

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.

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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 is developing a research and monitoring plan for the Walpole-Nornalup Marine Park, which forms one component of the Department’s research and monitoring strategy within the broader bioregion. Collectively, this monitoring information is used to assess the effectiveness of management strategies applied to ensure sustainable management of the State’s fish resources at the bioregional level. 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 Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) has also undertaken a Marine Bioregional Planning process for Commonwealth waters between Kangaroo Island, South Australia and Shark Bay. The federal minister for the environment has announced the final reserve network proposed for the South-West which spans the West Coast and South Coast bioregions.

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;
Protected 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 1) 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.

Currently there are no marine pest monitoring programs being undertaken by the Marine Biosecurity Research and Monitoring Group in the South Coast Bioregion. However, ongoing research includes an assessment of the likelihood of a marine pest being introduced into ports via commercial vessels and quantification of the risk associated with recreational vessels for the introduction and translocation of marine pests into this bioregion. Further detail may be found in the Appendix section entitled “Activities of the Marine Biosecurity Research Unit during 2012-13”.

SOUTH COAST ECOSYSTEM MANAGEMENT TABLE 1 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) ¹ 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.
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

Protected species

Protected fish species	Species	Risk	Status and Current Activities
Protected non 'Fish' species	Non fish (birds)	MODERATE	The capture of shearwaters in purse seine operations has been addressed by a code of conduct

¹ 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.

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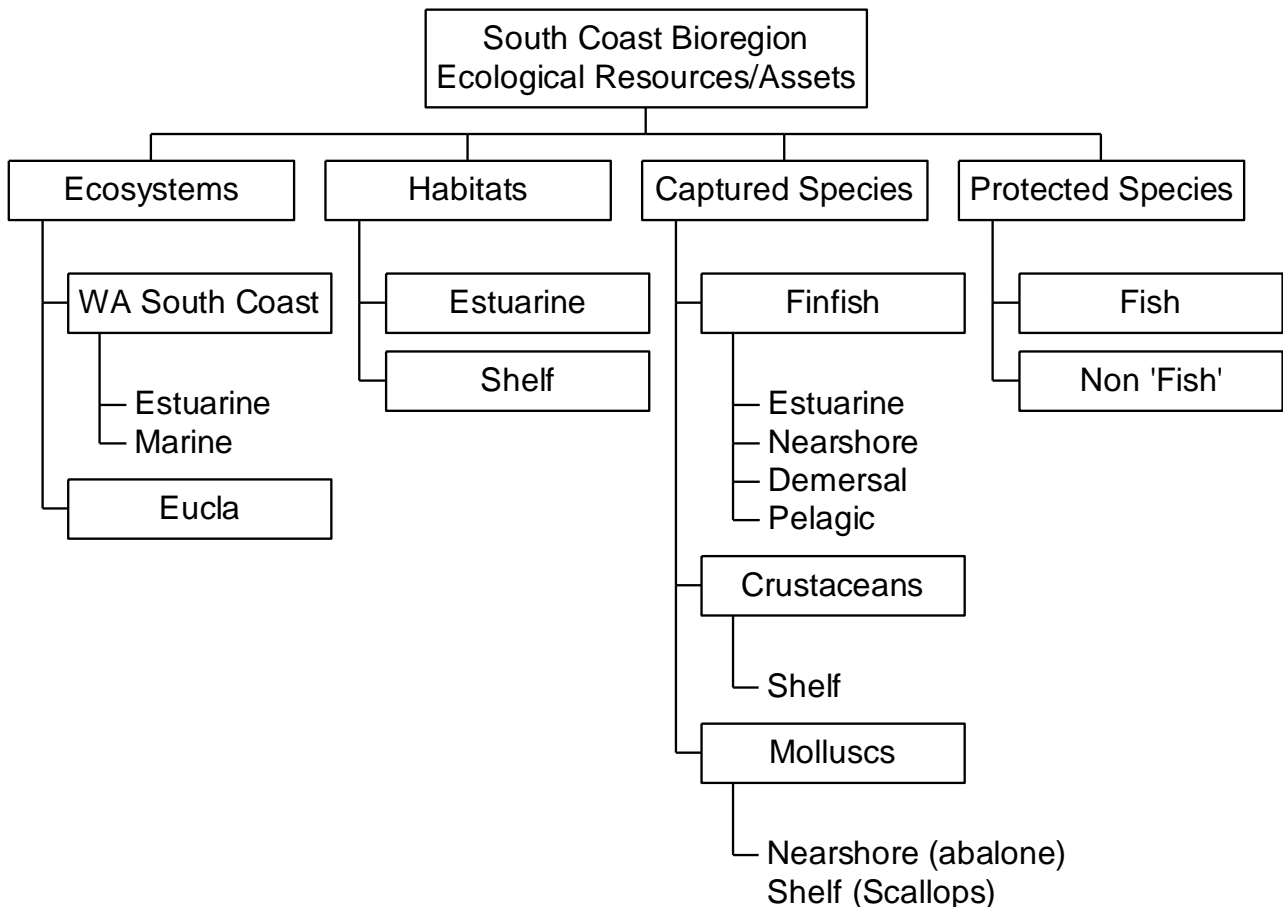
Protected fish species	Species	Risk	Status and Current Activities
	Mammals	MODERATE	The potential for the capture of sealions and seals by all fishing operations in this region, but especially gill nets has been the subject of a number of recent studies.
Protected 'Fish' Species	Fish	NEGLIGIBLE	There are few risks to the protected 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.

FISHERIES

South Coast Crustacean Fisheries Report: Statistics Only

J. How and M. Stadler

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, the Esperance Rock Lobster Managed Fishery (ERLF), the Southern Rock Lobster Pot Regulation Fishery operating in the Albany and Great Australian Bight sectors, and the South Coast deep-sea crab fishery (South Coast Crustacean Figure 1).

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

Southern rock lobsters comprise 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 lobsters are a significant component of the catch in the Windy Harbour/Augusta Rock Lobster Managed Fishery (not reported here due to confidentiality provisions relating to the small number of licensees).

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 ERLF, where crabs may only be taken by licensees in the ERLF.

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 season for fishing for rock lobsters throughout all south coast crustacean fisheries mirrors the previous West Coast Rock Lobster Managed Fishery season (prior to the 2010/11 season i.e. 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 endorsed 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 for the south coast crustacean fishery. Catch statistics for the fisheries are based on the period from 1 November to 31 October inclusive.

In 2011/12 there were two Windy Harbour/Augusta Rock

Lobster Managed Fishery Licences; eight licences in the ERMF (six vessels reported catch); 28 licences in the Southern Rock Lobster Pot Regulation Fishery (nine vessels reported catch) and 23 holders of Fishing Boat Licence Condition 105 (seven vessels reported catch).

Recreational

Recreational fishers generally only target rock lobsters. 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, bag limits and seasonal closures apply and all recreational fishers are required to hold a current recreational fishing licence authorising them to take rock lobster.

Landings and Effort

Commercial

Southern rock lobster	51 tonnes
Deep-sea crab	22 tonnes
Western rock lobster	not reported
due to confidentiality policy (too few operators)	

The 2011/12 season total catch of southern rock lobsters was 51.2 t, a decrease of 2% from the 2010/11 season. A catch of 26.2 t of southern rock lobsters was taken in the ERLF in 2011/12 – a decrease of 7% on the catch taken in the 2010/11 season (28.2 t). This is a slight downturn in the catch of southern rock lobster in the ERLF which had shown an increasing trend over recent seasons from low catches in 2008/09 (South Coast Crustacean Figure 2).

The combined catch for the Southern Rock Lobster Pot Regulation Fishery (Great Australian Bight (GAB) and Albany zones) in 2011/12 was 24.6 t, a 5% increase in catch compared to 2010/11. The catch in the Albany zone was 5.6 t, an increase of 16% compared to the 2010/11 season, while catch in the GAB zone remained very similar to last season with a 2% increase to 18.7 t (South Coast Crustacean Figure 2a). These catches have remained relatively stable since mid-2000, though there have been some fluctuations between the relative contribution from each region (South Coast Crustacean Figure 2a).

As a secondary target of the rock lobster fisheries, a total of 21.7 t of deep sea crabs was caught. The Albany zone is where the majority of crab catch is taken (South Coast Crustacean Figure 2b and 3) and included 6.9 t of giant crabs (an increase of 1.7 t from the 2010/11 season), 5.5 t of champagne crabs (an increase of 0.3 t from the 2010/11 season) and 1.6 t of crystal crabs (a decrease of 4.4 t from the 2010/11 season). Discussions with operators indicated that the dramatic decline in the crystal crab catch and increase in the catch of giant crabs in the 2010/11 season was a result of

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warm water currents along the continental shelf of the south coast, which they believe forced crystal crabs deeper and with the strong currents, made retrieval of the gear more difficult. This forced the crystal crabs deeper to a depth, combined with the strong currents, which was not economical to fish. This resulted in fishers targeting giant crabs. In the ERLF, 1.5 t of giant crabs were landed (an increase of 0.8 t from the 2010/11 season).

There was an overall nominal effort increase of 45% in the fishery (South Coast Crustacean Figure 4). The fishing effort in the ERLF increased by 29% in 2011/12 to 45,456 potlifts compared to the 35,339 potlifts in 2010/11. Effort increased by 62% in the Albany zone, however, it is not possible to split the effort of targeting lobsters from that of targeting deep-sea crabs.

Recreational Southern rock lobsters <5 tonnes

Estimates from mail surveys sent to a randomly selected sample of rock lobster 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 recreational rock lobster licence holders that catch southern rock lobsters are 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.

Fishery Governance

Target commercial catch range:

Southern rock lobsters 50 – 80 tonnes

In 2011/12, the south coast catch of 51.2 t was within the target catch range. However, this target catch range is

currently being reviewed as a part of the overall review of the management for this fishery.

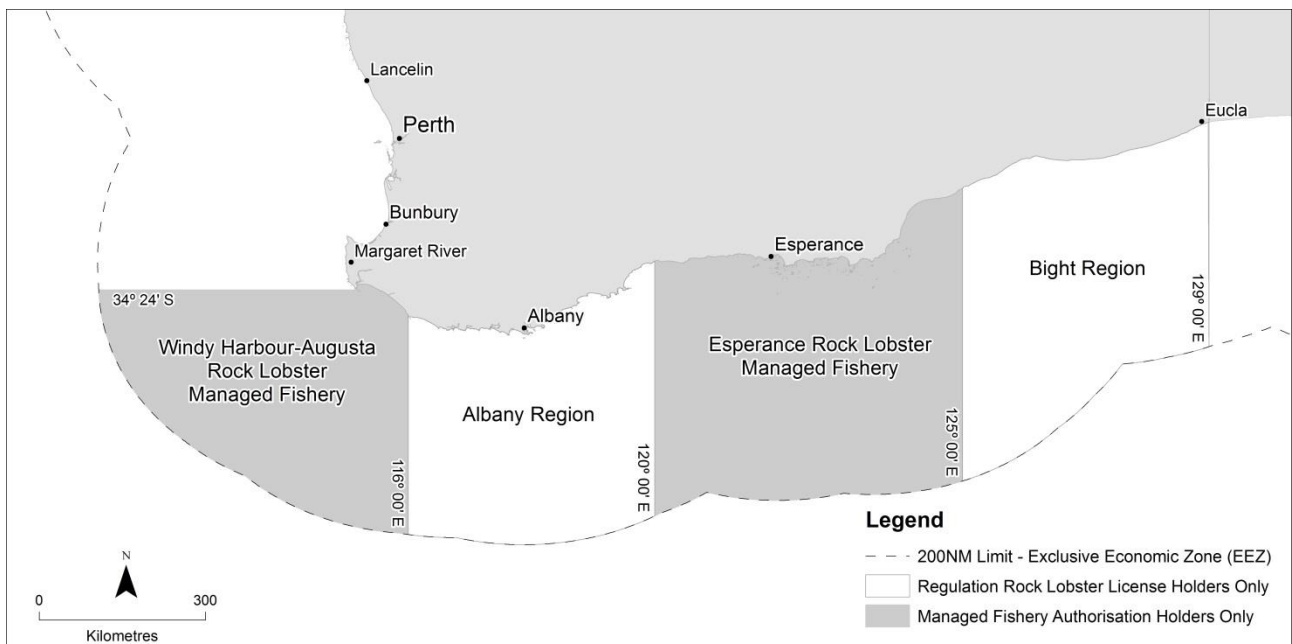
Current Fishing (or Effort) Level Acceptable

Effort in the fishery has increased over the last three seasons to 224,049 potlifts in 2011/12 (South Coast Crustacean Figure 4). This is lower than previous effort levels in the fishery which peaked in 1993/94 and was again high in mid-2000s.

New management initiatives (2012/13)

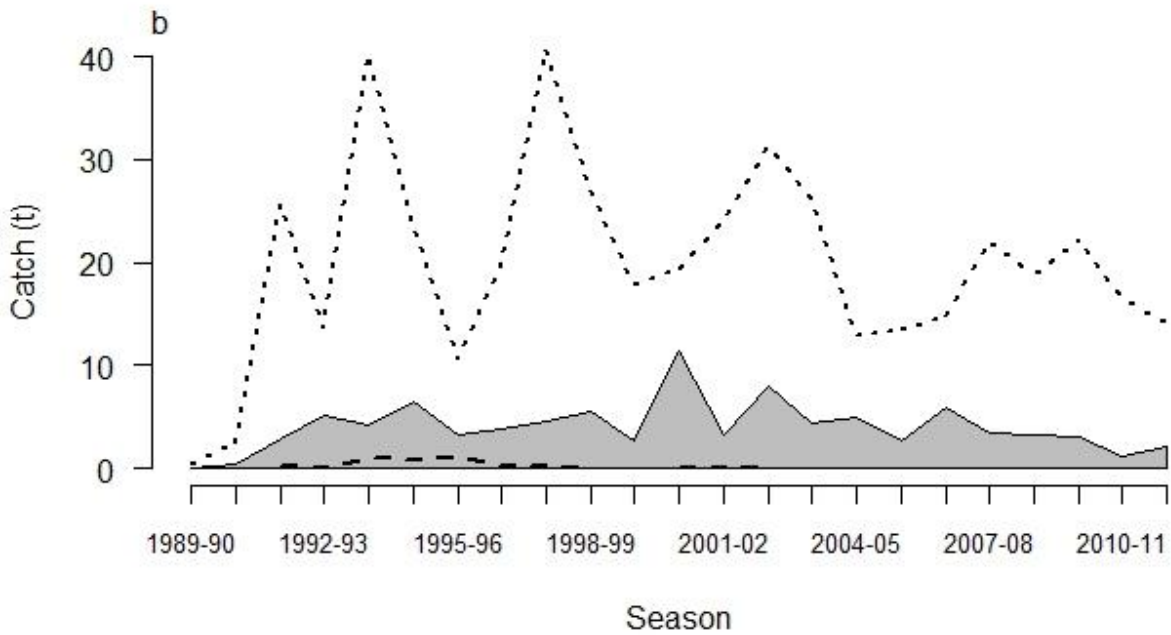
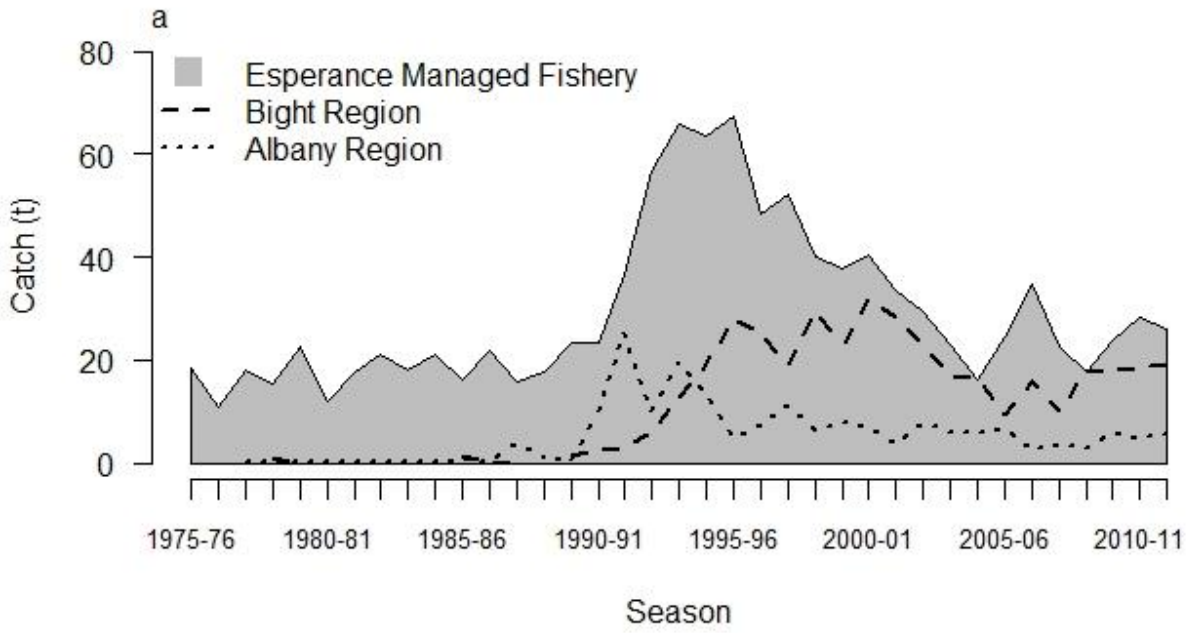
In January 2009 the Department released Fisheries Management Paper 232 entitled, ‘The South Coast Crustacean Fishery: A Discussion Paper’. This public discussion paper provided a review of the management arrangements and history of the four south coast crustacean fisheries, as well as making a number of recommendations on future management arrangements. Two key recommendations included that one management plan should cover all four crustacean fisheries and that an independent panel make recommendations on access and allocation of entitlement in the new fishery.

