were implemented in the Area 2 and Area 3 fisheries, respectively for the 2015 season. This change should reduce fishing effort to within the acceptable range and return effort to “acceptable” levels.

### New management initiatives (2014/15)

Consultation also took place with industry on relatively minor operational changes to the Abalone Management Plan 1992. These matters are currently being progressed. The fishery is also planning to apply for Marine Stewardship Council (MSC) accreditation.

## External Factors

In the last few years there have been a number of changes which impact on fishery governance, and particularly on catch rates. Lease divers are more common and industry size limits have been varied substantially above the legal minimum sizes. The value of the abalone fishery is still at historical low levels however this may change with recent decreases in the relative value of the Australian dollar.

In addition, environmental effects, such as weather conditions, and the effect of technology changes, continue to have significant effects on diver efficiency. Greenlip and Brownlip abalone were rated as moderate-high risk to the effects of climate change on these stocks.

### GREENLIP/BROWNLIP ABALONE TABLE 1

Greenlip and brownlip abalone catch and effort<sup>1</sup> by quota period since 2001.

Quota period	Greenlip TAC kg whole weight	Greenlip caught kg whole weight (all stocks)	Brownlip TAC kg whole weight	Brownlip caught kg whole weight <sup>3</sup>	Combined catch kg whole weight	Diver days (main stocks only) <sup>2</sup>	Greenlip Raw CPUE kg whole (meat) <sup>3</sup> wt per diver day)	Greenlip standardised CPUE (kg whole weight) per diver hour
2001	194,691	187,459	33,075	31,091	218,550	1,002	165 (62)	35
2002	194,691	166,828	33,075	27,458	194,286	1,027	134 (50)	32
2003	202,521	180,730	37,453	33,449	214,179	1,144 <sup>2</sup>	136 (51)	32
2004	190,520	170,385	35,000	34,196	204,581	1,154 <sup>2</sup>	129 (48)	32
2005	171,755	169,285	38,500	38,745	208,030	1,252	131 (49)	28
2006	171,755	168,752	39,750	37,265	206,017	1,161	133 (50)	28
2007	171,755	166,647	39,750	38,660	205,307	1,139	137 (51)	30
2008	163,220	157,224	41,900	39,515	196,739	1,144	135 (51)	30
2009	171,221	160,156	41,900	39,050	199,206	1,205	133 (50)	29
2010	171,221	165,558	41,900	39,006	204,564	1,196	138 (52)	34
2011	173,355	165,927	39,950	36,274	202,201	1,224	136 (51)	31
2012	173,355	167,562	36,150	34,187	201,749	1,438	116 (44)	31
2013	173,355	166,315	36,150	35,616	201,931	1,558	107 (40)	29
2014	165,354	158,889	36,150	33,808	192,697	1,578	101 (38)	29

1. Data source: quota returns.

2. Effort (diver days): main stocks are separated from stunted stocks,

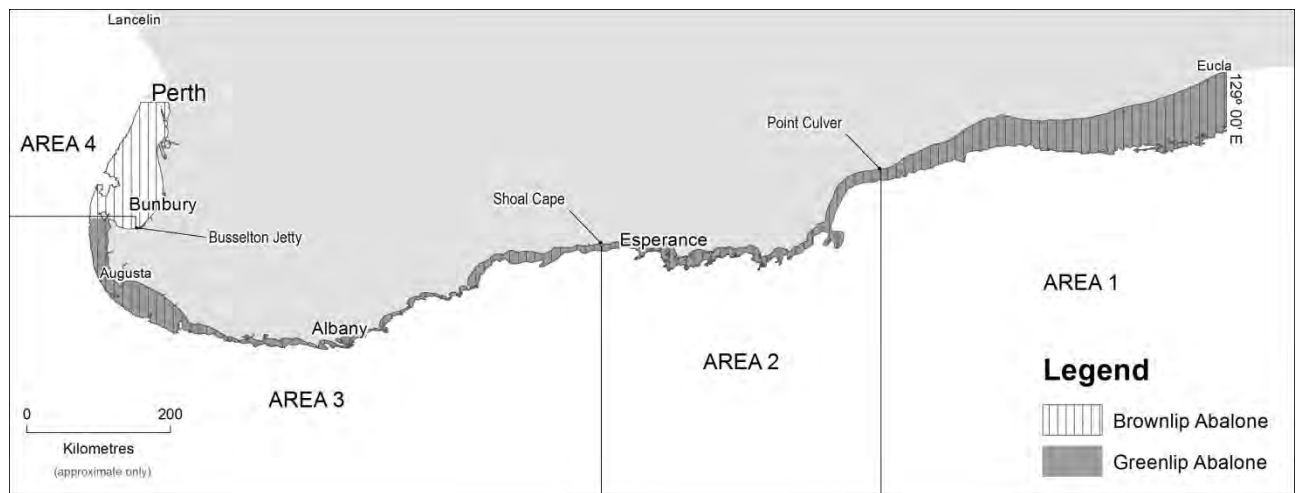
3. The conversion factor for meat weight to whole weight for Greenlip is 2.667 and Brownlip is 2.5.

**GREENLIP/BROWNLIP ABALONE TABLE 2**

Summary of telephone diary surveys of recreational effort (fisher days), catch rate (abalone per fisher day) and catch (tonnes whole weight) for the greenlip and brownlip abalone fisheries in 2004, 2006, and 2007.

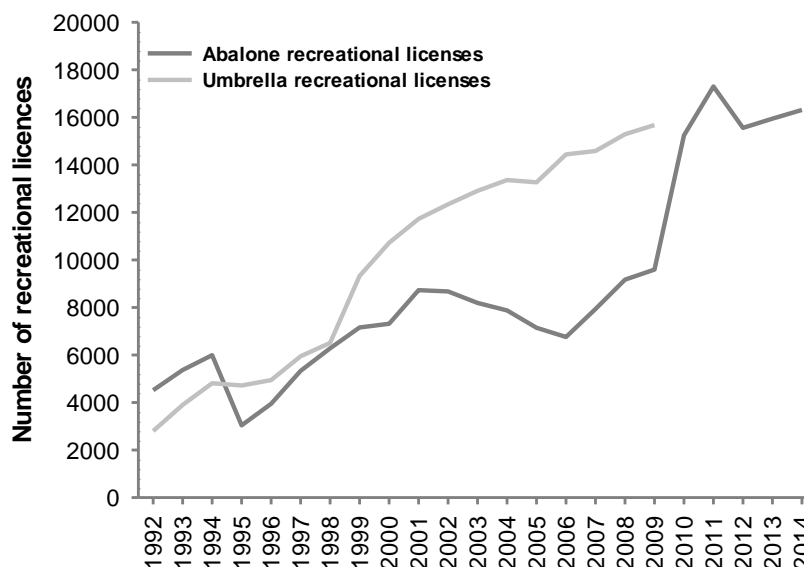
Location	Year	Effort	Greenlip		Brownlip	
			Catch Rate	Catch (tonnes)	Catch Rate	Catch (tonnes)
West Coast	2004	10,100 (6,500 – 13,600)	0.6	4 (2–6)	0.4	3 (1–5)
	2006	8,000 (4,700 – 11,300)	0.3	2 (0–3)	0.4	3 (0–5)
	2007	6,300 (3,800 – 8,800)	0.7	3 (0–6)	0.1	<1 (0–1)
South Coast <sup>1</sup>	2004	2,700 (1,700 – 3,700)	2.4	2 (1–5)	<0.1	<1 (0–1)
	2006	2,800 (1,600 – 3,900)	1.6	2 (0–4)	0.5	1 (0–2)
	2007	4,900 (1,700 – 8,000)	1.8	4 (0–8)	0.2	<1 (0–1)

1. Survey area is South Coast Bioregion (i.e. east of Black Point).



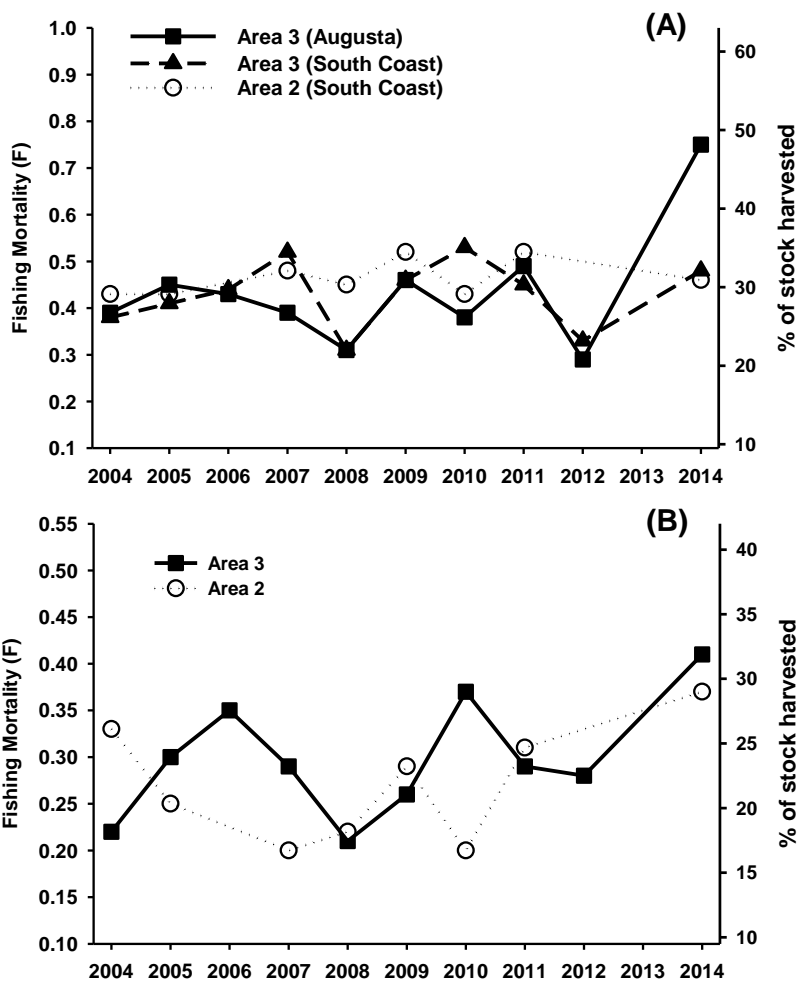
**GREENLIP/BROWNLIP ABALONE FIGURE 1**

Maps showing the distribution of (a) greenlip and (b) brownlip abalone in Western Australia, and (c) the management areas used to set quotas for the commercial fishery. Area 4 currently has no quota allocated.



**GREENLIP/BROWNLIP ABALONE FIGURE 2**

The number of licences issued in the recreational abalone fishery, by licence type, for the period since 1992. Data are licence counts at the end of the Perth metro abalone season (mid-December). Note umbrella licences were discontinued in 2010.



**GREENLIP/BROWNLIP ABALONE FIGURE 3**

Fishing mortality for greenlip (A) and brownlip (B) abalone. Estimates of fishing mortality (F) apply only to harvest-size animals, and are derived from catch-curve analysis using length-frequency data, and annualised growth increments based on following growth models. Augusta Greenlip:  $L_{\infty}=185$  mm,  $K = 0.30$ ; South Coast Greenlip:  $L_{\infty}=179$  mm,  $K = 0.30$ ; Brownlip:  $L_{\infty}=198$  mm,  $K = 0.32$ . Natural mortality (M) is assumed to be 0.25.

# South Coast Nearshore and Estuarine Finfish Resources Status Report

K. Smith, A. Quinn and E. Smith

Main Features			
Status		Current Landings (2014)	
Stock levels:		Commercial total	588 t (finfish only)
Australian herring	Inadequate	South Coast Salmon Fishery	300 t (salmon only)
Western Australian salmon	Adequate	South Coast herring trap net fishery	82 t (herring only)
Black bream (Stokes Inlet)	Adequate	South Coast Estuarine Fishery	190 t (finfish only)
Black bream (Beaufort Inlet)	Adequate	Other commercial	16 t (finfish only)
Black bream (Wilson Inlet)	Adequate	Recreational total	(not available for current year)
Black bream (Oyster Harbour)	Adequate	Most recent survey 2000/01	368 t (key species only)
Black bream (Walpole-Nornalup Inlet)	Not assessed	Recreational estuarine	(not available for current year)
Cobbler (Wilson Inlet)	Adequate	Most recent survey 2002/03	50 t (key species only)
Cobbler (Oyster Harbour)	Adequate	Recreational boat-based	
Fishing Level:		Most recent survey 2013/14	290 t (nearshore species only)
Australian herring	Unacceptable		
Other stocks	Acceptable		

## Fishery Description

### Commercial - Nearshore

Beach-based commercial fishers in nearshore waters of the South Coast Bioregion (SCB) catch various finfish species, mainly using beach seine nets, haul nets, gill nets and trap nets (Australian herring only). The main target species are western Australian salmon (*Arripis truttaceus*) and Australian herring (*Arripis georgianus*), with small quantities of southern garfish (*Hyporhamphus melanochir*) and sea mullet (*Mugil cephalus*) also taken.

Western Australian salmon and Australian herring both form large schools, particularly during their autumn pre-spawning seasons, that migrate along the coast in nearshore waters between South Australia and Kalbarri (WA). The main commercial fisheries for these species target pre-spawning schools as they migrate along south-western beaches in autumn. In WA, salmon is targeted exclusively by two commercial fisheries – the South Coast Salmon Managed Fishery (located in the SCB) and the South-West Coast Salmon Managed Fishery (located in the West Coast Bioregion (WCB)). In these fisheries, salmon are captured by teams of fishers who set beach seine nets from the shore using either row boats or small jet-powered boats. Historically, most of the commercial catch of Australian herring in WA has been taken on beaches in the SCB using herring trap nets (also known as ‘G’ trap nets) which are set

from the shore. The remainder of commercial herring catches are taken by various small nearshore and estuarine fisheries in the South Coast and West Coast Bioregions using beach seine nets, gill nets and haul nets.

### Commercial - Estuarine

Approximately 25 major estuaries exist in the SCB, extending from Black Point in the west, to the WA/SA border to the east. Thirteen estuaries are conditionally open to commercial fishing as part of the South Coast Estuarine Managed Fishery (SCEMF). This is a multi-species fishery targeting many estuarine finfish species, with the main fishing methods being gill net and seine (haul) net. The main target species are cobbler (*Cnidoglanis macrocephalus*), black bream (*Acanthopagrus butcheri*), sea mullet and Australian herring.

### Recreational

Most finfish caught recreationally in SCB estuaries and nearshore waters are taken by line fishing. Shore and boat-based fishing are both popular. The most commonly captured recreational species include Australian herring, various species of whiting (Family: Sillaginidae), trevally (*Pseudocaranx* spp.), black bream (estuaries only), western Australian salmon and southern garfish.



## SOUTH COAST BIOREGION

A relatively small amount of recreational net fishing occurs in the SCB, mainly targeting sea mullet.

### Governing legislation/fishing authority

#### Commercial

*South Coast Estuarine Fishery Management Plan 2005*

South Coast Estuarine Managed Fishery Licence

*Fisheries Notice No. 478 of 1991* (Herring 'G' nets)

Fishing Boat Licence Condition 42 (Herring 'G' nets)

*South Coast Salmon Fishery Management Plan 1982*

South Coast Salmon Managed Fishery Licence

*Proclaimed Fishing Zone Notice (South Coast) 1975*

*Salmon Block Net Prohibition Notice 1996*

*Salmon and Snapper Purse Seining Prohibition Notice 1987*

Commonwealth Government *Environment Protection and Biodiversity Conservation Act 1999* (Export Exemption for salmon fisheries)

#### Recreational

*Fish Resources Management Act 1994*; *Fish Resources Management Regulations 1995* and other subsidiary legislation

Recreational Net Fishing Licence

Recreational Fishing from Boat Licence

### Consultation processes

#### Commercial

The Department undertakes consultation directly with licensees on operational issues. Industry Annual Management Meetings are convened by the West Australian Fishing Industry Council (WAFIC), who are also responsible for statutory management plan consultation under a Service Level Agreement with the Department.

#### Recreational

Consultation processes are now facilitated by Recfishwest under a Service Level Agreement with the Department, although the Department undertakes direct consultation with the community on specific issues.

### Boundaries

#### Commercial - Nearshore

In the SCB, Australian herring can be taken commercially by holders of an unrestricted Fishing Boat Licence (FBL). However, the use of trap nets is restricted to holders of FBLs with Condition 42, who can only operate at 10 specific beaches along the south coast. As of 1 March 2015, fishing by means of a herring trap net is prohibited. This prohibition was introduced in response to research indicating a unacceptably high risk to the sustainability of the Australian herring stock.

The South Coast Salmon Managed Fishery covers WA waters from Cape Beaufort (Black Point) to the WA/SA border.

#### Commercial - Estuarine

The SCEMF encompasses the waters of all estuaries on the south coast of Western Australia between Cape Beaufort and 129° east longitude, including Princess Royal Harbour and Oyster Harbour, and all the rivers, streams and all the tributaries that flow into those estuaries. The areas that are open to commercial fishing are (from west-to-east) Broke Inlet, Irwin Inlet, Wilson Inlet, Princess Royal Harbour, Oyster Harbour, Waychinicup Inlet, Beaufort Inlet, Gordon Inlet, Hamersley Inlet, Culham Inlet, Jerdacuttup Lakes, Oldfield Inlet and Stokes Inlet.

#### Recreational

Recreational line fishing is permitted in most areas within estuaries and nearshore waters of the SCB. Some spatial closures exist, including closures around dive wrecks.

A limited number of areas within certain estuaries and nearshore waters of the SCB are open to recreational netting. Recreational net fishers must hold a licence. Recreational set nets are prohibited in all ocean waters of the South Coast at all times. Recreational net fishing regulations are complex – refer to the 'Recreational Net Fishing Guide' for details.

### Management arrangements

#### Commercial

The South Coast nearshore and estuarine commercial fisheries are managed primarily through input controls in the form of limited entry and gear restrictions, as well as seasonal and time closures, area closures and size limits.

The *South Coast Salmon Fishery Management Plan 1982* provides for licence holders to operate from assigned beaches between Shoal Cape and Cape Beaufort, with each fishing team having access to a single nominated beach only.

The *Prohibition on Herring Trap Nets Order 2015* prohibits the take of herring by means of a herring trap net. However, Australian herring may still be commercially caught by beach seine, set net and line methods by any licensed commercial fisher holding an unrestricted FBL, provided the use of this method is permitted in the particular area and the waters being fished are not subject to other fishery management arrangements.

#### Recreational

Recreational fishers in SCB estuaries and nearshore waters take a diverse array of finfish species. Size and possession limits apply to these species. A Recreational Fishing from Boat Licence is required to undertake any general fishing activity (including crabbing) conducted with the use of a powered boat anywhere in the State.

