

WEST COAST BIOREGION

ABOUT THE BIOREGION

The marine environment of the West Coast bioregion between Kalbarri and Augusta is predominantly a temperate oceanic zone, but it is heavily influenced by the Leeuwin Current, which transports warm tropical water southward along the edge of the continental shelf. Most of the fish stocks of the region are temperate, in keeping with the coastal water temperatures that range from 18° C to about 24° C. The Leeuwin Current is also responsible for the existence of the unusual Abrolhos Islands coral reefs at latitude 29° S and the extended southward distribution of many tropical species along the west and south coasts.

The Leeuwin Current system, which can be up to several hundred kilometres wide along the West Coast, flows most strongly in autumn/winter (April to August) and has its origins in ocean flows from the Pacific through the Indonesian archipelago. The current is variable in strength from year-to-year, flowing at speeds typically around 1 knot, but has been recorded at 3 knots on occasions. The annual variability in current strength is reflected in variations in Fremantle sea levels, and is related to El Niño or Southern Oscillation events in the Pacific Ocean.

Weaker counter-currents on the continental shelf (shoreward of the Leeuwin Current), such as the Capes Current that flows northward from Cape Leeuwin as far as Shark Bay, occur during summer and influence the distribution of many of the coastal finfish species.

The most significant impact of the clear, warm, low-nutrient waters of the Leeuwin Current is on the growth and distribution of the temperate seagrasses. These form extensive meadows in protected coastal waters of the West Coast Bioregion, generally in depths of 20 m (but up to 30 m), and act as major nursery areas for many fish species and particularly for the western rock lobster stock.

The West Coast is characterised by exposed sandy beaches and a limestone reef system that creates surface reef lines, often about 5 kilometres off the coast. Further offshore, the continental shelf habitats are typically composed of coarse sand interspersed with low limestone reef associated with old shorelines. There are few areas of protected water along the west coast, the exceptions being within the Abrolhos Islands, the leeward sides of some small islands off the mid-west coast, plus behind Rottnest and Garden Islands in the Perth metropolitan area.

The major significant marine embayments of the West Coast are Cockburn Sound and Geographe Bay. Beyond Cape Naturaliste, the coastline changes from limestone to predominantly granite and becomes more exposed to the influences of the Southern Ocean. Along the West Coast, there are 4 significant estuarine systems – the Swan/Canning, Peel/Harvey and Leschenault estuaries and Hardy Inlet (Blackwood estuary). All of these are permanently open to the sea and form an extension of the marine environment except when freshwater run-off displaces the oceanic water for a short period in winter and spring.

SUMMARY OF FISHING AND AQUACULTURE ACTIVITIES

The principal commercial fishery in this region is the western rock lobster fishery which is Australia's most valuable single-species wild capture fishery. There are also significant commercial trawl, dive and pot fisheries for other invertebrates including scallops, abalone, blue swimmer crabs and octopus. Commercial fishers take a range of finfish species including sharks, dhufish, snapper, baldchin groper and emperors using demersal line and net methods. Beach based methods such as beach seining and near-shore gillnetting, and hand-hauled nets are used to capture whitebait, mullet and whiting in a restricted number of locations.

The West Coast Bioregion, which contains the state's major population centres, is the most heavily used bioregion for recreational fishing (including charter based fishing). The range of recreational fishing opportunities includes estuarine fishing, beach fishing and boat fishing either in embayments or offshore for demersal and pelagic/game species often around islands and out to the edge of the continental shelf.

The principal aquaculture development activities in the West Coast Bioregion are the production of blue mussels (*Mytilus galloprovincialis*) and marine algae (*Dunaliella salina*) for beta-carotene production, and the emerging black pearl industry based on the production of *Pinctada margaritifera* at the Abrolhos Islands. The main mussel farming area is in southern Cockburn Sound, where conditions are sheltered and the nutrient and planktonic food levels are sufficient to promote good growth rates. Owing to the generally low productivity of the Western Australian coastline under the influence of the Leeuwin Current, areas outside embayments (where nutrient levels are enhanced) are unsuitable for bivalve aquaculture.

ECOSYSTEM MANAGEMENT

The marine benthic habitats and their associated biodiversity are largely protected along most of the West Coast from any physical impact of commercial fishing due to the extensive closures to trawling. These closures inside 200m depth were introduced in the 1970s and 1980s, in recognition of the significance of extensive areas of seagrass and reef as fish habitat (West Coast Ecosystem Management, Figure 1). The extent of these areas means that over 50% of the West Coast Bioregion inside 200 m depth could be classified as a marine

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protected area with an IUCN category of IV (Ecosystem Management Table 1; as per Dudley, 2008)¹.

Protection of fish habitat and biodiversity is also provided by marine protected areas consistent with IUCN categories of I, II and III along the west coast including:

Fish Habitat Protection Areas (FHPAs) at the Arolhos Islands, Lancelin Island Lagoon, Cottesloe Reef, and Kalbarri Blueholes; Reef Observation Areas within the Arolhos Islands FHPA and closures to fishing under s.43 of the Fish Resources Management Act 1994 at Yallingup Reef, Cowaramup Bay, the Busselton Underwater Observatory, and around the wrecks of the Saxon Ranger (Shoalwater Bay) and Swan (Geographe Bay); and marine conservation areas proclaimed under the Conservation and Land Management Act 1984 at Jurien Bay, Marmion, Swan Estuary, Shoalwater Islands, and the soon to be gazetted Ngari Capes Marine Park between Cape Leeuwin and Cape Naturaliste; and the Rottneet Island Marine Reserve. (West Coast Ecosystem Management, Figure 2).

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 recently announced the final reserve network proposed for the south-west which spans the West Coast and South Coast bioregions.

ECOSYSTEM BASED FISHERIES MANAGEMENT

Identification of Ecological Assets/Resources using the EBFM framework

Utilising the Integrated Marine and Coastal Regionalisation for Australia (IMCRA V. 4.0)² scheme, the West Coast Bioregion has been divided into 3 meso-scale regions: the Arolhos Islands, the Central West Coast and the Leeuwin-Naturaliste (West Coast Ecosystem Management Figure 3). 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)³ see How to Use section for more details. EBFM is a risk based management approach, which

¹ Dudley, N. (editor) (2008) Guidelines for applying protected area management categories. IUCN, Gland, Switzerland.

² Commonwealth of Australia (2006). A Guide to the Integrated Marine and Coastal Regionalisation of Australia Version 4.0. Department of the Environment and Heritage, Canberra, Australia.

³ Fletcher, W.J., Shaw, J., Metcalf, S.J. & D.J. Gaughan (2010) An Ecosystem Based Fisheries Management framework: the efficient, regional-level planning tool for management agencies. Marine Policy 34 (2010) 1226–1238

recognizes the social, economic and ecological values at a regional level and links between exploited fish stocks and the broader marine ecosystem, to ensure the sustainable management of all fisheries resources into the future. EBFM identifies these individual ('lower level') values, and provides a mechanism for reporting on their status and the fisheries management arrangements that are being applied.

The West Coast was the first bioregion where the EBFM process, including the comprehensive risk assessment of each of the ecological assets was applied (see West Coast Ecosystem Management Table 2). In terms of ecological assets (= resources), the Department utilises the following categories for the three IMCRA regions within the West Coast Bioregion:

- Ecosystem structure and biodiversity (on a meso-scale basis – subdivided into marine, estuarine/embayments);
- Captured fish species
- Protected species (direct impact – capture or interaction);
- Benthic habitat; 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; Inshore 20-250m; Offshore >250m). The full set of ecological assets identified for ongoing monitoring are presented in West Coast Ecosystem Management Figure 4.

Risk Assessment of Regional Ecological Assets

The EBFM process identifies the ecological assets in a hierarchical manner such that the assets outlined Figure 4 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 (West Coast Ecosystem Management Table 2) provides an overview and cumulative assessment of the current risks to the ecological assets of the West 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.

Summary of Monitoring and Assessment of Ecosystem Assets

The Department of Fisheries Research Division's Biodiversity and Biosecurity Branch has a number of research and monitoring initiatives underway.

An ecological risk assessment undertaken on the western rock lobster fishery identified that the ecological impacts of removing rock lobster biomass could be a moderate risk for deeper water reef community structure. A recently completed Fisheries Research and Development Corporation (FRDC)-funded project provided critical information on the relationships between rock lobster abundance, size distributions and benthic habitat characteristics in deep water. The project also provided preliminary data on the trophic role of rock lobster in deep water ecosystems.

Additional ecological research in deep waters comparing fished and unfished areas to assess the impacts of lobster fishing on the ecosystem was supported by funding from the Western Australian Marine Science Institution (WAMSI) and the FRDC. A suitable reference area in deep water was closed to lobster fishing in March 2011. Research since then has concentrated on the production of detailed substrate and benthic biota maps for the reference area and the development of sampling methodologies to effectively monitor benthic habitats in fished and unfished areas. Continued monitoring will provide the contrast required to enable the potential impacts of lobster fishing on deep water ecosystems to be quantified.

Work on examining the role of lobsters in shallow waters also continued as part of WAMSI through a number of projects run by ECU. These were completed in Jurien Bay and the Marmion Marine Parks. There is also work being undertaken on lobster interactions by the Department, CSIRO and UWA at the Rottne Island protected areas.

Research focusing on key habitats and their associated fish and invertebrate assemblages at the Houtman Abrolhos Islands has been expanded. This program is divided into two components the first of which, uses permanent coral transects located at each of the island groups to collect important baseline information on coral communities. This information allows researchers to quantify the effects of natural (i.e. climate change) and anthropogenic (i.e. fishing activities) impacts on sensitive coral habitats. The second component, funded by state NRM in 2009, focused on the establishment of baseline maps and information on the current distribution and composition of the fish, coral, algal and other communities within the Abrolhos Islands. Detecting change will also need the development of cost effective indicators that can measure significant changes generated by either natural or anthropogenic causes that could affect the fisheries and other activities in this region.