In 2013 an independent access and allocation panel provided a recommended method of determining the criteria for access to each of the four proposed zones in the new fishery and the level of entitlement to be allocated to those who gain access. These recommendations are under consideration and if approved by the Minister for Fisheries, will form the basis for entry to one new ‘South Coast Crustacean Fishery Management Plan’ covering all four fisheries. The new Management Plan arrangements would then be developed following the procedures described under the *Fish Resources Management Act 1994*. This process will be reported in next seasons update.



SOUTH COAST CRUSTACEAN FIGURE 1

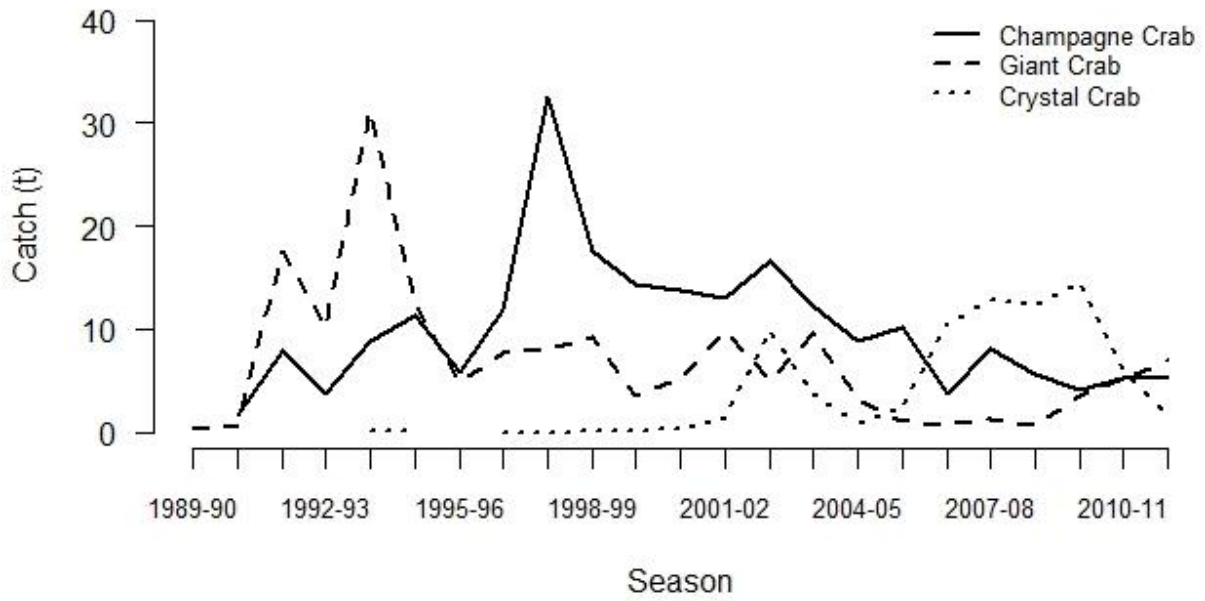
Management boundaries in the South Coast crustacean fisheries.



SOUTH COAST CRUSTACEAN FIGURE 2

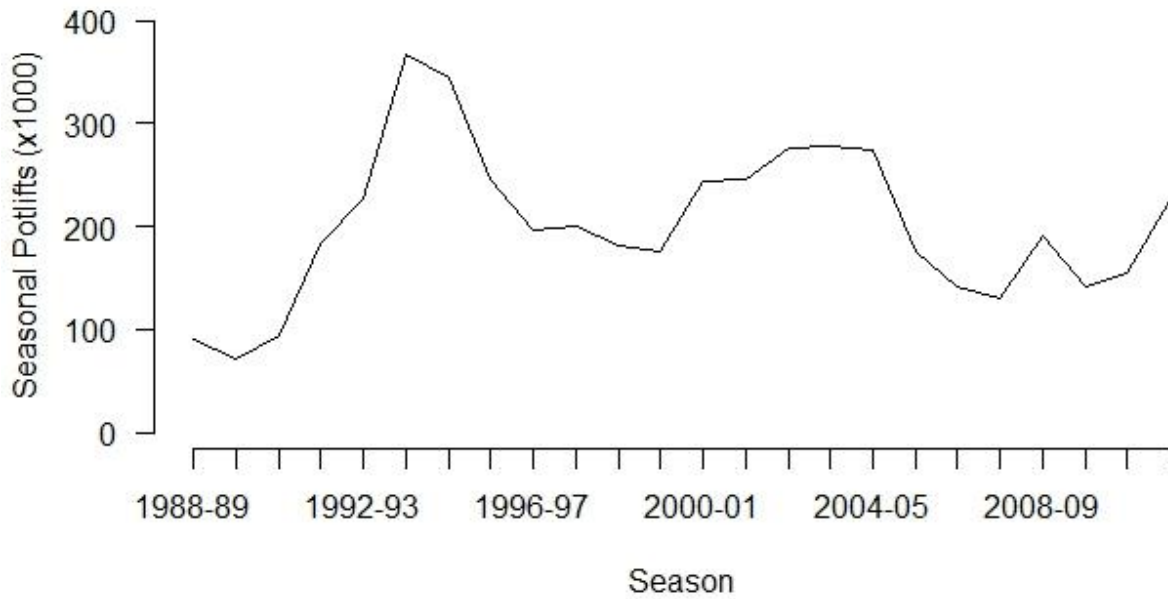
Seasonal catches of a) southern rock lobster and b) deep sea crab by management area.

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SOUTH COAST CRUSTACEAN FIGURE 3

Seasonal catches of deep sea crab species since 1989/90 in the Albany region.



SOUTH COAST CRUSTACEAN FIGURE 4

Annual level of seasonal effort for all regions in the fishery.

Greenlip/Brownlip Abalone Fishery Status Report

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

Main Features

Status		Current Landings	
Stock level	Adequate	Commercial	
		Total	202 t
Fishing level	Acceptable	Greenlip	168 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 laevigata*), and brownlip abalone (*H. conicopora*), both of which can grow to approximately 200 mm shell length.

Abalone divers operate from small fishery 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 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.

Recreational

Consultation processes are now facilitated by Recfishwest under a Service Level Agreement 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 Individual Transferable Quotas (ITQs).

The overall TACC for 2012 was 209 t (whole weight). The TACC is administered through 16,100 ITQ units, with a minimum unit holding of 450 units. The licensing period runs from 1 April to 31 March of 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 155 mm, 150 mm and 145 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 a dedicated abalone recreational fishing licence. Licences are not restricted in number, but the recreational fishing season is

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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 revised decision-rule framework for the quota setting in each area of the fishery.

Current research initiatives include the use of digital video imagery assessment by industry divers, who survey selected sites with an underwater video camera, fishery-independent survey data collected from 140 sites across the fishery, and mark-recapture analysis of growth and mortality in brownlip abalone.

The telephone diary survey estimates the statewide catch of greenlip and brownlip abalone at regular intervals. For the last survey, in 2007, around 500 licence holders were randomly selected from the licensing database, with selection stratified by licence type (abalone or umbrella) and respondent location (country or Perth metropolitan area). 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 stock enhancement continued in 2012/13, under the externally funded Seafood CRC project titled “*Bioeconomic evaluation of commercial scale stock enhancement in abalone*”. Results from this project will inform industry and management on the viability of stock enhancement as a management tool for this fishery.

Retained Species

Commercial landings (season 2012): 202 tonnes

In 2012 the greenlip/brownlip catch was 202 tonnes whole weight (Greenlip Brownlip Abalone Table 1), which was the same as the 2011 catch. The Area 1 (Nullarbor fishery) exploratory quota remained at 1.2 t but was not fished in 2012.

The greenlip catch of 167.6 t whole weight from a total quota of 173.3 t, was very similar to the 2010 catch of 165.9 t. The brownlip catch of 34 t whole weight for the 2012 season was 6% lower than the 2011 catch of 36 t, and represents 94% of the quota of 36.1 t (Greenlip Brownlip Abalone Table 1).

Recreational catch (season 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) and it is unlikely that this catch level would have differed greatly in 2012.

Fishing effort/access level

Commercial

Total fishing effort on the main stocks in 2011 was 1,438 days. This was 17% higher than 2011 (1,224 days).

Recreational

For the 2012 season, 15,561 licences were issued allowing abalone fishing. This is similar to the numbers of abalone specific licences that have been obtained since the umbrella recreational licenses, 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 2012 fishing season, based on commercial catch and effort statistics, length-frequency and shell morphometry sampling, biological growth studies, and some fishery-independent surveys.

Standardised catch per unit effort (SCPUE): As a result of a recent review¹, the SCPUE for the greenlip fishery is now used as the principal indicator of the abundance of legal-sized abalone and the basis for the decision-rule

1 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.

framework. Raw CPUE data (kg whole wt per diver per day) is also presented for comparative purposes.

In 2012, the SCPUE for the combined greenlip stocks was 35 kg whole weight per hour (Greenlip Brownlip Abalone Table 1). This was an increase from the 2011 value of 34 kg per hour (Greenlip Brownlip Abalone Table 1).

Fishing mortality (F): This analysis determines the proportion of the available abalone stock that is being harvested. Fishing mortality of greenlip abalone declined between 2011 and 2012 for the Augusta region and the South Coast of Area 3 (Greenlip Brownlip Abalone Figure 3a). Average *F*, based on a 3-yr running mean (2010-2012) was 0.39 (Augusta), 0.44 (Area 3 South Coast) and 0.48 (Area 2).

Fishing mortality of brownlip abalone in Area 3 was stable between 2011 and 2012, but no data were available from Area 2 for 2012 to ascertain the trend (Greenlip Brownlip Abalone Figure 3b). Average *F*, based on the most recent 3-yr running mean was 0.31 (Area 3) and 0.27 (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 155 mm shell length for the faster-growing portions of the fishing grounds, and 150 mm for the remainder.

In 2012, the average sizes of greenlip and brownlip caught were 187 g and 239 g respectively which are both well above the minimum breeding sizes of 140 g for greenlip and 160 g for brownlip respectively.

For brownlip, the assessment showed that the TACC was being caught at a lower average meat weight (declined from 286 g in 2006 to 239 g in 2012). TACC was therefore reduced to 39.9 t in 2012 (Greenlip Brownlip Abalone Table 1).

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 2012, the average sizes of greenlip and brownlip caught were 187 g and 239 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 (1,438 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). This was due to operational developments in the fishery including the use of 2 divers per day on some vessels and new divers with lower catching efficiency.

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.

Protected species interaction: **Negligible**

The only protected 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 sectors of the community that appreciate the abalone as a delicacy. There were 15,561 licenses 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 2012:

Level 3 - \$5 - 10 million (\$8.0 million)

The estimated average price received by commercial fishers was \$107/kg meat weight (\$40/kg whole weight) for greenlip

SOUTH COAST BIOREGION

and \$91/kg meat weight (\$36/kg whole weight) for brownlip abalone, resulting in a fishery valued at \$8.0 million, compared to \$8.3 million in 2011.

Greenlip prices in 2012 were lower than 2011 (\$112/kg), and are still low compared to 10 years ago due to high value of the Australian dollar, although this pattern may now be changing.

Fishery Governance

Target effort range: 907 – 1,339 days

Current effort level: 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 (209 t in 2012) 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 2011 was 1,438 days (main stocks), which is above the governance range. The range was exceeded due to 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).

New management initiatives (2011/12)

Consultation also took place with industry on relatively minor operational changes to the Abalone Management Plan 1992. These matters are currently being progressed.

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 becoming 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 increases 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/BROWNLIP ABALONE TABLE 1

Greenlip and brownlip abalone catch and effort¹ by quota period.

Quota period ²	Greenlip TAC kg whole weight	Greenlip caught kg whole weight (all stocks)	Brownlip TAC kg whole weight	Brownlip caught kg whole weight ⁴	Combined catch kg whole weight	Diver days (main stocks only) ³	Greenlip Raw CPUE kg whole (meat) ⁴ wt per diver day	Greenlip standardised CPUE (kg whole weight) per diver hour
1989		229,619	–	36,977	266,596	1,324	158 (59)	
1990	126,500	118,395	–	19,118	137,514	696	164 (62)	
1991	148,500	132,194	–	14,658	146,852	816	158 (59)	
1992	192,500	170,608	–	30,404	201,012	1,120	152 (57)	35
1993	197,450	173,397	–	31,153	204,550	1,238	140 (53)	35
1994	200,750	171,820	–	32,222	204,042	1,337	129 (48)	36
1995	187,264	145,467	–	27,061	172,528	1,087	134 (50)	31
1996	189,750	171,337	–	21,932	193,269	904	177 (66)	38
1997	207,350	182,317	–	26,297	208,614	1,059	172 (65)	35
1998	200,750	181,810	–	22,197	204,006	1,031	166 (62)	35
1999	184,023	175,765	28,000 ⁵	28,047	203,812	922	182 (68)	39
2000	194,691	189,511	34,875	34,179	223,690	1,029	178 (67)	41
2001	194,691	187,459	33,075	31,091	218,550	1,002	165 (62)	37
2002	194,691	166,828	33,075	27,458	194,286	1,027	134 (50)	34

Quota period ²	Greenlip TAC kg whole weight	Greenlip caught kg whole weight (all stocks)	Brownlip TAC kg whole weight	Brownlip caught kg whole weight ⁴	Combined catch kg whole weight	Diver days (main stocks only) ³	Greenlip Raw CPUE kg whole (meat) ⁴ wt per diver day)	Greenlip standardised CPUE (kg whole weight) per diver hour
2003	202,521	180,730	37,453	33,449	214,179	1,144 ³	136 (51)	33
2004	190,520	170,385	35,000	34,196	204,581	1,154 ³	129 (48)	34
2005	171,755	169,285	38,500	38,745	208,030	1,252	131 (49)	30
2006	171,755	168,752	39,750	37,265	206,017	1,161	133 (50)	30
2007	171,755	166,647	39,750	38,660	205,307	1,139	137 (51)	33
2008	163,220	157,224	41,900	39,515	196,739	1,144	135 (51)	33
2009	171,221	160,156	41,900	39,050	199,206	1,205	130 (49)	33
2010	171,221	165,558	41,900	39,006	204,564	1,196	138 (52)	37
2011	173,355	165,927	39,950	36,274	202,201	1,224	136 (51)	34
2012	173,355	167,562	36,150	34,187	201,749	1,438	117 (44)	35

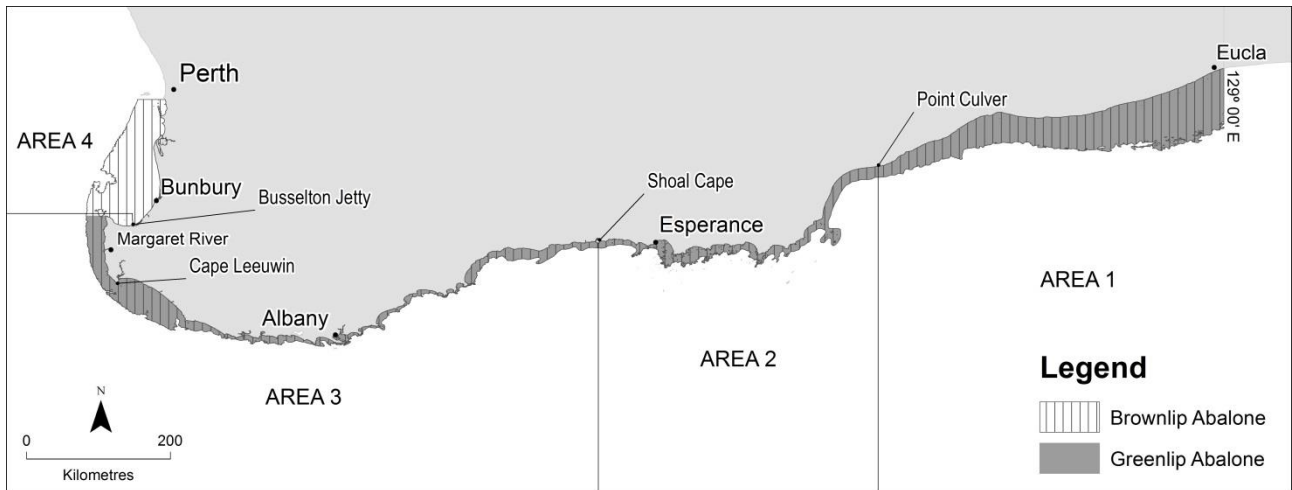
1. Data source: quota returns.
2. The length of quota period has varied with management changes, and for simplicity has been recorded against the nearest calendar years.
3. Effort (diver days): main stocks are separated from stunted stocks, which are subject to controlled fishing regimes and not directly comparable.
4. Greenlip conversion factor (meat weight to whole weight) is 2.667. Brownlip conversion factor for meat weight to whole weight is 2.5.
5. Brownlip allocations not fixed across Areas 2 and 3 (ex-Zone 1 and 2) prior to 1999. Brownlip TAC fixed for the first year in 1999.