As many of the recreationally targeted species are also targeted by the commercial sector, resource-sharing issues are a consideration in these fisheries.

#### Indicator species

The Department of Fisheries has selected indicator species for monitoring and assessing the status of the finfish resources in the SCB<sup>1</sup>. Western Australian salmon, black bream and cobbler are indicators for this Bioregion's nearshore and estuarine finfish suites. Australian herring and

<sup>1</sup> Department of Fisheries (DoF). 2011. Resource Assessment Framework (RAF) for Finfish Resources in Western Australia. Fisheries Occasional Publication No. 85. Department of Fisheries, Perth.

sea mullet are also significant components of fishery landings in this Bioregion (see *West Coast Nearshore and Estuarine Finfish Resources Status Report* for the status of these stocks).

### Research summary

The status of the fish resources in nearshore and estuarine waters of the SCB is assessed by monitoring the status of indicator species. Level 2 assessments of indicators are based on trends in commercial catch and effort obtained from compulsory monthly fisher returns, trends in recreational catch and effort obtained from voluntary fisher logbooks (the 'Research Angler Program') and recreational fishing surveys, and trends in juvenile recruitment obtained from fishery-independent surveys. Level 3 assessments of indicators include all of the above information plus information about rates of fishing mortality (F) estimated from the age composition of the stock. Fish frames collected from commercial and recreational fishers are generally used to determine age structure. When available, archived biological samples are used to estimate historical F levels to provide information on trends in fishing mortality.

All indicators are currently assessed at Level 2. Recent monitoring of the age structure of fishery landings has been undertaken for cobbler (Wilson Inlet only) and western Australian salmon. In future, this information will be used to develop Level 3 assessments for these stocks.

## Retained Species

### Total commercial finfish landings (2014):

**398 tonnes in nearshore waters**

**190 tonnes in estuarine waters**

### Commercial landings by fishery (2014):

**South Coast Salmon 300 tonnes (salmon only)**

**Herring trap net 82 tonnes (herring only)**

**South Coast Estuarine 190 tonnes (finfish only)**

Commercial finfish catches (South Coast Nearshore and Estuarine Table 1) are taken by estuarine fisheries and beach-based nearshore fisheries using gill nets, haul nets and beach seines.

In 2014, the total commercial catch of finfish by estuarine and beach-based fisheries in the SCB was 588 t and included approximately 47 species. The majority of the catch consisted of western Australian salmon (52% by weight), Australian herring (18%), cobbler (10%) and black bream (5%).

In nearshore waters, the finfish catch in 2014 was comprised predominantly of western Australian salmon (75% by weight) and Australian herring (22%). The estuarine finfish catch was comprised mainly of cobbler (30%), black bream (16%), sea mullet (14%) and Australian herring (9%).

Since 2000, landings by the South Coast Estuarine Managed Fishery have been predominantly finfish, which typically comprise 92-98% of the annual catch (by weight). The non-fish component is dominated by blue swimmer crabs (*Portunus armatus*). Annual crab landings are normally relatively low (<10 t) in this fishery but peaked at 39 t in both

2001 and 2014, and were also relatively high (32 t) in 2013. These peaks in catch appear to be the result of two periods of strong crab recruitment along the south coast. Both occurred during years when the Leeuwin Current flowed strongly and transported crab larvae from the west coast to the south coast. Record high water temperatures along the south coast since 2011 have also created favourable conditions for crabs to survive once recruited. Crabs are mainly taken by gill nets in this fishery.

### Key finfish species - nearshore

**Australian herring:** see West Coast Nearshore and Estuarine Finfish Resources report.

**Western Australian salmon:** This species comprises a single stock in southern Australian waters. It is targeted commercially in Western Australia and South Australia (SA). Since 2000, 68% of total commercial landings of western Australian salmon in WA have been taken in the SCB, with the remaining 32% taken in the WCB.

Annual commercial landings of western Australian salmon in WA have been highly variable since the commercial fishery commenced in 1944. Peaks in total annual landings occurred in 1968 (4,223 t), 1984 (3,543 t) and 1995 (4,046 t) (South Coast Nearshore and Estuarine Figure 1). Total landings have been declining since 1995, with the decline becoming more pronounced after 2005. In 2012, a total catch of 122 t was reported, which is the lowest since the commencement of commercial fishing in the 1940s. In 2014, the total catch was 364 t. The declining trend since 1995 is mainly driven by the trend in the SCB, where the annual catch steadily declined from a peak of 2,728 t in 1995 to an historical low of 75 t in 2012. In 2014, the South Coast catch was 303 t. In the WCB, landings of salmon have ranged from 0 to 1,364 t per year since the commencement of the fishery (South Coast Nearshore and Estuarine Figure 1). In 2014, the West Coast catch was 60 t.

In WA, the historically low catch levels in recent years are believed to be due to a combination of factors – lack of targeting in response to low market demand, reduced availability of fish in some years due to low recruitment and environmental factors affecting catchability.

Commercial fishery landings of western Australian salmon in SA have also declined, following a similar trend to WA landings. From 1983/84 to 2002/3, total SA landings were relatively stable at around 400-600 t per year. In the mid 2000s, landings declined sharply, and have subsequently been <200 t per year<sup>1</sup>. A total catch of 61 t was recorded in 2013/14. Trends in SA landings have been attributed<sup>1</sup> to variations in the level of targeted effort but may also partly reflect variations in the supply of recruits to SA from the spawning area in WA.

### Key finfish species - estuarine

**Cobbler:** Since 2000, 95% of commercial landings of cobbler in WA have been caught in estuaries of the SCB, with most of the remaining 5% taken in estuaries of the WCB. Over this period, 78% of cobbler landings in the SCB were in Wilson Inlet, 11% in Irwin Inlet, 8% in Oyster Harbour and

<sup>1</sup> Fowler, A.J., McGarvey, R., Steer, M.A. & Feenstra, J.E. (2014). The South Australian Marine Scalefish Fishery Status Report - Analysis of Fishery Statistics for 2013/14. Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2007/000565-9. SARDI Research Report Series No. 816. 44 pp.

3% in Princess Royal Harbour. Total annual landings in the SCB ranged from 40 t (in 2004) to 95 t (in 2003).

In 2014, 57 t of cobbler was caught in South Coast estuaries. The majority (59%) of this catch was taken in Wilson Inlet. In Wilson Inlet, annual cobbler landings steadily increased after the 1940s (minimal catch at this time) until the mid 1980s. Since 1985, annual landings have varied substantially but the overall trend has been stable. Annual landings reached an historical peak of 79 t in 1985 and again in 2003. Fluctuations in landings are believed to mainly reflect variations in the availability of cobbler due to variations in recruitment.

**Black bream:** In 2014, 98% of commercial landings of black bream in WA were caught in the SCB, with the remaining 2% from the WCB. In the SCB, landings were mainly taken in Beaufort Inlet (49% of landings), Wilson Inlet (17%), Oyster Harbour (14%) and Stokes Inlet (6%). Minor black bream landings were reported in 7 other estuaries.

Since 2000, total landings of black bream in South Coast estuaries have ranged from 30 t (in 2000) to 65 t (in 2010). In 2014, a total of 31 t of black bream was landed.

Historically, Stokes Inlet has contributed the greatest proportion of black bream landings of any single South Coast estuary. From 1980 to 2014, annual landings in Stokes Inlet exhibited a stable (non-directional) trend and averaged 11 t per year (range 1-37 t).

Since 2005, Beaufort Inlet has surpassed Stokes Inlet as the main producer of black bream along the south coast. Minimal landings of black bream were taken in Beaufort Inlet prior to 1993. From the late 1990s to 2005, landings gradually increased and have remained relatively high in subsequent years. Since 2005, annual landings have ranged from 10 to 26 t.

Annual landings of black bream in Wilson Inlet and Oyster Harbour also followed an increasing trend after the late 1990s. Wilson Inlet landings peaked at 18 t in 2005 and Oyster Harbour landings peaked at 12 t in 2008. The catches in these estuaries then declined gradually, reaching 5 t and 4 t, respectively, in 2014. These catch trends appear to be the result of a strong pulse of recruitment by black bream in each estuary in the mid-1990s.

**Recreational catch estimate (2013):** NA

**Nearshore + estuarine catch (most recent estimate 2000/01): 368 tonnes (key species only)**

**Estuarine catch only (most recent estimate 2002/03): 50 tonnes (key species only)**

**Boat-based nearshore + estuarine catch (most recent estimate 2013/14): 315 tonnes (nearshore species only)**

Recreational catch levels of finfish in nearshore and estuarine waters of the SCB were not estimated in 2013. The most recent nearshore estimates are from the National Recreational and Indigenous Fishing Survey conducted in 2000/01 (Henry and Lyle 2003<sup>1</sup>). The most recent estuarine estimates are

1 Henry, G.W. & Lyle, J.M. (2003). The National Recreational and Indigenous Fishing Survey. FRDC Project No. 99/158. NSW Fisheries Final Report Series No. 48.

from a creel survey in 2002/03 (Smallwood and Sumner 2007)<sup>2</sup>. While the dominant species in the current catch are probably similar to those caught in these surveys, the catch and effort levels by recreational fishers may have changed substantially. Therefore, the current total catch level cannot be estimated.

In 2000/01, the most abundant species retained in nearshore waters in the SCB were Australian herring (52% by number), skipjack trevally (*Pseudocaranx georgianus*) (11%), King George whiting (*Sillaginodes punctata*) (10%), whiting (various species, excluding King George) (9%) and western Australian salmon (3%). In estuarine waters, the most abundant species in the retained catch in 2000/01 were black bream (39% by number), King George whiting (23%), Australian herring (11%), mullet (Mugilidae) (6%) and skipjack trevally (4%). In 2000/01, shore-based fishers caught 73% of retained fish in nearshore waters and 28% in estuaries.

The 2002/03 survey involved 17 estuaries, including 11 of the 13 estuaries open to commercial fishing (no commercial catches were taken in the remaining 2 estuaries during the study period). The most commonly reported species were King George whiting, black bream, Australian herring, skipjack trevally, pink snapper (*Pagrus auratus*), flathead (Platycephalidae), tarwhine (*Rhabdosargus sarba*) and garfish, comprising approximately 80% of all fish (by number) retained by recreational fishers during the survey.

In the commercially-fished estuaries, the recreational catch of these 8 species was estimated to be approximately 29% (by weight) of the combined commercial and recreational catch of these species during the survey period. A total of 48 species were reported in the recreational catch from south coast estuaries. However, the total recreational catch (by weight) of all species could not be estimated in 2002/03 due to uncertainties associated with small samples of less abundant species and limited data on the average size of fish in the catch.

With the inclusion of less abundant species and catches taken in estuaries closed to commercial fishing, the recreational catch share of recreationally-targeted finfish species in SCB estuaries was estimated to be 30-40% in 2002/03. If the landings of non-recreational species (cobbler, sea mullet and yellow-eye mullet) are also included, the recreational catch share of total finfish landings was estimated to be approximately 20%.

In 2002/03, the highest recreational fishing catch and effort of any south coast estuary was reported from the Walpole/Nornalup Inlet, which is closed to commercial fishing. The main species taken in this estuary was black bream, with an estimated recreational catch of 15 t during the survey period.

State-wide surveys of boat-based recreational fishing were conducted in 2011/12 and 2013/14<sup>3,4</sup>. During these surveys,

2 Smallwood, C.B. & Sumner, N.R. (2007). A 12-month survey of recreational estuarine fishing in the West of Western Australia during 2002/03. Fisheries Research Report No. 159. Department of Fisheries, Western Australia. 56pp.

3 Ryan K.L., Wise B.S., Hall N.G., Pollock K.H., Sulis E.H. & Gaughan D.J. (2013). An integrated system to survey boat-based recreational fishing in Western Australia 2011/12. Fisheries Research Report No. 249, Department of Fisheries, Western Australia. 162 pp.

4 Ryan, K.L., Hall, N.G., Lai, E.K., Smallwood, C.B., Taylor, S.M., Wise, B.S. 2015. State-wide survey of boat-based recreational fishing in Western Australia 2013/14. Fisheries Research Report No. 268, Department of Fisheries, Western Australia.

nearshore and estuarine species (including whiting species, Australian herring, black bream, silver trevally, southern garfish and western Australian salmon) comprised around 75% of all finfish retained by boat-based fishers in the SCB (South Coast Nearshore and Estuarine Table 2). State-wide surveys are scheduled to be repeated at regular intervals in future. It is important to note that these surveys provide information on catches from boat-based recreational fishers only. Catches from shore-based fishers, who take the majority of nearshore species, are not estimated. Thus estimates from these state-wide surveys underestimate the total recreational catches of nearshore and estuarine species.

The weight of nearshore and estuarine finfish retained by boat-based recreational fishers in the WCB in 2013/14 was estimated to be approximately 315 tonnes<sup>1</sup>.

#### Recreational catch share

The recreational catch share of total finfish landings in nearshore and estuarine waters of the SCB cannot be determined for the current year.

#### Fishing effort/access level

##### Commercial

Since 1990, the number of licences in nearshore and estuarine commercial fisheries has been substantially reduced via a Voluntary Fishery Adjustment Scheme (VFAS) (i.e. licence buy-backs). The removal of licences has eliminated a significant amount of latent effort (inactive licences) that previously existed in these fisheries.

Fishing effort in nearshore and estuarine fisheries is usually calculated as 'method days' i.e. the number of days fished by each method. Fishing effort is sometimes reported as the number of units of access (vessels, licensees, teams, etc). This measure is sometimes the only type of effort data available throughout the history of the fishery and provides a general indication of effort changes over time. The commercial method of fishing for western Australian salmon and Australian herring (i.e. beach-based netting) includes a considerable amount of time spent observing or searching for fish ('spotting'). Hence effort in these fisheries is difficult to accurately quantify. The number of licensed teams that operate during each fishing season provides an approximate measure of effort in these fisheries.

**South Coast Estuarine Fishery:** Total effort in this fishery was reduced by a VFAS, which reduced the number of licensees from 66 in 1987 to 25 in 2002. The total annual effort peaked at 7,928 method days (all methods) in 1992 and then steadily declined until about 2004. Similarly, the average number of boats fishing per month peaked at 42.9 in 1992 and then declined. Since 2004 effort has been stable at around 3,500-4,000 method days per year. The majority of effort is spent gill netting, haul netting and seine netting. In 2014, the fishery reported a total of 4,090 method days and an average of 18.6 boats fished per month.

In 2014, 45% of effort (method days) occurred in Wilson Inlet, 23% in Oyster Harbour, 15% in Princess Royal Harbour, 8% in Irwin Inlet and 5% in Beaufort Inlet. The remaining effort occurred in Broke Inlet, Stokes Inlet, Culham Inlet, Oldfield River and Jerdacuttup Lakes. Three

estuaries (Gordon Inlet, Dempster Inlet and Waychinicup Inlet) were not fished during 2014.

**Herring trap net fishery:** The total number of licensed teams reached a peak of 30 in 1984, and has since been reduced by a VFAS to the current level of 11 (operating from 10 beaches). In 2014, only 3 teams recorded effort during the season. This is a continuation of the low participation level in this fishery in recent times. Commercial fishers report that these historically low effort levels are in response to the lack of markets and low wholesale prices paid for Australian herring.

**South Coast Salmon Fishery:** Since 1999, there have been 18 licensed teams in this fishery. Some teams are inactive each year. Effort (number of active teams) has followed a declining trend since 2002. In 2014, western Australian salmon landings were reported by 8 of the 18 licensed teams.

##### Recreational

Current estimates of total recreational effort expended on targeting nearshore or estuarine finfish in the SCB are unavailable.

The 2000/01 National Recreational and Indigenous Fishing Survey, which included all methods and Bioregions, provided the most recent information on total recreational fishing effort in the SCB<sup>2</sup>. About 90% of the nearshore and estuarine 'fishing events' that were targeting finfish during the survey used line fishing (bait or lure). About 85% of line fishing events (nearshore and estuarine combined) occurred in nearshore waters. The estimated nearshore line fishing effort in 2000/01 comprised 223,158 shore-based and 50,368 boat-based fishing events during the 12-month survey period. In estuaries, the line fishing effort comprised 21,800 shore-based and 30,087 boat-based fishing events.

Recreational fishing effort in 17 south coast estuaries was estimated by a creel survey conducted in 2002/03<sup>3</sup>. Total effort during the survey period was estimated at 254,171 fisher hours or 86,482 fisher days. This total included boat-based (202,658 hours), shore-based (47,816 hours) and house boat (3,698 hours) fishing. Recreational netting and charter boat effort was not quantified in this survey, but was considered to have been negligible (less than 2% of total effort). In the 2002/03 survey, recreational fishing effort was estimated to have occurred mainly in Walpole/Nornalup Inlet (33% of total effort), Oyster Harbour (29%), Princess Royal Harbour (12%), Wilson Inlet (12%) and Wellstead Estuary (6%).

State-wide surveys of boat-based recreational fishing were conducted in 2011/12 and 2013/14. These surveys estimated the total effort expended by boat-based recreational fishers in the SCB, including effort expended on all species. However, the proportion of boat-based effort spent specifically targeting nearshore finfish during these surveys is unknown. In 2011/12, 49% of total annual boat-based fishing effort (boat days) in the SCB was estimated to have occurred in nearshore habitats (i.e. bottom depth <20m) and 22% in estuaries. In 2013/14, 54% of total boat-based effort was in nearshore habitats and 17% in estuaries.

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<sup>1</sup> This catch weight includes only those species named in Table 2.

<sup>2</sup> See footnote 1, previous page

<sup>3</sup> See footnote 2, previous page

## Stock Assessment

**Assessments complete:** Yes

**Assessment level and method:**

**Level 3 - Fishing mortality**

**Breeding stock levels:**

**Australian herring<sup>1</sup>** Inadequate

**Assessment level and method:** Level 2 - Catch rates

**Breeding stock levels:**

**West Australian salmon** Adequate

**Cobbler (Wilson Inlet)** Adequate

**Cobbler (Oyster Harbour)** Adequate

**Black bream (Stokes Inlet)** Adequate

**Black bream (Beaufort Inlet)** Adequate

**Black bream (Wilson Inlet)** Adequate

**Black bream (Oyster Harbour)** Adequate

**Black bream (Walpole-Nornalup Inlet)** Not assessed

**Indicator species - nearshore**

**Western Australian salmon:** Western Australian salmon form a single breeding stock across southern Australia. Adults undertake a westward migration along the southern coast of Australia to the lower WCB, where they spawn during autumn. The Leeuwin Current disperses eggs and larvae to coastal nurseries distributed from the WCB to Victoria. After spawning, adults migrate back to the SCB (but not to South Australia or Victoria). Traditionally, commercial fishers in WA have targeted western Australian salmon during the autumn (mainly March/April) pre-spawning migration. In some years, south coast fishers also capture salmon during their 'back run', which occurs around September.