The Biodiversity and Biosecurity Branch are involved in several studies that involve mapping of habitats in this bioregion. The focus of these projects is to map the dominant marine habitats, and conducting biodiversity surveys in order to build spatial habitat models of the marine environment. Outputs from these habitat mapping and biodiversity surveys will assist in the identification of key marine indicators, and will support regional natural resource management groups in establishing marine ecosystem monitoring targets. The habitat maps produced will provide information on the distribution and extent of various substrates (e.g. reef versus sediment), relief, dominant vegetation types and different classes of sessile invertebrates.

The Department has recently received funding to establish ongoing ecosystem monitoring and research to underpin management of the recently gazetted Ngari Capes Marine

Park.

In the West Coast bioregion, sampling mostly by other agencies (e.g. UWA, ECU, CSIRO) has focused on the Abrolhos Islands, Jurien Bay, Rottne and Cape Naturaliste. Bathymetric and towed video surveys have been completed at all of these sites, as well as biodiversity sampling including research trawls using the RV *Naturaliste* and Baited Remote Underwater Video Stations (BRUVS). This work was being coordinated through the WAMSI Node 4 project 4.2. (<http://www.wamsi.org.au/>).

The Department continues to undertake research to assess the impacts on fisheries from other activities and determine appropriate management responses. The Department also inputs into the Western Australian Environmental Protection Authority's environmental impact assessment process when a development proposal has the potential, if implemented, to impact on the aquatic environment.

The Department actively engages with the natural resource management groups within the West Coast to promote sustainable use of the aquatic environment, and has 'introduced aquatic organism incursion' and 'fish kill incident response' programs to minimise risks to the marine environment through the introduction of exotic aquatic organisms, or other incidents which have the potential to have an adverse effect.

The Biodiversity and Biosecurity branch have implemented a series of biosecurity related projects during 2011 – 2012. These projects aim to detect the presence of introduced marine pests (IMPs) using a suite of tools and sampling techniques. Early detection of IMPs is vital if any attempt at eradication or other management strategies are to be successful. A large-scale, nationally approved survey of Fremantle Port was completed in early 2011, and an interim survey conducted in early 2012. In addition the Marine Biosecurity Research group, with financial and *in-kind* assistance from Fremantle Port Authority and the Defence Services Group is running an Early Warning System program using *in-situ* settlement arrays to provide a mechanism for the early detection of marine pests in Fremantle Port and HMAS Stirling waters. The Marine Biosecurity Research group has developed Commonwealth approved marine pest monitoring designs for Geraldton Port and HMAS Stirling. Surveillance at these ports is expected to be undertaken in the near future. Further detail of monitoring and research may be found in the Introduced Pests Status report provided at the end of this chapter. Other biosecurity activities include a survey of the Careening Bay Naval waters at Garden Island for the possible presence of the invasive mussel *Perna viridis*, an additional survey of Fremantle Port Waters for the possible presence of the introduced barnacles *Balanus improvisus* and *Amphibalanus pulchellus*, and a survey of Mandurah waters and canals for the possible presence of the invasive Asian paddle crab *Charybdis japonica*.

A project supported by WAMSI 4.4, developed a bycatch risk assessment method to rapidly assess the cumulative risk to sustainability of multiple fisheries¹. The method draws on

¹ Evans, R. and Molony, B. W. 2010. Ranked Risk Assessment for Bycatch in Multiple Fisheries: a Bioregional Risk Assessment Method. Fisheries Research Report No. 212. Department of Fisheries, Western Australia. 88pp.

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other techniques already published in scientific literature and adds a new cumulative ranked estimate of total catch across multiple fisheries. The Ranked Risk Assessment of Multiple Fisheries (RRAMF) allows ranking of bycatch species within each fishery and to accumulate the ranks across multiple fisheries incorporating the relative impact of each fishery. The RRAMF method was tested on the West Coast and Gascoyne Coast Bioregions of Western Australia using fishery independent data for general teleost and elasmobranch bycatch; and fishery dependent data for threatened,

endangered and protected species (TEPS). The RRAMF analyses reveal all bycatch species received low to moderate risk scores in these Bioregions. The RRAMF for the TEPS showed that while most species have high biological risk, the low interaction rates reported by fisheries maintained low to moderate risk categories for most species groups. A trial has also been conducted using a camera placed on a demersal gillnet vessel to investigate the efficacy of electronic monitoring to (a) identify protected species interactions, and (b) determine by-product and target species catches.

WEST COAST ECOSYSTEM MANAGEMENT TABLE 1

The areas and proportions of the West Coast Bioregion making up continental shelf waters (< 200 m depth) where habitats are protected from the physical disturbance of trawl fishing. The areas which are formally closed to trawling would be equivalent to meet the IUCN criteria for classification as marine protected areas as category IV. The area of habitat effectively protected refers to the area where trawling doesn't occur.

| Total Area of Shelf | Area of shelf equivalent to IUCN marine protected area <= category IV (%) | Maximum area of actual trawling activity | Total area of habitat effectively protected (%) |
|---------------------|---|--|---|
| 19600 sq nm | 11000 sq nm (56%) | 300 sq nm | 19300 sq nm (98%) |

WEST COAST ECOSYSTEM MANAGEMENT TABLE 2

ANNUAL UPDATE OF RISK LEVELS FOR EACH WEST COAST ECOLOGICAL ASSET.

Risk levels in this Table are developed by combining the risks of lower level elements (usually indicator species) that make up each of these higher level (regional) components. Low and Moderate values are both considered to be acceptable levels of risk, whereby Moderate Risks will generally have some level of directed management actions associated with these which will be outlined in the detailed reports in the rest of the West Coast section. High and Significant risks indicate that the asset is no longer in a condition that is considered acceptable and additional management actions are required by the Department except where the value is followed by (non-fishing) this indicates that all, or the majority of the risk value, was not generated by fishing or related activities but by activities managed by other agencies.

Ecosystem Structure and Biodiversity

| Ecosystem | Aquatic zone | Risk | Status and Current Activities |
|------------------|--------------|----------|---|
| Abrolhos Islands | Marine | MODERATE | <p>The Abrolhos Islands are protected within a 'Fish Habitat Protection Area', and are not considered to be at unacceptable risk from fisheries related activities.</p> <p>There are a number of research programs including monitoring of the health of coral communities at the Abrolhos Islands. This program, which utilises permanent transects located at each of the island groups collected important baseline information on coral communities, allowing researchers to quantify whether lobster fishing with pots results in damage to sensitive coral habitats, and to determine the vulnerability of coral communities at the Abrolhos to climate change.</p> <p>Surveys of the community structure of finfish are also underway within and outside of non-fishing areas.</p> |

| Ecosystem | Aquatic zone | Risk | Status and Current Activities |
|---------------------|-------------------|---------------------------|--|
| Central West Coast | Marine | MODERATE | An assessment of the community structure and trophic level of all commercially caught fish species over the past 30 years found no evidence of systematic changes that could be evidence of an unacceptable impact on this ecosystem (Hall and Wise, 2011) ¹ . Further ecological research in shallow (ECU) and deep waters, supported by funding from the Western Australian Marine Science Institution (WAMSI) and the latter by Fisheries Research and Development Corporation (FRDC). This will allow ecosystem structure in a newly created deep water closed area to be compared with that in nearby fished areas. A key objective of this project will be to enable potential ecosystem impacts of lobster fishing in these deeper water ecosystems to be quantified. |
| | Estuaries/ Embay. | SIGNIFICANT (non-fishing) | The estuaries and embayments within this area have been identified as being at significant risk, due to external factors (water quality issues due to high nutrient runoff from surrounding catchment) which have the potential to affect fish and other communities. Poor water quality within the Peel – Harvey and Swan – Canning estuaries, and to a lesser extent Cockburn Sound are of particular concern. |
| Leeuwin Naturaliste | Marine | LOW | The impacts from fishing and other sources on the marine communities are relatively low in this region. |
| | Estuaries | HIGH (non-fishing) | External factors such as water quality issues in the Blackwood Estuary, due to high nutrient run-off from surrounding land, as well as acid-sulphate soil contamination are of concern to sustainable fish stocks and the ecosystem in general. |

Captured fish species: Details of the analyses for these scores are located in the individual fishery reports.

| Captured Species | Aquatic zone | Risk | Status and Current Activities |
|------------------|----------------------------------|---------------------------|---|
| Finfish | Estuarine | SIGNIFICANT (non-fishing) | There is concern for some indicator fish stocks within estuaries in the West Coast Bioregion mainly due to external (non-fishing) factors (poor water quality). |
| | Nearshore (0-20m depth) | HIGH | With the increasing concerns for Australian herring, tailor and whiting in the nearshore regions, research projects are underway to assess these stocks and to develop methods to measure shore based fishing catch and effort. |
| | Inshore demersal (20-250m depth) | MODERATE | Following assessments of the demersal indicator species (dhufish, pink snapper, baldchin groper), management actions designed to reduce both the commercial and recreational catch levels by 50% have now been implemented. Determining catch shares for commercial and recreational users has been underway and a review in late 2010 confirmed that the catch levels have been reduced to desired levels. These stocks are now therefore considered to be in a recovery phase. An updated assessment is planned for 2013. |