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.

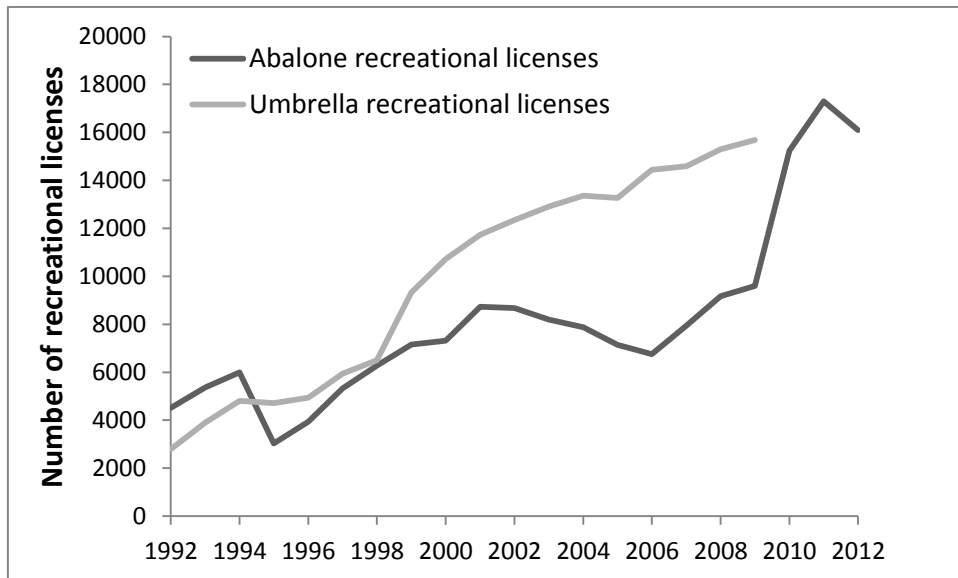
Location	Year	Effort	Greenlip		Brownlip	
			Catch Rate	Catch (tonnes)	Catch Rate	Catch (tonnes)
West Coast	2004	10,100 (6,500 – 13,600)	0.6	4 (2–6)	0.4	3 (1–5)
	2006	8,000 (4,700 – 11,300)	0.3	2 (0–3)	0.4	3 (0–5)
	2007	6,300 (3,800 – 8,800)	0.7	3 (0–6)	0.1	<1 (0–1)
South Coast ¹	2004	2,700 (1,700 – 3,700)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



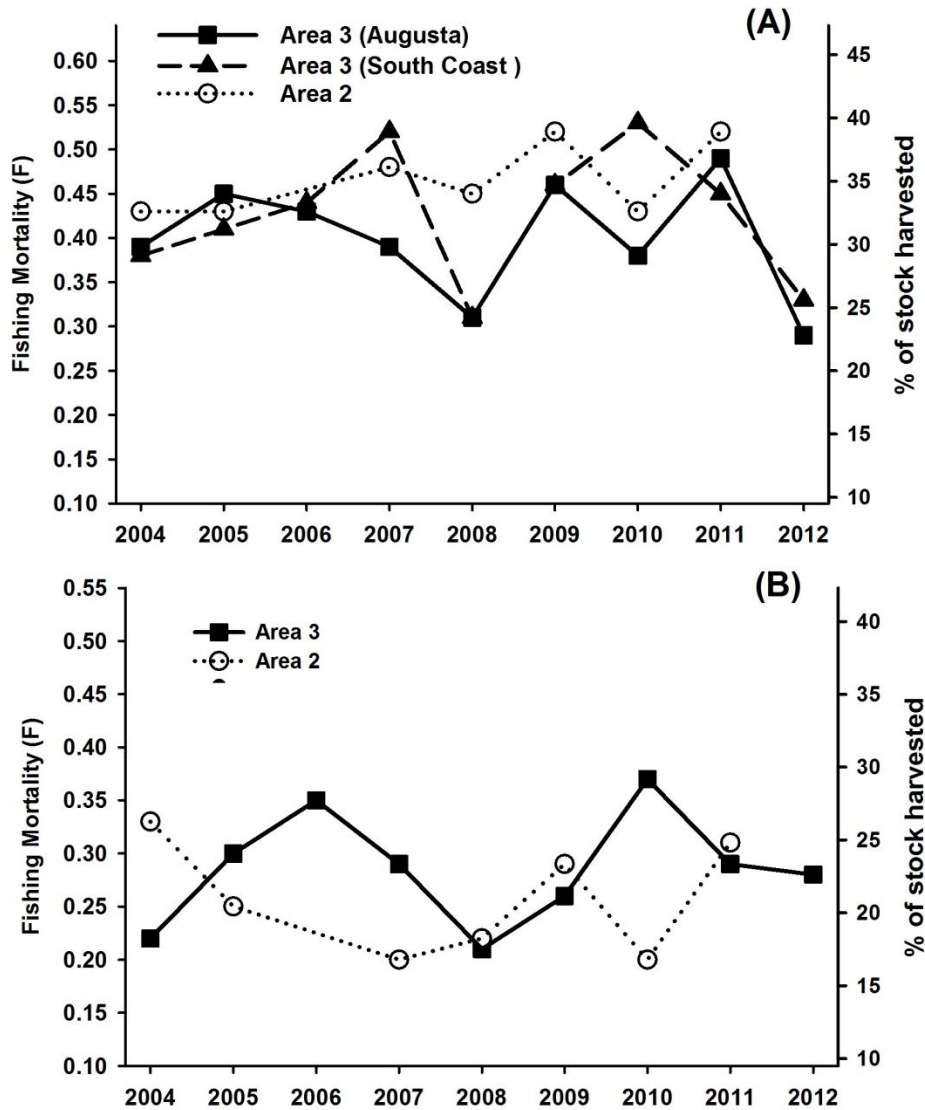
GREENLIP/BROWNLIP ABALONE FIGURE 1

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 license 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. West Coast 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. Howard and M. Stadler

Main Features	
Status	Current Landings (2012)
Stock levels:	Commercial total 383 t (finfish only)
Australian herring Inadequate	South Coast Salmon Fishery 75 t (salmon only)
Western Australian salmon Adequate	South Coast herring trap net fishery 109 t (herring only)
Black bream (Stokes Inlet) Adequate	South Coast Estuarine Fishery 187 t (finfish only)
Black bream (Beaufort Inlet) Adequate	Other commercial 12 t (finfish only)
Black bream (Wilson Inlet) Adequate	
Black bream (Oyster Harbour) Adequate	Recreational total (not available for current year)
Black bream (Walpole-Nornalup Inlet) Not assessed	Most recent survey 2000/01 368 t (key species only)
Cobbler (Wilson Inlet) Adequate	Recreational estuarine
Cobbler (Oyster Harbour) Adequate	Most recent survey 2002/03 50 t (key species only)
	Recreational boat-based
Fishing Level:	Most recent survey 2011/12 37 t (key species only)
Australian herring Unacceptable	
Other stocks Acceptable	

Fishery Description

Commercial - Nearshore

Beach-based commercial fishers in nearshore waters of the South Coast Bioregion catch various finfish species, mainly using trap nets (herring only), beach seines, haul nets and gill nets. The main target species are western Australian salmon (*Arripis truttaceus*) and Australian herring (*Arripis georgianus*), with small quantities of southern sea 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 South Coast Bioregion) and the South-West Coast Salmon Managed Fishery (located in the West Coast Bioregion). 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. Most of the commercial catch of Australian herring in WA is taken on beaches in the South Coast Bioregion 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 South Coast Bioregion, 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 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 South Coast Bioregion 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 (Sillaginidae), trevally (*Pseudocaranx* spp.), black bream (estuaries only), western Australian salmon and southern sea garfish.

A relatively small amount of recreational net fishing occurs in the South Coast Bioregion, 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 although the Department undertakes direct consultation with the community on specific issues.

Boundaries

Commercial - Nearshore

In the South Coast Bioregion, Australian herring can be taken commercially by holders of an unrestricted Fishing Boat Licence (FBL). 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.

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

Commercial - Estuarine

The South Coast Estuarine Managed Fishery 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, Waychincup 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 South Coast Bioregion. Some spatial closures exist, including closures around dive wrecks.

A limited number of areas within certain estuaries and nearshore waters of the South Coast Bioregion 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 Herring Trap Net Notice (Order 478 of 1991) prohibits the use of herring trap nets except by licensed commercial fishers using a fishing boat with the appropriate FBL condition (Condition 42). Holders of FBLs with this condition may take Australian herring using 'G' trap nets on 10 separately nominated south coast beaches. There is a closed season for the use of 'G' trap nets (10 February to 25 March each year) that closely matches the peak western Australian salmon migration season along the south coast. Australian herring may also 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 South Coast Bioregion 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 South Coast Bioregion (DoF 2011¹). Western Australian salmon, black bream and cobbler are indicators for this Bioregion's nearshore and estuarine finfish suites. Australian herring and 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).

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

Research summary

The status of the fish resources in nearshore and estuarine waters of the South Coast Bioregion 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 fishery landings. Fish frames collected from recreational and commercial fishers are used to determine age structure. When available, archived biological samples are used to estimate historical F levels.

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

An integrated survey of boat-based recreational fishing was conducted in WA during 2011/12 (Ryan *et al.* 2013¹). During this survey, nearshore and estuarine species, including King George whiting, black bream and Australian herring and school whiting, were the most common species caught in the South Coast Bioregion. This survey provided estimates for boat-based recreational fishers. Catches from shore-based fishers, who take a significant proportion of nearshore and estuarine species, were not estimated.

Retained Species

Total commercial finfish landings (2012):

196 tonnes in nearshore waters

187 tonnes in estuarine waters

Commercial landings by fishery (2012):

South Coast Salmon 75 tonnes (salmon only)

Herring trap net 109 tonnes (herring only)

South Coast Estuarine 187 tonnes (finfish only)

Commercial finfish catches (South Coast Nearshore and Estuarine Table 1) are taken by estuarine fisheries and beach-based nearshore fisheries using trap nets (herring only), gill nets, haul nets and beach seines. Minor quantities of the same species that are taken by other methods (e.g. fish traps and line) are generally not included in this report, although catches by all methods and all fisheries are included in the total catches reported for key species and are taken into account in stock assessments.

In 2012, the total commercial catch of finfish by estuarine and beach-based fisheries in the South Coast Bioregion was

383 t and included at least 38 species. The majority of the catch consisted of Australian herring (35% by weight) caught primarily by the trap net fishery, western Australian salmon (20%) caught by the South Coast Salmon Managed Fishery, cobbler (14%) and black bream (11%) caught by the South Coast Estuarine Managed Fishery.

In 2012, the nearshore finfish catch was comprised predominantly of Australian herring (59% by weight) and western Australian salmon (36%). The estuarine finfish catch was comprised mainly of cobbler (29%), black bream (24%), sea mullet (16%) and Australian herring (9%).

Since 2000, 95% of landings by the South Coast Estuarine Managed Fishery have been finfish. The non-fish component is dominated by blue swimmer crabs (*Portunus armatus*), which ranged from 1 t in 2006 to 39 t in 2001. In 2012, 14 t of blue swimmer crab was reported by this fishery. The majority of estuarine finfish landings in 2012 were taken by gill nets (92%), with smaller amounts taken by haul nets and fish traps.

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 South Coast Bioregion, with the remaining 32% taken in the West Coast Bioregion.

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, the total WA catch was 122 t, which was the lowest since the commencement of commercial fishing in the 1940s. The decline since 1995 reflects the trend in the South Coast Bioregion, where the annual catch steadily declined from a peak of 2,728 t in 1995 to 75 t in 2012.

Commercial fishery landings of western Australian salmon in SA have also declined. From 1983/84 to 2002/3, total SA landings were relatively stable at around 400-600 t per year. In 2003/4, landings declined sharply, and from 2003/4 to 2011/12 landings were mostly <200 t per year². The decline in SA landings may partly reflect a decline in the supply of recruits to SA from the spawning area in WA. 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.

In the West Coast Bioregion, landings of salmon have ranged

¹ Ryan, K.L., Wise, B.S., Hall, N.G., Pollock, K.H., Sulin, 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.

² Fowler, A.J., McGarvey, R., Steer, M.A. & Feenstra, J.E. (2012). South Australian Marine Scalefish Fishery. Stock Status Report 2011/12. Report to PIRSA Fisheries and Aquaculture South Australian Research and Development Institute (Aquatic Sciences), Adelaide. F2007/000565-7. SARDI Research Report Series No. 681. 44 pp.

from 0 to 1364 t per year since the commencement of the fishery. In 2012, 47 t of western Australian salmon was reported (South Coast Nearshore and Estuarine Figure 1).

Key finfish species - estuarine

Cobbler: Since 2000, 95% of commercial landings of cobbler in WA have been caught in estuaries of the South Coast Bioregion, with the remaining 5% taken in estuaries of the West Coast Bioregion. Over this period, 79% of cobbler landings in the South Coast Bioregion were in Wilson Inlet, 9% in Irwin Inlet, 8% in Oyster Harbour and 3% in Princess Royal Harbour. Total annual landings in the South Coast Bioregion ranged from 40 t (in 2004) to 95 t (in 2003).

In 2012, 53 t of cobbler was caught in the South Coast Estuarine Managed Fishery. The majority (82%) 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 2012, 97% of commercial landings of black bream in WA were caught in the South Coast Bioregion, with the remaining 3% from the West Coast Bioregion. In the South Coast Bioregion, landings were mainly taken in Beaufort Inlet (55% of landings), Stokes Inlet (16%), Oyster Harbour (14%) and Wilson Inlet (6%). Minor black bream landings were reported in 11 other estuaries.

In 2012, a total of 43 t of black bream was landed in South Coast estuaries. Since 2000, total South Coast landings of black bream have ranged from 30 t (in 2000) to 65 t (in 2010). The 2010 catch was the highest recorded in the South Coast Bioregion since 1993 (when the catch was 70 t), mainly due to high landings within Stokes Inlet.

Historically, Stokes Inlet has contributed the greatest proportion of black bream landings of any single South Coast estuary. From 1980 to 2012, annual landings in Stokes Inlet exhibited a stable (non-directional) trend and averaged 12 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 3 t and 6 t, respectively, in 2012. These catch trends appear to be the result of strong recruitment by black bream in Beaufort Inlet, Wilson Inlet and Oyster Harbour in the mid-1990s.