Total landings of western Australian salmon in WA have been declining since 1995, with the decline becoming more pronounced after 2005. This trend has been primarily driven by declining landings in the SCB, where the majority of the annual catch is traditionally taken. The SCB commercial catch and catch rate have been declining since 1995 (South Coast Nearshore and Estuarine Figures 1 and 2). In 2012, the catch (75 t) reached the lowest level since the commencement of the South Coast fishery in the 1940s. The catch rate (4 t per licensed team) was also the lowest on record. In 2014, the catch was 303 t. The historically low catch SCB levels in recent years are believed to be due to a combination of factors – lack of targeting due to weak market demand and low wholesale prices paid for this species, reduced availability of fish in some years due to low recruitment and low catchability due to environmental factors (e.g. relatively high water temperatures).

The recreational catch of western Australian salmon is relatively low (unlike the closely related species Australian herring which has a high recreational catch). Hence, given the very limited commercial targeting of this species recently, the overall fishing pressure on western Australian salmon has

been relatively low and is unlikely to have resulted in low stock availability. A higher level assessment (level 3) of salmon is underway in order to increase certainty about stock status.

In 2014, a low catch of 60 t was reported in the WCB. Low (0-100 t) catches have occurred periodically (approximately every 11 years) throughout the history of this fishery. However, very low catches have occurred in the past 5 consecutive years (2010-2014), which is atypical. Low catches have previously been restricted to a single year.

Landings of salmon in the WCB are strongly influenced by the Leeuwin Current and water temperature. Low or nil catches typically occur during years of strong Leeuwin Current (resulting in warmer water along the West Coast). For example, the low catch in 2011 was likely due to a 'heatwave' event during the spawning period, when a strong Leeuwin Current and unusually high water temperatures discouraged the northward migration of western Australian salmon (Pearce *et al.* 2011<sup>2</sup>). This behavioural response, resulting in WCB low catches, was also observed in 2000 when a strong Leeuwin Current resulted in above average water temperatures on the west coast. Relatively warm ocean conditions along the lower west coast in 2012 may have again affected catchability. The 2011 'heatwave' is also believed to have affected the catchability of salmon and limited the catch in the SCB in 2011.

Annual recruitment by juvenile (age 0 years) western Australian salmon has been variable since recruitment surveys commenced in 1994 but the long-term trend has been stable (South Coast Nearshore and Estuarine Figure 3). The lowest recorded recruitment coincided with the 'heatwave' event in 2011. Levels of annual recruitment provide an indication of future breeding stock level and are likely to influence catch rates 3-4 years later when each year class recruits to the fishery.

**Indicator species - estuarine**

**Cobbler:** Commercial targeting of cobbler in WA is restricted to estuaries. Each estuary hosts a discrete stock of cobbler, which is genetically distinct to other estuarine populations and also distinct to cobbler populations in adjacent ocean waters. Historically, commercial targeting of cobbler in the SCB has mainly occurred in Wilson Inlet and to a lesser extent in the estuaries around Albany (Oyster Harbour, Princess Royal Harbour).

Commercial catch rates suggest a stable long-term trend in the availability of cobbler in Wilson Inlet and Oyster Harbour since 1980 (South Coast Nearshore and Estuarine Figure 4).

The Department of Fisheries has conducted annual fishery-independent surveys of juvenile recruitment of cobbler in Wilson Inlet since 2006. Information from these surveys will assist in interpreting variations in catch and catch rates. Regular monitoring of the age structure of fishery landings also occurs in Wilson Inlet. In future, this information may be used to estimate levels of fishing mortality in this stock, which will be used in conjunction with trends in recruitment and catch rates to assess stock status.

<sup>1</sup> The stock assessment for Australian Herring is presented in the West Coast Nearshore and Estuarine Fisheries Report

<sup>2</sup> Pearce, A., Lenanton, R., Jackson, G., Moore, J., Feng, M. & Gaughan, D. (2011). The "marine heat wave" off Western Australia during the summer of 2010/11. Fisheries Research Report No. 222. Department of Fisheries, Western Australia. 40 pp.

**Black bream:** Black bream are restricted to estuaries. Each estuary hosts a discrete stock of black bream, which is genetically distinct to other estuarine populations. Most estuaries and coastal lagoons in south-western WA host a black bream population.

The majority of commercial black bream landings in the SCB are taken in four main estuaries - Stokes Inlet, Beaufort Inlet, Wilson Inlet and Oyster Harbour. From 1980 to 2014, commercial catch rates of bream in these estuaries have increased, suggesting an increase in the abundance of each stock (South Coast Nearshore and Estuarine Figure 5). Bream abundance varies in response to environmental factors including river flow, temperature, salinity, oxygen and nutrient loads. These factors determine the condition and productivity of the estuary, which affects growth and reproductive success in bream.

The current status of black bream in Walpole-Nornalup Inlet cannot be assessed due to lack of recent data. Walpole-Nornalup Inlet is the most popular recreational fishery for black bream in the SCB. The estuary is closed to commercial fishing.

## Non-Retained Species

**Bycatch species impact:** **Low**

The small-scale commercial fisheries in nearshore and estuarine waters mainly use gill, seine and haul nets that are deployed in a targeted manner. Few non-target species are taken. Mesh size regulations ensure that target species caught by these methods are within an appropriate size range. Minimal discarding occurs because virtually all fish taken can be retained and marketed.

Recreational fishers mainly use line-based methods in nearshore and estuarine waters. This method can result in the capture and release of a significant number of non-target species and undersized fish. The risks associated with post-release mortality vary considerably among species. In general, fish in nearshore and estuarine waters are captured from shallow depths and suffer less barotrauma-related injuries than deep water species.

**Listed species interaction:** **Negligible**

It is compulsory for commercial fishers to report all interactions with protected listed marine species. New Zealand fur seals and Australian sea lions are occasionally surrounded by beach seine nets used in the South Coast nearshore and estuarine fisheries, but are released immediately by the fishers. This is possible because seine netting is a labour-intensive operation and the fishing team will immediately notice a seal in the net. Fishers are able to release a seal from their seine net without injury to the animal.

The abundance of fur seals on the south coast has steadily increased over the last 15 years, resulting in an increasing level of interaction with fishers, especially in estuaries of the Albany region (R. Campbell, pers. comm.). There have been no reports of incidental mortalities of seals in these fisheries and it is believed that the present level of interaction (direct and indirect) is not a significant threat to the populations of fur seals and sea lions. An assessment of the impact of

interactions is performed on an annual basis and, if required, appropriate management plans will be devised to mitigate these interactions.

Birds such as pelicans, cormorants and shearwaters sometimes interact with commercial fishing nets in estuaries and with recreational line-fishing gear but the risks to bird populations are considered to be low.

## Ecosystem Effects

**Food chain effects:** **Low**

Excessive removal by commercial and recreational fisheries of certain species, such as Australian herring or western Australian salmon, from the food chain could potentially impact on prey and predator species including larger fish, cetaceans and seabirds. However, commercial fishing effort directed towards these species in recent years has been declining and is relatively low compared to historic levels. Recreational fishing effort directed towards Australian herring is relatively high.

**Habitat effects:** **Negligible**

The operation of gill nets and haul nets over predominantly sand and mud bottoms is unlikely to have any impact on these habitats in estuaries and nearshore waters. Similarly, the line fishing methods used by recreational fishers have a negligible impact on the bottom substrates. Anchoring by recreational fishing vessels may have localised impacts on habitats such as seagrass.

Haul nets may be deployed over low or medium density seagrass. This type of net tends to 'roll' over the surface of seagrass beds without removing attached leaves or uprooting plants. At times, haul nets may collect floating vegetation including seagrass leaves or algae.

## Social Effects

### Commercial

In 2014, there were approximately 37 commercial fishers involved in the South Coast Salmon Fishery and approximately 12 commercial fishers involved in the South Coast herring trap net fishery. In 2014, the South Coast Estuarine Managed Fishery employed an average of 21 fishers per month. Additional employment is created by these fisheries in the processing and distribution networks and retail fish sales sectors.

Australian herring and western Australian salmon fisheries in the SCB supply WA bait and human consumption markets. The South Coast Estuarine Fishery is an important source of fresh local fish to regional centres. Additionally, a small proportion of estuarine landings are sold to zoos across Australia as animal food.

The use of trap nets and seine nets by Australian herring and western Australian salmon fishers may temporarily impact on beach access by members of the public.

### Recreational

The 2000/01 National Recreational and Indigenous Fishing Survey estimated that approximately 12% of the State's total

recreational fishing effort occurred in the SCB<sup>1,2</sup>. Fish resources in estuaries and nearshore waters of the Bioregion are a focus for recreational fishers and have a high social value in the region.

Within the SCB, approximately 21% of the recreational fishing effort was estimated to occur in estuaries and rivers. A high proportion of people who fish in each South Coast estuary are non-residents, travelling from Perth, other WA regions or interstate. Consequently, fishing in South Coast estuaries has a great benefit to local tourism.

Australian herring is the most common finfish species retained by recreational fishers in the SCB and therefore has high social value. In 2000/01, Australian herring were estimated to comprise 15% (by number) of all finfish retained by SCB recreational fishers. In 2013/14, a statewide survey of boat-based fishing estimated that herring comprised 20% of all finfish retained by boat-based recreational fishers in the SCB.

## Economic Effects

### Estimated annual value (to fishers) for 2014:

#### South Coast Estuarine Fishery

**Level 2: \$1 to 5 million (finfish + invertebrates)**

#### South Coast Salmon + Herring trap net fisheries

**Level 1: <\$1 million**

## Fishery Governance

### Commercial

#### Current Fishing (or Effort) Level

**South Coast Estuarine Fishery** **Acceptable**

**Herring trap net fishery** **Under Review**

**South Coast Salmon Fishery** **Acceptable**

#### Target commercial catch range:

**South Coast Estuarine Fishery** **200 – 500 tonnes**

**South Coast herring** **475 – 1,200 tonnes**

**Salmon (South Coast + South West Fisheries)**  
**1,200 – 2,800 tonnes**

The 2014 South Coast Estuarine Managed Fishery total catch of finfish (190 t) was below the target range of 200-500 t. A high abundance of blue swimmer crabs in south coast estuaries contributed to relatively low finfish landings in 2014. This fishery has reported a steady increase in landings of blue swimmer crabs, from 1 t in 2006 to 14 t in 2012, 32 t in 2013 and 39 t in 2014. In some estuaries, fishers report that the presence of crabs in fishing nets has been inhibiting the capture of finfish. In some estuaries, fishing effort has been redirected toward targeting crabs instead of finfish.

The 2014 South Coast catch of Australian herring (104 t) was well below the target range. The catch has now been below

the target range for 12 consecutive years. Recent research outcomes regarding stock status were used as a basis for new management arrangements introduced in 2014/15 to ensure the sustainability of this iconic species (see ‘New management initiatives’). A formal Recovery Strategy for the Australian herring stock is being developed.

The total catch of western Australian salmon (West Coast and South Coast landings combined) in 2014 (364 t) was below the target range. The catch has now been below the target range for 8 consecutive years. Low catches are believed to be due to the combined effects of lack of targeting due to weak market demand, low catchability due to environmental factors and low availability of fish due to recruitment variation.

**Recreational Current Fishing (or Effort) Level:** **Not available**  
**Target catch range:** **Not developed**

### New management initiatives (for 2014/15)

The Wilson and Irwin Inlet Crab Pot Trial commenced on 18 February 2015 by exemption, and allows the commercial take of blue swimmer crabs by nominated South Coast Estuarine Managed Fishery licence holders. There are eight fishers using a combined total of 199 traps across the Wilson and Irwin Inlets, authorised by exemption to use crab traps in a two year trial.

The trial seeks to test a different method of catching blue swimmer crabs, to determine if fishers can more efficiently target the species, resulting in better catch-care and improved market prices. The Department is monitoring the catch rates of blue swimmer crabs through the trial, with fishers required to fill in log-books for research purposes. The exemption period extends until 28 February 2017, with a 12 month review scheduled within this time frame. Following research outcomes surrounding Australian herring which demonstrated an unacceptably high risk to the sustainability of the stock, a number of management initiatives have been introduced in an effort to recover the stock. Daily bag limits for recreational fishers for Australian herring have been reduced from 30 to 12. Commercial fishers are prohibited from using herring trap nets. These measures may be reviewed pending the recovery of Australian herring stock.

## External Factors

Climate change is expected to have impacts on nearshore and estuarine ecosystems. Changes in environmental variables such as ocean temperature, currents, winds, nutrient supply, rainfall, ocean chemistry and extreme weather conditions are expected to have major impacts on marine ecosystems<sup>3</sup>. These impacts are expected to create both difficulties and opportunities for fisheries.

In 2011, a very strong Leeuwin Current resulted in unusually warm ocean temperatures in coastal waters of the southern WCB and the western SCB. This ‘heatwave’ event resulted

1 See footnote 1, page 252

2 Barhathah, T. (2006). Department of Fisheries community survey 2005. Fisheries Occasional Paper No. 33. Department of Fisheries, Perth.

3 Hobday, A.J., Poloczanska, E.S. & Matear, R.J. (eds) (2008). Implications of Climate Change for Australian Fisheries and Aquaculture: a preliminary assessment. Report to the Department of Climate Change, Canberra, Australia. August 2008.

in atypical distributions of various species (e.g. tropical species occurring in temperate waters) and unusual fish behaviour.<sup>1,2</sup> The event altered the distribution and behaviour (eg. spawning activity, migration) of western Australian salmon and Australian herring, which affected recruitment and catch levels of these species in 2011 and subsequent years. Relatively warm coastal ocean temperatures also occurred in 2012 and 2013 in the WCB and the western SCB.

It is likely that annual variation in coastal currents (particularly the Leeuwin and Capes Currents) influences the recruitment patterns of larvae of nearshore species such as Australian herring and western Australian salmon and thus their subsequent recruitment into each region. Coastal currents also influence the distribution and catchability of adult fish. For example, warmer beach water temperatures are associated with lower catchability of western Australian salmon.

Fluctuating market demand is a significant factor affecting the annual commercial catch level of many species. Limited demand and low wholesale prices paid for Australian herring and western Australian salmon in recent years have limited commercial catch and effort levels. By purchasing only a

limited quantity of Australian herring and western Australian salmon each year, fish processors effectively restrict catch levels. Commercial fishers sometimes elect not to capture a school of fish, or release part of their catch, when a market is not available.

Variations in the abundance of target species in SCB estuaries are often driven by environmental factors, independent of fishing. These factors can have a dominant influence on the commercial catch and effort from year-to-year. For example, high rainfall may contribute to higher catches of black bream.

Catchment processes, such as clearing of vegetation, flow regulation and nutrient input, can have major downstream effects on estuary condition and on fishery production. Attempts to quantify the influence of these complex, interacting factors on fishery production are difficult with the limited biological and environmental monitoring data that are available from SCB estuaries.

The influence of environmental factors on recruitment to estuaries is further complicated by the practice of human intervention to breach estuarine sandbars, mostly for reasons related to estuarine amenity coupled with ecosystem 'health'.

#### SOUTH COAST NEARSHORE AND ESTUARINE TABLE 1

Total annual catches of finfish from the estuarine and beach-based nearshore commercial fisheries in the South Coast Bioregion, 2010 to 2014.

Species	Scientific name	Catch (tonnes)				
		2010	2011	2012	2013	2014
Western Australian salmon	<i>Arripis truttaceus</i>	291.4	165.2	75.0	139.4	303.4
Australian herring	<i>Arripis georgianus</i>	182.7	110.7	134.4	250.6	103.9
Cobbler	<i>Cnidoglanis macrocephalus</i>	69.8	65.5	53.1	67.2	56.9
Black bream	<i>Acanthopagrus butcheri</i>	65.5	43.9	42.7	41.2	31.2
Sea mullet	<i>Mugil cephalus</i>	32.3	29.8	30.7	33.9	27.9
Southern garfish	<i>Hyporhamphus melanochir</i>	13.7	11.1	5.4	14.0	6.7
King George whiting	<i>Sillaginodes punctata</i>	7.0	8.0	9.9	11.5	13.3
Leatherjackets	Monacanthidae	7.3	7.5	10.9	11.0	11.6
Tarwhine	<i>Rhabdosargus sarba</i>	2.8	6.7	3.9	4.6	6.0
Flatheads	Platycephalidae	3.0	4.4	3.2	5.0	3.0
Yelloweye mullet	<i>Aldrichetta forsteri</i>	2.6	3.9	4.9	3.4	5.2
Snook	<i>Sphyraena novaehollandiae</i>	1.3	1.7	1.7	1.9	1.4
Pink snapper	<i>Pagrus auratus</i>	0.9	1.3	2.1	0.6	2.2
Trevally	Carangidae	2.1	2.0	1.5	3.1	1.7
Flounder	Pleuronectidae	1.5	1.3	0.8	2.2	2.2
Trumpeters/Grunters	Teraponidae	0.3	1.6	0.3	0.3	0.5
Yellowtail scad	<i>Trachurus novazelandiae</i>	0.6	0.8	2.2	0.1	1.8
Tailor	<i>Pomatomus saltatrix</i>	0.4	0.4	0.3	1.8	2.3
Mulloway	<i>Agyrosomus japonicus</i>	0.4	0.7	1.0	0.5	0.5
Scaly mackerel	<i>Sardinella lemura</i>	0.4	0.3	0.3	0.9	0.7
Whiting species	<i>Sillago spp.</i>	0.4	0.6	1.4	0.7	1.7
Other finfish	Teleostei	3.3	3.5	3.7	3.4	4.0
<b>TOTAL</b>		<b>689.6</b>	<b>470.8</b>	<b>389.5</b>	<b>598.2</b>	<b>588.1</b>

<sup>1</sup> See footnote 2, page 254

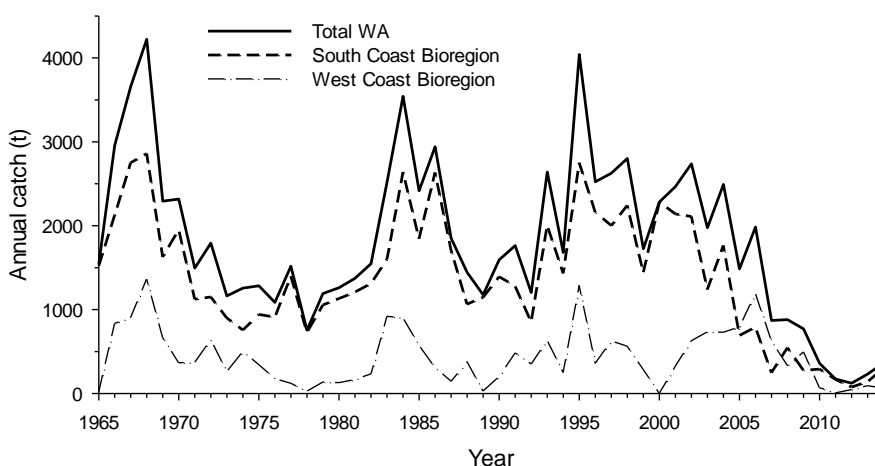
<sup>2</sup> Caputi N., Jackson G. and Pearce A. (2014). The marine heat wave off Western Australia during the summer of 2010/11 – 2 years on. Fisheries Research Report No. 250. Department of Fisheries, Western Australia. 40pp.