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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| Captured Species | Aquatic zone | Risk | Status and Current Activities |
|------------------|---------------------------------|----------|--|
| | Offshore demersal (>250m depth) | LOW | While the indicator species in this deepwater location are vulnerable to overfishing the current catch levels are low and therefore the stocks are not at risk. Long term management arrangements for fishing in these depths, particularly for the recreational sector are still being finalised. |
| | Pelagic | LOW | There is still minimal capture of pelagic fish in this bioregion. |
| Crustaceans | Nearshore/ Estuarine | MODERATE | The stocks of crabs in Cockburn Sound have now recovered and the fishery has re-opened. Research on the other stocks of crabs in this region (e.g. Peel/Harvey) has been completed and the stocks are all considered to be in an adequate state and fishing levels are acceptable. |
| | Shelf (Lobsters) | MODERATE | The stock levels of western rock lobster and prawns are both currently at appropriate levels. The strong management that was applied to the rock lobster fishery has ensured that the lobster spawning stock is currently at record high levels despite on-going relatively low puerulus recruitment over the past 6 seasons. |
| Molluscs | Nearshore | MODERATE | The stocks of abalone are conservatively managed with strong management controls on both commercial and recreational fishers but the heat wave in 2010/11 caused the almost total loss of Roes abalone in the Kalbarri region.. Scallops are managed to acceptable levels using an input controlled system and a catch rate threshold. |

Protected species - Details on the analyses for these scores are either located within the individual fishery reports or in the bioregional level analyses documented in the EBFM report for this Bioregion (Fletcher et al., 2012¹).

| Protected species | Species | Risk | Status and Current Activities |
|------------------------------|-------------------|------|--|
| Protected non 'Fish' species | Turtles/ Seabirds | LOW | There is minimal impact from fishing activities on any turtle species within this bioregion and the small trawl fishery has to operate using grids. Little Penguins are considered most at risk from boat strikes and non-fishing activities. Few other issues were identified. |
| | Mammals | LOW | Sea lion exclusion devices now implemented for rock lobster pots near sea lion breeding islands which has reduced the risk to low levels. The reduction in fishing effort for lobsters had considerably reduced potential entanglement of whales but the extension of the season post June may require a re-assessment of this risk. |
| Protected 'Fish' Species | Fish | LOW | Blue groper (Rottnest Island), Cobbler (Swan Canning) and White Sharks are within this category and are already unable to be landed by commercial or recreational fishers. |

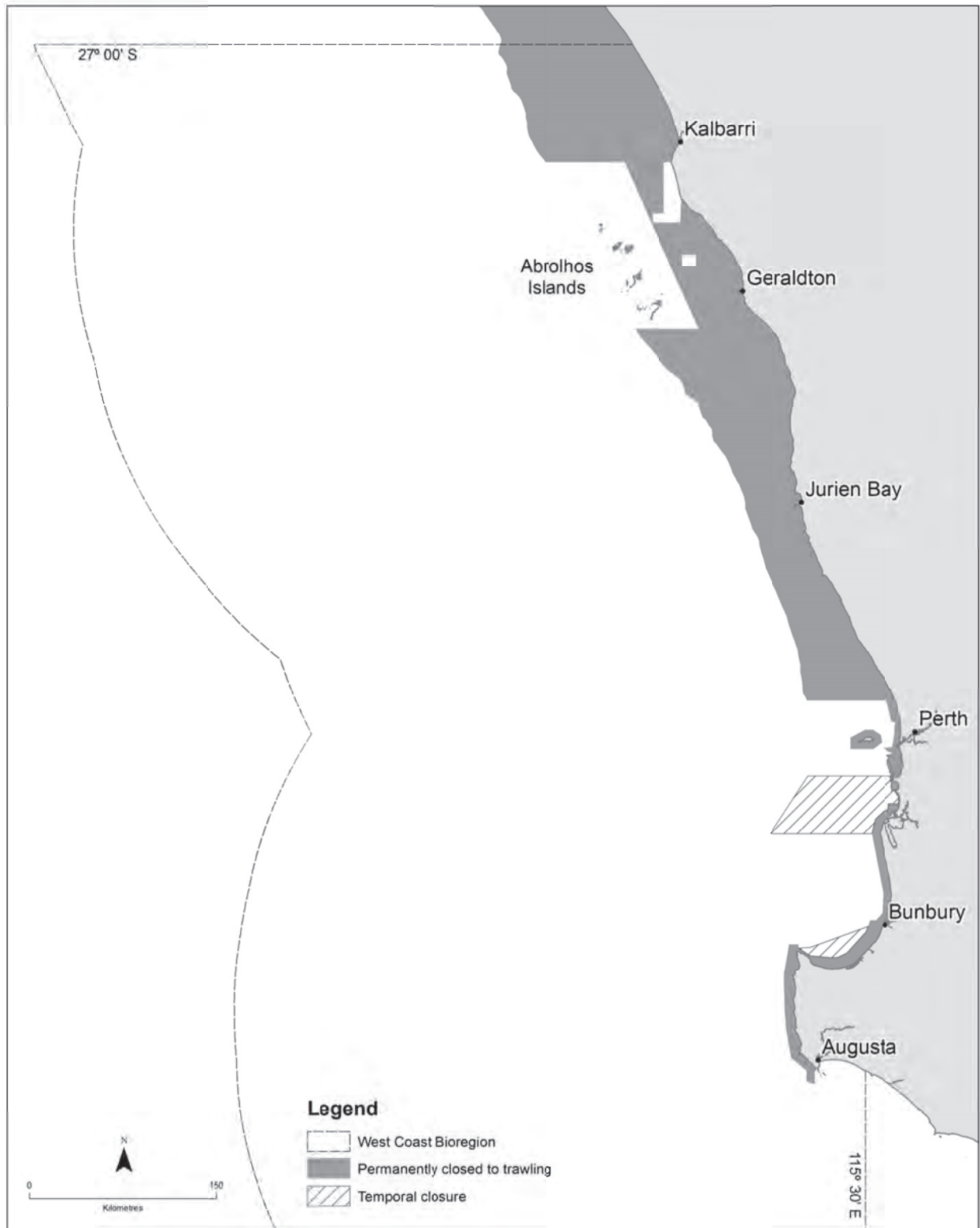
¹ Fletcher, W.J., Gaughan., D.J., Shaw, J. and S.J. Metcalf (2012) Ecosystem Based Fisheries Management: Case Study Report West Coast Bioregion. *Fisheries Research Report No. 212, Department of Fisheries, Western Australia 104pp.*

Benthic habitat - Details on the analyses for these scores are located in West Coast Ecosystem Management Table 1 above and in the individual fishery reports.

| Benthic Habitat | Category | Risk | Status and Current Activities |
|-----------------------------------|--|---------------------------|---|
| Estuaries and Embayments | Sand | SIGNIFICANT (non-fishing) | Estuarine and embayment habitats are threatened by various non-fishing factors (poor water quality, direct loss of habitat through coastal infrastructure and physical disturbance, e.g. dredging), sedimentation and smothering by algae. There are minimal impacts of fishing on these habitats |
| | Seagrass | MODERATE (non-fishing) | Seagrass habitat threatened from non-fishing related activities (coastal infrastructure and associated dredging (direct habitat loss, turbidity), eutrophication. Strong controls exist for direct destruction of seagrass. |
| Nearshore (0-20 m depth) | Sand | LOW | Minimal direct impacts (see Table 1) and high recovery rates. |
| | Seagrass | LOW | No destructive fishing methods allowed in these areas. |
| | Mangroves | LOW | No destructive fishing methods allowed in these areas |
| | Rocky Reef | LOW | Minimal direct impacts and high recovery rates. |
| | Coral Reef (Abrolhos) | LOW MODERATE | Minimal direct impacts. Regular monitoring of corals at the Abrolhos Is. |
| Inshore demersal (20-250 m depth) | Sand/ Seagrass/ Rocky Reef/ Coral Reef/ Sponge | LOW | Minimal direct impacts. See Ecosystem Table 1 for details |
| Offshore demersal (>250 m depth) | Sand/ Rocky Reef/ Sponge | LOW | Minimal direct impacts. See Ecosystem Table 1 for details |