Recreational catch estimate (2012): 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 2011/12):

37 tonnes (key species only)

Recreational catch levels of finfish in nearshore and estuarine waters of the South Coast Bioregion were not estimated in 2012. The most recent nearshore estimates are from the National Recreational and Indigenous Fishing Survey conducted in 2000/01 (South Coast Nearshore and Estuarine Table 2). The most recent estuarine estimates are from a creel survey in 2002/03 (South Coast Nearshore and Estuarine Table 3). 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 South Coast Bioregion 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 recreational and commercial 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 South Coast Bioregion 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

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bream, with an estimated recreational catch of 15 t during the survey period.

A state-wide survey of boat-based recreational fishing was undertaken in 2011/12 (South Coast Nearshore and Estuarine Table 4). During this survey, total of 112 finfish species were taken by boat-based fishers in the South Coast Bioregion with nearshore and estuarine species dominating the catch. The most common were King George whiting (26% of the South Coast catch by number), black bream (18%), Australian herring (9%), southern school whiting (*Sillago bassensis*) (5%), silver trevally (5%) and bight redfish (*Centroberyx gerrardi*) (4%). An estimated 12 t of King George whiting and 7 t of black bream was retained by boat-based fishers in the South Coast Bioregion in 2011/12.

Total landings of nearshore and estuarine fish could not be estimated from the 2011/12 survey data because shore-based fishers, who are believed to take the majority of the recreational nearshore and estuarine finfish catch, were not included in the survey. The Department of Fisheries recently conducted a pilot study of shore-based fishers in an attempt to determine the best method to quantify recreational fishing catch and effort from this sector (Smallwood *et al.* 2011¹).

Recreational catch share

The recreational catch share of total finfish landings in nearshore and estuarine waters of the South Coast Bioregion cannot be determined for the current year and since there has been no survey for over five years it is not appropriate to estimate the current catch share.

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 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 reported fishing days peaked at 6,747 days 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. Total effort assessed as both the number of fishing days and the average number of boats fishing per month has followed a stable trend since 2004. In 2012, the fishery reported a total of 3,597 fishing days and an average of 17.4 boats fished per month.

In 2012, 39% of effort (method days) occurred in Wilson Inlet, 23% in Oyster Harbour, 18% in Princess Royal Harbour, 7% in Irwin Inlet, 7% in Beaufort Inlet, 3% in Broke Inlet and 2% in Stokes Inlet. The remaining effort (1%) occurred in Hamersley River, Culham Inlet, Oldfield River and Jerdacuttup Lakes. Two estuaries (Gordon Inlet and Waychinicup Inlet) were not fished during 2012.

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 2012, only 5 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 2012, 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 South Coast Bioregion 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 South Coast Bioregion (Henry and Lyle 2003)². 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 (Smallwood and Sumner 2007)³. 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

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

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

1 Smallwood, C.B., Pollock, K.H., Wise, B.S., Hall, N.G. & Gaughan, D.J. (2011). Quantifying recreational fishing catch and effort: a pilot study of shore-based fishers in the Perth Metropolitan area. Fisheries Research Report 216. Department of Fisheries, Perth.

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%).

An integrated survey of boat-based recreational fishing in WA was conducted in 2011/12 (Ryan *et al.* 2013). In this survey, 49% of total annual boat-based fishing effort (boat days) in the South Coast Bioregion was estimated to have occurred in nearshore habitats (i.e. bottom depth <20m) and 22% in estuaries.

Stock Assessment

Assessments complete: **Not all**

Assessment level and method:
Level 3 - Fishing mortality

Breeding stock levels:

Australian herring¹ **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 West Coast Bioregion, where they spawn during autumn. The Leeuwin Current disperses eggs and larvae to coastal nurseries distributed from the West Coast Bioregion to Victoria. After spawning, adults migrate back to the South Coast Bioregion (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, with approximately 95% of South Coast landings and 100% of West Coast landings taken during the January-June period each year.

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 South Coast Bioregion, where the majority of the annual catch is traditionally taken. The South Coast Bioregion 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 licenced team) was also the lowest on record. The historically low catch levels in recent years are believed to be due to a combination of factors – lack of targeting in response to the lack of markets and low wholesale prices paid for this species, reduced availability of fish in some years due to low recruitment and environmental factors affecting catchability.

In 2012, a relatively low catch (47 t) and catch rate (6 t per team) was also reported in the West Coast Bioregion. Very low (0-100 t) catches have occurred periodically (approximately every 11 years) throughout the history of this fishery and so the 2012 level was not exceptional. However, very low catches have occurred in the past 3 consecutive years (2010-2012), which is atypical. Low catches have previously been restricted to a single year.

Landings of salmon in the West Coast Bioregion 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). 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.* 2011²). This behavioural response, resulting in 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 ‘heatwave’ in 2011 is also believed to have affected the catchability of salmon and limited the catch in the South Coast Bioregion 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. Relatively high recruitment in 2008 and 2009 was followed by relatively low recruitment in 2010, 2011 and 2012 (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 South Coast Bioregion has mainly occurred in

2 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.

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

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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). Catch rates suggest a slight increase in availability in these estuaries after 2000. The catch rate in Wilson Inlet remained relatively high in 2011/12. The catch rate in Oyster Harbour has been declining since 2007/8 and the catch rate in 2011/12 was the lowest recorded in this estuary since 1980/81 (3rd lowest on record). This suggests relatively low current abundance.

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 was recently implemented in Wilson Inlet. In future, this information will be used to monitor levels of fishing mortality in this stock, which will be used in conjunction with trends in recruitment and catch rates to assess stock status.

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 South Coast Bioregion are taken in four main estuaries - Stokes Inlet, Beaufort Inlet, Wilson Inlet and Oyster Harbour. From 1980 to 1995, commercial catch rates in these estuaries were relatively low and followed a stable trend, then steadily increased until about 2005 (South Coast Nearshore and Estuarine Figure 5). Since 2005, catch rates have remained relatively high in Beaufort Inlet, Oyster Harbour and Stokes Inlet. The catch rate has been declining since 2005 in Wilson Inlet, although recent levels are still high relative to historical levels.

Black bream landings vary in response to environmental factors in individual estuaries. The simultaneous increases in catch rates in numerous South Coast Bioregion estuaries from 1995 to 2005 suggest that a widespread factor, such as rainfall, has influenced black bream availability and recruitment across the region.

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 South Coast Bioregion. 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.

Protected 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 relatively low and declining. 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 2012, there were approximately 22 commercial fishers involved in the South Coast Salmon Fishery and approximately 15 commercial fishers involved in the South Coast herring trap net fishery. In 2012, 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 South Coast Bioregion 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 South Coast Bioregion (Henry and Lyle 2003¹, Barharthah 2006²). 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 South Coast Bioregion, approximately 21% of the recreational fishing effort is 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 South Coast Bioregion (and in WA) and therefore has high social value. In 2000/01 Australian herring were estimated to comprise 15% of all finfish retained by South Coast recreational fishers.

Economic Effects

Estimated annual value (to fishers) for 2011/12:

South Coast Estuarine Fishery

(finfish landings only) Level 2: \$1 to 5 million

South Coast Salmon + Herring trap net fisheries

Level 1: <\$1 million

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.

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

Fishery Governance

Commercial

Current Fishing (or Effort) Level

South Coast Estuarine Fishery **Acceptable**

Herring trap net fishery **Under Review**

South Coast Salmon Fishery **Under Review**

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 2012 South Coast Estuarine Managed Fishery total catch of finfish (187 t) was below the target range of 200-500 t. A high abundance of blue swimmer crabs in south coast estuaries is likely to have contributed to relatively low finfish landings in 2012. This fishery has reported a steady increase in landings of blue swimmer crabs, from 1 t in 2006 to 14 t in 2012. In some estuaries, fishers report that the presence of large numbers of undersized crabs in fishing nets has been inhibiting the capture of finfish. In some estuaries, fishing effort appears to have been redirected towards targeting crabs instead of finfish.

The 2012 South Coast herring catch of Australian herring (135 t³) was well below the target range. The catch has now been below the target range for 10 consecutive years. Recent research outcomes regarding stock status are being used as a basis for reviewing management arrangements to ensure ongoing sustainability for this iconic species.

The total catch of western Australian salmon (West Coast and South Coast landings combined) in 2012 (122 t⁴) was below the target range and was the lowest recorded since the commencement of these fisheries in the 1940s. The catch has now been below the target range for 6 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 (relatively high water temperatures) and low availability of fish due to recruitment variation. 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. An age-based assessment of salmon to determine stock status using a catch-curve weight – of – evidence assessment could be considered in order to increase certainty in stock status.

3 Australian herring catch reported in Annual Report is lower than that reported here, due to the submission of additional 2012 catch and effort data by commercial fishers after publication of the Annual Report. The latest data are included here.

4 Australian salmon catch reported in Annual Report is lower than that reported here, due to the submission of additional 2012 catch and effort data by commercial fishers after publication of the Annual Report. The latest data are included here.

The performance measure for the South Coast Salmon Fishery relates to annual salmon commercial catch, which is taken predominantly during the spawning season and is therefore an indicator of breeding stock levels. In 2012, the catch was below the target range. However, the low catch was primarily due to limited targeting due to weak market demand, low recruitment and low catchability due to environmental factors. Collectively, all available information suggests that the total breeding stock level was adequate in 2012.

Recreational

Current Fishing (or Effort) Level: Not available

Target catch range: Not developed

New management initiatives (for the next year)

New state-wide recreational fishing rules (bag limits, size limits and total possession limits) were introduced in February 2013. This single set of state-wide rules replaced the various Bioregion-specific rules that previously applied to recreational fishers in WA.

An Exemption was implemented in late 2012 that allows South Coast Salmon Licence holders to fish for salmon by line from a Licensed Fishing Boat in the waters of the fishery. The Exemption is aimed at developing a more consistent market for small quantities of high quality, fresh salmon for human consumption and will be trialled over a three year period.

This fishery is scheduled to undergo MSC pre-assessment in late 2014.

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 (Hobday *et al.* 2008¹). 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 West Coast Bioregion and the western South Coast Bioregion (Pearce *et al.* 2011). This 'heatwave' event resulted in atypical distributions of various species (e.g. tropical species occurring in temperate waters) and unusual fish behaviour.

The event altered the distribution and behaviour (eg. spawning activity, migration) of western Australian salmon and Australian herring, which reduced catch levels of these species in 2011 and may continue to affect them in subsequent years (due to effects on recruitment). Relatively warm coastal ocean temperatures also occurred in 2012 in the West Coast Bioregion and the western South Coast Bioregion.

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 South Coast Bioregion estuaries are largely driven by environmental factors, independent of fishing. These factors often 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 South Coast Bioregion 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'.

¹ 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.

SOUTH COAST NEARSHORE AND ESTUARINE TABLE 1

Total annual catches of finfish (except sharks and rays) from the estuarine and beach-based nearshore commercial fisheries in the South Coast Bioregion, 2008 to 2012.

Species	Scientific name	Catch (tonnes)				
		2008	2009	2010	2011	2012
Western Australian salmon	<i>Arripis truttaceus</i>	545.1	258.0	291.3	164.9	75.0
Cobbler	<i>Cnidoglanis macrocephalus</i>	77.4	86.6	69.8	65.5	53.1
Black bream	<i>Acanthopagrus butcheri</i>	37.8	50.0	65.5	43.9	42.7
Australian herring	<i>Arripis georgianus</i>	236.3	151.3	182.7	110.6	135.0
Sea mullet	<i>Mugil cephalus</i>	21.8	26.3	32.3	29.8	30.4
Southern garfish	<i>Hyporhamphus melanochir</i>	16.8	7.6	13.7	11.1	5.4
King George whiting	<i>Sillaginodes punctata</i>	9.1	6.8	7.0	8.0	9.4
Leatherjackets	Monacanthidae	5.5	2.9	5.6	5.1	5.9
Flatheads	Platycephalidae	9.2	5.2	3.0	4.4	3.1
Tarwhine	<i>Rhabdosargus sarba</i>	5.3	2.7	2.8	6.7	3.9
Yelloweye mullet	<i>Aldrichetta forsteri</i>	4.6	3.4	2.6	3.9	4.5
Snook	<i>Sphyraena novaehollandiae</i>	2.9	2.4	1.3	1.7	1.6
Pink snapper	<i>Pagrus auratus</i>	3.6	1.9	0.9	1.3	2.1
Trevally	Carangidae	2.4	2.9	2.1	2.0	1.5
Flounders	Pleuronectidae	1.1	0.2	1.5	1.3	0.4
Trumpeters/Grunters	Teraponidae	0.3	1.7	0.3	1.6	0.3
Yellowtail scad	<i>Trachurus novaezelandiae</i>	0.3	0.2	0.6	0.8	2.2
Mulloway	<i>Agyrosomus japonicus</i>	0.5	0.3	0.4	0.7	1.0
Whiting species	<i>Sillago</i> spp.	1.2	0.3	0.4	0.6	1.4
Scaly mackerel	<i>Sardinella lemura</i>	0.5	0.9	0.4	0.3	0.3
Tailor	<i>Pomatomus saltatrix</i>	0.1	0.1	0.4	0.4	0.3
Other finfish	Teleostei	3.5	3.3	3.3	3.5	3.7
TOTAL		985.4	615.3	687.8	468.1	383.2

SOUTH COAST NEARSHORE AND ESTUARINE TABLE 2

Estimated total recreational catches of key species in nearshore and estuarine waters in the South Coast Bioregion in 2000/01 (Henry and Lyle 2003¹).

Species	Scientific name	2000/01 Catch (tonnes)
Western Australian salmon	<i>Arripis truttaceus</i>	117
Trevally	<i>Pseudocaranx</i> spp.	93
Australian herring	<i>Arripis georgianus</i>	79
King George whiting	<i>Sillaginodes punctata</i>	40
Black bream	<i>Acanthopagrus butcheri</i>	28
Whiting	<i>Sillago</i> spp.	11
TOTAL		368

SOUTH COAST NEARSHORE AND ESTUARINE TABLE 3

Estimated total recreational catches of key species in estuaries in the South Coast Bioregion in 2002/03 (Smallwood and Sumner 2007²).

Species	Scientific name	2002/03 Catch (tonnes)
Black bream	<i>Acanthopagrus butcheri</i>	23.3
King George whiting	<i>Sillaginodes punctata</i>	10.9
Trevally	<i>Pseudocaranx</i> spp.	6.1
Australian herring	<i>Arripis georgianus</i>	4.1
Southern blue-spotted flathead	<i>Platycephalus speculator</i>	2.6
Pink snapper	<i>Pagrus auratus</i>	2.6
Tarwhine	<i>Rhabdosargus sarba</i>	0.5
Southern sea garfish	<i>Hyporhamphus melanochir</i>	0.2
TOTAL		50.3

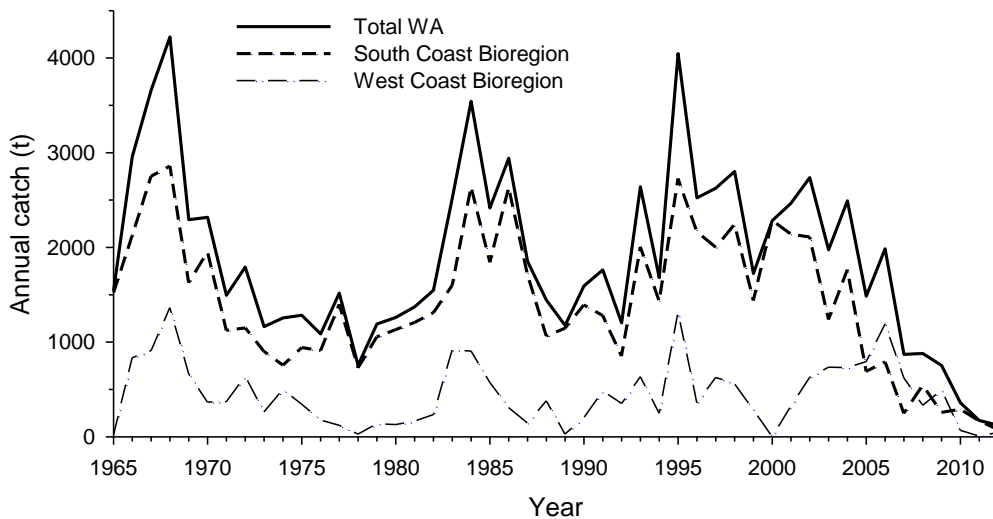
1 Henry, G.W. & Lyle, J.M. (2003). The National Recreational and Indigenous Fishing Survey. FRDC Project No. 99/158. NSW Fisheries Final Report Series No. 48.