**SOUTH COAST NEARSHORE AND ESTUARINE TABLE 2**

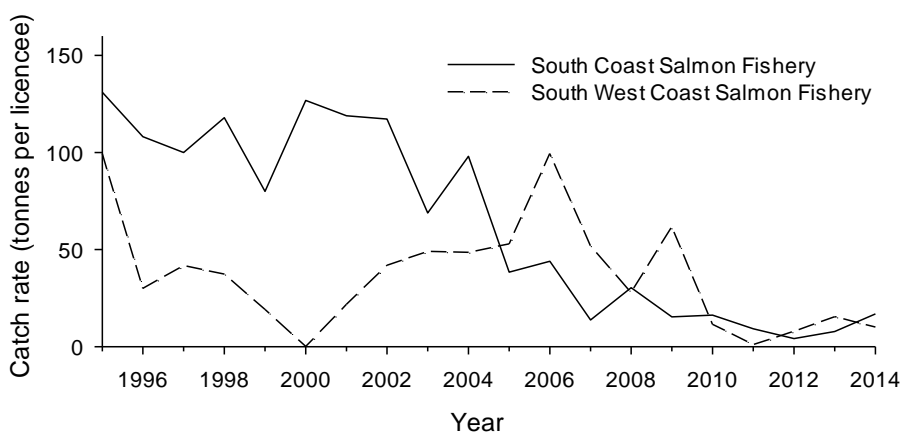
Estimated annual catch of key nearshore and estuarine finfish species in the South Coast Bioregion by boat-based recreational fishers in 2011/12 and 2013/14. The percentage of the total boat-based finfish catch represented by each species is also shown. (See Ryan *et al.* 2013 and 2015, details above).

Common name	Species	Catch (number of fish)		% of total finfish catch	
		2011/12	2013/14	2011/12	2013/14
King George whiting	<i>Sillaginodes punctatus</i>	59,011	46,730	29.9	30.7
Australian herring	<i>Arripis georgianus</i>	28,443	30,102	14.4	19.8
Black bream	<i>Acanthopagrus butcheri</i>	22,839	7,160	11.6	4.7
School whiting	<i>Sillago spp.</i>	16,731	21,009	8.5	13.8
Silver trevally	<i>Pseudocaranx spp.</i>	9,797	5,622	5.0	3.7
Southern garfish	<i>Hyporamphus melanochir</i>	2,375	1,180	1.2	0.8
Western Australian salmon	<i>Arripis truttaceus</i>	2,174	1,576	1.1	1.0
All other finfish		55,813	38,737	28.3	25.5



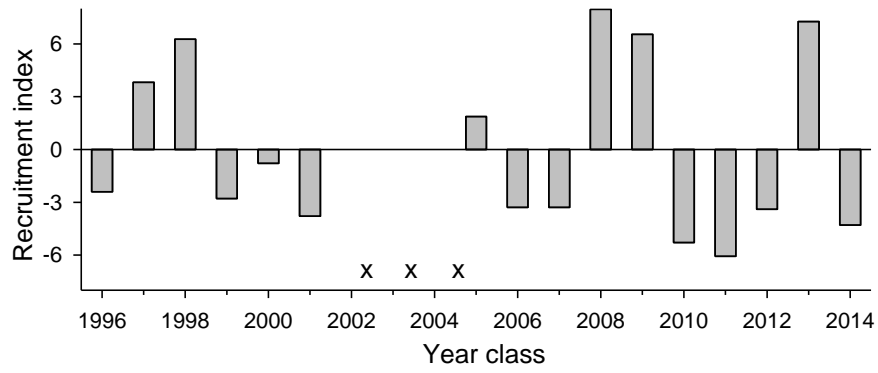
**SOUTH COAST NEARSHORE AND ESTUARINE FIGURE 1**

Total annual commercial catches of western Australian salmon in the South Coast and West Coast Bioregions, 1965 – 2014.



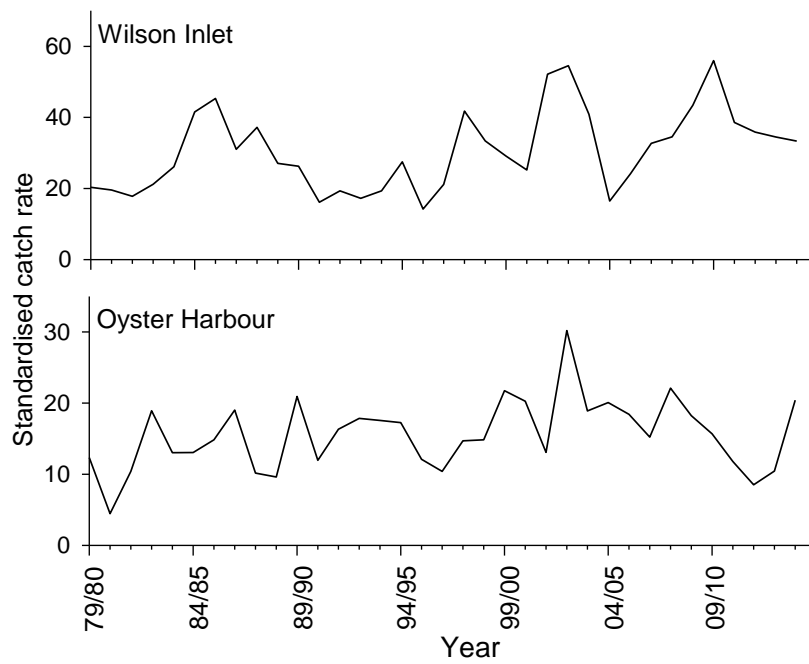
**SOUTH COAST NEARSHORE AND ESTUARINE FIGURE 2**

Total annual commercial catch rate (tonnes per licensee per year) of western Australian salmon in the South Coast Salmon Fishery (South Coast Bioregion) and the South West Coast Salmon Fishery (West Coast Bioregion), 1995 – 2014.



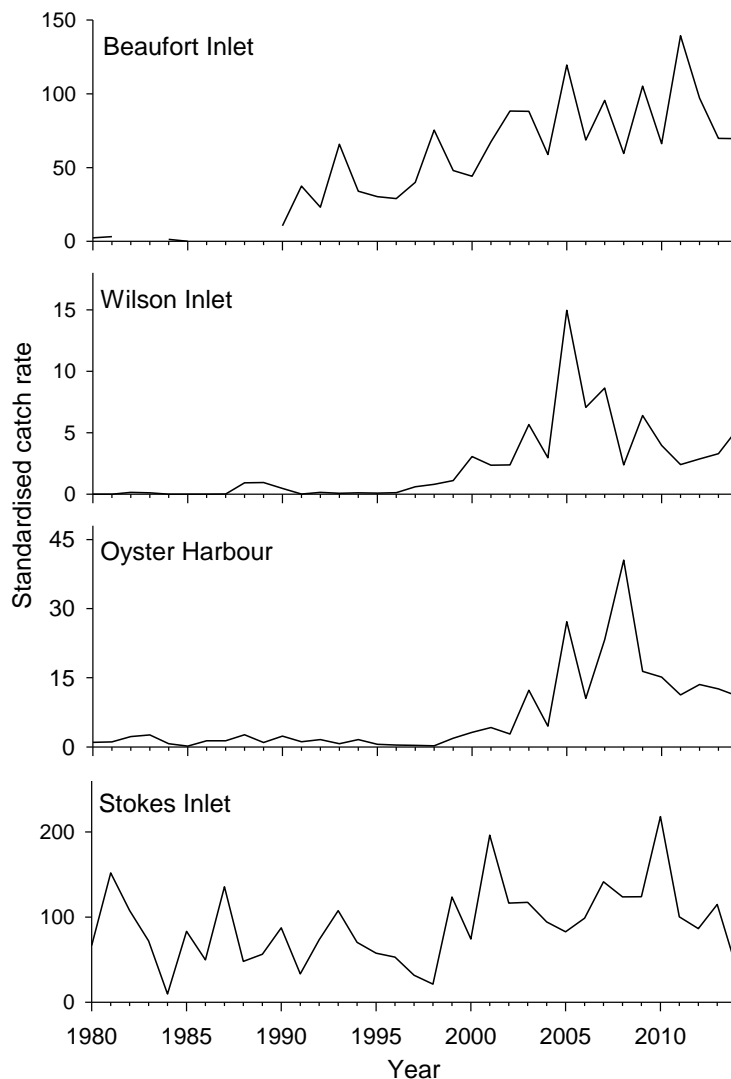
**SOUTH COAST NEARSHORE AND ESTUARINE FIGURE 3**

Annual fishery-independent relative recruitment index for western Australian salmon in the South Coast Bioregion, 1996 – 2014. Data represent annual deviations from the long-term average. e.g. bars above the line indicate better than average number of recruits. (x – no sampling conducted in that year).



**SOUTH COAST NEARSHORE AND ESTUARINE FIGURE 4**

Annual commercial catch rates of cobbler in Wilson Inlet and Oyster Harbour, 1979/80 – 2013/14.



**SOUTH COAST NEARSHORE AND ESTUARINE FIGURE 5**

Annual commercial catch rates of black bream in Beaufort Inlet, Wilson Inlet, Oyster Harbour and Stokes Inlet, 1980 – 2014.

## South Coast Purse Seine Fishery Report: Statistics Only

*G. Jackson, S. Turner and E. Smith*

### Fishery Description

The South Coast Purse Seine Managed Fishery (SCPSF) is based on the capture of pilchards (*Sardinops sagax*) by purse seine gears in the waters between Cape Leeuwin and the Western Australia/South Australia border. The *South Coast Purse Seine Limited Entry Fishery Notice 1994* also covers the take of yellowtail scad (*Trachurus novaezelandiae*), Australian anchovy (*Engraulis australis*), scaly mackerel (*Sardinella lemuru*), sandy sprat (*Hyperlophus vittatus*) blue sprat (*Spratelloides robustus*) and maray (*Etrumeus teres*).

### Boundaries

The SCPSF consists of five Management Zones (South Coast Purse Seine Fishery Figure 1) as follows:

- Zone 1 - extends from Peak Head to Vancouver Peninsula (the waters in and around King George Sound, Albany);
- Zone 2 - extends from Point D'Entrecasteaux to Cape Knob;
- Zone 3 - Bremer Bay Zone, extends from Cape Knob to longitude 120°E;
- Zone 4 - Esperance Zone, extends from 120°E to the WA/SA border.
- Zone 5 - between Cape Leeuwin and Point D'Entrecasteaux (not significantly fished)

These zones are broken down into finer spatial scale blocks for reporting of catch and effort in the statutory daily/trip catch and effort returns and the catch disposal records. However, for this report, catches are reported for the major zones (Zones 1 and 2, combined; Zone 3 and Zone 4, separately) plus the total catches (South Coast Purse Seine Fishery Figure 2) based on the statutory catch and effort returns.

### Management arrangements

The SCPSF is primarily managed through output controls in the form of Individually Transferable Quota (ITQ) units. The quota season for the SCPSF runs from 1 July to 30 June the following year. Four of the five zones in the fishery (i.e. Zones 1 – 4) have been allocated a set amount of ITQ units, the value of which is determined by dividing the Total Allowable Catch (TAC) for a zone by the total number of units allocated to that zone. The TAC has been relatively stable over the past 10 years and will be reviewed on an as-needs basis. The total number of units allocated across each of the four zones in the fishery amount to 890 and has remained unchanged from the previous season. The Albany zone has an annual TAC of 2,683 tonnes, while both the Bremer Bay and Esperance zones each have an annual TAC of 1,500 tonnes. Zone 5 of the fishery is considered a development zone and can only be fished by a licence holder in the SCPSF with a minimum holding in another zone, it has no specific TAC or units and has not been fished for a number of years.

### Landings and Effort 2013/14

**Bremer Bay and Esperance:** **Not reported**  
**due to confidentiality provisions**

**Albany** **885 tonnes**

Effort in the SCPSF was again lower than in recent years with a total of 843 days fished in 2013/14 (2009/10: 1,450 days; 2010/11: 1,290 days, 2011/12: 1,359 days, 2012/13: 1,175 days).

The 2013/14 pilchard catch in the SCPSF was 1,501 tonnes, the lowest since 2003 and continued the downturn since the trend of slowly increasing catches since the late 1990s (South Coast Purse Seine Figure 2). As with last season, the lower

effort levels do not suggest a decline in biomass as nominal daily catch rate continues to show an overall increasing trend (South Coast Purse Seine Figure 2). Most of the commercial catches were reported from the Albany zone (885 t). Less than 15 t of other pelagic species were also landed, again mostly yellowtail scad.

While effort and catches overall remain below those recorded during the late 1980s and 1990s, catch rates are now greater than the pre-virus levels.

### Fishery Governance

**Target commercial catch range:** **Acceptable**

For the 2013/14 season, the total pilchard catch (1,501 t) was still well below the total TAC for the entire fishery (5,683 t) (South Coast Purse Seine Fishery Table 1) with catches from each of the Management Zones remaining below their respective TACs.

**Current Fishing (or Effort) Level:** **Acceptable**

Based on the most recent assessment (completed in 2006) and the recent history of the fishery, the level of spawning biomass in each Management Zone is likely to be at adequate levels and the current level of fishing is acceptable. The catch levels in other jurisdictions further support the continued recovery in the biomass of pilchards across southern Australia.

### New management initiatives (2014/15)

Since 2006/07, the SCPSF listed species bycatch mitigation program has undertaken a range of measures to monitor and mitigate fleshy-footed shearwater bycatch during the peak interaction period between 1 March and 30 April. These bycatch mitigation measures are reviewed annually and are continually being refined and improved.

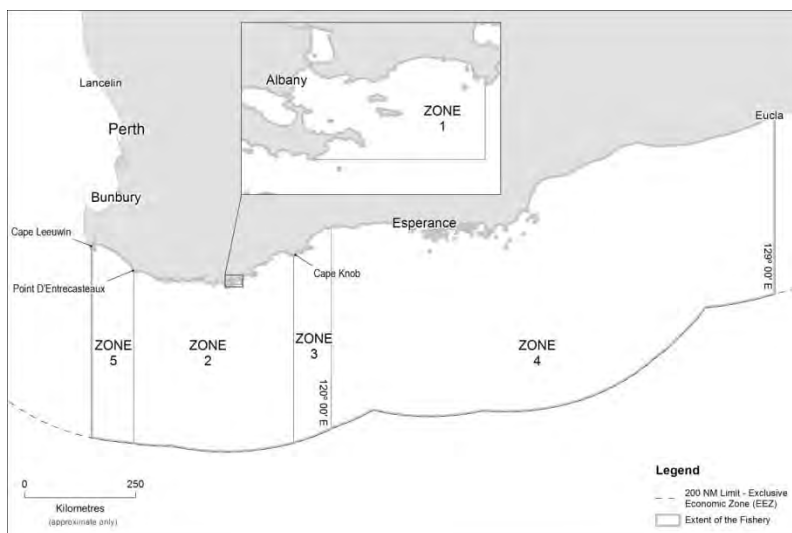
There are no significant legislative management changes planned for this fishery.

In 2014, the fishery underwent pre-assessment for Marine Stewardship Certification.

### SOUTH COAST PURSE SEINE FISHERY TABLE 1

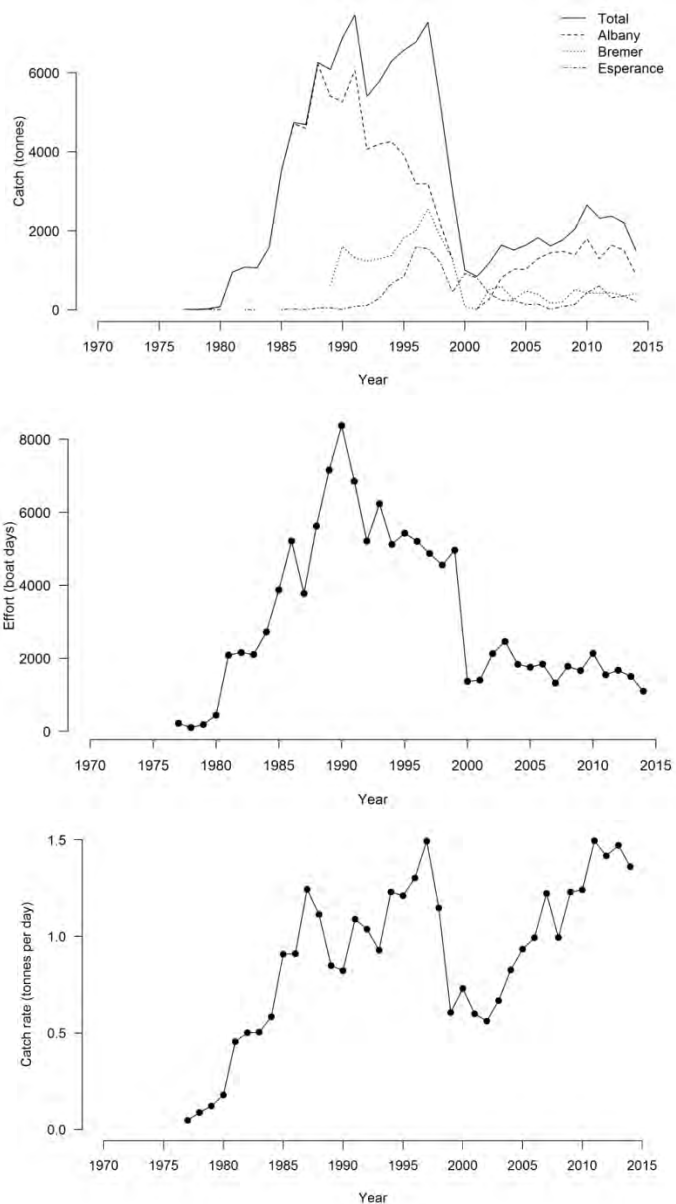
2013/14 pilchard catches and TACs in tonnes (t) for each of the major Management Zones. \* Three or less vessels operated in each of these zones in 2013/14 and cannot be reported.