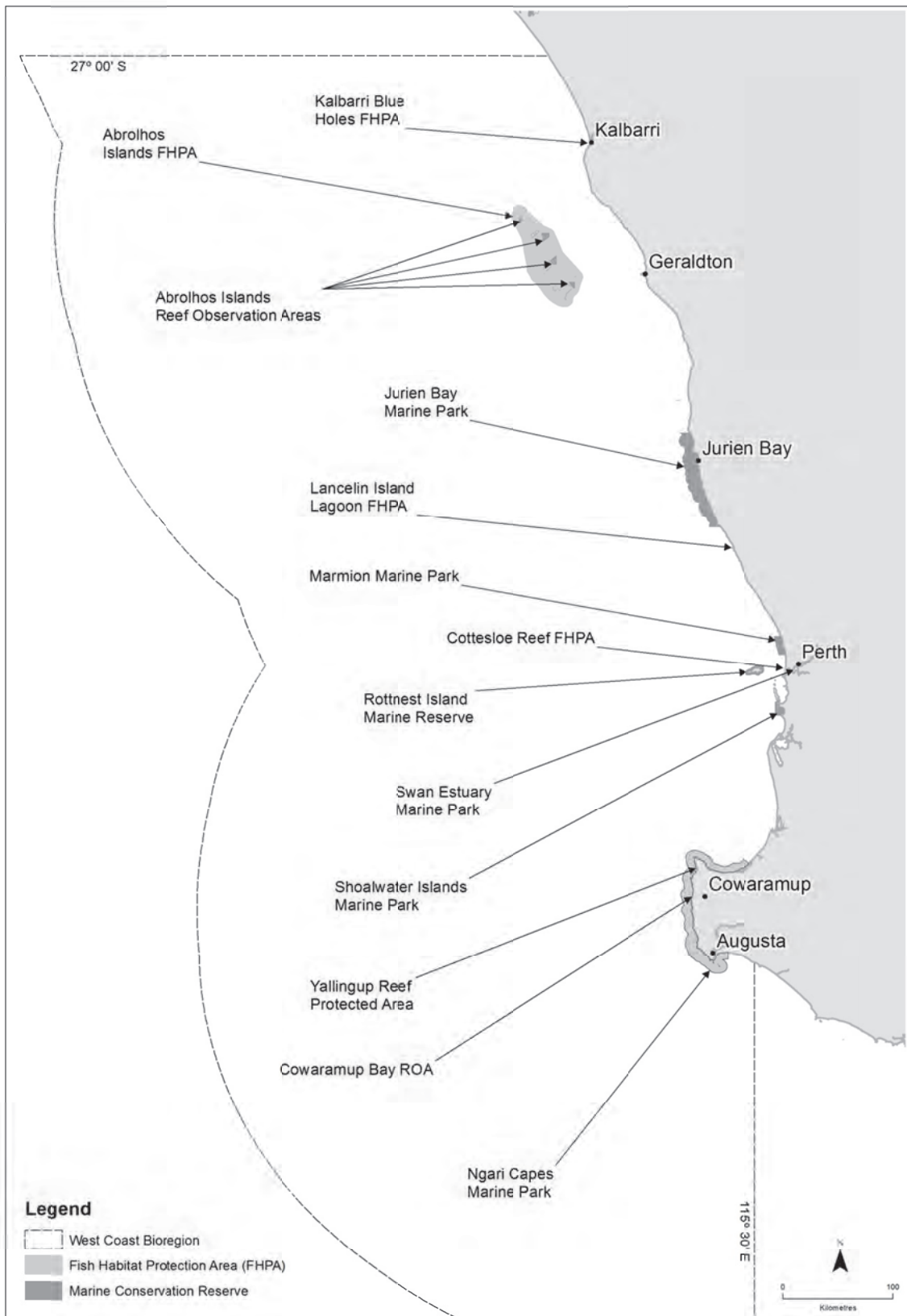
External Drivers - Details on some of the analyses used for these scores are located in the individual fishery reports plus there were whole of region assessments completed in the draft West Coast EBFM report.

| External Drivers | Risk | Status and Current Activities |
|-------------------------------|------------------------|---|
| Introduced Pests and Diseases | MODERATE in short term | Port monitoring plans have been implemented targeting high risk port locations. These designs have been developed in line with the National System for introduced marine pest monitoring. The extent and findings of monitoring activities in this bioregion are detailed in the Introduced Pests Status Report at the end of this chapter. |
| | HIGH in medium term | |
| Climate | MODERATE in short term | Projects to examine potential impacts on this bioregion are now underway or planned. Some climate change impacts on rock lobster biology had already been taken into account in the stock assessment process. |
| | HIGH in medium term | |



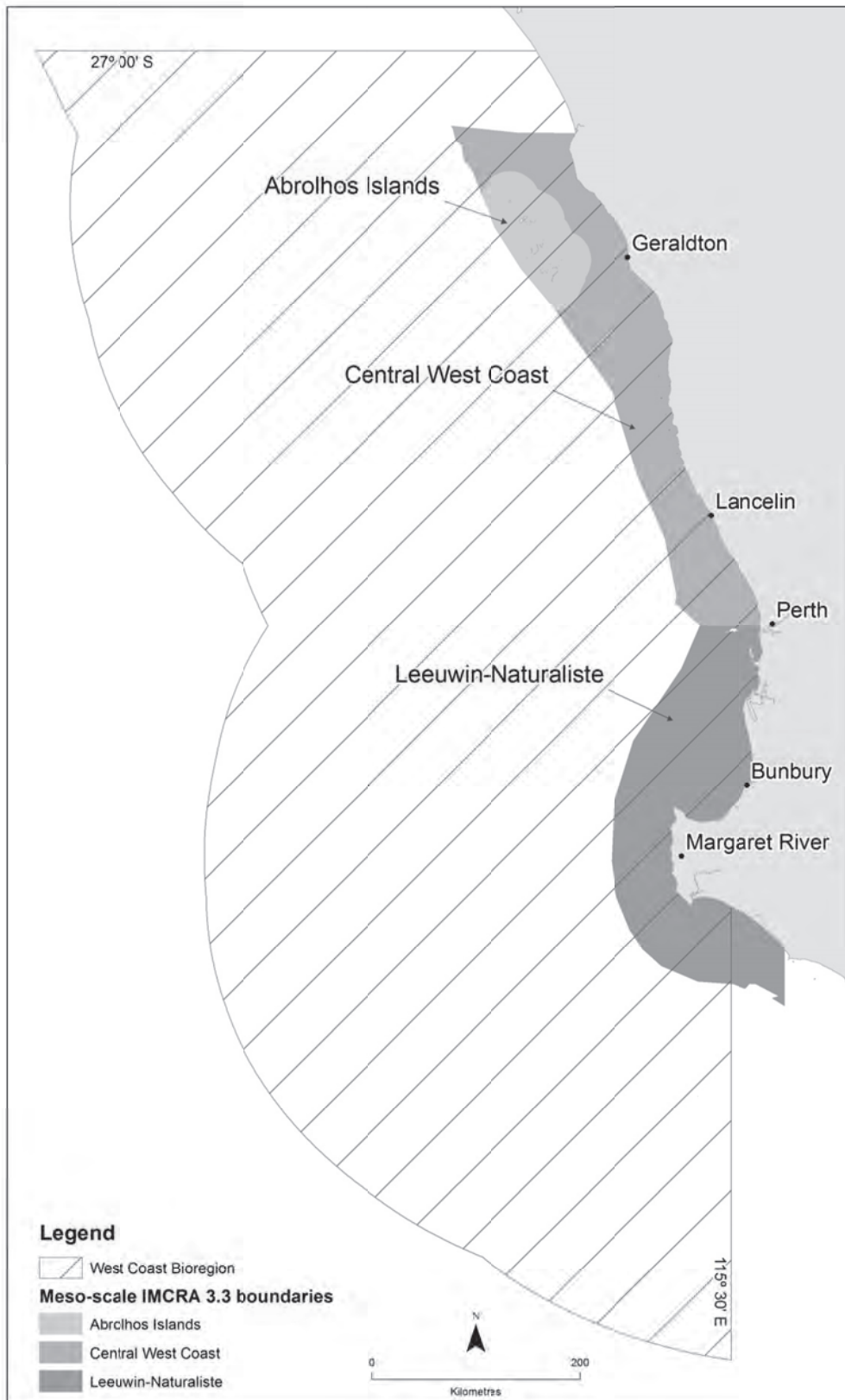
WEST COAST ECOSYSTEM MANAGEMENT FIGURE 1

Map showing areas of permanent and extended seasonal closures to trawl fishing in the west coast bioregion. The areas permanently closed are consistent with IUCN marine protected area category IV.



WEST COAST ECOSYSTEM MANAGEMENT FIGURE 2

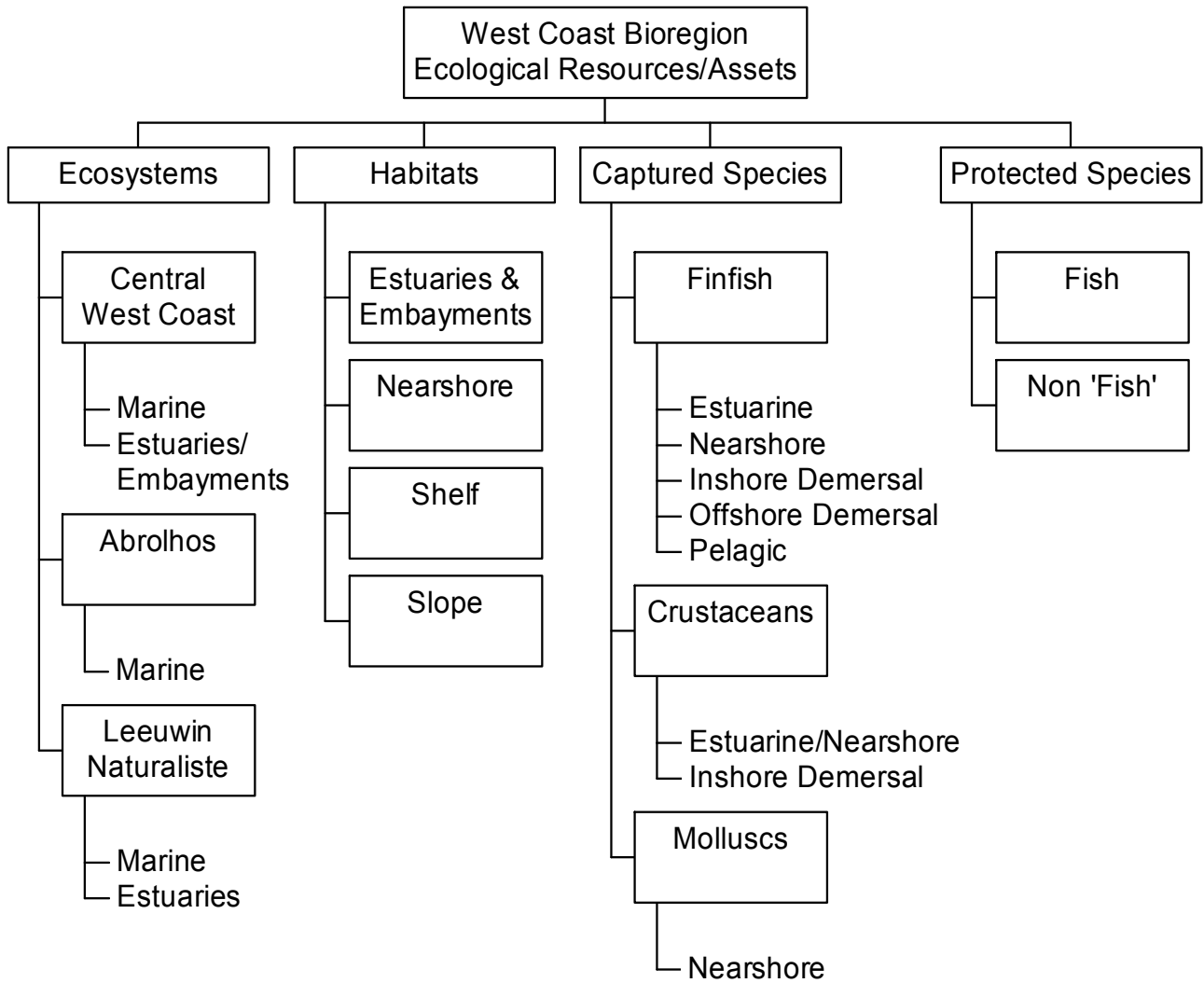
Map showing current and proposed formal marine protected areas in the west coast bioregion various areas of which are either consistent with IUCN categories I, II, III, IV or V.