2 Smallwood, C.B. & Sumner, N.R. (2007). A 12-month survey of recreational estuarine fishing in the South Coast bioregion of Western Australia during 2002/03. Fisheries Research Report 159. Department of Fisheries, Perth.

SOUTH COAST NEARSHORE AND ESTUARINE TABLE 4

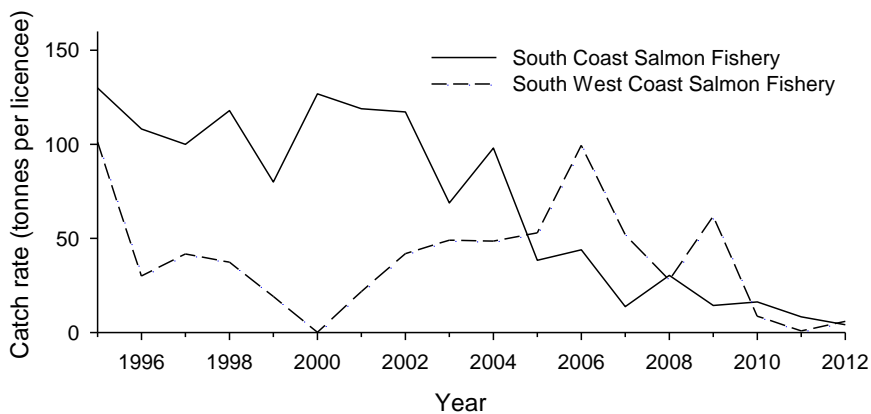
Estimated annual catch of key nearshore and estuarine finfish species in the South Coast Bioregion by boat-based recreational fishers in 2011/12 (Ryan *et al.* 2013).

Species		Catch (tonnes)
King George whiting	<i>Sillaginodes punctata</i>	12
Black bream	<i>Acanthopagrus butcheri</i>	7
Western Australian salmon	<i>Arripis truttaceus</i>	7
Silver trevally	<i>Pseudocaranx dentex</i>	5
Australian herring	<i>Arripis georgianus</i>	4
Southern school whiting	<i>Sillago bassensis</i>	2
TOTAL		37



SOUTH COAST NEARSHORE AND ESTUARINE FIGURE 1

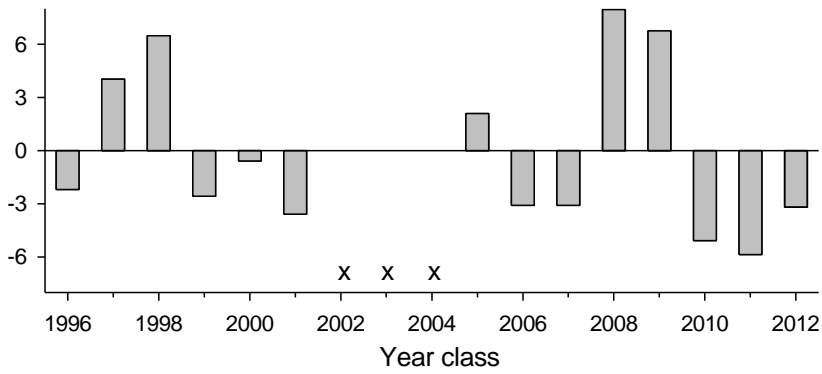
Total annual commercial catches of western Australian salmon in the South Coast and West Coast Bioregions, 1965 – 2012.



SOUTH COAST NEARSHORE AND ESTUARINE FIGURE 2

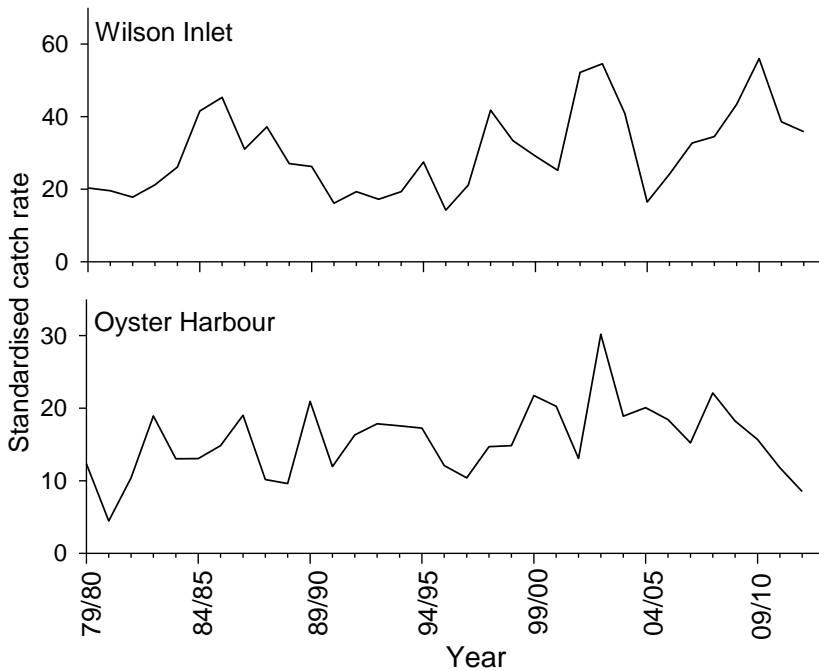
Total annual commercial catch rate (tonnes per licensee per year) of western Australian salmon in the South Coast Salmon Fishery (South Coast Bioregion) and the South West Coast Salmon Fishery (West Coast Bioregion), 1995 – 2012.

SOUTH COAST BIOREGION



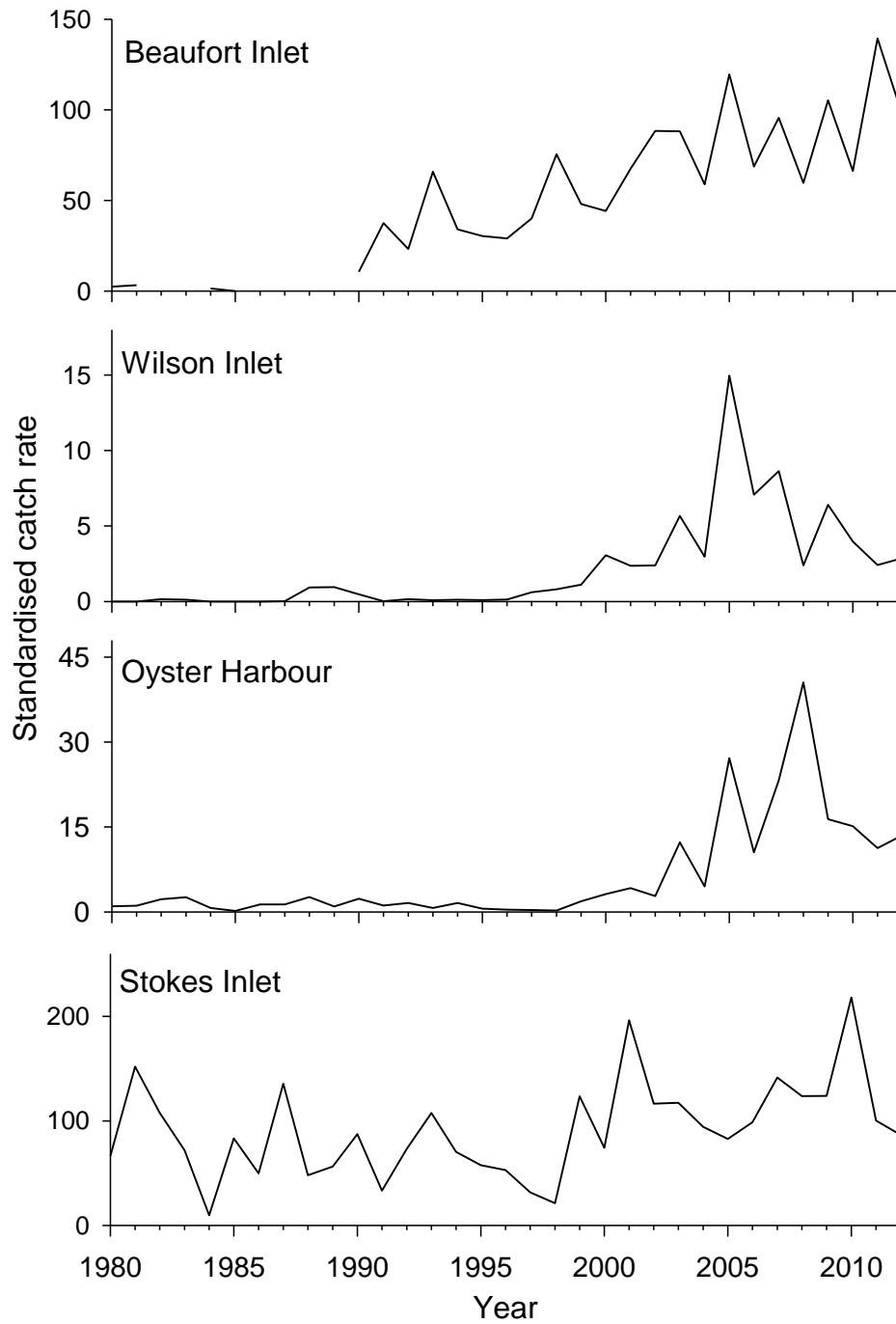
SOUTH COAST NEARSHORE AND ESTUARINE FIGURE 3

Annual fishery-independent relative recruitment index for western Australian salmon in the South Coast Bioregion, 1996 – 2012. 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 – 2011/12.



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 – 2012.

South Coast Purse Seine Fishery Report: Statistics Only

B. Molony, E. Lai, M. Stadler, M. Holtz and R. Jones

Fishery Description

The South Coast Purse Seine Managed Fishery (SCPSF) is based on the capture of pilchards (*Sardinops sagax*) by purse seine nets in the waters between Cape Leeuwin and the Western Australia/South Australia border. The South Coast Purse Seine Management Plan 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). 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. The Bremer Bay Zone (Zone 3) extends from Cape Knob to longitude 120°E. The large Esperance Zone (Zone 4) extends from 120°E to the WA/SA border. An additional zone (Zone 5) exists between Cape Leeuwin and Point D'Entrecasteaux but has not been significantly fished to date. The Zones are broken down into finer spatial scale blocks for reporting of catch and effort in the mandatory Catch and Effort Disposal forms but 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 mandatory catch and effort logbook submissions.

Management arrangements

This SCPSF is primarily managed through output controls in the form of individual transferable quota (ITQ) units. Four of the five zones in the fishery (i.e. zones 1 – 4) have been allocated a set amount of ITQ units whose values are determined by dividing the total allowable catch (TAC) for that 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 but is primarily dependant on the status of fish stocks. The total number of units allocated across each of the four zones in the fishery amount to 890 and remained unchanged from the previous season. The quota season for the SCPSF runs from 1 July to 30 June of the following year. 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

Bremer Bay and Esperance:	Cannot report
Albany	1641 tonnes

Effort in the SCPSF was within the range of recent years in 2011/12, with a total of 1,359 days of fishing (2009/10: 1,450 days; 2010/11: 1,290 days). Compared to 2010/11 fishing season, effort increased in the Albany Zones (Zones 1 and 2), decreased in the Esperance Zone (Zone 4), and was stable in the Bremer Bay Zone (Zone 3).

The 2011/12 pilchard catch in the South Coast Purse Seine fishery was the second highest since 1998. Commercial pilchard catches during the 2011/12 were 2,380 t similar to catches reported in recent years (2010/11: 2,322 t; 2009/10: 2,647 t) but still trending upward since the late 1990s (South Coast Purse Seine Figure 2). This suggests that the pilchard biomass is still recovering since the pilchard virus and kills of the late 1990s. Less than 8 t of other pelagic species were also landed, dominated by yellowtail scad.

Most of the commercial catches were reported from the Albany Zones (1,641 t). However, overall effort and catches remain below those recorded during the late 1980s and 1990s.

Fishery Governance

Target commercial effort range: Not available

For the 2011/12 season, the total pilchard catch (2,380 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 well 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 (2012/13)

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

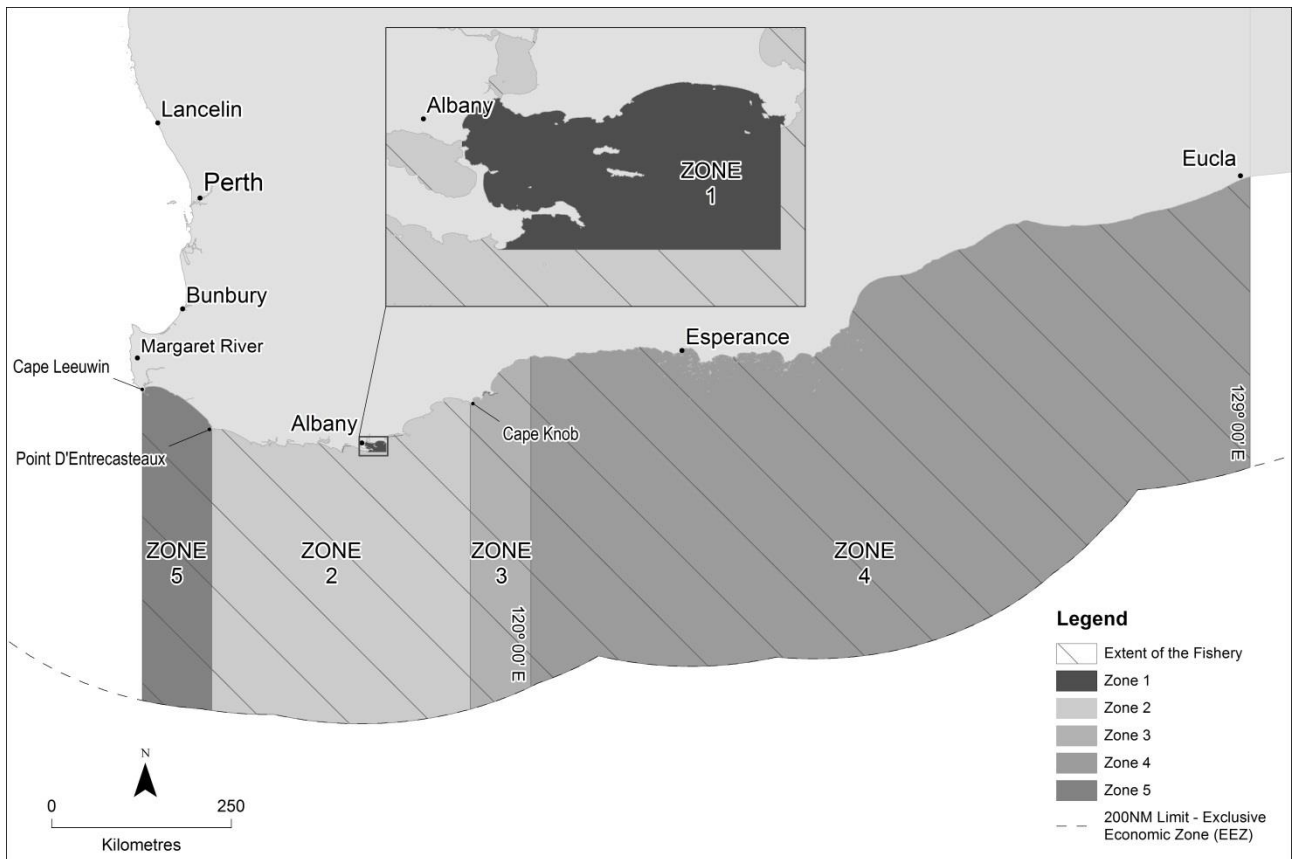
There are no significant legislative management changes planned for this fishery.

This fishery is planned to undergo MSC pre-assessment in late 2014.