Management Zone	TAC (t)	2013/14 catch (t)	2013/14 catch as per cent of TAC
Albany (Zones 1 and 2)	2,683	885	33.0%
Bremer Bay (Zone 3)	1,500	*	-
Esperance (Zone 4)	1,500	*	-
Total for Fishery	5,683	1,501	26.4%



**SOUTH COAST PURSE SEINE FISHERY FIGURE 1**

Map of the extent of the South Coast Purse Seine Fishery.



**SOUTH COAST PURSE SEINE FISHERY FIGURE 2**

Total annual catch of pilchards (*Sardinops*) for main zones (Albany, Bremer, Esperance) (upper panel), total effort (boat days fished) (middle panel) and nominal catch rate (tonnes per day) (lower panel) in the South Coast Purse Seine Fishery, 1970-2014.

# Temperate Demersal Gillnet and Demersal Longline Fisheries Status Report

R. McAuley, M. Braccini, S.J. Newman & J.O'Malley

Main Features			
Status		Current Landings (2013/14)	
Stock level		Demersal Gillnet and Demersal Longline Fishery	
Gummy shark	Adequate	Total sharks and rays	994 t
Dusky shark	Recovering	Total scalefish	192 t
Sandbar shark	Recovering	Indicator species	
Whiskery shark	Adequate	Gummy shark	445 t
Fishing Level		Dusky shark	190 t
JASDGDLF Zone 1	Acceptable	Sandbar shark	45 t
JASDGDLF Zone 2	Acceptable	Whiskery shark	161 t
WCDGDLF	Acceptable	Sharks and rays by other commercial fisheries	4 t
		Recreational catch (2013/14)	<5% of commercial catch

## Fishery Description

The Temperate Demersal Gillnet and Demersal Longline Fishery (TDGDLF) is comprised of the Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery (JASDGDLF) and the West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery (WCDGDLF). These fisheries operate in continental shelf waters along the south and lower west coasts, respectively. The majority of operators employ demersal gillnets and power-hauled reels to target sharks, with scalefish also being a legitimate component of the catch. Demersal longline is also a permitted method of fishing, but is not widely used.

The main shark species targeted in the TDGDLF are gummy shark (*Mustelus antarcticus*), dusky shark (*Carcharhinus obscurus*), whiskery shark (*Furgaleus macki*) and sandbar shark (*Carcharhinus plumbeus*). On the south coast, operators primarily target gummy and dusky sharks, while dusky and sandbar sharks are targeted on the west coast. Whiskery sharks are an important component of the catch for both fisheries. These four species have been selected as indicators for the status of the temperate shark 'suite' as they account for approximately 80% of the fisheries' shark catch and represent the range of life history strategies of the other shark species caught by these fisheries.

As their stocks span multiple Bioregions, dusky, sandbar and whiskery sharks are assessed and monitored as indicators of the Statewide inshore demersal suite of shark species. Gummy sharks, however, have a more limited southern range and are an indicator species of the South Coast Bioregion inshore demersal shark species suite. The two fisheries are reported together here because extensive research has demonstrated that they share these key unit stocks.

## Governing legislation/fishing authority

### South Coast

Joint Authority Southern Demersal Gillnet and Demersal Longline Management Plan 1992

Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery Licences

### West Coast

West Coast Demersal Gillnet and Demersal Longline (Interim) Management Plan 1997

West Coast Demersal Gillnet and Demersal Longline Interim Managed Fishery Permits

## Consultation processes

The Department undertakes consultation directly with licensees on operational issues. Industry Annual General Meetings are convened by the West Australian Fishing Industry Council (WAFIC), who are also responsible for statutory management plan consultation under a Service Level Agreement with the Department.

## Boundaries

The JASDGDLF spans the waters from 33° S latitude to the WA/SA border and comprises three management zones (Demersal Gillnet and Longline Figure 1). Zone 1 extends southwards from 33° S to 116° 30' E longitude off the south coast. Zone 2 extends from 116°30' E to the WA/SA border (129° E). A small number of Zone 3 units permit fishing throughout Zone 1 and eastwards to 116° 55'40" E. For the

purposes of this report, Zone 3 catch and effort data are amalgamated into Zone 1 or Zone 2 as appropriate.

The WCDGDLF technically extends northwards from 33° S latitude to 26° S longitude (Demersal Gillnet and Longline Figure 1). However, the use of shark fishing gear has been prohibited north of 26° 30' S (Steep Point) since 1993. Demersal gillnet and longline fishing inside the 250 metre depth contour has been prohibited off the Metropolitan coast (between latitudes 31° S and 33° S) since November 2007.

### Management arrangements

The Southern and West Coast fisheries are regulated through two complementary management plans. The JASDGDLF (Joint Authority jurisdiction fishery) became managed under WA state law in 1988 and since then the fishery has been managed by the Western Australian Government on behalf of a Joint Authority comprising the Western Australian and Commonwealth Governments. The WCDGDLF (a state jurisdiction fishery) is managed by the Western Australian Government under a management plan introduced in 1997.

Both fisheries are managed via input controls in the form of transferable time/gear effort units, with additional restrictions on mesh and hook sizes, net height ('drop') and maximum net length. Historically, each unit has permitted the use of a specified length of net or an equivalent number of hooks for one month. However, in 2009, the Department transitioned the fishery to a more explicit hourly effort management system, with the objectives of removing excessive latent effort capacity and restricting effort within each management zone to 2001/02 levels. All units were permitted to use 27 m of gillnet or 9 longline hooks for 288 hours in the WCDGDLF, 264 hours in Zones 1 and 3 of the JASDGDLF and 380 hours in Zone 2 of the JASDGDLF. However in 2014 the unit value in the WCDGDLF in respect of hooks was reduced to 1 hook x 1 hour in response to a dramatic increase in demersal longline effort and catch of demersal scalefish. In addition to these effort controls all boats operating in the TDGDLF are closely monitored by the Department's satellite-based Vessel Monitoring System.

A suite of shark management arrangements in target and non-target fisheries have been in effect since the 2006/07 season to ensure sustainable catches of target, byproduct and bycatch species, to assist in the recovery of historically over-exploited whiskery, dusky and sandbar shark stocks and to maintain acceptably low risks to endangered, threatened and protected species (ETPs). These include:

- the Statewide commercial protection of all sharks and rays;
- a general prohibition of metal trace wire and large hooks (except in the Northern Shark and Mackerel Fisheries), which had previously been used to target large whaler sharks;
- a significant increase in penalties for illegally possessing sharks or rays; and
- a closure during the main whiskery shark pupping season of inshore waters to 200m depth throughout all of the WCDGDLF and the waters of the South Coast west of 118° E (in the JASDGDLF) to assist in the recovery of the over-exploited whiskery shark stock.

In addition, to further assist in the protection of medium-high risk dusky stocks, a 70 cm maximum (inter-dorsal fin length) size limit for all whaler sharks taken by recreational fishers within the waters of the South Coast and West Coast Bioregions, was introduced in February 2009.

The Metropolitan Area between latitudes 31° S and 33° S (inshore of 250 metres depth) was closed to most commercial fishing activities, including those of the WCDGDLF, in November 2007. To offset the Metropolitan Area Closure and mitigate potential impacts of effort displacement to northern grounds of the fishery, the Government established a Voluntary Fisheries Adjustment Scheme (VFAS) that bought back 36% of WCDGDLF entitlements.

The TDGDLF was first declared as an approved Wildlife Trade Operations (WTO) in February 2006. The fishery has been reassessed twice, and most recently re-accredited in May 2012, under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The accreditation allows continued export of product from these fisheries for the period of its currency. The current WTO expires on 28 August 2015.

In addition to the renewal of the WTO, the fishery was re-accredited for the purposes of Part 13 of the EPBC Act which provides protection for operators who may interact with ETPs. Addressing the potential interaction between fishers and Australian sea lions is a condition of this Part 13 accreditation.

Following the outcomes of the Wetline Review, the Government made a commitment to address the long-term sustainability of demersal scalefish on the West Coast by reducing both commercial and recreational demersal scalefish catches by at least 50% of 2005/06 levels. Demersal scalefish are an important component of the TDGDLF catch and the fisheries are being closely monitored to ensure the combined catch of demersal scalefish taken from the commercial sector does not exceed the target (see West Coast Demersal Scalefish Fishery Status Report).

### Research summary

Major FRDC-funded studies of the shark fishery on the south and west coasts of Western Australia, undertaken over the period 1993–2004, have provided a detailed basis for monitoring and assessing the fisheries. The extensive biological and fishery information gained from these studies have been reported in three FRDC final reports, numerous international journal publications and have been used to develop stock assessment models for the fisheries' key target stocks to determine their likely responses to current levels of exploitation and to test alternative harvest regimes. A FRDC-funded study of movements of the four indicator shark stocks commenced in 2011. Results from this study will be used to help in the reassessment of the status of these stocks enabling greater reference to their spatial and temporal dynamics.

Current research monitoring involves analysis of statutory fishing returns data and periodic biological sampling of commercial and fishery-independent catches. To support the fishery management arrangements introduced in 2006 and to improve assessments of key stocks and facilitate the more detailed reporting requirements of the fisheries' export accreditation under the Commonwealth's EPBC Act, statutory daily/trip catch and effort logbooks were introduced

in 2006/07. After rectifying some initial problems this exercise generally improved reporting standards and has provided the basis for development and implementation of new catch and effort data validation protocols.

Tactical research was also completed on bycatch issues with ETP species. Two National Heritage Trust funded projects investigated movements and aggregation locations of grey nurse sharks (*Carcharias taurus*) and a recent FRDC-funded project examined the relative spatial risks of Australian sea lion (*Neophoca cinerea*) interactions with demersal gillnets. A further FRDC-funded study to estimate quantitative rates of Australian sea lion encounters with demersal gillnets was undertaken in 2010–11. WA Government-funded research into white shark (*Carcharodon carcharias*) movements around the south-west of Western Australia may also yield information on the ecology and population structure of this protected species.

## Retained Species

### Commercial landings (seasons 2013/14)<sup>1</sup>:

<b>All sharks (and rays):</b>	<b>994 tonnes</b>
<b>Indicator shark species:</b>	<b>841 tonnes</b>
<b>Gummy:</b>	<b>445 tonnes</b>
<b>Dusky<sup>2</sup>:</b>	<b>190 tonnes</b>
<b>Whiskery:</b>	<b>161 tonnes</b>
<b>Sandbar:</b>	<b>45 tonnes</b>

**Other finfish (i.e. non shark) catch:** In addition to their primary catch of sharks, the JASDGDLF and WCDGDLF land a variety of scalefish species, which totalled 192 t in 2013/14 (Demersal Gillnet and Longline Figure 3). This catch included 96.5 t of demersal scalefish species taken in the West Coast Bioregion and 95.1 t of demersal scalefish taken in the South Coast Bioregion and a total of 13.8 t of non-demersal scalefish species (Demersal Gillnet and Longline Table 1). For details of other fisheries' demersal scalefish catches in those Bioregions, see West Demersal Scalefish Resource Status Report and South Coast Demersal Scalefish Resource Report.

**Shark catches in other fisheries:** Sharks were also historically caught off the south and west coasts in a variety of other commercial fisheries. However, due to the very poor standard of reported species identification of non-targeted shark catches and those catches' contribution to identified sustainability risks to some stocks (e.g. dusky shark), the retention of sharks and rays was prohibited in most non-target fisheries throughout the State by commercially protecting all sharks and rays (elasmobranchs) in November 2006. Reported elasmobranch catches by vessels operating in other managed fisheries between North West Cape and the South Australian border subsequently declined to less than 5 t per year (4 t in 2013/14).

**Recreational catch estimates:** < 5% of total catch

The recreational catch of sharks by fishers operating from trailer-boats between Augusta and Kalbarri was estimated from two Department of Fisheries surveys conducted in 1996/97 and 2005/06. The total recreational shark catch was estimated to have declined from ca. 7,000 sharks per year in 1996/97 to ca. 5,500 sharks per year in 2005/06, although only about half of these were reported to have been retained. The reported species composition of the retained catch in 2005/06 was similar to that of the TDGLF. Whaler shark species were the most commonly retained group (31%), followed by hound sharks (gummy, whiskery, etc.; 28%), wobbegongs (14%) and hammerheads (10%). Assuming an average weight of 5 kg per shark, then the recreational take of sharks in the West Coast Bioregion would have been less than 15 t.

Two integrated survey of boat-based recreational fishing in WA during 2011/12 and 2013/14 estimated the recreational catch of a range of species of sharks (Ryan *et al.* 2015<sup>3</sup>). In 2013/14, for the West Coast and South Coast Bioregions, less than 11,000 sharks ( $\pm \sim 4,150$ ) were estimated as being caught by the boat based recreational sector, with more than 82% released. Most catches were reported from the West Coast Bioregion and were dominated by Port Jackson, gummy and dusky sharks.

### Fishing effort/access level

There are 57 licences in the JASDGDLF (24 in Zone 1 and 33 in Zone 2) and 20 WCDGDLF permits, which can be used collectively in conjunction with a Fishing Boat Licence. Only 5 Zone 1, 15 Zone 2 and 6 WCDGDLF vessels reported active fishing returns during 2013/14, similar to the levels of participation in the fisheries over the last five years.

As gillnetting is by far the dominant method employed in the fisheries, the historically small amount of longline fishing effort is incorporated within analyses by transforming longline shark catches by gillnet Catch Per Unit Effort (CPUE). Although standardised fishing effort has previously been reported in units of kilometre gillnet hours ( $\text{km gn.hr}^{-1}$ ), the hourly component of effort reported in monthly fishing returns prior to 2006/07 is known to be a poor indication of the time nets actually spent fishing (i.e. 'soak time'). With the transition from monthly to hourly effort entitlement units and the introduction of a daily catch and effort logbooks in 2006/07, actual soak times have been more accurately reported over the last seven years. Thus, the hourly components of fishing effort reported in monthly and daily fishing returns are not directly comparable. To allow for historical comparison and assessment of effort and CPUE trends in the fisheries, the entire time series of effort data have been recalculated in comparable units of kilometre gillnet days ( $\text{km gn.d}^{-1}$ ; Demersal Gillnet and Longline Figure 4). For these same reasons, fishing effort is also monitored against 2001/02 target levels in units of  $\text{km gn.d}^{-1}$ .

Fishery and zone-specific limits on demersal gillnet and demersal longline fishing effort, equivalent to their 2001/02 levels, were agreed for the start of the 2006/07 season by specifying the number of days that monthly units could be

<sup>1</sup> All reported weights are live weight

<sup>2</sup> Dusky shark catches include catches of bronze whaler (*Carcharhinus brachyurus*), which cannot be accurately separated in catch returns data prior to 2006/07.

<sup>3</sup> Ryan, K.L., Hall, N.G., Lai, E.K., Smallwood, C.B., Taylor, S.M., Wise, B.S. 2015. State-wide survey of boat-based recreational fishing in Western Australia 2013/14. Fisheries Research Report No. 268, Department of Fisheries, Western Australia. 208pp.



fished in each management zone. These (daily) effort limits are considered likely to deliver sustainable catches of target, byproduct and bycatch species and acceptably low risks to ETP species. Effort limits were subsequently re-defined and legislated as hourly units of entitlement using conversion rates of 24 hours day<sup>-1</sup> in Zones 1 and 3 of the JASDGDLF, 20 hours day<sup>-1</sup> in Zone 2 and 24 hours day<sup>-1</sup> in the WCDGDLF. Thus, specified fishing effort limits for each management zone of the fishery are:

JASDGDLF Zones 1 and 3:	84,075 km gn.hr <sup>-1</sup> (3,503 km gn.d <sup>-1</sup> )
JASDGDLF Zone 2:	144,102 km gn.hr <sup>-1</sup> (7,205 km gn.d <sup>-1</sup> )
WCDGDLF <sup>1</sup> :	67,692 km gn.hr <sup>-1</sup> (2,832 km gn.d <sup>-1</sup> )

Expended effort in 2013/14 was 46,200 km gn.hr (2,822 km gn.d-1) in Zone 1; 114,600 km gn.hr (6,305 km gn.d-1) in Zone 2 and 14,200 km gn.hr (679 km gn.d-1) in the WCDGDLF (Demersal Gillnet and Longline Table 1). The effort decline in the WCDGDLF is consistent with the gradual declining trend observed in recent years explained by the combination of a reduction of fishing units due to the VFAS, area closures and new effort management regimes. When measured in km gn.hr<sup>-1</sup>, 59% of the fisheries' effort capacity was utilised in 2013/14 (55% in Zone 1, 80% in Zone 2 and 21% in the WCDGDLF). When measured in km gn.d<sup>-1</sup>, 72% of the fisheries' effort capacity was utilised in 2013/14 (81% in Zone 1, 88% in Zone 2 and 24% in the WCDGDLF). Zone 1 and 2 km gn.d<sup>-1</sup> effort is high (noting Zone 1 effort in 2012/13 was also 100%) and is closely monitored.

## Stock Assessment

**Assessment complete:** Yes

**Assessment level and method:**

**Gummy shark** Level 2 - CPUE  
(annual -relative to previous Level 5 assessment)

**Dusky shark** Level 2 - CPUE  
(annual -relative to previous Level 4 assessment)

**Sandbar shark** Level 2 - CPUE  
(annual -relative to previous Level 4 assessment)

**Whiskery shark** Level 5 - Age Structured Model

**Breeding stock levels:**

**Gummy shark** Adequate

**Dusky shark** Recovering

**Sandbar shark** Recovering

**Whiskery shark** Adequate

The current status of the whiskery and gummy shark stocks is adequate. The current effort levels and consequent CPUE and catch levels are all acceptable. The dusky and sandbar shark

stocks are currently recovering. The current effort levels and consequent CPUE and catch levels are all acceptable, permitting recovery of the stock. It is highly likely that the four stocks are above the point where recruitment would be impaired.

Stock assessments are carried out for the four indicator shark species caught by the fishery using a combination of catch and effort data, periodic empirical estimates of fishing mortality rates, biological information and dynamic biomass and demographic simulation models. For assessment purposes, monthly catch and effort data are corrected to account for missing fishing returns prior to 1989/90, inaccurately reported species compositions and an increasing effort efficiency of 2% yr<sup>-1</sup> prior to 1995/96, to account for major advances in gear technology (e.g. monofilament nets and GPS) and vessel development (i.e. introduction of larger vessels). Missing, misreported and confounded catches submitted in daily/trip logbook returns between 2006/07 and 2008/09 were recovered or corrected using fishers' personal records, fish processor returns, face to face and phone interviews with fishers or were derived from average fish weights in accurately-reported logbook records or from previously observed size frequency data and available length weight relationships.