WEST COAST ECOSYSTEM MANAGEMENT FIGURE 3

Map showing the three main IMCRA ecosystems in the West Coast Bioregion: the Abrolhos Is.; the Central West Coast; the Leeuwin-Naturaliste.

Note- This is based on Map 2 in IMCRA v4.0.



WEST COAST ECOSYSTEM MANAGEMENT FIGURE 4

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

INTRODUCED PESTS STATUS REPORT

Regional Monitoring and Research Update

The introduction and spread of marine pests in WA waters poses a serious threat to native biodiversity and can have widespread effects on both our economy and health. To this end the Marine Biosecurity Research group are actively involved in developing and implementing targeted marine pest monitoring and research programs in two ports in the West Coast bioregion. The aim is to detect the presence of introduced marine pests (IMPs) using a suite of tools. Early detection of IMPs is vital if any attempt at eradication or other management strategies are to be successful. The Marine Biosecurity Research group previously completed a large-scale marine pest monitoring program in Fremantle Port in early 2011. This biennial program adhered to the Australian Marine Pest Monitoring Guidelines and was endorsed by the Commonwealth. To compliment this survey MBR has developed targeted supplementary monitoring designs to be completed in the intervening years. The survey for Fremantle Port was completed in early 2012.

In addition the Marine Biosecurity Research group, with financial and in-kind assistance from Fremantle Port Authority and the Defence Services Group is running an Early Warning System program using in-situ sampling equipment to potentially provide a mechanism for the early detection of marine pests in Fremantle Port and HMAS Stirling waters.

The Marine Biosecurity Research group has developed Commonwealth approved marine pest monitoring designs for

Geraldton Port and HMAS Stirling. Surveillance at these ports is expected to be undertaken in the foreseeable future.

Through this combined surveillance the species that have been detected in this region are reported in Introduced Pests Table 1.

The Marine Biosecurity Research group are currently conducting five main research projects in the West Coast bioregion (see below). While conducted in this bioregion the research outputs are designed to be applicable to biosecurity management across the state.

- Assessment of the likelihood of a marine pest being introduced into the ports of this bioregion;
- Determination of the efficacy of wrapping a recreational vessel hull to eliminate/kill biofouling on the wet areas of the hull;
- Quantification of the risk associated with recreational vessels for the introduction and translocation of marine pests along our coast;
- Evaluation of the efficacy of crab condos to sample for non-aggressive pest crab species; and
- Determination of the growth, physiology, reproductive strategies, response to stress and impacts of the invasive ascidian *Didemnum perlucidum*.

INTRODUCED PESTS TABLE 1

Introduced marine species detected in this bioregion.

| Common name | Scientific name | Type of organism | IMS/IMP listing |
|-----------------------|------------------------------|------------------|----------------------------------|
| Mediterranean fanworm | <i>Sabella spallanzanii</i> | Polychaete | Pest |
| Scallop | <i>Scaechlamys livida</i> | Mollusc | Introduced species |
| Aeolid nudibranch | <i>Godiva quadricolor</i> | Mollusc | Introduced species |
| | <i>Alexandrium catanella</i> | Dinoflagellate | Pest |
| Ciona | <i>Ciona sp.</i> | Ascidian | Introduced species |
| Asian paddle crab | <i>Charybdis japonica</i> | Crab | Pest |
| Ivory barnacle | <i>Balanus improvisus</i> | Barnacle | Pest |
| | <i>Balanus pulchellus</i> | Barnacle | Introduced species |
| Asian green mussel | <i>Perna viridis</i> | Mussel | Pest |
| Asian date mussel | <i>Musculista senhousia</i> | Mussel | Pest |
| | <i>Didemnum perlucidum</i> | Ascidian | Introduced species – likely pest |

FISHERIES

West Coast Rock Lobster Fishery Status Report

S. de Lestang, A. Thomson, M. Rossbach, J. Kennedy, G. Baudains and A. Steele

| Main Features | | | |
|---------------|------------|--|--------|
| Status | | Current Landings (Season 2010/11) | |
| Stock level | Adequate | Commercial catch | 5501 t |
| Fishing Level | Acceptable | Recreational catch | 150 t |

Fishery Description

Commercial

The West Coast Rock Lobster Managed Fishery (WCRLF) targets the western rock lobster, *Panulirus cygnus*, on the west coast of Western Australia between Shark Bay and Cape Leeuwin, using baited traps (pots). This fishery was one of the first limited entry fisheries in the world and utilised a sophisticated Individual Transferrable Effort based system for over 20 years. In 2009/10 catch limits and catch targets for each zone of the fishery were introduced. In 2010/11 individual catch limits based on a Total Allowable Commercial Catch (TACC) was set. It is planned that by 2013/14 the fishery will have moved to a full Individual Transferable Quota (ITQ) fishery. With annual production historically averaging about 11,000 t this has been Australia's most valuable single species wild capture fishery and was the first fishery in the world to achieve Marine Stewardship Certification (MSC). In early 2012 the fishery was re-certified by MSC for the third time.

Recreational

The recreational rock lobster fishery primarily targets western rock lobsters using baited pots and by diving.

Governing legislation/fishing authority

Commercial

West Coast Rock Lobster Management Plan 1993 and other subsidiary legislation

West Coast Rock Lobster 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 Rock Lobster Fishing Licence

Consultation processes

Commercial

The Department of Fisheries consults with the Western Rock Lobster Council (WRLC) on operational issues. Industry meetings are convened by the WRLC, while the West Australian Fishing Industry Council (WAFIC) is 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 fishery is situated along the west coast of Australia between Latitudes 21°44' to 34°24' S. The fishery is managed in 3 zones: south of latitude 30° S (C Zone), north of latitude 30° S (B Zone) and, within this northern area, a third offshore zone (A Zone) around the Abrolhos Islands.

Recreational

The recreational rock lobster fishery operates on a state-wide basis and encompasses the take of all rock lobster species. Fishing is concentrated on western rock lobsters in inshore regions in depths of less than 20 meters between North West Cape and Augusta. The majority of recreational lobster fishing occurs in the Perth metropolitan area and Geraldton.

Management arrangements

Commercial

The West Coast Rock Lobster Managed Fishery (WCRLF) is divided into three zones. Historically, this has enabled effort to be distributed across the entire fishery (to prevent concentration of effort and exploitation in localised areas) and has also permitted the implementation of management controls which addressed zone-specific issues.

In 2010/11, management for the fishery continued to implement the processes designed to secure its long-term sustainability following a significant decline in puerulus settlement over a period of several years. Measures undertaken in 2010/11 to initiate transition to a full ITQ based framework included maintaining the TACC at 5,500 tonnes (roughly half the long-term average annual catch) and the introduction of a catch limit (or quota) on licences that varied in accordance with the number of units of entitlement on the licence and the zone to which the licence relates (as outlined below).

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Previously, the fishery was managed through a total allowable effort (TAE) system and associated input controls such as the number of pots fished per unit in the fishery, along with other restrictions such as; temporal closures including weekend and moon closures, and biological controls including size limits and protection of females in breeding condition; i.e. in tarspot, berried or setose condition. While many of these input controls remained in place for the 2010/11 season, the move to allocate a maximum catch limit per unit represents a significant step toward transitioning the Fishery to a full ITQ system, which is expected to be in place for the 2013/14 fishing season.

The management arrangements for the 2010/11 season were as follows:

- Total Allowable Commercial Catch (TACC) of 5,500 tonnes.
- Individual catch limits with the following number of kilograms per unit:
 - Zone A – 36kg from 15th November to 14th March (fishing in Zone B waters).
 - Zone A – 51kg from 15th March to end of season (fishing in Zone A waters).
 - Zone B – 81kg for entire season.
 - Zone C – 75kg for entire season.
- Fishing Prohibited weekends (rescinded in June of 2011).
- Big bank to remain closed.
- Season extended to 31st August.
- Zone C start date moved from 25th November to 15th November.
- 20 fathom line rule removed.
- Introduction of crate tags, catch and disposal records, authorised receivers, holding over books, and catch weighing procedures (including the use of landing areas) to monitor fishers' catch.
- Limited 'within season' transferability of licences and entitlement.

The change towards a TACC/ITQ framework required a great deal of adjustment and cooperation by both industry and the Department. The Department needed to design a new management and compliance strategy that was capable of accommodating the practicalities of quota monitoring in an industry where many fishers land their catch in remote locations.