SOUTH COAST PURSE SEINE FISHERY TABLE 1

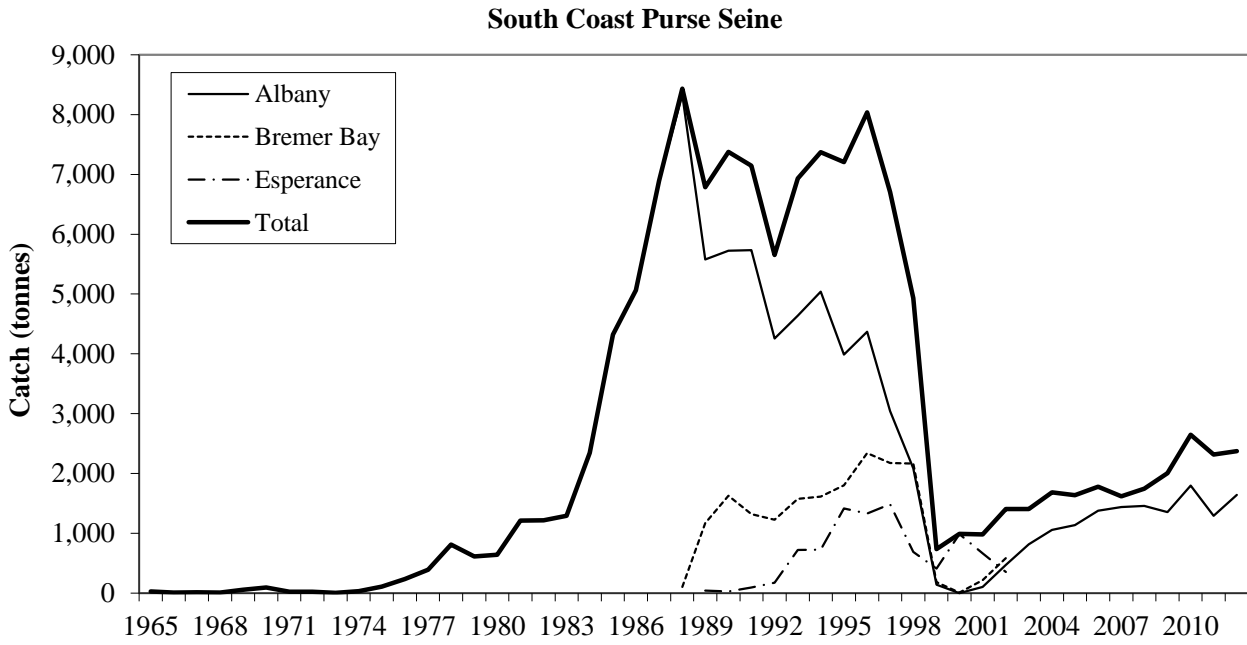
2011/12 pilchard catches and TACs in tonnes (t) for each of the major Management Zones. * Three or less vessels operated in each of these zones in 2011/12 and cannot be reported.

Management Zone	TAC (t)	2011/12 catch (t)	2011/12 catch as percent of TAC
Albany (Zones 1 and 2)	2,683	1,641	61.2%
Bremer Bay (Zone 3)	1,500	*	-
Esperance (Zone 4)	1,500	*	-
Total for Fishery	5,683	2,380	41.9 %



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

Annual catches of pilchards along the south coast, by major fishing zone, 1965 – 2011/12. Data post 2002 for the SCPSF operating in the Bremer Bay and Esperance Zones are not shown due to three or fewer vessels fishing in those years. However, the total catches for the SCPSF include catches reported from all Zones of the fishery.

Temperate Demersal Gillnet and Demersal Longline Fisheries Status Report

M. Braccini, R. McAuley & F. Rowland

Main Features

Status		Current Landings (2011/12)	
Stock level		Demersal Gillnet and Demersal Longline Fishery	
Gummy shark	Adequate	Total sharks and rays	909 t
Dusky shark	Recovering	Total scalefish	150 t
Sandbar shark	Recovering	Indicator species	
Whiskery shark	Adequate	Gummy shark	354 t
Fishing Level		Dusky shark	233 t
JASDGDLF Zone 1	Acceptable	Sandbar shark	34 t
JASDGDLF Zone 2	Acceptable	Whiskery shark	102 t
WCDGDLF	Acceptable	Catch of sharks and rays by other commercial fisheries	4 t
		Recreational catch (2011/12)	<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 both fisheries catch. 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 bioregional boundaries, dusky, sandbar and whiskery sharks are assessed and monitored as indicators of the State-wide 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 Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery 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°

SOUTH COAST BIOREGION

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 West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery 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 JASDGLF (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 an interim 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 now permit the use of 27 m of gillnet or 9 longline hooks for 288 hours in the WCDGDLF, 264 hours in Zones 1 and 3 of the JASDGLF or 380 hours in Zone 2 of the JASDGLF. 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 (ETP) species. These include:

- the State-wide 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 JASDGLF) 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) 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 zone 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*. The accreditation allows continued export of product from these fisheries for a period of three years. 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 threatened and protected species (TEPs) by accrediting the fisheries management plans as managing the fishery so as not to put populations of ETPs at undue risk. 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 three year 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 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 Commonwealths Environment Protection and Biodiversity Conservation (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 is also completed on bycatch issues with Threatened Endangered and Protected (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 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 20011/12)¹:

All sharks (and rays):	909 tonnes
Indicator shark species:	723 tonnes
Gummy:	354 tonnes
Dusky²:	233 tonnes
Whiskery:	102 tonnes
Sandbar:	34 tonnes

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 150 t in 2011/12 (Demersal Gillnet and Longline Figure 3). This catch included 50 t of demersal scalefish species taken in the West Coast Bioregion and 79 t of demersal scalefish taken in the South Coast Bioregion and a total of 21 t of non-demersal scalefish species (Demersal Gillnet and Longline Table 1). For details of other fisheries' demersal scalefish catches in those bioregions, see Demersal Scalefish Fishery Status Report and South Coast Wetline Fishery 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 2011/12).

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 Demersal Gillnet and Demersal Longline fisheries. 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 about 13.5 t.

An integrated survey of boat-based recreational fishing in WA during 2011/12 estimated the recreational capture of sharks at 25,908 individuals, from which only 4,514 were retained (Ryan *et al* 2013³). For the West Coast and South Coast Bioregions, a total of 15,086 individuals were captured and 3,056 retained, which equates to approximately 15 t. The most commonly retained species were hound sharks (43%), followed by whalers (28%), other sharks (14%), wobbegongs (9%) and hammerheads (5%). For the West Coast Bioregion, the most commonly retained species were also hound sharks (38%), followed by whalers (31%), other sharks (16%), wobbegongs (10%) and hammerheads (5%), and the total number of retained individuals was 2,664. This is consistent with the number of retained sharks estimated for this region in 2005/06.

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, 11 Zone 2 and 6 WCDGDLF vessels reported active fishing returns during 20011/12, similar to the levels of participation in the fisheries over the last four 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 (km gn .hr), 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 spend 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 six years. Thus, the hourly components of fishing effort reported in monthly and daily fishing returns are not directly comparable. To allow for historical

1 All reported weights are live weight

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

3 Ryan, K.L., Wise, B.S., Hall, N.G., Pollock, K.H., Sulin, 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.

comparison and assessment of effort and CPUE trends in the fisheries, the entire 37 year time series of effort data have been recalculated in comparable units of kilometre gillnet days (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 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 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⁻¹ in Zones 1 and 3 of the JASDGDLF, 20 hours day⁻¹ in Zone 2 and 24 hours day⁻¹ 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 ⁻¹ (3,503 km gn.d ⁻¹)
JASDGDLF Zone 2:	144,102 km gn.hr ⁻¹ (7,205 km gn.d ⁻¹)
WCDGDLF ¹ :	67,692 km gn.hr ⁻¹ (2,832 km gn.d ⁻¹)

Expended effort in 2001/12 was 64,772 km gn.hr (3,589 km gn.d⁻¹) in Zone 1; 106,792 km gn.hr (5,790 km gn.d⁻¹) in Zone 2 and 11,238 km gn.hr (523 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 fishing units reduction due to the VFAS, area closures and new effort management regimes. When measured in km gn.hr, 62% of the fisheries' effort capacity was utilised in 2001/12 (77% in Zone 1, 74% in Zone 2 and 17% in the WCDGDLF). When measured in km gn.d⁻¹, 73% of the fisheries' effort capacity was utilised in 2001/12 (102% in Zone 1, 80% in Zone 2 and 18% in the WCDGDLF). Zone 1 km gn.d⁻¹ effort is at its maximum and must be 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

¹ 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.

(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

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⁻¹ 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 in all months 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 stock assessment model that incorporates contemporary catch, effort, size and movement information that is due to be developed over the next three years.

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 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⁻¹) 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 increasing trend in the effective CPUE over the past seven 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 2006¹, 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)

¹ 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.

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 have 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 since the introduction of the annual closed season (see management arrangements above) begin recruiting to the fishery (around 2012/13).

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⁻¹, 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 (see Northern Shark Fisheries Status Report), 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

SOUTH COAST BIOREGION

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 (i.e. over the coming three years). 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 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* 2012¹).

Protected species interaction: **Negligible-Low**

Historical on-board observer programs have shown that protected species interactions were very low throughout the fishery. The Demersal Gillnet and Longline Table 2 details individual interactions between the fishery and all protected species since 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), or within 3 nautical miles of the Arolhos Islands baselines, where populations of turtles and sea lions are present.

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)² 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 50 and 66 crew were employed in the JASDGLF and over between 20 and 23 were employed in the WCDGDLF during 2011/12. As sharks are generally not targeted by recreational fishers in Western Australia, their direct social importance to this group is negligible.

Indirect: Sharks are viewed as a menace by some members of the community due to their perceived danger to humans and their predation of recreationally caught fish. However, others consider them to be important components of marine ecosystems that need to be conserved.

Economic Effects

Estimated annual value (to fishers) for 2011/12:

JASDGLF: **Level 2 - \$1 - 5 million**

WCDGDLF: **Level 2 - \$1 - 5 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 \$35/kg. Categories of shark which do not have saleable fins were excluded from fin valuation.

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

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.

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

Current Fishing Level

JASGDGLF Zone 1 Acceptable

JASGDGLF Zone 2 Acceptable

WCDGDGLF Acceptable

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 protected 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 2000/05, except for 2006/07 when they were 5 tonnes below the minimum limit. The dusky shark catch in 2011/12 was 233 t which is within the target range of 200–300t. However, the fishery has not utilised its full entitlement during 2011/12 and as such the Department will need to carefully 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 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 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 WCDGDGLF 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, and 34 t in 2011/12. The historically low catch of sandbar sharks is likely to reflect the low level of fishing effort and other fleet dynamics in the WCDGDGLF. 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 (see Northern Shark Fisheries Status Report).

New management initiatives (for 2012/13)

The review of the whiskery shark 'pupping' closure for the 2012/2013 fishing season resulted in a reduction of the closure to the peak pupping period of the entire month of September only. The area of the closure remained as in previous years. Given that the virgin biomass has likely exceeded B_{40} a reduction in the duration of the closure was considered appropriate. However, although cohorts born since 2006 will recruit to the fisheries around 2012/13, with the longterm sustainability of the species in mind, and the uncertainty surrounding the status of the whiskery shark stocks in the absence of a formal stock assessment (due for commencement in 2014/15) the Department will review the closure again for the 2013/14 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 TDGDGLF 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 TDGDGLF to assist in evaluating management options to ensure interactions with Australian sea lions are maintained with acceptable levels.

The WTO for the TDGDGLF 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. This accreditation allows fishers to interact with endangered, threatened and protected species with fear of prosecution. The accreditation carries a condition associated with addressing interactions between the fishery and Australian sea lions. The Department is convening an Australian sea lion working group that will consist of Departmental staff from both management and research, as well as industry, the conservation sector and the Department of Environment and Conservation. It is intended that the above mentioned working group will identify management measures that address this Part 13 condition and 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 TDGDGLF 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 TDGDGLF operators.

External Factors

As the TDGDLF key target species span multiple regional boundaries 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 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 2011/12 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							
Gummy	<i>Mustelus antarcticus</i>	34.4	318.8	0.5	326.6	27.1	353.7
Dusky whaler	<i>Carcharhinus obscurus</i>	122.5	95.0	15.1	120.8	111.8	232.7
Whiskery	<i>Furgaleus macki</i>	24.9	73.3	3.3	78.2	23.3	101.6
Sandbar	<i>Carcharhinus plumbeus</i>	9.9	5.5	18.5	10.3	23.5	33.8
Hammerheads	F. Sphyrnidae	21.6	36.8	1.6	39.2	20.8	60.0
Spinner (long nose grey)	<i>Carcharhinus brevipinna</i>	40.0	6.7	12.5	11.8	47.5	59.2
Wobbegongs	F. Orectolobidae	18.1	11.2	3.5	15.3	17.5	32.8
Rays	Batoidea	2.4	5.7	3.4	6.6	5.0	11.5
Common saw shark	<i>Pristiophorus cirratus</i>	0.9	7.1	<0.1	7.1	1.0	8.1
School	<i>Galeorhinus galeus</i>		1.2		1.2		1.2
Other elasmobranchs		7.9	4.4	2.4	5.5	9.2	14.7
Total elasmobranchs		282.6	565.7	60.9	622.6	286.7	909.2
Scalefish							
Queen Snapper	<i>Nemadactylus valenciennesi</i>	11.1	25.6	0.2	28.5	8.3	36.9
Blue Groper	<i>Achoerodus gouldii</i>	21.5	20.1	0.5	25.7	16.5	42.1
Dhufish	<i>Glaucosoma hebraicum</i>	8.7	1.2	2.4	2.3	9.9	12.2
Pink snapper	<i>Pagrus auratus</i>	6.7	8.4	5.7	9.8	11.1	20.9

Name	Species or taxon	JASDGLF		WCDGDLF	Bioregion		Total
		Zone 1	Zone 2		South Coast	West Coast	
Boarfishes	F. Pentacerotidae	1.5	5.7	<0.1	6.1	1.1	7.2
Samsonfish	<i>Seriola hippos</i>	4.1	1.4	1.8	3.0	4.4	7.4
Redfishes	<i>Centroberyx</i> spp.	0.3	6.1	<0.1	6.4	0.1	6.5
Mulloway	<i>Argyrosomus hololepidotus</i>	2.4	1.2	0.6	1.4	2.8	4.2
Sweetlips	F. Haemulidae			1.0		1.0	1.0
Baldchin groper	<i>Choerodon rubescens</i>		<0.1	1.4	<0.1	1.4	1.4
Other scalefish		6.1	2.5	1.7	3.0	7.3	10.2
Total scalefish		62.4	72.2	15.3	86.1	63.8	149.9
'Demersal scalefish suite' component		49.9	67.6	11.7	79.3	49.9	129.2
Fishing effort (km gn d)		3,589 (102) ¹	5,790 (80) ¹	523 (18) ²			9,902 (73) ²
Fishing effort (1000 km gn hr)		65 (77) ³	107 (74) ³	11 (17) ³			183 (62) ³

1 Percentage of respective 2001/02 levels

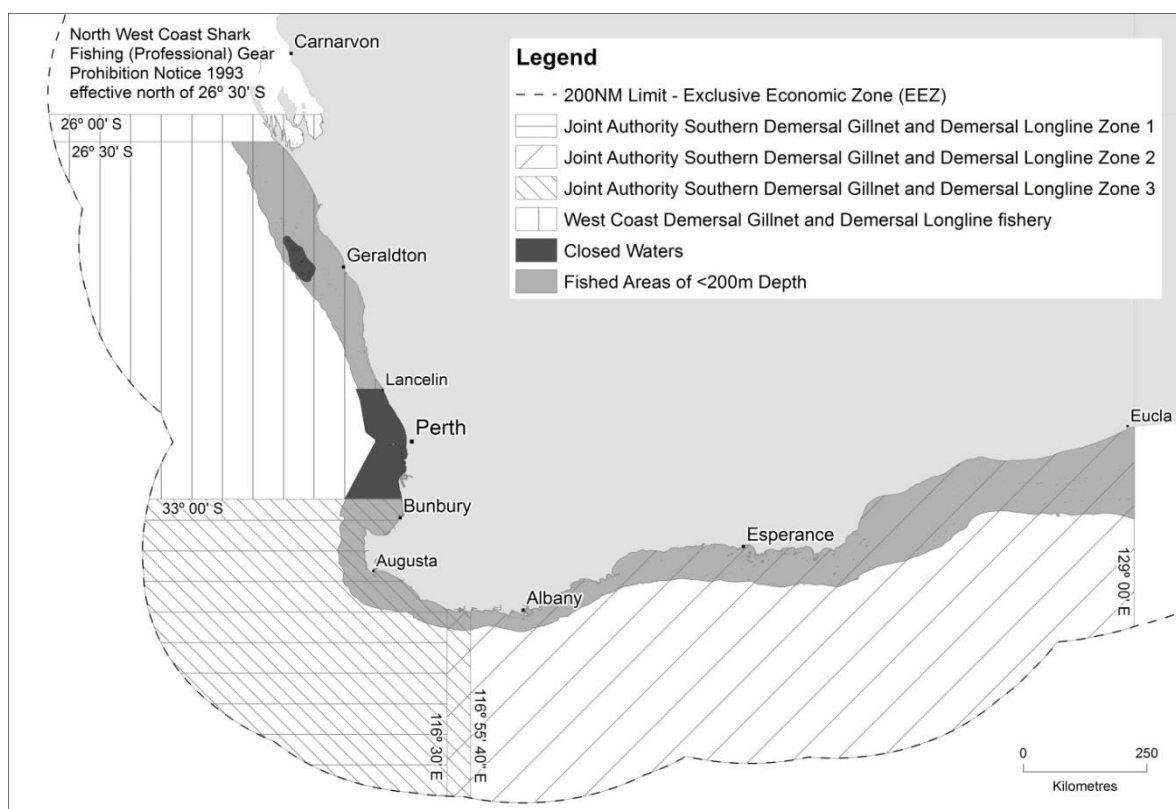
2 Percentage of VFAS adjusted 2001/02 levels