Trends in the relative abundance of the fisheries' four indicator species are inferred from each species' annual 'effective' Catch Per Unit Effort (CPUE) data. Effective CPUE is calculated by dividing the corrected gillnet-only catch by the equivalent gillnet effort from the regions of the fisheries that overlap each species' primary distribution (as defined below). Due to the introduction in 2006 of an annual two month closure to protect near-term pregnant whiskery sharks and the prohibition of demersal gillnet fishing in the metropolitan region in November 2007, catch and effort data reported from west of 118°E during August, September and October and between latitudes 31°S and 33°S are excluded from the effective CPUE time series.

**Gummy shark:** The best (median) estimate from age-structured modelling indicated that in 1997/98 the Western Australian gummy shark stock was 42.7% of its virgin biomass, slightly above its minimum acceptable level of 40% of its virgin level. As gummy shark catches are almost exclusively comprised of adults, the upward trend in effective CPUE from the area off the south coast between longitudes 116°E and 129°E between the mid 1990s and 2005/06, suggested that breeding biomass steadily increased following reductions in demersal gillnet fishing effort commencing in 1992 (Demersal Gillnet and Longline Figure 5). Although recent CPUE estimates have been higher than at any time since records began, the unprecedented spike and subsequent decline in effective CPUE over the last five years is inconsistent with previous estimates and will be considered in more detail during development of a new integrated stock assessment model that incorporates contemporary catch, effort, size and movement information that is being developed.

**Dusky shark:** Due to the size selectivity characteristics of the mesh sizes permitted in the fishery and its area of operation, dusky shark catches have historically consisted of neonate (young of the year) and one to two year old fish, which collectively accounted for 89% of the observed catch during the 1990s. Due to the age-selective nature of the fishery and longevity of the species, which takes about 30 years to reach

<sup>1</sup> The WCDGDLF limit is adjusted to 64% of the 2001/02 effort level to account for the reduction in entitlement units arising from the 2008 Voluntary Fishery Adjustment Scheme.

maturity and may live for more than 50 years, the available time series of catch and effort data are insufficient for developing a dynamic population simulation model for this stock (as has been used for gummy and whiskery sharks). The status of the Western Australian dusky shark stock was therefore assessed using stochastic demographic modelling techniques to evaluate the sustainability of empirically-estimated fishing mortality rates of sharks born between 1994 and 1996.

The most recent demographic assessment for this stock was conducted in 2005 and subsequent assessments have relied on analyses of catch and CPUE data from south of 28°S latitude to 120°E longitude off the south coast, in relation to the demographic rates estimated by that model. This analysis confirmed that demersal gillnet and longline fishing mortality rates were likely to have been sustainable for the cohorts of sharks born in 1994/95 and 1995/96. However, the model also predicted that very low levels of fishing mortality (1–2% yr<sup>-1</sup>) applied to sharks older than 10 years of age would result in negative rates of population growth. Although the area of the WCDGDLF between 26° 30' S and North West Cape was closed in 1993 to protect adult dusky sharks, they are known to have been caught by various fisheries operating within and outside WA jurisdiction. Previous assessments therefore concluded that the declining trend observed in the effective CPUE series between the mid 1990s and 2004/05 (Demersal Gillnet and Longline Figure 6) could indicate that breeding biomass had been gradually depleted by these poorly-quantified sources of fishing mortality.

There has been an overall increasing trend in the effective CPUE over the past eight years. While the effects of reduced gear competition in the WCDGDLF resulting from the reduction in fishing units due to the VFAS and a general reduction in fishing effort could have contributed to the increasing trend, the average effective CPUE for the past five years has been higher than any time since 1984/85. This suggests that recruitment has been increasing strongly since measures were introduced to protect adult sharks and constrain effort in the TDGDLF. Combined with the recent catches of juvenile sharks of this species having been reduced to approximately half of the quantity determined to be sustainable in 1994/95 and 1995/96, along with the comprehensive measures to mitigate cryptic mortality of older dusky sharks that have been introduced from 2006<sup>1</sup>, the current management arrangements are considered suitably precautionary to ensure that fishing mortality is now at a level such that recovery of this stock is occurring.

**Whiskery shark:** Previous age structured modelling of the whiskery shark stock (based on hourly CPUE data) concluded that total biomass was depleted to less than 40% of its virgin level by the early 1990s but the stock had shown preliminary signs of recovery to slightly above 40% of virgin biomass by the late 2000s. Using the new series of daily effective CPUE data from south of 28°S latitude to 129°E longitude off the south coast (Demersal Gillnet and Longline Figure 7) in the model supports the conclusion that total biomass was heavily depleted during the 1980s. However, this model implementation indicates that total biomass at the

commencement of mandatory catch and effort reporting in 1975/76 was less certain than previous assessments suggested (95% confidence intervals that biomass was between 69% and 100%). Significantly, the model also suggests (with 95% confidence) that biomass may only have fallen as low as 45.4% in 1995/96. The best (median) estimates of total biomass indicated only very modest increases and that biomass in 2009/10 was 52.1% of its virgin level (95% confidence intervals of 46.4 to 56.8%). Further analyses of CPUE data are currently being undertaken in conjunction with exploration of alternative model assumptions, in an attempt to better understand these model results.

Nevertheless, as these and previous model outputs suggest that whiskery shark biomass currently exceeds the minimum acceptable level and all recent modelling indicates that total and mature female biomass trends are increasing, the status of the WA whiskery shark stock is now considered to be acceptable.

Furthermore, accelerated rates of whiskery stock recovery are expected to become evident in catch and CPUE data when sharks born during the years that were subject to an annual whiskery shark pupping closure (see management arrangements above) begin recruiting to the fishery (around 2012/13 and beyond).

**Sandbar shark:** Due to the sandbar shark's longevity and age-specific nature of fishing mortality in the target fisheries, stock assessment was undertaken using empirically-derived estimates of fishing mortality and demographic modelling techniques, similar to those used for dusky shark. FRDC-funded research undertaken between 2000 and 2005 confirmed that sandbar sharks taken in the TDGDLF were the same unit stock as was being targeted in the Northern Shark Fisheries. The model indicated that combined levels of fishing mortality in the target TDGDLF and Northern Shark Fisheries, as well as in non-target commercial fisheries and the recreational fishing sector were increasingly unsustainable between 2001 and 2004 and had probably been so since at least 1997/98. As those mortality rates corresponded to combined reported catches of 250–440 tonnes year<sup>-1</sup>, the combined catch of 918 tonnes reported by the target sector in 2004/05 (762 tonnes of which was reported by the northern shark fisheries) is considered to have been highly unsustainable. This conclusion was supported by fishery-independent survey data collected from the area between northern Shark Bay and Eighty Mile Beach where mature sandbar sharks are prevalent, which indicate there was a significant decline in breeding stock abundance between 2002 and 2005.

Subsequent assessments of stock status have used analyses of the combined catches by the TDGDLF and northern shark fisheries relative to those fisheries' catches during the assessment period. Although an effective CPUE region has been identified as south of 26°S latitude to 118°E longitude off the south coast (Demersal Gillnet and Longline Figure 8), the full extent of expected reductions in recruitment caused by previous excessive catches of breeding stock, are unlikely to be reflected in CPUE data until cohorts born since 2004/05 enter the fishery between 6 and 9 years of age. Although the significant declines in WCDGDLF fishing effort may mask the magnitude of reductions in those cohorts' abundance, TDGDLF sandbar shark catches since 2008/09 have been at levels that should allow a gradual recovery of the breeding stock. With the breeding stock likely to be close to the

<sup>1</sup> i.e. commercial protection of sharks in most non-target fisheries, total protection of all whaler sharks with an inter-dorsal fin length greater than 70 cm in the South and West Coast Bioregions, 70 cm maximum (inter-dorsal fin) size limit for dusky sharks in the TDGDLF, implementation of bycatch reduction devices in trawl fisheries, prohibition of metal snoods in most commercial fisheries.

minimum acceptable limit (40% of virgin biomass), the WCDGDLF will need to be carefully monitored over coming years to ensure that catch levels of sandbar sharks are maintained consistent with continued stock recovery.

**Other sharks:** The four indicator species of the temperate shark 'suite' account for approximately 80% of the fisheries' and Bioregional shark catch and represent the range of life history strategies of other shark species caught by the fisheries. Thus, the status of indicator stocks is believed to generally reflect the status of other sharks in the South and West Coast Bioregion.

## Non-Retained Species

**Bycatch species impact:** **Low**

The catch composition of the fishery was examined in detail for the period 1994 to 1999. There is some discarded bycatch of unsaleable species of sharks, rays and scalefish. During ESD risk assessment of these fisheries in 2002, all impacts on stocks of bycatch species were determined to be low risk. As maximum potential fishing effort is now explicitly capped at less than 70% of the mid to late 1990s levels, bycatch in all management zones is expected to have been proportionally reduced. Recent multi-fisheries bycatch risk assessment has identified the Port Jackson shark among the higher risk bycatch species in the West Coast Bioregion. Although this species is one of the largest components of the demersal gillnet and demersal longline fisheries bycatch and is recorded as bycatch in other commercial fisheries, cumulative risks were assessed as low-moderate due to its very high post-capture survival from gillnet fisheries (Braccini *et al.* 2012<sup>1</sup>).

**Listed species interaction:** **Negligible-Low**

Historical on-board observer programs have shown that ETP species interactions were very low throughout the fishery. The Demersal Gillnet and Longline Table 2 details individual interactions between the fishery and all ETP species since recording began in fishery returns in 2006/07.

Recently completed analyses of potential encounter rates of Australian sea lions with demersal gillnet gear and interpretation of those rates in the light of historical observer data have supported Department's Negligible-Low risk rating and suggested that sea lion captures in these fisheries are likely to be extremely low frequency events.

It should also be noted that demersal gillnet and longline fishing is not permitted between Steep Point (26°30' S) and a line drawn north of North West Cape (114°06' E) to Koolan Island, or within 3 nautical miles of the Abrolhos Islands baselines, where populations of turtles and Australian sea lions are present.

1 Braccini, J.M., Van Rijn, J.A. & L.H. Frick. High post-capture survival for sharks, rays and chimaeras discarded in the main shark fishery of Australia? PLoS ONE, 7: e32547

## Ecosystem Effects

**Food chain effects:** **Low**

The recent analysis of potential changes in ecosystem structure of finfish on the South and West Coast Bioregions (Hall & Wise, 2011)<sup>2</sup> found no evidence of any systematic change in species diversity, richness or trophic index indicating that this fishery is not having a material impact on food chain or trophic structure.

**Habitat effects:** **Negligible**

The level of effort is such that the gear is deployed infrequently over approximately 40% of the fisheries' operational area (Demersal Gillnet and Longline Figure 1) and under normal circumstances the physical impact of the gear on the bottom is minimal. Moreover the very small footprint of each net would combine to make a very small percentage (<< 5%) of the area that would be contacted by this gear on an annual basis.

## Social Effects

**Direct:** Fishing returns reported that between 57 and 69 crew were employed in the JASDGDLF and between 21 and 28 were employed in the WCDGDLF during 2013/14. As sharks are generally not targeted by recreational fishers in Western Australia, their direct social importance to this group is negligible.

**Indirect:** The capture of sharks generates a high level of community interest and debate.

## Economic Effects

**Estimated annual value (to fishers) for 2013/14:**

**JASDGDLF:** **Level 3 - \$5 - 10 million**

**WCDGDLF:** **Level 1 - <\$1 million**

\* As fishers do not specify the value of fins on their catch returns, fin values were calculated at an average of 3% of sharks' whole weight and value was conservatively estimated using a price of \$20/kg. Categories of shark which do not have saleable fins were excluded from fin valuation.

## Fishery Governance

**Target commercial catch range:**

**All key shark species** **725–1,095 tonnes**

**Individual key shark species:**

**Gummy shark** **350–450 tonnes**

**Dusky shark** **200–300 tonnes**

**Sandbar shark** **< 120 tonnes**

**Whiskery shark** **175–225 tonnes**

2 Hall, N.G. and Wise, B.S. 2011. Development of an ecosystem approach to the monitoring and management of Western Australian fisheries. FRDC Report - Project 2005/063. Fisheries Research Report No. 215. Department of Fisheries, Western Australia. 112 pp.

**Current Fishing Level**

<b>JASDGDLF Zone 1</b>	<b>Acceptable</b>
<b>JASDGDLF Zone 2</b>	<b>Acceptable</b>
<b>WCDGDLF</b>	<b>Acceptable</b>

The total catch for 2013/14 was within target range, similar to previous years and considered acceptable given effort levels.

Maximum acceptable effort levels for each management zone have been based on their respective 2001/02 (daily) levels. These levels are considered likely to deliver sustainable harvests of the fisheries' target and byproduct species and acceptably low levels of bycatch and listed species interactions. Under explicit hourly-gear input control arrangements, effort should not exceed these limits.

**Gummy shark** catches exceeded the upper limit of their acceptable range between 2003/04 and 2009/10, and reached a historically high level in 2007/08 (755 t). As the steadily increasing CPUE trend observed between the early-mid 1990s and 2005/06 is believed to have been a result of increasing stock abundance, the consistently high catches reported in recent years are not of concern. Although gummy shark catches were lower than their historical peak, current catches were similar to last year and at the lower limit of their target range. As gummy CPUE appears to have been maintained at a relatively high rate, this year's catch is not of concern. However, until the implications of the unprecedented recent spike in effective CPUE can be ascertained and a new stock assessment model developed, CPUE will be closely monitored to ensure that it remains at expected levels and the downwards trajectory of the last three years does not continue.

**Dusky shark** catches have been within their acceptable range since 20004/05, except for 2006/07 when they were 5 tonnes below the minimum limit. The dusky shark catch in 2012/13 was 204 t which is within the target range of 200–300 t. Catch rates in 2013/14 were similar to previous years. It is worth noting that the fishery has not utilised its full entitlement during 2013/14 and as such the Department will continue to closely monitor the catch levels to ensure they do not increase above sustainable levels. The acceptable catch range will require re-evaluation if catches increase in coming years.

**Whiskery shark** Total catches of whiskery shark have steadily declined since the mid-1990s although until 2010/11 catches had been maintained slightly above or below the minimum acceptable level. The 127 t catch in 2010/11 and 102t catch in 2011/12 were 48 and 73 t, respectively, less than the minimum level and had been the fisheries' lowest annual catch since 1975/76. The 2013/14 catch of 161 t is only 14 t below the minimum level. The low catches of recent years mostly reflect the outcomes of management measures to recover this stock, in particular, the introduction of the seasonal whiskery 'pupping' closure. As these measures are intended to increase catch rates in coming years the acceptable catch range may need to be reviewed as the magnitude and rate of stock recovery can be determined.

**Sandbar shark** catches exceeded their maximum acceptable level until effort declined dramatically in the WCDGDLF in 2008/09 when catches declined to more sustainable levels of 81 t in 2008/09, 107 t in 2009/10, 71 t in 2010/11, 34 t in 2011/12, 49 t in 2012/13 and 45 t in 2013/14. The historically

low catch of sandbar sharks is likely to reflect the low level of fishing effort and other fleet dynamics in the WCDGDLF. At these levels, recruitment to the breeding stock should improve in coming years and gradually allow the mature biomass to recover from more than a decade of excessive catches in the northern shark fisheries.

**New management initiatives (2014/15)**

Given recent modelling indicates that total and mature female biomass trends of whiskery sharks are increasing, and the status of the stock is now considered to be acceptable, a decision was made not to implement a whiskery pupping closure for the 2014/15 fishing season.

The FRDC-funded desktop study that began in August 2010 to estimate potential interaction rates of Australian sea lions with demersal gillnets in the TDGDLF was completed and accepted by FRDC in early 2012. The model developed as part of the project was used to conduct a (partial) reanalysis of existing independent observer data from the TDGDLF to assist in evaluating management options to ensure interactions with Australian sea lions are maintained with acceptable levels.

The WTO for the TDGDLF was renewed on 31 May 2012 and expires on 28 August 2015. In addition, the Part 13 accreditation of the management plans for the fisheries were re-accredited. The accreditation carries a condition associated with addressing interactions between the fishery and Australian sea lions. The Department convened an Australian sea lion Working Group (the Working Group) that consists of Departmental staff, as well as industry, the conservation sector and the Department of Parks and Wildlife (formerly the Department of Environment and Conservation). The Working Group are developing strategies to address the EPBC Act's Part 13 accreditation condition and specifically are identifying management measures that will mitigate interaction between the fishery and Australian sea lions.

The proposed South-west Commonwealth marine reserve network was proclaimed in November 2012. Following the change of Federal Government in 2013 the marine reserve network is to be reviewed. The potential for the reserves to impact on the TDGDLF will depend on the outcomes of that review. The State Ngari Capes Marine Park was also reserved in June 2012, however the zoning scheme has not yet been given effect. This marine park is likely to have some impact on Zone 1 TDGDLF operators.

The TDGDLF underwent pre-assessment for Marine Stewardship Certification in 2014.

**External Factors**

As the TDGDLF key target species span multiple Bioregions there are a number of factors outside of the control of the fishery which can negatively impact the performance of key temperate shark stocks. In particular, the potential for ongoing catches of breeding stock of sandbar sharks across the northern shark fisheries (from Western Australia, Northern Territory and northern Queensland and Commonwealth managed fisheries) remains cause for concern. Other potential factors affecting key temperate shark stocks include targeted fishing for gummy shark by Commonwealth managed vessels that occurs to the east of

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Zone 2 of the JASDGLF (although the fishery is tightly managed via quota controls) and incidental catches of dusky and gummy sharks in other State and Commonwealth Government-managed fisheries. While the risks associated with these outside influences are largely unqualified they

must be taken into account in the stock assessment for individual species (and the TDGDLF 'suite') to ensure appropriate management strategies are implemented that address the long-term sustainability of the shark stocks.

**DEMERSAL GILLNET AND LONGLINE TABLE 1**

Summary of the 2013/14 catch (t live wt.) by the WA temperate Demersal Gillnet and Demersal Longline Fisheries. Data are given by management zone and also by Bioregion (italicised). Indicator species and catches are highlighted in bold.