The new management arrangements have provided western rock lobster fishers with increased flexibility in their fishing operations, as well as the opportunity to maximise the prices they receive for their product by fishing during periods where the market price of lobsters is high.

Recreational

The recreational component of the western rock lobster fishery is managed under fisheries regulations. A mixture of input and output controls is used which is designed to ensure that the recreational sector enjoys the amenity of its access to the rock lobster resource, while fishing to their 5% allocated share.

Recreational input controls include:

- Maximum of 2 pots per licence holder (no limit on total number of licences).
- Pots must meet specific size requirements and have gaps to allow under-size rock lobsters to escape.
- Divers can only catch by hand, snare or blunt crook to prevent lobster damage.
- Fishing for rock lobsters at the Abrolhos Islands is restricted to potting.
- The season runs from 15th November to 30th June each year on the coast, with a shorter season (15th March to 30th June) at the Abrolhos Islands.
- Night-time fishing for lobsters by either diving or potting is prohibited.
- Management regulations on minimum size limits, protection of breeding females and the maximum size of females that can be taken are the same as those for commercial fishers.

Output controls in 2010/11 were applied in the form of a bag limit of 6 lobsters per person per day, a boat limit of 12 lobsters and a possession limit of 24 lobsters.

There is also a requirement for recreationally-caught lobsters to be tail-clipped in order to stop these animals from being sold illegally as part of 'shamateur' activity. For the 2010/11 season, there was a change to the use of escape gaps within the recreational fishery between North-West Cape and Cape Leeuwin. Pots were required to have escape gaps with a minimum height of 55mm, and minimum width of 305mm.

During the 2010/11 season the recreational sector took 2.6% of the total catch of the West Coast Rock Lobster Fishery.

Integrated Fisheries Management

In March 2008, through the Integrated Fisheries Management process, the Minister determined that the allocated shares of the sectors of the West Coast Rock Lobster resource would be 95% to the commercial sector, 5% to the recreational sector and one tonne to customary fishers. The 2009/10 season was the first season where these shares were formally allocated to each sector.

Research summary

Research activities focus on assessing stock sustainability, forecasting future catch and breeding stock levels. This involves fishery-dependent and independent monitoring of breeding stock levels and puerulus settlement. Industry performance is monitored through compulsory catch and effort records from both fishers and processors, comprehensive data from the voluntary logbook scheme, and a commercial monitoring program, all of which are used for modelling and stock assessment.

An environmental management strategy was developed for use in the assessment of the broader ecosystem impacts of rock lobster fishing in the context of Ecological Sustainable Development (ESD) and MSC certification. This strategy includes research into the ecosystem effects of rock lobster fishing in deep water. A second Fisheries Research and Development Corporation (FRDC) funded project to examine the effects of western rock lobster fishing on the deep-water

ecosystem off the west coast of Western Australia was started in 2009, using a comparison between fished and unfished deep water areas.

A second project examining lobster populations in fished and unfished zones is ongoing at Rottne Island. This project consists of annual sampling using pots and underwater dive surveys at Armstrong Bay and Parker Point sanctuary zones. Results from the first five years after the no-take regions were implemented have shown a slight increase in lobster numbers within the protected areas. This study also aims to provide additional information on growth, natural mortality and size/sex-specific catchability.

Concern about the status of the breeding stock in the Big Bank region resulted in this area being closed to lobster fishing. Additional independent breeding stock survey sites have been sampled in this area since 2009 to generate baseline information to assess the effects of this closure.

A risk assessment workshop to examine the low puerulus settlement was held in April 2009. The workshop focused on examining the 'likelihood' of factors that could have caused the decline in puerulus settlement. The workshop concluded that the decline in settlement could have been caused by changes in environmental conditions and productivity in the eastern Indian Ocean, or a decline in the abundance of the rock lobster breeding stock, particularly in the northern region of the fishery, or a combination of these two factors. A report on this workshop can be found on the Departments website

(http://www.fish.wa.gov.au/Documents/occasional_publications/fop071.pdf).

A significant amount of research has been focused on the cause of these low settlement levels in recent years. Six projects have been developed and funded by the Fisheries Research and Development Corporation (FRDC):

Project 1. Identifying factors affecting the low western rock lobster puerulus settlement in recent years.

Project 2. Evaluating source-sink relationships of the Western Rock Lobster Fishery using oceanographic modelling.

Project 3. Evaluating the use of novel statistical techniques for determining harvest rates and efficiency increases in the Western Rock Lobster Fishery.

Project 4. Evaluation of population genetic structure in the western rock lobster.

Project 5. Assessing possible environmental causes behind the reduced colonization of puerulus collectors by a wide suite of species.

Project 6. A joint funded project between the FRDC and the Marine National Facility - RV Southern Surveyor. Biological Oceanography of the Western Rock Lobster – Winter / Spring Dynamics.

These projects have added to the current knowledge of western rock lobster larvae and settlement and the relationships these have with the environment. They have however not specifically identified the cause of the recent declines in settlement levels, and work in this area is ongoing.

To assess the economic performance of the fishery has been funded by the Seafood CRC. This project is examining maximum economic yield assessment, in light of the recent move towards a quota management system, and ways to

incorporate the economic assessment into the outputs generated by the stock assessment model.

For the recreational component of this fishery, an annual mail-based survey of participants has been used to estimate the annual catch and effort for the past 20 years. The trends generated by these data, together with data on puerulus settlement are used to predict the recreational catch and effort in following seasons. Since 2000/01, telephone diary surveys of recreational rock lobster fishers have also been undertaken in a number of years which have been used to generate a conversion factor to scale the estimates from the annual mail surveys.

Retained Species

Commercial landings (season 2010/11):

5501 tonnes

Lobsters: Trends in the annual catches from the West Coast Rock Lobster Managed Fishery are shown in West Coast Rock Lobster Figure 1. Due to the new management changes (TACC) introduced in response to the very poor puerulus settlement in 2008/09 and subsequent years, the catch landed by the WCRLF for 2010/11 (5501 t) was less than in 2009/10 (5899 t). In 2010/11 catches in A, B and C Zones were 950, 1875 and 2676 t, respectively, with A Zone 13.9% lower, B Zone 10.5% lower and C Zone 0.9% lower than the previous season.

Octopus: Octopus are also caught in rock lobster pots, generally in shallow water (<40 m), and a catch rate of 0.02 octopus per pot lift was recorded in 2010/11 from Catch and Disposal Records data. This was within the historical range of 0.02 – 0.045 per pot lift (1985/86 to 2009/10) based on logbook data.

This catch rate translates to an estimated 45,263 octopus caught in all regions of the fishery during 2010/11. Octopus catches were estimated for A, B and C Zones as 716; 29,095; and 15,460, respectively.

The catch rate of octopus (incidental landings) is an indicator for this fishery, and at 0.02 octopus per pot lift achieved the performance measure of being no more than 10% outside of the historical range $\pm 10%$ (0.020–0.043 octopus per pot lift).

Recreational catch estimate (season 2010/11):

150 tonnes

Since the 1986/87 season, a mail survey has been used to estimate the total catch of the recreational sector. At the end of each fishing season, approximately 10% of people licensed to fish recreationally for rock lobster have been randomly sent a survey asking about their retained catch and level of effort for the season just completed. Typically, 40 – 60% of these surveys have been returned. It has been acknowledged that this survey method suffers from a recall bias (the inability of people to remember exact details of what fishing they may have completed as long as 7.5 months prior) and due to not all survey recipients returning the survey, a non-response bias (the possibility of non-respondents being

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different in their fishing behaviour and success than respondents). To reduce the impact of these biases on catch estimates, a phone-diary survey that is considered to suffer less from these biases (Baharthah, 2007)¹, has been conducted in concert with the mail survey for a number of seasons to develop a conversion factor. The resultant conversion factor has been used to standardise catch estimates from the far cheaper mail survey to that of the phone-diary survey.

Historically a conversion factor of 0.53 was used to standardise the recreational mail survey catch estimate (this was based only on a two year comparison of the different surveys). Recently an additional five seasons of data has been collected and analysed, with a new conversion factor of 0.45 calculated (Thomson et al. submitted)². This new conversion factor has now been applied to all historical total catch estimates.

The recreational catch of western rock lobster for 2010/11 was estimated at 150 t based on the adjusted mail survey, with 98 t taken by potting and 52 t by diving. This represents close to 3% of the total catch of lobsters.

Comparative catch estimates for 2009/10 were 212 t, with 147 t by potting and 65 t by diving. The estimated recreational catch in 2010/11 was therefore 29% below the 2009/10 catch estimate. This decline was predicted (Figure 7).

Fishing effort/access level

Commercial

In 2010/11 the numbers of vessels fishing for lobster were 71 in A Zone, 70 in B Zone and 138 in C Zone. Thus, in comparison to the 297 active boats in 2009/10, a fleet of 279 vessels fished in 2010/11, which was a reduction of 6%.

Under the new management arrangements (TACC) pots allowed to be used to catch rock lobsters is based on 50% of a vessel's unit entitlement. In 2010/11 the fishery recorded 2,376,794 potlifts, which was a small increase on the previous season's potlifts of 2,204,126. The slight increase is due to the changing behaviour of fishers as they slowly adapt to the new management arrangements e.g. fishing in lower catch rate periods when the beach price is higher.

Recreational

A total of 37,882 licences were issued that permitted fishing for lobsters during some part of the 2010/11 season. This is a decline in the number of licences purchased in 2009/10 (43,787). The 2010/11 season represented the first season since 1993/94 where rock lobster specific licences were required, thus only people planning to fish for rock lobsters

would purchase a licence. In 2009/10 an umbrella licence that allowed for rock lobster fishing was available.