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

DEMERSAL GILLNET AND LONGLINE TABLE 2

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

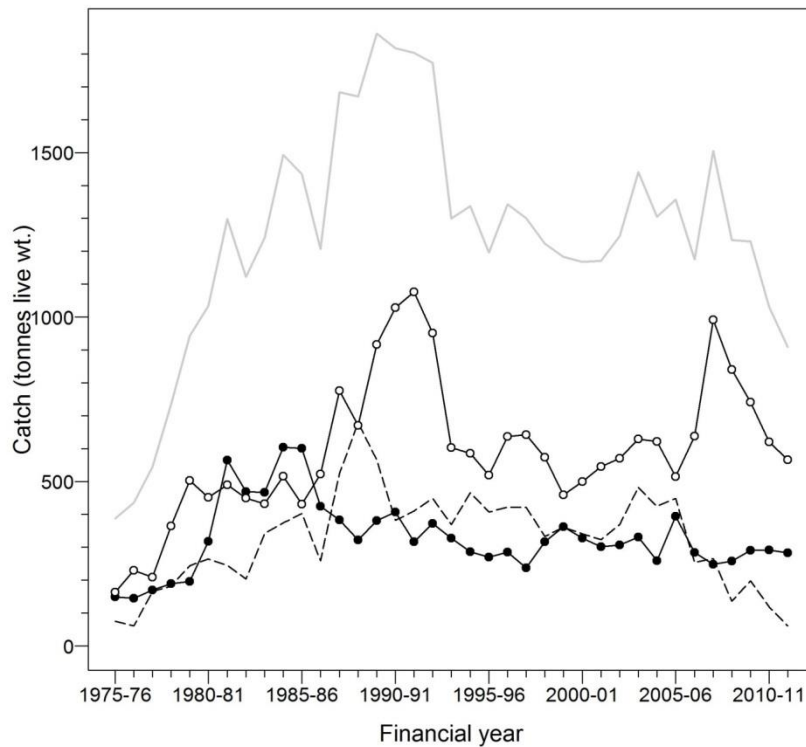
ETP SPECIES	2006/07		2007/08		2008/09		2009/10		2010/11		2011/12	
Alive(A)/Dead(D)	A	D	A	D	A	D	A	D	A	D	A	D
Dolphins	6		1		1	2		2		3		
Manta Rays	2								2			
Muttonbird, General							7		4			
Sawfish, General			1						1			
Sea Birds	1	3		2	2	1						
Sea Lions						2						3
Seal, NZ Fur	1	1		2	1	5		7		1		3
Shark, Grey Nurse	61	18	38	16	63	18	59	27	53	19	69	18
Shearwater, Fleshfooted								2				
Snake, Sea				2								
Turtle, General	4	3	5		2	2	2	1	1		3	
Whales					1							
White Pointer	10	3	10	3	14	2	2	1	3	5	19	3



DEMERSAL GILLNET AND LONGLINE FIGURE 1

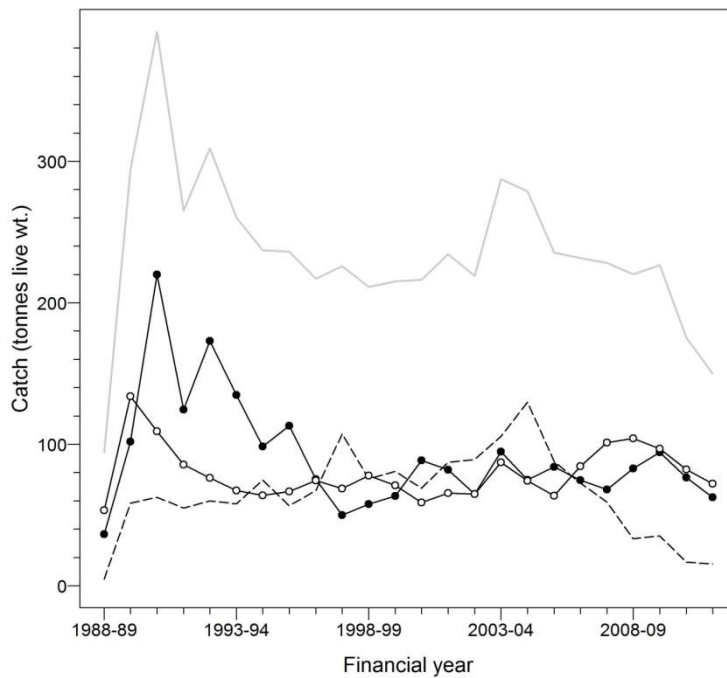
Management boundaries of the WA temperate Demersal Gillnet and Demersal Longline Fisheries. Black shading

represents fished areas of less than 200m depth.



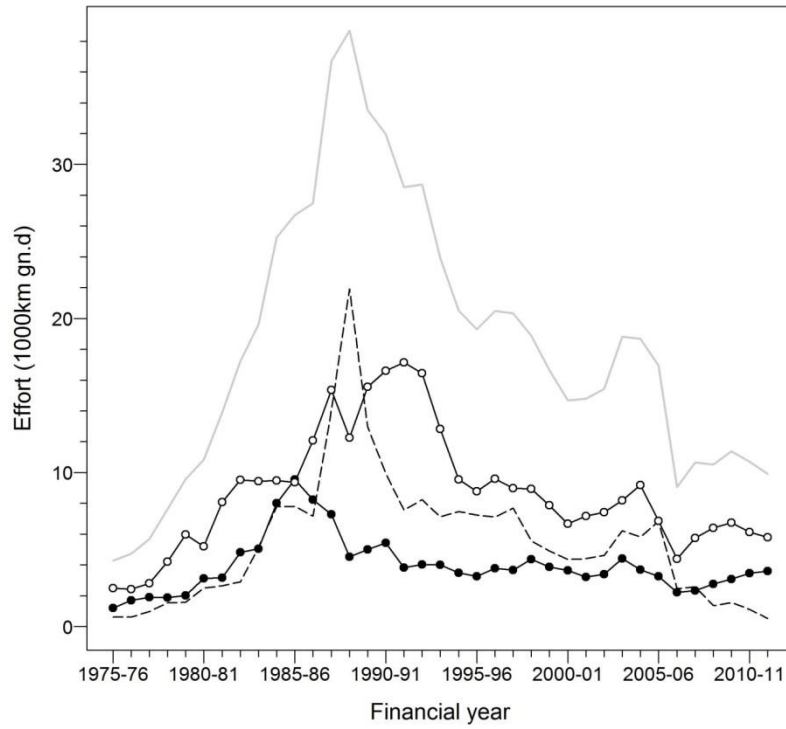
DEMERSAL GILLNET AND LONGLINE FIGURE 2

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



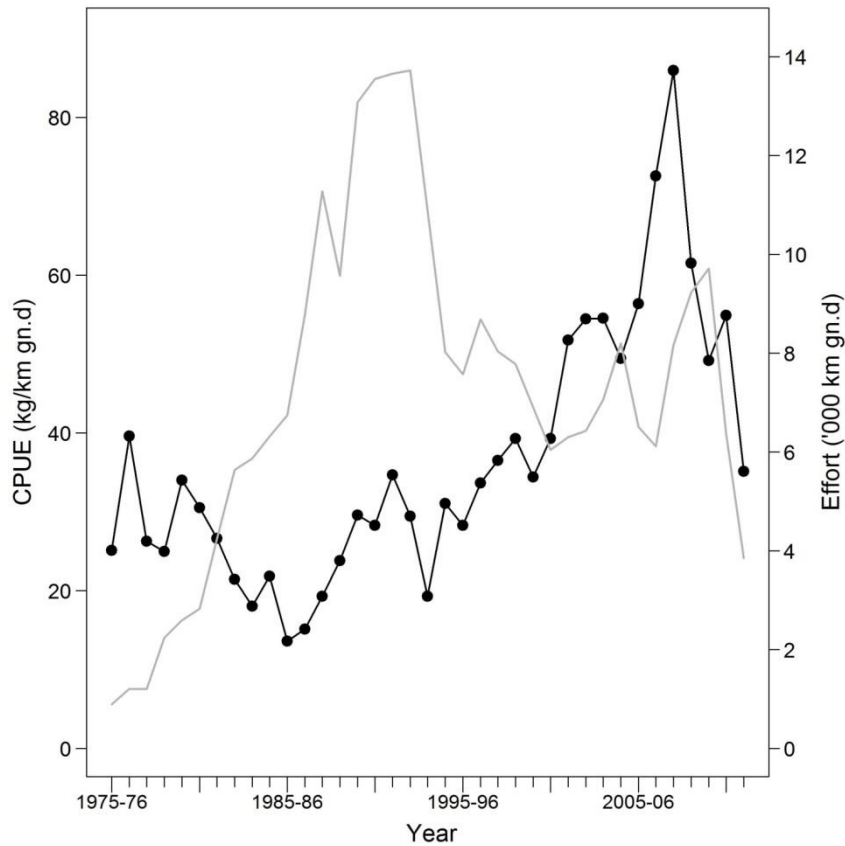
DEMERSAL GILLNET AND LONGLINE FIGURE 3

Total scalefish catch. Black circles = JASDGLF Zone 1; white circles = JASDGLF Zone 2; dashed black line = WCDGLDF; 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.



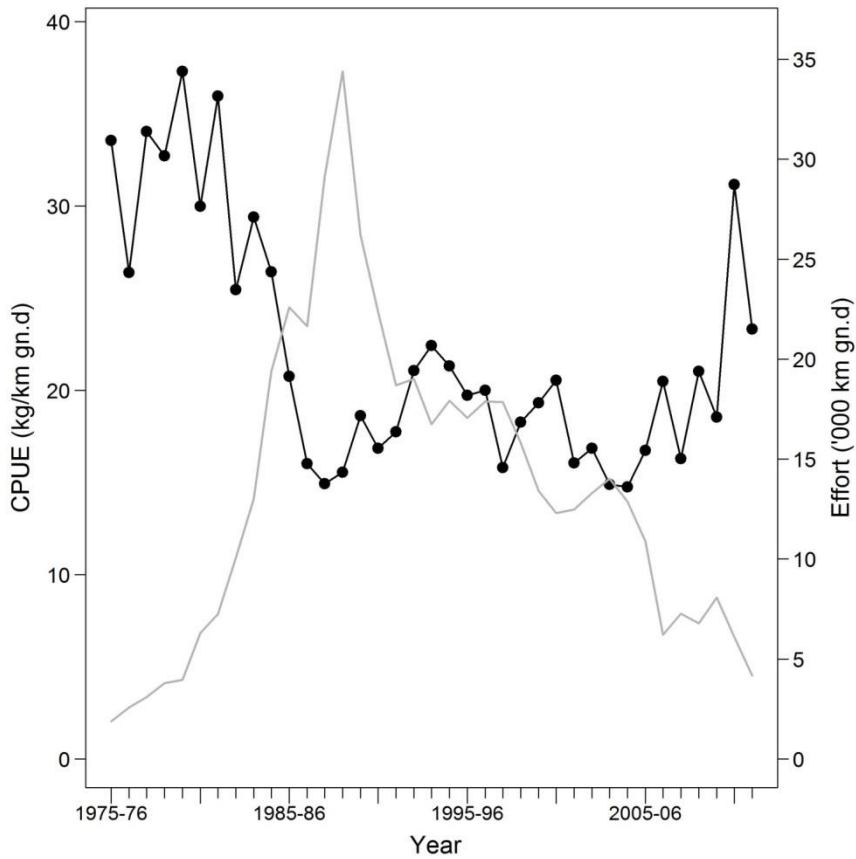
DEMERSAL GILLNET AND LONGLINE FIGURE 4

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



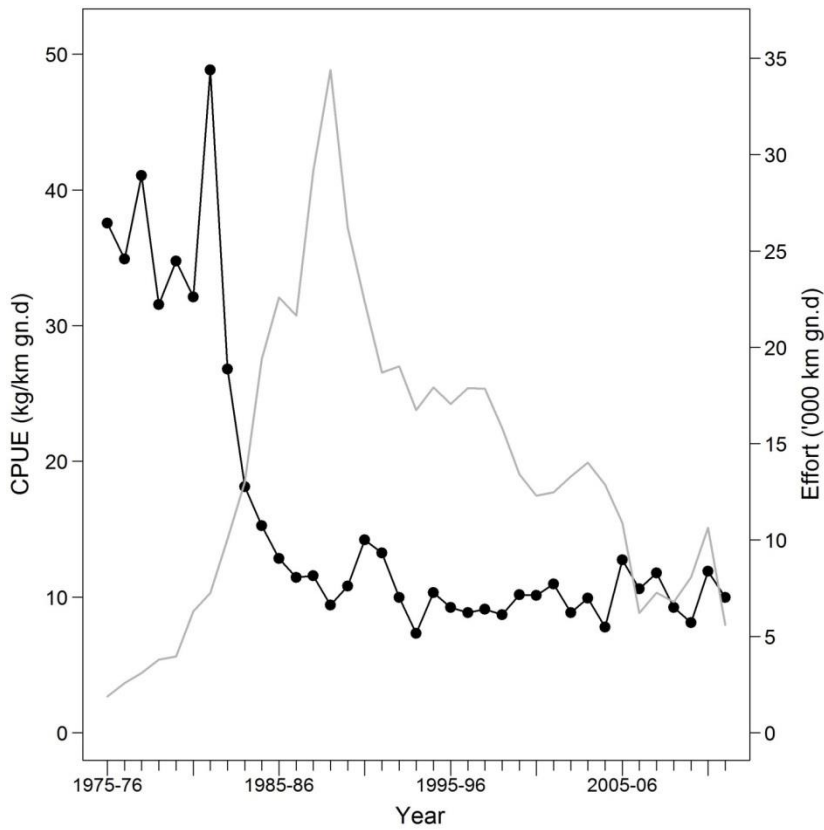
DEMERSAL GILLNET AND LONGLINE FIGURE 5

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



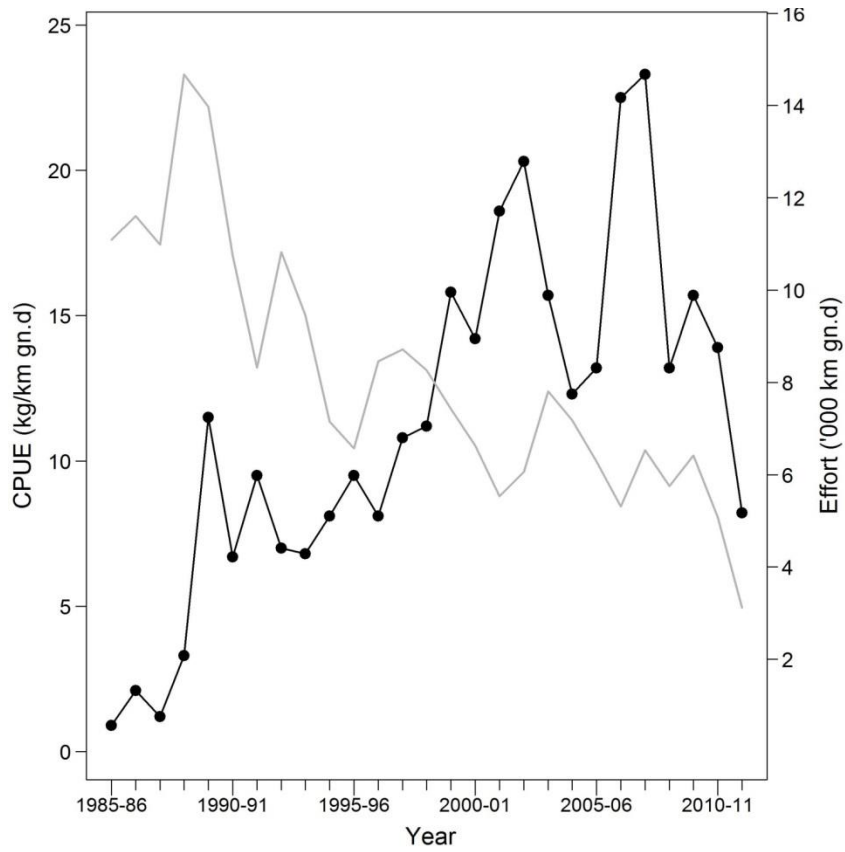
DEMERSAL GILLNET AND LONGLINE FIGURE 6

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, E. Lai and M. Stadler

Fishery Description

Commercial

Operators in this fishery target demersal scalefish species such as pink snapper, Bight redfish, blue morwong (queen snapper) and hapuku stocks in waters of the South Coast Bioregion, primarily using droplines and handlines. The fishery is herein referred to as the south coast “wetline” fishery, although minor quantities of demersal scalefish taken in nearshore waters by haul nets and set nets whilst targeting nearshore species (e.g. herring, whiting, mullet) are included.