Name	Species or taxon	JASDGLF		WCDGDLF	Bioregion		Total
		Zone 1	Zone 2		South Coast	West Coast	
Sharks and rays							
<b>Gummy</b>	<i>Mustelus antarcticus</i>	<b>20.9</b>	<b>423.4</b>	<b>0.4</b>	<b>429.4</b>	<b>15.3</b>	<b>444.7</b>
<b>Dusky whaler</b>	<i>Carcharhinus obscurus</i>	<b>96.8</b>	<b>84.4</b>	<b>9.1</b>	<b>98.5</b>	<b>91.8</b>	<b>190.3</b>
<b>Whiskery</b>	<i>Furgaleus macki</i>	<b>33.1</b>	<b>120.2</b>	<b>7.4</b>	<b>129.5</b>	<b>31.3</b>	<b>160.8</b>
<b>Sandbar</b>	<i>Carcharhinus plumbeus</i>	<b>12.6</b>	<b>6.4</b>	<b>26.1</b>	<b>10.1</b>	<b>35.1</b>	<b>45.2</b>
Hammerheads	Sphyrnidae	21.7	34.9	0.6	37.7	19.5	57.1
Spinner (long nose grey)	<i>Carcharhinus brevipinna</i>	20.9	8.1	4.7	9.5	24.1	33.6
Wobbegongs	Orectolobidae	13.9	10.8	3.2	15	12.9	28
Rays	Batoidea	1.8	4.6	2.9	4.8	4.5	9.3
Common saw shark	<i>Pristiophorus cirratus</i>	0.3	7.9		7.9	0.3	8.2
School	<i>Galeorhinus galeus</i>		1.9	<0.1	1.9	<0.1	1.9
Other elasmobranchs		5	5.9	4.1	6.9	8.2	15.1
<b>Total elasmobranchs</b>		<b>227.1</b>	<b>708.6</b>	<b>58.5</b>	<b>751.2</b>	<b>242.9</b>	<b>994.2</b>
Scalefish							
Blue Morwong	<i>Nemadactylus valenciennesi</i>	8.5	27.4	0.7	31.6	4.9	36.6
<b>Blue Groper</b>	<i>Achoerodus gouldii</i>	<b>17</b>	<b>21.3</b>	<b>0.9</b>	<b>27</b>	<b>12.2</b>	<b>39.2</b>
<b>West Australian dhufish</b>	<i>Glaucosoma hebraicum</i>	<b>6.2</b>	<b>0.6</b>	<b>8</b>	<b>1.3</b>	<b>13.5</b>	<b>14.8</b>
<b>Pink snapper</b>	<i>Chrysophrys auratus</i>	<b>7.7</b>	<b>10.5</b>	<b>38.6</b>	<b>12.3</b>	<b>44.5</b>	<b>56.8</b>
Boarfishes	Pentacerotidae	1.1	5.2		5.4	0.9	6.3
Samsonfish	<i>Seriola hippos</i>	2.6	4.6	2.7	5	5	10
<b>Redfishes</b>	<i>Centroberyx</i> spp.	<b>0.1</b>	<b>5.8</b>	<b>&lt;0.1</b>	<b>5.9</b>	<b>&lt;0.1</b>	<b>5.9</b>
Mulloway	<i>Argyrosomus japonicus</i>	1.5	2.4	0.6	2.5	2.1	4.6
Sweetlips	Haemulidae			0.5		0.5	0.5
<b>Baldchin groper</b>	<i>Choerodon rubescens</i>	<b>&lt;0.1</b>		<b>3.1</b>		<b>3.1</b>	<b>3.1</b>
Other scalefish		4.6	2.9	6.4	4.0	11	15
Total scalefish		49.3	80.8	61.5	95.1	96.5	191.6
<i>'Demersal scalefish suite' component</i>		40.6	71.4	57.5	84.1	85.4	169.5
<b>Fishing effort (km gn d)</b>		2,822 (81) <sup>1</sup>	6,305 (87) <sup>1</sup>	679 (24) <sup>2</sup>			9,806 (72) <sup>2</sup>
<b>Fishing effort (1000 km gn hr)</b>		46 (55) <sup>3</sup>	115 (80) <sup>3</sup>	14 (21) <sup>3</sup>			175 (59) <sup>3</sup>

1 Percentage of respective 2001/02 levels

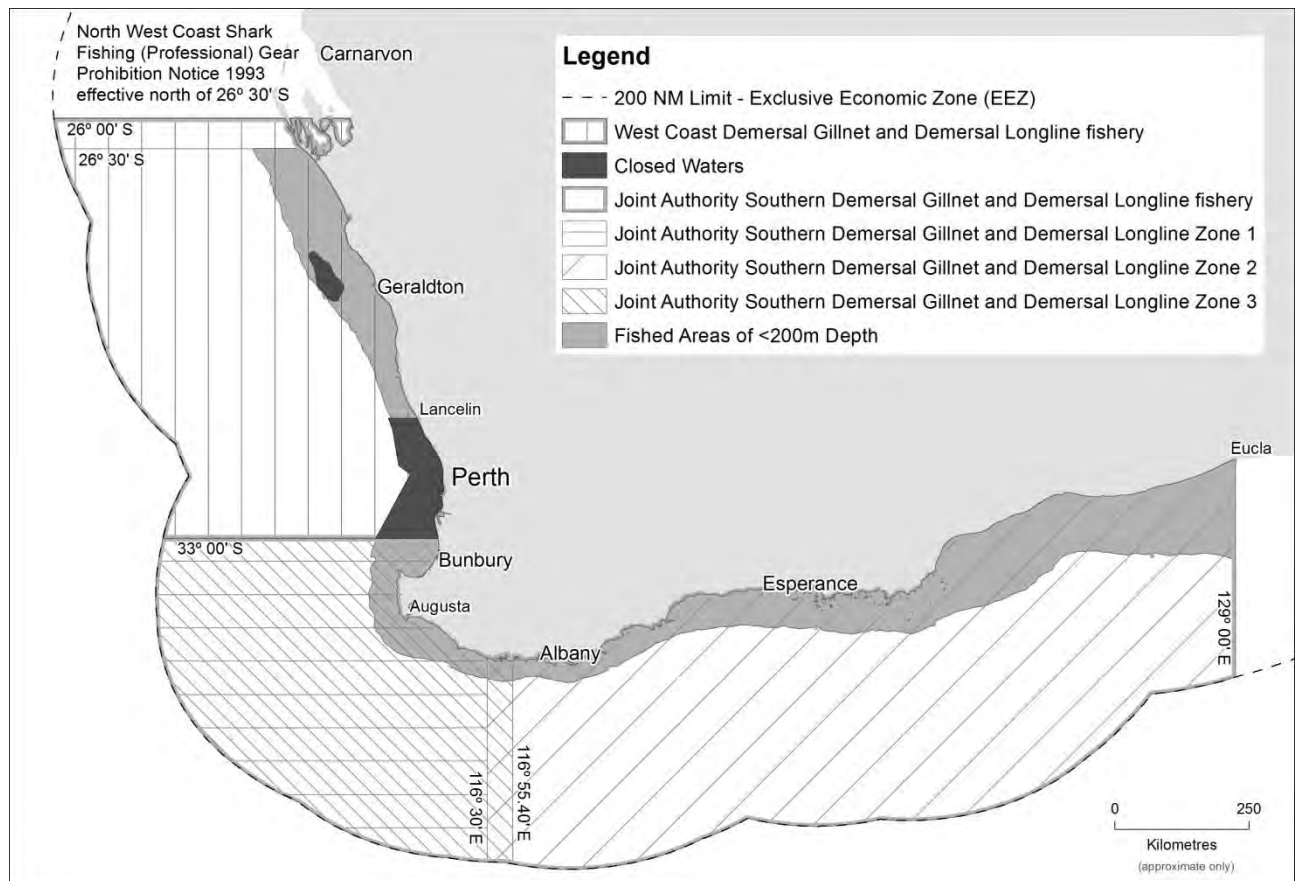
2 Percentage of VFAS adjusted 2001/02 levels

3 Values in parentheses are percentages of each management zone's maximum hourly effort capacity

**DEMERSAL GILLNET AND LONGLINE TABLE 2**

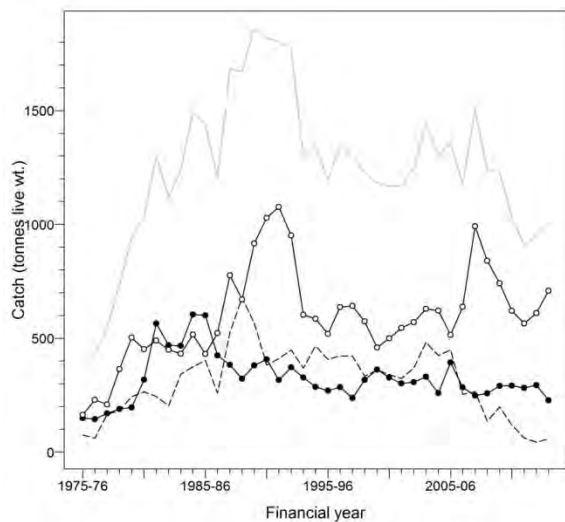
Recorded interactions with Endangered, Threatened, Protected (ETP) species.

ETP SPECIES	2007/08		2008/09		2009/10		2010/11		2011/12		2012/13		2013/14	
Alive(A)/Dead(D)	A	D	A	D	A	D	A	D	A	D	A	D	A	D
Dolphins	1		1	2		2		3						
Manta Rays							2				1			
Muttonbird, General					7	4								
Sawfish, General	1						1							
Sea Birds		2	2	1										
Sea Lions				2					3		1	1		
Seal, NZ Fur		2	1	5		7		1		3				
Shark, Grey Nurse	38	16	63	18	59	27	53	19	69	18	68	19	48	18
Shearwater, Fleshfooted						2								
Snake, Sea		2												
Turtle, General	5		2	2	2	1	1		3		3		1	
Whales			1											
White Shark	10	3	14	2	2	1	3	5	19	3	17	1	17	3



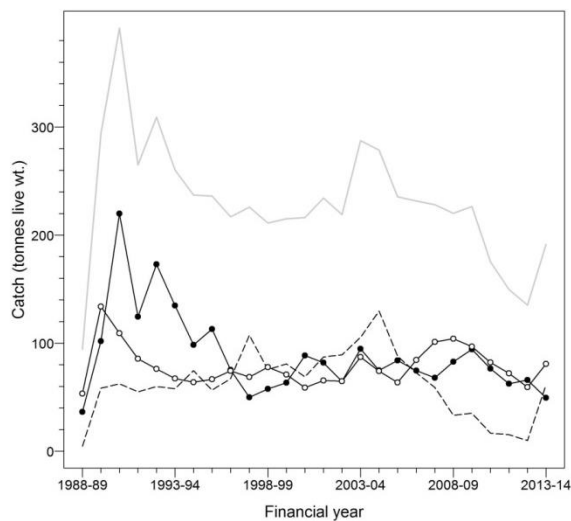
**DEMERSAL GILLNET AND LONGLINE FIGURE 1**

Management boundaries of the WA temperate Demersal Gillnet and Demersal Longline Fisheries. Grey shading represents fished areas of less than 200m depth.



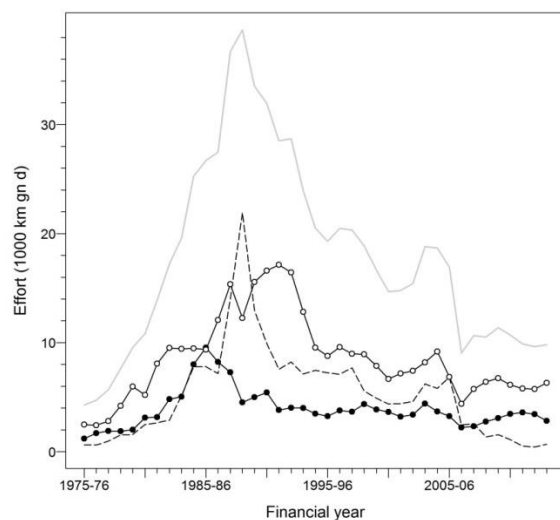
**DEMERSAL GILLNET AND LONGLINE FIGURE 2**

Total elasmobranch catches. Black circles = JASDGDLF Zone 1; white circles = JASDGDLF Zone 2; dashed black line = WCDGDLF; plain grey line = total from the three management zones.



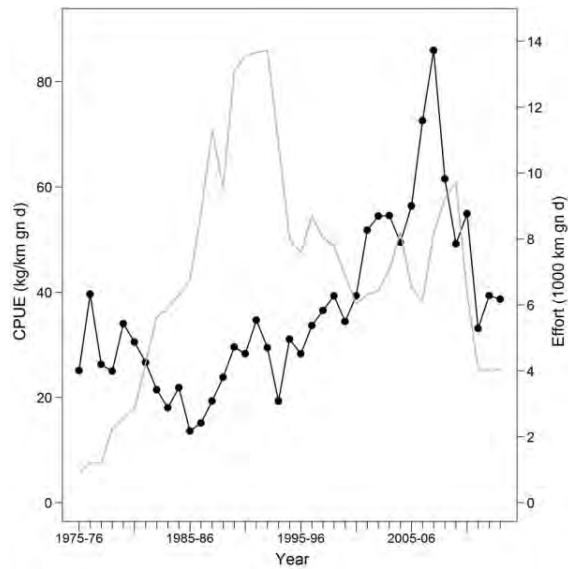
**DEMERSAL GILLNET AND LONGLINE FIGURE 3**

Total scalefish catch. Black circles = JASDGDLF Zone 1; white circles = JASDGDLF Zone 2; dashed black line = WCDGDLF; plain grey line = total from the three management zones. Catches prior to 1988/89 cannot be distinguished from other fisheries' gillnet and longline catches and are omitted.



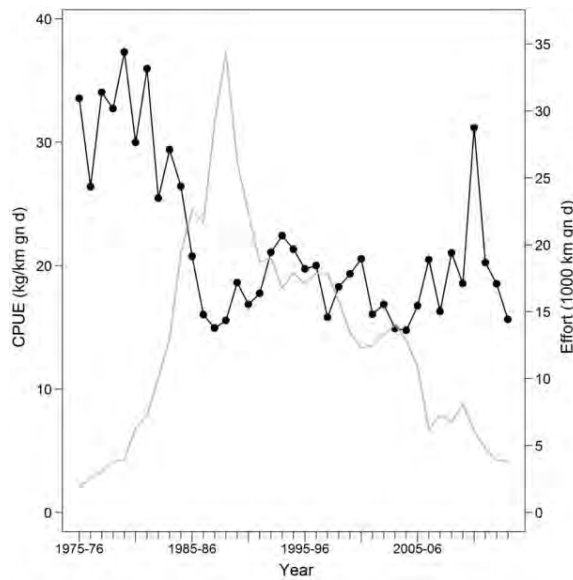
**DEMERSAL GILLNET AND LONGLINE FIGURE 4**

Standardised demersal gillnet and demersal longline effort. Black circles = JASDGDLF Zone 1; white circles = JASDGDLF Zone 2; dashed black line = WCDGDLF; plain grey line = total from the three management zones.



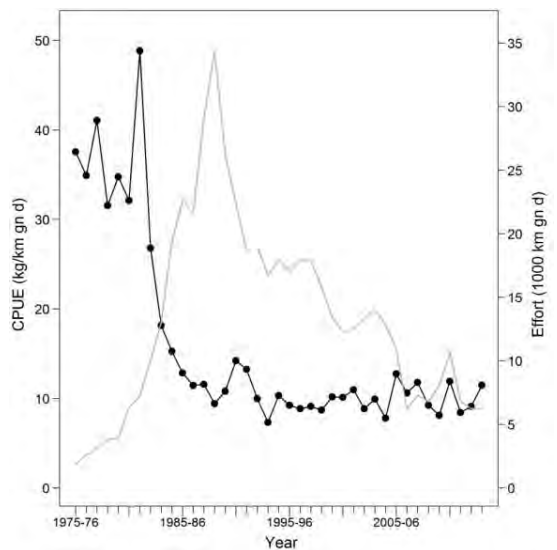
**DEMERSAL GILLNET AND LONGLINE FIGURE 5**

Gummy shark effective effort (grey line) and CPUE (black circles).



**DEMERSAL GILLNET AND LONGLINE FIGURE 6**

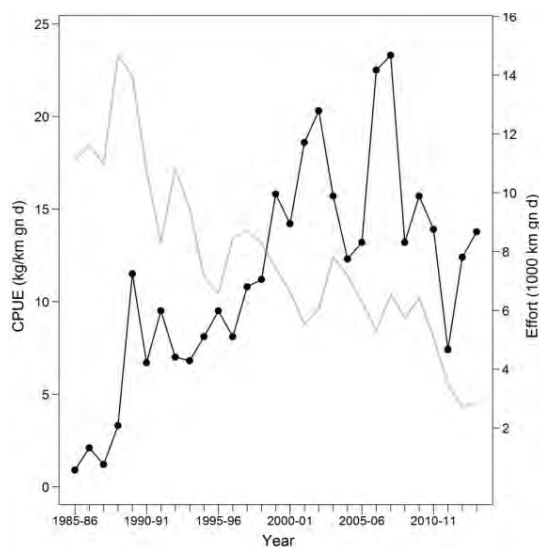
Dusky shark effective effort (grey line) and CPUE (black circles).



**DEMERSAL GILLNET AND LONGLINE FIGURE 7**

Whiskery shark effective effort (grey line) and CPUE (black circles),



**DEMERSAL GILLNET AND LONGLINE FIGURE 8**

Sandbar shark effective effort (grey line) and CPUE (black circles).

## South Coast Demersal Scalefish Resource Report: Statistics Only

*J. Norriss and S. Walters*

### Fishery Description

#### Commercial

Operators in this fishery target demersal scalefish species such as pink snapper, Bight redfish, blue morwong (queen snapper) and hapuku, and the pelagic Samson fish in waters of the South Coast Bioregion (SCB), primarily using droplines and handlines. The fishery is herein referred to as the south coast “wetline” fishery, although the catch reported here also includes minor quantities of demersal scalefish taken in nearshore waters by haul nets and set nets whilst targeting nearshore species (e.g. herring, whiting, mullet), and by fish trapping, particularly leatherjackets.

The take of scalefish by trawl methods, salmon by line and beach netting, estuarine netting and pilchards by purse seine in the SCB are separately managed fisheries and their catches are not included here. The capture of demersal species by the Joint Authority Southern Demersal Gillnet and Demersal Longline Fishery operating in the South Coast Bioregion is also managed and reported separately (see Temperate Demersal Gillnet and Longline Fisheries Status Report).

#### Recreational

Recreational fishers, mostly using line based methods from boats, also take these species.

#### Boundaries

This wetline fishery operates in the South Coast Bioregion’s (SCB) oceanic waters from near Black Point at 115° 30’ E to the WA/SA border at 129° E (South Coast Demersal Scalefish Resource Figure 1).

#### Governing Legislation

##### Commercial

*Fish Resources Management Act 1994, Fish Resources Management Regulations 1995* and other subsidiary legislation.

The commercial wet line fishery is currently ‘open access’ and as such is accessible to the holder of a Commercial Fishing Licence (for the fisher) fishing from an unrestricted Fishing Boat Licence (for the boat).

##### Recreational

*Fish Resources Management Act 1994, Fish Resources Management Regulations 1995* and other subsidiary legislation.