An estimated 21,400 (57%) licences were actually used to catch lobsters in 2010/11. This was very close to the forecasted number of 22,890. Sales of licences and associated usage figures are substantially higher in years of anticipated good recruitment into the fishery, which in turn results in those years producing a relatively higher overall recreational rock lobster catch due to a combination of increased lobster abundance and higher fishing effort. The number of licences used for rock lobster fishing in 2010/11 was 18% lower than those during the previous season, i.e. 2009/10 (26,260).

The average rates of usage by active pot and diving fishers (i.e. excluding all those who held a licence but failed to use it) were 26 and 10 days, respectively during the 2010/11 fishing season. These rates were similar in the 2009/10 fishing season.

Finally, the average diary-adjusted catch taken by active pot and diving fishers were 14 and 10 lobsters, respectively during the 2010/11 fishing season. In the 2009/10 season the average number of lobsters caught by pot and dive fishers was 16 and 9, respectively.

Stock Assessment

Assessment complete: Yes

Assessment level and method:

Level 5 - Size-structured population model

Breeding stock levels: Adequate

Targeted commercial catch next season

(2011/13): 6,938 tonnes TACC³

Projected recreational catch next season

(2011/12): 80 ± 40 tonnes

The stock assessment process for this fishery utilises the broad range of fishery and fishery-independent monitoring data as outlined in the research summary.

Indices of egg production are the main indicators for assessing the health of the lobster stock. Prior to 2008/09 these were empirically-based measures presented as the north and south coast fishery-dependent breeding stock indices based on commercial monitoring data and the fishery-independent breeding stock survey (IBSS) indices. Since 2008/09 the development of a fully integrated stock-assessment model that incorporates these data sources along with other information has enabled more robust and spatially comprehensive estimates of egg production to be generated. These model-based indices are now used for assessing the health of this stock and their continued use was a key recommendation from the recent stock assessment review of the fishery completed in May 2010.

The current focus for stock assessment is to determine what effects five years of low puerulus settlements will have on

¹ Baharthah, T. 2007. Comparison of three survey methods applied to the recreational rock lobster fishery of Western Australia. Master of Science Thesis. School of Engineering and Mathematics. Edith Cowan University, Western Australia.

² Thomson, A.W., Wise, B.S., and Baharthah, T. (In review). Correcting the recall, non-response and avidity bias in a mail survey of recreational western rock lobster fishers using phone-diary surveys. Canadian Journal of Fisheries and Aquatic Science.

³ Note this TACC covers a 15 month season and does not represent an increase compared to the 2011/12 season.

future catches and breeding stock levels and to assess the effects of different management measures in mitigating any negative impacts.

The proposed management arrangements, which have been updated from the changes implemented in 2005/06, 2008/09 and 2009/10, and which include reductions in the pot usage rate, reductions in maximum size limit for females and the closure of Big Bank, have ensured that the overall breeding stock projected five years into the future will remain above the threshold levels of the early to mid 1980s with a probability greater than 75% (West Coast Rock Lobster Figures 2, 3 and 4).

A performance measure for the fishery is that the egg production index for the three zones are projected to be above their respective threshold levels (that estimated to be the early-mid 1980s levels) five years into the future with a probability greater than 75%. The fishery has therefore met this performance measure.

Catch per Unit Effort (CPUE)

A second assessment measure in this fishery is the catch per unit of effort (CPUE) achieved annually by the fishery (West Coast Rock Lobster Figure 5). With the change in management from being effort controlled to TACC based on individual catch limits in 2010/11, commercial fishing behaviour has changed dramatically. Under effort controls, fishers were driven to utilise all available effort to maximise their catches. Under a TACC fishery, fishers are driven to maximise profits through catching the most valuable grades of lobsters during the most profitable periods of the season, while using as little effort as possible. This has resulted in an increase in pot soak times and a move to fishing more in lower catch rate periods when beach prices are generally at their highest. This impacts the relativity of commercial catch rates between the pre and post TACC phases of the fishery, therefore these two periods cannot be compared directly.

Commercial

The downward trend from the 1970s to the 1980s reflects increasing effort during this period (West Coast Rock Lobster Figure 1), which automatically led to a lower CPUE. This trend was reversed in the early 1990s through a substantial management-induced reduction in effort (i.e. pot usage was reduced to 82% of the unit holding).

Typically short-term fluctuations in abundance resulting from the cyclical nature of puerulus settlement were reflected in the legal-sized lobster abundance (CPUE) 3 to 4 years later. The increase in CPUE to 1.68 kg/pot lift (around 52% higher than the previous year) for the 2008/09 fishing season, however, relates more to the significant reduction in effort levels during that season. The low TACC set for the subsequent two fishing seasons (2009/10 and 2010/11) of about half the long term average annual landing of 11 000 t successfully maintained high levels of legal biomass and high catch rates in these two seasons. It should be noted that the catch rate does not directly reflect the overall abundance of lobsters, because legal catches do not include the large biomass of under-size animals and breeding females, which are both fully protected.

Recreational

The average recreational pot and diving diary-adjusted catch rates were 0.56 and 0.95 lobsters per person per fishing day in the 2010/11 fishing season. These catch rates are very similar to the 0.66 lobsters for potting and 0.97 lobsters for diving in the 2009/10 fishing.

Juvenile Recruitment and Catch Prediction

Post-larval (puerulus) recruitment to the fishery is monitored on a lunar monthly basis. Recruitment levels are affected by fluctuations in environmental conditions such as strength of the Leeuwin Current and the frequency and intensity of low-pressure systems generating westerly winds. Annual indices of puerulus settlement for 2010/11 were at low levels at nearly all sampling sites (West Coast Rock Lobster Figure 6). This settlement was below the long-term average at all sites, although it has shown a general improvement compared with the previous four seasons. The 2010/11 settlement will start to impact on catches during the 2013/14 fishing season.

Non-Retained Species

By-catch species impact:

Low

The bycatch of finfish and other species landed during normal rock lobster fishing operations must be recorded with details provided to the Department as part of the fishers statutory catch declaration. These data show that approximately 3.5 t of bycatch were landed during the 2010/11 fishing season.

Protected species interaction:

Low

Previously, the WCRLF interacted with the Australian sea lion, *Neophoca cinerea*, resulting in the accidental drowning of an estimated small number of sea lion pups in rock lobster pots, as the pups attempted to feed on the bait or rock lobsters contained in the pots. Such incidents were restricted to shallow waters (< 20 m) and to areas within 30 km of the mainland sea lion breeding colonies on the mid-west coast.

In order to eliminate these accidental drownings, from November 15, 2006 all pots fished in waters less than 20 m within approximately 30 km of the 3 breeding colonies, i.e. just north of Freshwater Point to just south of Wedge Island, were fitted with an approved Sea Lion Exclusion Device (SLED). SLEDs have also been required to be added to all pots fishing in areas less than 20 m in depth around the Easter and Pelsaert Groups in the Abrolhos Islands since 15 March 2011. Video trials have indicated that this device does stop sea lion pups from entering lobsters pots and drowning.

Approved SLED designs include an internal rigid structure, directly under the pot neck and an external design across the top of the pot, both of which ensure that the diagonal distance from the SLED to the neck of the pot is not greater than 132 mm. Further information on the SLED management package is available at <http://www.fish.wa.gov.au/Sustainability-and-Environment/Aquatic-Biodiversity/Pages/Protected-Species.aspx>.

Monitoring of commercial pots in the SLED zone in 2007/08 – 2008/09 showed that over 95% of pots checked had an approved SLED.

The performance measure for this fishery is that no increase in the rate of capture of sea lions occurs. During the 2010/11 western rock lobster season, no sea lion captures were reported, whereas the historical level is just over three sea lions per season. The fishery has therefore met this performance measure.

Turtle deaths as a direct result of interaction with the lobster fishery are very rare. Of the 6 turtle species that occur in the waters of the western rock lobster fishery, very few are reported to interact with western rock lobster fishing gear each year. The small number of interactions were concluded to be above a negligible risk, although still rated as a low risk. Given the significant reductions in effort and hence pot ropes in the water since this assessment was completed, the current risk is probably now even lower.

The performance measure for the fishery is that there is no increase in interactions with turtles. In 2010/11, no interactions with turtles were reported. This incident rate is below the historical range of between two and five entanglements per season over the preceding five seasons. The fishery has therefore met this performance measure.

There are occasional reports of a whale becoming entangled with pot ropes. The humpback whale is the predominant species that interacts with the WCRLF, during its northward migration to the North West Shelf breeding grounds in June to August. Owing to the fishery's historical closed season, there was a limited period for interaction; however, with the increasing population of whales and the extension of the fishing season into July and August, interactions are considered likely to occur in the future, although this increase might be offset by the recent marked reduction in effort levels.

Interactions are reported by industry to the Department of Environment and Conservation (DEC) and a specialist team is used to disentangle the animal, with a very high success rate. The western rock lobster fishing industry has developed a code of practice to minimise the interaction with whales in conjunction with DEC and SeaNet. The environmental management strategy adopted for the WCRLF requires monitoring of, and attempts to, minimise accidental interaction with these species wherever practicable.

The performance measure for the fishery is that there is no increase in the rate of interactions with whales and dolphins (entanglements). Over the recorded history (1989–2009), commercial lobster fishing has resulted in zero to four whale/dolphin interactions per season. Four whale entanglements with lobster gear were recorded during the 2010/11 lobster season. The fishery has therefore met this performance measure.