The take of scalefish by trap and trawl methods, salmon by line and beach netting, estuarine netting and pilchards by purse seine in the South Coast Bioregion are separately managed fishery activities. 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 separately (see Demersal Gillnet and Longline Fisheries Status Report).

Recreational

Recreational fishers, mostly using line based methods from boats, target this suite of species.

Boundaries

The fishery operates in the South Coast Bioregion’s oceanic waters from near Black Point at 115° 30’ E to the WA/SA border at 129° E (South Coast Wetline 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’ for the holder of an unrestricted Fishing Boat Licence (for the boat) and a Commercial Fishing Licence (for the fisher).

Recreational

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

Total Landings (Season 2012):

105.2 tonnes (demersal scalefish only)

Commercial

Estimates of catches are monitored through the mandatory Catch and Effort Statistics (CAES) logbook 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 South Coast Bioregion. These indicator species are used to monitor the status of the resource and make up the large majority of the catches (~80 to 90%) of

this suite by the commercial fishery. In addition, Hapuku, blue-eye trevalla and eightbar grouper have been identified as indicator species for the offshore demersal suite of finfish in the South Coast Bioregion.

The catch of 105.2 t of demersal scalefish during 2012 is similar to the two previous years and remains within the range of catches since 2000 (77–139 t, South Coast Demersal Scalefish Resource Figure 2). The slightly lower catches reported since 2007 are mainly due to the ability to now better allocate catches east and west of 115° 30’ E to either the South Coast Bioregion wetline fishery or the West Coast Demersal Scalefish Managed Fishery, respectively. In addition, 23.5 t of non-demersal scalefish were reported in 2012, predominantly Samson fish (13.1 t, pelagic suite) and skipjack trevally (2.0 t, nearshore suite).

Recreational

Preliminary data from a survey of boat based recreational fishing for the 12 months to 29 February 2012 indicates the catch (tonnes ± standard error) of some demersal indicator species: Bight redfish 11.8 (±1.7), blue morwong 12.0 (±1.8), pink snapper 9.4 (±2.3). Final estimates of the suite will be available in 2013 from the full survey report.

Fishery Governance

Target commercial catch range: Not available

A formal catch range has not been developed for this fishery. However, the 2012 catch of demersal species falls within the 77 - 139 t range of annual catches reported since 2000.

Current Fishing (or Effort) Level: Not available

This fishery is likely to undergo review following the completion in 2015 of a newly commenced Western Australian Natural Resource Management (WANRM) Office funded research project, described under New Management Initiatives (below). Development of an interim catch range will be considered during this review. An assessment of the 2005 and 2006 catches of hapuku from the South Coast Bioregion suggests they may be fully exploited, although there is uncertainty about the status of this resource (Wakefield *et al.* 2010¹). Opportunistic sampling of the catch-at-age of this species will occur in synchrony with the WANRM project.

1 Wakefield, C.B., Newman, S.J. and Molony, B.W. 2010. Aged-based demography and reproduction of hapuku, Polyprion oxygeneios, from the south coast of Western Australia: implications for management. ICES Journal of Marine Science, 67: 1164-1174

SOUTH COAST BIOREGION

New management initiatives (2012/2013)

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 South Coast Bioregion. Increased resource sharing conflict between the recreational and commercial sectors and within the commercial sector has been reported.

A new WANRM-funded research project commenced in 2013 with the objective of providing age based stock assessments of inshore demersal indicator species for the South Coast Bioregion (snapper, Bight redfish, blue morwong and western blue groper), and to provide information on their stock structure. A research report will be finalised in 2015.

The nearshore species targeted by open access inshore (oceanic) netters are also vulnerable and the recent increase in this activity has led to reports of resource sharing and user group conflict.

The Department will continue to monitor the fishery and intends to develop more formal management arrangements for wetline fishing off the South Coast. These arrangements will aim to help address stakeholder concerns and provide an improved framework for the sustainable management of the

commercial line and net fisheries and recreational fishery into the future.

This fishery is planned to undergo MSC pre-assessment in late 2014.

External Factors

The Great Australia Bight Trawl Sector (GABTS) is part of a Commonwealth managed fishery operating across southern Australia. Off the Western Australia coast it operates in waters from Cape Leeuwin to the South Australian border, excluding State fishery shelf waters (depth less than 200 metres), except for east of 125° E (approximately 250 km east of Esperance) to the South Australian border where shelf waters are fished by the GABTS. Bight redfish are an important component of the GABTS catch, with 352 tonne caught in the 2011-12 fishing season. The proportion taken in waters off West Australia is unknown. Thus the South Coast Demersal Scalefish resource is also exploited by the GABTS and is affected by management arrangements in that fishery. The current WANRM-funded project is working in collaboration with the GABTS and stock assessments and other analyses will also include details of catches by this sector.

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, 2007–2012.

Species	2008	2009	2010	2011	2012
Bight Redfish*	47.2	33.5	31.2	35.9	44.7
Blue groper	1.1	1.2	0.6	1.3	0.5
Blue Morwong	5.2	8.0	4.9	5.0	4.4
Pink Snapper	37.9	44.9	40.7	29.6	27.9
Hapuku	13.1	18.5	13.6	16.6	14.4
Blue-eye trevalla	5.5	2.4	3.3	3.4	2.5
Eightbar grouper	0.6	0.7	0.5	1.5	3.4
Other demersal scalefish	15.6	12.5	13.2	8.9	7.5
Total demersal scalefish	126.3	121.8	108.0	102.1	105.2
Total non-demersal scalefish**	27.7	26.6	21.4	32.4	23.5
Total Scalefish	153.9	148.4	129.4	134.5	128.7

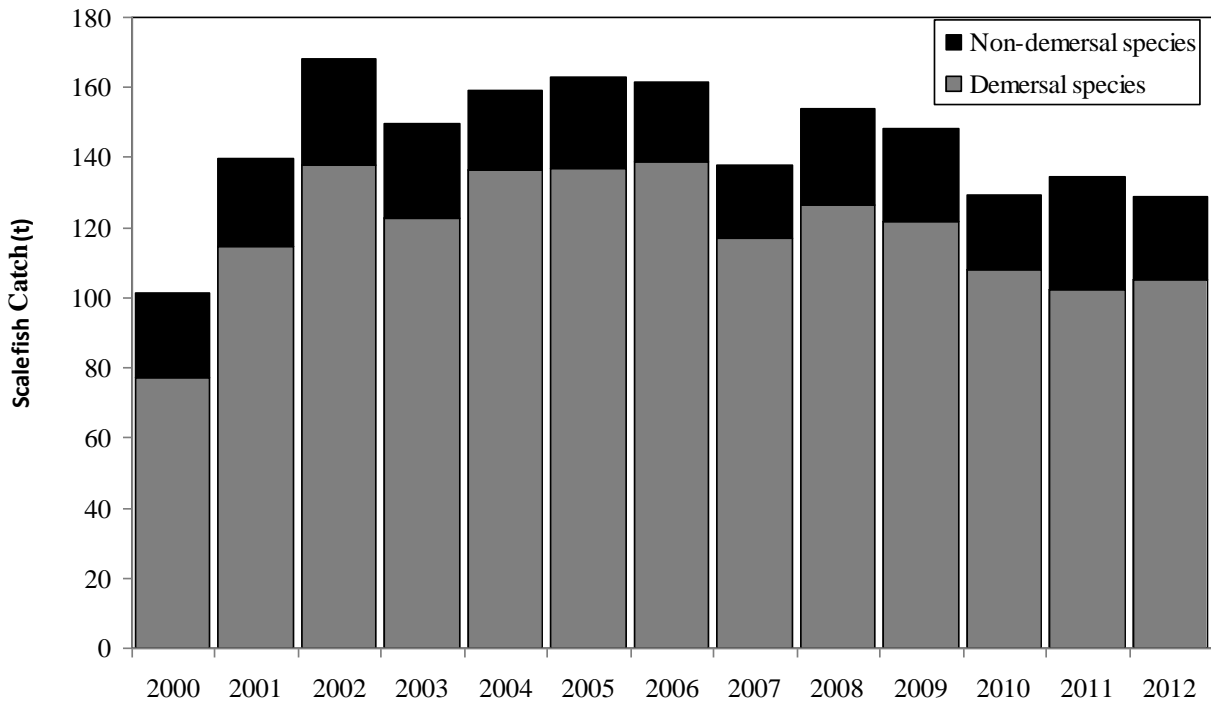
* Estimates of Bight redfish catches include fishes reported as 'Bight redfish', 'yelloweye redfish' and 'redfish', confirmed by recent catch sampling to be almost exclusively Bight redfish.

** Non demersal scalefish includes fishes from the pelagic suite (mainly Samson fish) and nearshore suite (mainly skipjack trevally).



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—2012.

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 Biosecurity Plan, developed with input from the Department of Fisheries. Independent audits are undertaken to ensure compliance with the Biosecurity Plan.

An offshore abalone farm near Augusta is achieving encouraging early results for abalone that are being grown out using purpose-built concrete structures located on the sea

bed. The operator is testing two new sites under an Exemption issued by the Department of Fisheries.

The abalone aquaculture industry sector currently operates under the policy entitled *Abalone Aquaculture in Western Australia*. To address the risk of a disease outbreak in wild and cultured abalone stocks, and because abalone aquaculture comprises an increasingly important part of Western Australia's growing aquaculture industry, the Department of Fisheries is reviewing its Abalone Aquaculture Policy. A key purpose of the revised Abalone Aquaculture Policy 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) based at Albany and Esperance and using a Recreational Mobile patrol vehicle. FMOs conducted compliance activities of both the recreational and commercial fisheries. The compliance strategies include both overt and covert operations. Inspections of fishing activities are done at land based locations, at-sea inspections, commercial processors, aquaculture and wholesale/retail outlets. The inspections are of vessels, catches, fishing gear, marine safety equipment and checking of licenses for both the commercial and recreational fisheries.

There are two part-time South Coast Marine Education Officers who deliver the Education program for the South Coast.

Activities during 2011/2012

Compliance

Due to the variety of commercial and recreational fisheries, expanse of coastline and variable and seasonal weather conditions, Fisheries and Marine Officers employ a risk management driven approach to prioritise and plan compliance activities.

Overall, Fisheries and Marine Officers delivered a total of 3800 hours of "field" compliance activity during 2011/2012.

South Coast Compliance Table 1 represents an increase from the previous year (South Coast Compliance Figure 1).

Commercial Fisheries

Officers made contact with a total of 250 commercial fishers in the field, across the south coast. Generally only minor breaches were detected, mainly in terms of licensing issues, quota management and breaches of individual fisheries management arrangements.

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

Inspections of the Estuarine fisheries and Commercial Licence Inspections.

A dedicated effort was applied to persons unlawfully interfering with commercial fishing gear. A covert strategy coupled with intelligence information identified the target places and times of probable offending resulting in a number of persons being apprehended and prosecuted. These operations were complimented by the assistance of some commercial fishers who provided equipment and fish to aid the investigation.

During the year, 10 infringement warnings and 8 infringement notices were issued with a further 6 cases resulted in prosecution action being taken against commercial fishers (or those offending against commercial gear)

Recreational Fisheries

Recreational compliance activities concentrated mainly on checking shore and boat based anglers, net fishers and shellfish collectors. Fisheries and Marine Officers contacted a total of 6947 recreational fishers. During 2011/2012, there were 95 infringement warnings and 46 infringement notices issued and 6 prosecution actions were taken against recreational fishers.

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

The areas of highest risk of non-compliance with the 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.

Education

Community and school education programs in the Southern Bioregion were conducted by the Marine Education Officer's. Activities included the delivery of school incursions and excursions to 1564 primary and secondary students across the region in 70 structured sessions. A further

571 people were contacted through structured community education activities such as school holiday programs, presentations to interest groups and direct community engagement with recreational fishers.

Four regional events were also attended with 1625 contacts made. These included agricultural shows and science expos. Where possible, education initiatives were delivered in collaboration with other environmental education providers. Partnerships included the Department of Parks and Wildlife, South Coast Natural Resource Management, the WA Museum, the Fishers with Disabilities Association and the Oyster Harbour Catchment Group.

Initiatives in 2012/2013

Compliance

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 has resulted in greater capacity to target specific offence types, utilising risk analysis to deploy resources more efficiently.

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 continues to be driven with FMOs attending several investigation and management courses.

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

profile presence and roster start-times are designed to maximise contacts with recreational fishers.

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 Environment and Conservation, and 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 recreation fishers for commercial purposes will target the known high risk areas. Intelligence information identifies this activity is taking place and the mostly likely locations and methods that are being used by some recreational fishers.

Education

The education program will aim to strengthen direct engagement with the community, including recreational and commercial fishers. This will be done through providing direct engagement opportunities for the community at boat ramps and caravan parks, as well as regional events and fishing competitions.

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-based incursions and excursions focused on sustainability and key departmental initiatives, as well as provide 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 and Biosecurity Watch.

SOUTH COAST COMPLIANCE TABLE 1

Summary of compliance and educative contacts and detected offences within the South Coast Bioregion during the 2011/12 financial year.

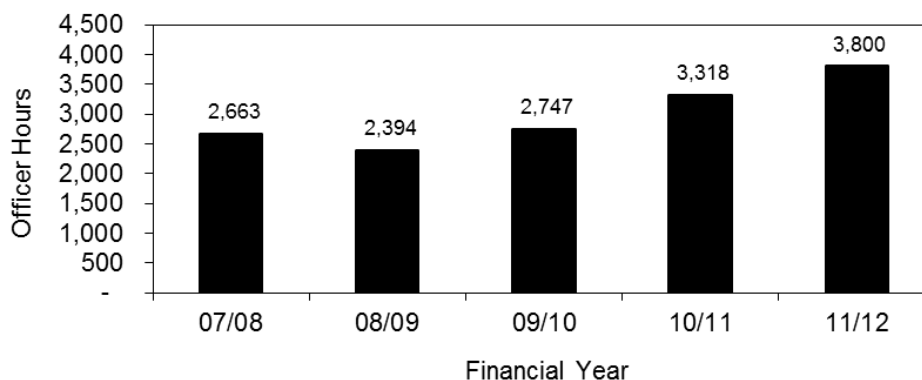
PATROL HOURS DELIVERED TO THE BIOREGION		3,800 Officer Hours
CONTACT WITH THE COMMERCIAL FISHING COMMUNITY		
Field Contacts by Fisheries & Marine Officers		250
Infringement warnings		10
Infringement notices		8
Prosecutions		6
Fishwatch reports**		7
CONTACT WITH THE RECREATIONAL FISHING COMMUNITY		
Field Contacts by Fisheries & Marine Officers		6,947
Infringement warnings		95
Infringement notices		46
Prosecutions		6
Fishwatch reports		17
OTHER FISHING-RELATED CONTACTS WITH THE COMMUNITY*		
Field Contacts by Fisheries & Marine Officers		320
Fishwatch reports		14
VMS (Vessel Days)***		3,482

*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 Bioregion Compliance Patrol Hours



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 5 years. The 2011/12 total gives the patrol hours in the bioregion that resulted in the contacts detailed in Table 1. (The totals exclude time spent on other compliance related tasks e.g. travel time between patrol areas, preparation and planning time etc.)