#### Total Landings (Season 2014):

**79.0 tonnes demersal scalefish**

**42.0 tonnes non-demersal scalefish**

##### Commercial

Commercial catches (South Coast Demersal Scalefish Resource Table 1) are monitored through the Department’s statutory Catch and Effort Statistics (CAES) return system. Bight redfish, blue groper, blue morwong and pink snapper have been identified as indicator species for the inshore demersal suite of finfish for the SCB. These indicator species are used to monitor the status of the resource and represent the large majority of the catches in this suite by the commercial fishery. Hapuku, blue-eye trevalla and eightbar

grouper have been identified as indicator species for the offshore demersal suite.

Two more catch statistics are included in this chapter as they are unreported elsewhere: samson fish, one of the indicator species for the SCB pelagic suite; and leatherjackets not caught by the South Coast Estuarine Managed Fishery and taken in oceanic waters mostly by trap. A high leatherjacket catch in 2011 was due to a concerted attempt to develop that fishery at the time.

The catch of 79.0 t of demersal scalefish during 2014 is the second lowest annual catch since at least 2000, with only the 2013 catch lower. Catches in earlier years ranged from 104 to 147 tonne (South Coast Demersal Scalefish Resource Figure 2). Pink snapper, Bight redfish and hapuku catches were at their second lowest since 2000, and blue morwong at its lowest. The recent low catches may be due to reduced fishing effort, although the reason is currently not well understood given the difficulty of quantifying effort in this “open access” fishery. In addition, 42.0 t of non-demersal scalefish catch was reported in 2014, comprising mainly of samson fish, leatherjacket species and bonito.

#### Recreational

Two surveys of boat based recreational fishing for the 12 months to 29 February 2012, and to 30 April 2014, provided the following respective SCB catch point estimates: pink snapper 9.4 and 5.3 t, Bight redfish 11.8 and 9.9 t, blue morwong 12.0 and 7.8 t. The recreational catch of Samson fish was estimated to be 670 and 748 fish kept, respectively.

### Fishery Governance

**Target commercial catch range:** Not available

**Current Fishing (or Effort) Level:** Not available

A formal catch range has not been developed for this fishery, but will be considered following the completion of a Western Australian Natural Resource Management Office (WANRM) funded research project in 2015, described under New Management Initiatives (below).

### New management initiatives (2014/15)

Following the introduction of the *West Coast Demersal Scalefish (Interim) Management Plan 2007* and reductions in effort applied to the West Coast Rock Lobster Managed Fishery, there have been concerns about a shift in fishing effort to the SCB and consequential resource sharing issues.

A WANRM-funded research project commenced in 2013, with the objectives of providing age based stock assessments of inshore demersal indicator species for the South Coast Bioregion (pink snapper, Bight redfish, blue morwong and western blue groper), and to elucidate the stock structure of Bight redfish. A research report will be finalised in 2015 which will inform the development of more formal fishery management arrangements.

The Department commenced a review of wetline fishing (including ‘open access’ commercial line, net and fish trap fishing) on the South Coast in late 2015. Through this review, the Department intends to implement more formal management arrangements for these fisheries to provide an improved framework for the sustainable management of commercial line, net and trap fisheries into the future.

### External Factors

Bight redfish are an important component of the catch of the Great Australia Bight Trawl Sector (GABTS), part of a Commonwealth (Australian Fisheries Management Authority [AFMA]) managed fishery operating across southern Australia as far west as Cape Leeuwin. Off the Western Australia coast (i.e. west of 129° E) it operates outside State fishery shelf waters (depth less than 200 metres), except for east of 125° E (approximately 250 km east of Esperance) where shelf waters are also able to be fished. In the 2013-14 fishing season, 196 t of Bight redfish were taken by the GABTS, although mostly from waters off South Australia. Thus the South Coast Demersal Scalefish resource is also exploited by the GABTS and is affected by management arrangements in that fishery. The WANRM-funded research project has collaborated with AFMA in an attempt to elucidate Bight redfish stock connectivity. A report is due in 2015.

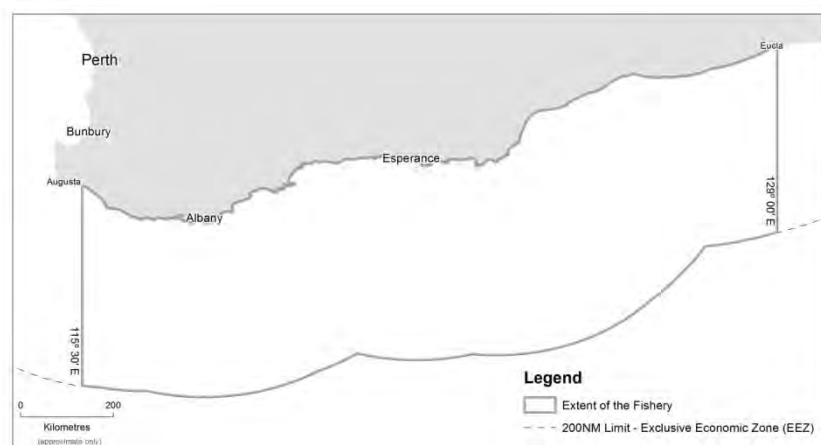
**SOUTH COAST DEMERSAL SCALEFISH RESOURCE TABLE 1**

Catches (t) of demersal indicator species, total demersal and total non-demersal scalefish catches by the 'open access' commercial wetline fishery in the South Coast Bioregion, 2010–2014.

Species	2010	2011	2012	2013	2014
Bight Redfish*	31.2	36.4	45.8	22.1	26.6
Blue groper	0.7	1.4	0.4	0.9	0.5
Blue Morwong	5.0	5.2	4.4	4.0	4.0
Pink Snapper	40.7	30.2	27.4	17.9	21.3
Hapuku	12.8	16.8	14.5	7.5	11.3
Blue-eye trevalla	2.2	3.4	3.1	0.6	0.6
Eightbar grouper	0.6	1.7	3.4	1.5	2.9
Other demersal scalefish	14.8	11.8	10.3	9.0	11.9
Total demersal scalefish	108.0	106.8	109.4	63.4	79.0
Samson fish (pelagic)	15.4	19.4	13.5	14.0	14.8
Leatherjackets (nearshore)	4.9	39.1	6.3	11.5	6.0
Total other non-demersal scalefish**	4.6	11.5	9.4	32.5	21.2
Total Scalefish	133.0	176.8	138.6	121.5	120.9

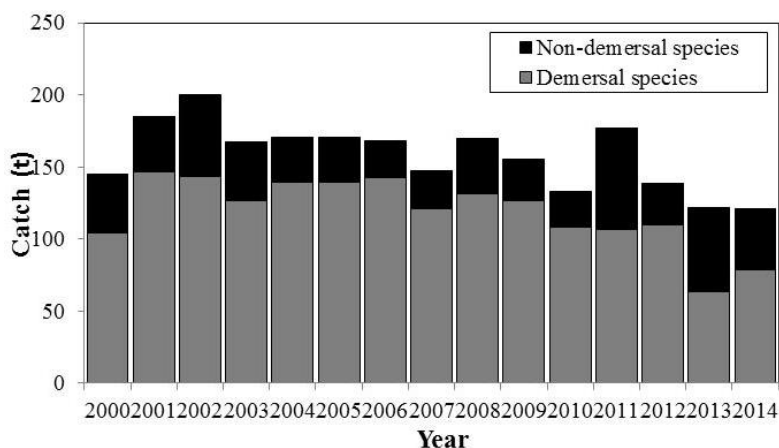
\* Estimates of Bight redfish catches include fishes reported as 'Bight redfish', 'yelloweye redfish' and 'redfish', confirmed by recent catch sampling to be > 99% Bight redfish (add genus species name).

\*\* Includes catches of pelagic and nearshore species, excluding samson fish and leatherjackets which are given separately.



**SOUTH COAST DEMERSAL SCALEFISH RESOURCE FIGURE 1**

Map of the extent of the "open access" wetline fishery in the South Coast Bioregion.



**SOUTH COAST DEMERSAL SCALEFISH RESOURCE FIGURE 2**

Catches (t) of demersal and non demersal scalefish in the "open access" wetline fishery, 2000–2014.

# AQUACULTURE

## Regional Research and Development Overview

Greenlip abalone (*Haliotis laevis*) is considered a key species for aquaculture development on the south coast of WA.

An abalone farm and associated hatchery near Bremer Bay have been upgraded and modified to cater for planned growth in production and to accommodate biosecurity requirements. The land-based farm and hatchery are being operated according to a Management and Environmental Monitoring Plan (MEMP), which includes provisions for biosecurity. Independent audits are undertaken to ensure compliance with biosecurity measures.

The licence holder for a marine-based greenlip abalone farm near Augusta has been granted a variation to include an additional two areas in Flinders Bay for abalone aquaculture

and is currently increasing production. The marine-based abalone farm is also operating under a MEMP and the Department of Fisheries has a compliance plan in place.

The Department of Fisheries is currently assessing an application for exemption to conduct trials on the suitability of areas in Wylie Bay, near Esperance, for abalone aquaculture.

The abalone aquaculture industry sector is now operating and being managed according to the July 2013 Abalone Aquaculture in Western Australia Policy. A key purpose of the Abalone Aquaculture Policy, which places a high level of emphasis on biosecurity, is to establish clear management guidelines and hence provide greater certainty to the sectors of the abalone industry.

## COMPLIANCE AND COMMUNITY EDUCATION

Commercial and recreational fisheries compliance in the South Coast bioregion is undertaken by Fisheries and Marine Officers (FMOs) from: Busselton, Albany and Esperance District Offices as well as utilising a recreational mobile patrol vehicle based at Bunbury. Compliance strategies include both overt and covert operations. Inspections of fishing activities are conducted on land, at-sea, at commercial fish processing establishments, wholesale/retail outlets and aquaculture sites. FMOs inspect vessels, catches, fishing gear, marine safety equipment and commercial and recreational licences. Marine Education Officers deliver a community education program.

### Activities during 2013/2014

Due to the variety of commercial and recreational fisheries, expanse of coastline and the variable and seasonal weather conditions, FMOs use risk assessments to prioritise and plan compliance activities.

Overall, FMOs delivered a total of 2,562 'on-patrol' officer hours to the bioregion, which is a reduction from the previous year. Reduction in patrol hours can be attributed to a reduced number of available staff due to shark mitigation projects and time associated with delivering training to relevant FMOs (South Coast Compliance Figure 1).

FMOs made contact with a total of 150 commercial fishers in the field, across the south coast. Offences detected included licence issues, quota management and breaches of individual fisheries management arrangements (South Coast Compliance Table 1).

The remainder of the commercial fishery compliance effort was directed to the wide range of minor commercial fisheries operating in the bioregion.

During the year, 20 infringement warnings and eight infringement notices were issued with a further five cases resulting in prosecution action being taken against

commercial fishers (or those offending against commercial gear).

Recreational compliance activities concentrated mainly on checking shore and vessel based anglers, abalone fishers and shellfish collectors. FMOs contacted a total of 6,498 recreational fishers. During 2013/14, there were 73 infringement warnings and 57 infringement notices issued and six prosecution actions were taken against recreational fishers (South Coast Compliance Table 1).

Compliance patrols in recreational fisheries principally involve checks to ensure that fishers are adhering to size and bag limits and complying with seasonal restrictions that apply in the recreational abalone fishery.

The fisheries of highest risk of non-compliance with management arrangements were considered to be abalone, marron, marine finfish and estuarine netting. There continues to be a growing awareness of the open season and availability of abalone on the south coast.

Community and school education programs in the South Coast Bioregion were conducted by the Marine Education Officers. Activities included the delivery of school excursions and excursions to 825 primary and secondary students across the region in 28 structured sessions. A further 470 people took part in structured community education activities such as school holiday programs and presentations to interest groups. Two agricultural shows were attended and a number of information displays to engage directly with recreational fishers at key locations such as boat ramps and caravan parks were held, with a total of 1,382 contacts made. A new initiative for 2013/14 included the delivery of presentations to migrant groups on recreational fishing rules and regulations. A session was held in Katanning and Albany, with the aid of a translator.

Where possible, education initiatives were delivered in collaboration with other environmental education providers. Partnerships included Reefwest, the Department of Parks

and Wildlife, South Coast Natural Resource Management, the WA Museum, the Fishers with Disabilities Association, the Albany Migrant Resource Centre, the Katanning Community Resource Centre and the Oyster Harbour Catchment Group.

### **Initiatives in 2014/2015**

Compliance and management personnel continue to refine compliance planning to deliver greater efficiencies and outcomes through the use of risk assessments and intelligence processes. This will result in greater capacity to target specific offence types, utilising risk analysis to deploy resources more efficiently.

There will be a renewed focus on complaints and investigations with a view towards improving the keeping of records, gathering and managing evidence and delivering outcomes of those matters in a more timely fashion – with feedback (where appropriate) to the complainants.

Biosecurity is a strategic focus for the region with the complimentary efforts between compliance staff and the Biosecurity Unit.

Training and development of staff will continue to be driven with FMOs attending several investigation and management courses.

Peak fishing periods including higher influx of holiday makers and fishers will become a focus of both high-profile presence of FMOs, and of community education activities. The Mobile Recreational Fishing vehicle will be rostered to conduct patrols in the Bioregion and increase the high profile presence.

The Walpole – Nornalup Inlets Marine Park will see the personnel in the southern bioregion engaged in a range of tasks including delivery of marine park compliance services and education programs. Operational plans have been developed with the Department of Parks and Wildlife, and the Department of Transport with a focus on joint operations to maximize the management presence in the marine park.

A dedicated and targeted approach on the unlawful taking of abalone by recreational fishers for commercial purposes will concentrate on known high risk areas. A compliance plan

will be developed for abalone aquaculture operations in Flinders Bay. The objective of the plan is to create a regulatory environment which promotes, encourages and ensures compliance by the holders of the licence and their staff. The plan will be based on risk assessments and provide for regular inspections of the operations at that location. A similar plan will also be developed for abalone aquaculture operations at Bremer Bay.

The education program will aim to strengthen direct engagement with the community, including commercial and recreational fishers. This will be done through providing face to face engagement opportunities for the community at boat ramps and caravan parks, as well as regional events and fishing competitions. Indirect engagement to address local issues will continue to include articles in newspapers and community newsletters, as well as information mail-outs to strategic locations such as visitor centres, tackle and bait outlets and service stations.

Education staff will continue the delivery of community activities such as school holiday programs and workshops, in partnership with other agencies where possible.

The education program will continue to deliver school incursions and excursions focused on sustainability and key departmental initiatives, as well as providing resources to teachers which help to create positive marine stewardship within their class.

Education for the Walpole-Nornalup Inlets Marine Park will continue to be delivered in collaboration with the Department of Parks and Wildlife. The Marine Education Officers will also support all local community participation initiatives such as the South Coast Demersal Send Us Your Skeletons program, the Research Angler Program, Redmap and Biosecurity Watch.

An emerging issue for 2014/15 is to address the issue of waste management and rock fishing safety at Salmon Holes Beach in Albany. The Marine Education Officers plan to develop partnerships with key stakeholders such as the Department of Parks and Wildlife, South Coast Natural Resource Management, Recfishwest and the City of Albany to address these issues.

**SOUTH COAST COMPLIANCE TABLE 1**

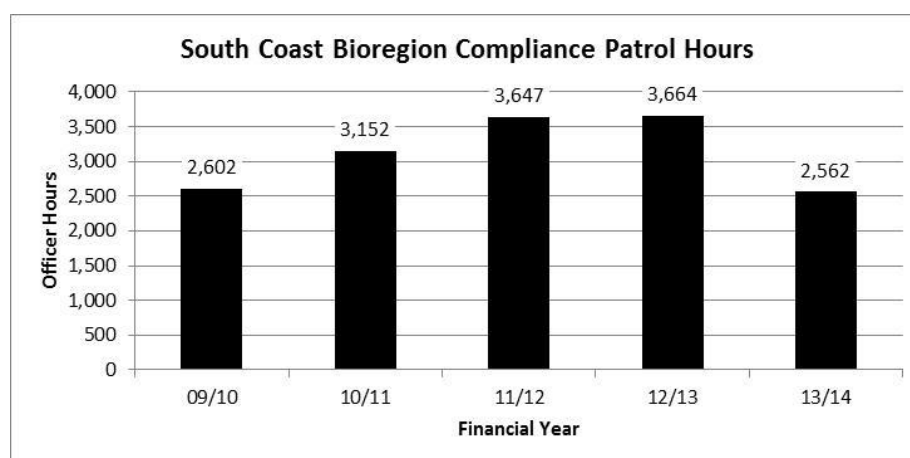
Summary of compliance and educative contacts and detected offences within the South Coast bioregion during the 2013/14 financial year.

<b>PATROL HOURS DELIVERED TO THE BIOREGION</b>		<b>2,562 Officer Hours</b>
<b>CONTACT WITH THE COMMERCIAL FISHING COMMUNITY</b>		
Field Contacts by Fisheries & Marine Officers		150
Infringement warnings		20
Infringement notices		8
Prosecutions		5
Fishwatch reports**		11
VMS (Vessel Days)***		3,128
<b>CONTACT WITH THE RECREATIONAL FISHING COMMUNITY</b>		
Field Contacts by Fisheries & Marine Officers		6,498
Infringement warnings		73
Infringement notices		57
Prosecutions		6
Fishwatch reports		40
<b>OTHER FISHING-RELATED CONTACTS WITH THE COMMUNITY*</b>		
Field Contacts by Fisheries & Marine Officers		107
Fishwatch reports		0

\*Contacts are classified according to the specific fishery, which is usually clearly delineated as being either commercial or recreational. The "Other" category is used where multiple fisheries are contacted and it is not possible to accurately classify the contacts into one specific fishery – typically, the majority of these contacts are recreational in nature (e.g. personal contacts in Marine Protected Areas), but contacts made in relation to fish kills, shark patrols and inspections of commercial fish wholesale and retail premises etc. are also included in this category.

\*\* Fishwatch reports are allocated to the District Offices relevant to the Bioregion. It is not possible to distinguish between calls relating to Inland Bioregions.

\*\*\* VMS (Vessel Days) represents the number of vessel days recorded in this bioregion. That is, a count for each day that each vessel was polled within the bioregion.

**SOUTH COAST COMPLIANCE FIGURE 1**

"On Patrol" Officer Hours showing the level of compliance patrol activity delivered to the South Coast Bioregion over the previous five years. The 2013/14 total gives the patrol hours in the bioregion that resulted in the contacts detailed in Table 1. (The totals exclude: time delivered by the Department's large patrol vessels PV Walcott PV Houtman and PV Hamelin; time spent on other compliance related tasks e.g. travel time between patrol areas, preparation and planning time etc.. Time spent in Marine Park sanctuary zones is also excluded because this time may overlap field time outside a sanctuary zone and as a result, the historic data is slightly lowered compared to that reported in previous reports).