Ecosystem Effects

Food chain effects:

Moderate

Overall, the fishery is unlikely to cause significant trophic ('food web') cascade effects, as the protected sub-legal-sized lobsters and breeding stock components form a relatively constant significant proportion of the biomass which remains from year-to-year, and the catch, particularly in inshore areas, is less than the annual variability in biomass due to natural recruitment cycles. However, the rock lobster-specific ecological risk assessment completed in 2008 considered that, due to the lack of information, the removal of lobster in deep-water regions might be having some level of impact on the surrounding ecosystem. This forum subsequently classed this as a moderate risk. Consequently it has become a focus of research, with preliminary work, funded by FRDC now completed and a second WAMSI/FRDC project has been initiated to expand on these preliminary findings.

Habitat effects:

Low

The legislated design of rock lobster pots, the materials they are made from and the strict control of replacement pots prevent 'ghost fishing' problems arising. A study of human impacts on the marine environments of the Abrolhos Islands estimated that potting might impact on less than 0.3% of the surface area of fragile habitat (corals) at the Abrolhos, where fishing is only allowed for 3½ months of the year. Generally, throughout the coastal fishery, rock lobster fishing occurs on sand areas around robust limestone reef habitats, covered with coralline and macro-algae such as kelp (*Ecklonia* spp.). This type of high-energy coastal habitat is regularly subjected to swell and winter storms and so is considered highly resistant to damage from rock lobster potting. The significant recent reductions in fishing effort will have reduced these risks even further.

Social Effects

Commercial

The western rock lobster fishery is an important sector of Western Australia's economy, with the commercial catch from the current reporting season valued ex-vessel at \$194 million. Employment is seasonal, the fishing season covering nine and a half months from 15 November to 31 August.

A total of 279 vessels and approximately 780 people were engaged directly in fishing for rock lobsters in 2010/11. During the year, 6 main processing establishments, located in the Perth metropolitan area (3) and Geraldton (1), Ledge Point (1) and Cervantes (1) serviced practically every location where fishing occurred.

Recreational

With around 21,400 people taking about 300,000 individual lobsters in the last season alone, this fishery represents a major recreational activity and provides a significant social benefit to the Western Australian community.

Economic Effects

Estimated annual value (to fishers) for 2010/11:

Level 5 - > \$20 million (\$194 million)

The price that commercial fishers received for the western rock lobster in 2010/11 was an estimated average of \$35.20/kg in all zones of the fishery. This was 13.5% increase on the \$31.00/kg paid in 2009/10, with the increase due partly to fishers only landing catch when the advertised beach price was high. The overall value of the fishery increased marginally from the previous season's value of \$183 million as a result of high grading of the catch and higher price paid by overseas buyers.

The bulk of the product was exported to Japan, Taiwan, Hong Kong/China, United States and some into Europe.

Fishery Governance

Commercial

Current Fishing (or Effort) Level: Acceptable

Commercial catch target (11/13): 6931 tonnes

Between 1975/76 and 2010/11 commercial catches have averaged 10,443 and ranged from 5,501 t in 2010/11 to 14,523 t in 1999/2000. The variations in catches result primarily from varying levels of recruitment, which have been largely associated with the environmental conditions experienced by western rock lobster larvae and post-larvae, and levels of fishing effort. The record low puerulus settlement in 2008/09 and poor settlement in 2009/10 followed two previous years of low levels of settlement all of which has resulted in catch limits being imposed to generate a carry-over of legal biomass rather than continuing the historical strategy of catching a similar proportion of the available stock each year. These actions were designed to ensure a carryover of lobsters into what would have otherwise been low catch years (2010/11 – 2013/14). For the 2008/09 season this involved restricting the catch to below 7,800 t which required significant effort reductions for both the whites (reduced 35% compared to the previous whites) and reds (reduced by ca. 60% compared to the previous reds) portions of the season. A different strategy was adopted for the 2009/10 and 2010/11 seasons, with catch limits set at 5,500 t ± 10% and 5,500 t, respectively, being used to reduce catch rather than effort reductions. The 2011/13 season is a 15 month season therefore the catch target (TACC) has been increased in proportion to what previously would have been taken at the start of following season.

Recreational

Current Fishing (or Effort) Level Acceptable

Target recreational catch limit (11/12): 290 tonnes

Between 1986/87 and 2010/11 recreational catches have varied between 104 t in 1987/88 to 400 t in 2002/03. Variation of these catches results primarily from variable levels of recruitment, which are driven by the environmental conditions as described above. From 2008/09 onwards the commercial and recreational sectors have been managed under the principles of Integrated Fisheries management (IFM), which allocates the commercial and recreational

sectors 95% and 5% of the total catch, respectively. Under this arrangement the limit for the recreational catch for 2010/11 based on a commercial catch of 5501 t was 290 t.

The recreational catch estimate for the 2010/11 season was 150 ± 25 t (95% confidence interval of the mean) which was well below their limit catch of 290 t.

New management initiatives (2011/12)

To move the Fishery to a full ITQ in 2013 and to accommodate the change in licensing period (proposed to commence in January 2013), the 2011/12 season will commence on November 2011 and extend through to January 2013, although fishing will not be permitted between 1st October 2012 and 14th November 2012 (note: the fishing season for Zone A [Abrolhos Islands] commences on 15 March 2012 and will finish on 30 September 2012). As a consequence the 2011/12 season will be referred to as the 2011/13 season.

The change to the licensing period from November/September to January/January is being made to allow fishers to commence their "quota season" during the higher value "reds" part of the season and finish fishing during the lower value, but highly catchable "whites" part of the season. To allow for the extended fishing season (and the inclusion of an extra "whites" period), the previously announced TACC of 5,500 tonnes will be increased to 6,938 tonnes for the 2011-13 season.

The management arrangements for the 2011/13 season will also provide increased flexibility by allowing permanent and temporary transfers of units of entitlement within the fishing season (not permitted during the 2010/11 season).

The use of the Department's Integrated Voice Recognition (IVR) catch monitoring system will be mandatory from the 15th November 2011. IVR will record pre fishing, pre landing and post landing (including the landed catch) nominations which will assist in maintaining the compliance integrity of the quota system. Fishers will need to use IVR to record their fishing activity as of the start of the 2011/13 season.

External Factors

The variations in western rock lobster catches both commercially and recreationally are largely a result of variable levels of puerulus settlement due to changes in the Southern Oscillation (El Niño or La Niña events in the Pacific Ocean) and their effect on the Leeuwin Current. A positive relationship exists between Leeuwin Current strength and levels of puerulus settlement. The southward-flowing Leeuwin Current also affects the spatial distribution of puerulus settlement along the coast. Catches are also dependent upon the environmental conditions at the time of fishing.

The 2010/11 settlement levels were a slight improvement on 2009/10 however this is still below the long-term average. The factors that may be contributing to this low settlement are being examined (see Research Summary).

Towards the end of 2010, evidence began to emerge of unusually warm waters flooding along the Western Australian coastline. By February 2011 it was clear that a significant warming event was taking place, with widespread

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reports of fish kills and tropical species being found further south than their normal range. Both large-scale satellite-derived sea-surface temperatures and local temperature logger measurements showed that temperatures were $>3^{\circ}\text{C}$ above the normal summer averages in some regions. The term “marine heat wave” was coined to describe the unprecedented nature of the spatially and temporally extensive event.

Increases in sea-water temperatures over the last 30-40 years, which may be related to climate change, appear to be affecting some of the biological parameters such as size at

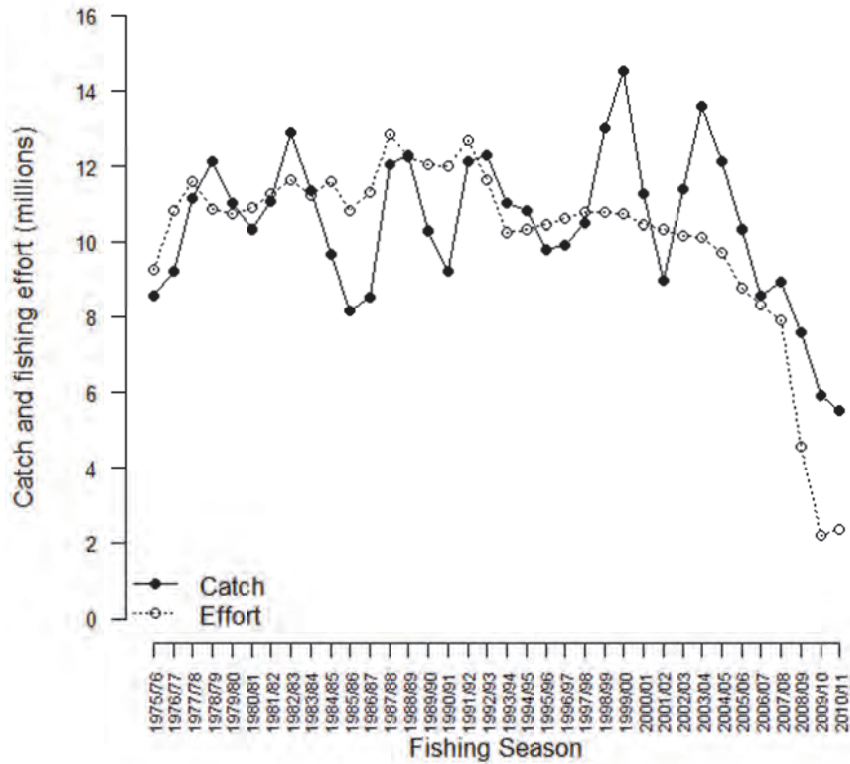
maturity and size of migrating lobsters. These changes are being taken into account in the stock assessment model and therefore in the future stock assessment of the fishery. An FRDC project examining climate change effects on fisheries will continue work in this area.

The economic performance of the fishery is being strongly affected by the value of the Australian dollar (affecting the price of lobsters), fuel and labour costs as well as the changes to the management of the fishery including the introduction of individual catch limits.

WEST COAST ROCK LOBSTER TABLE 1

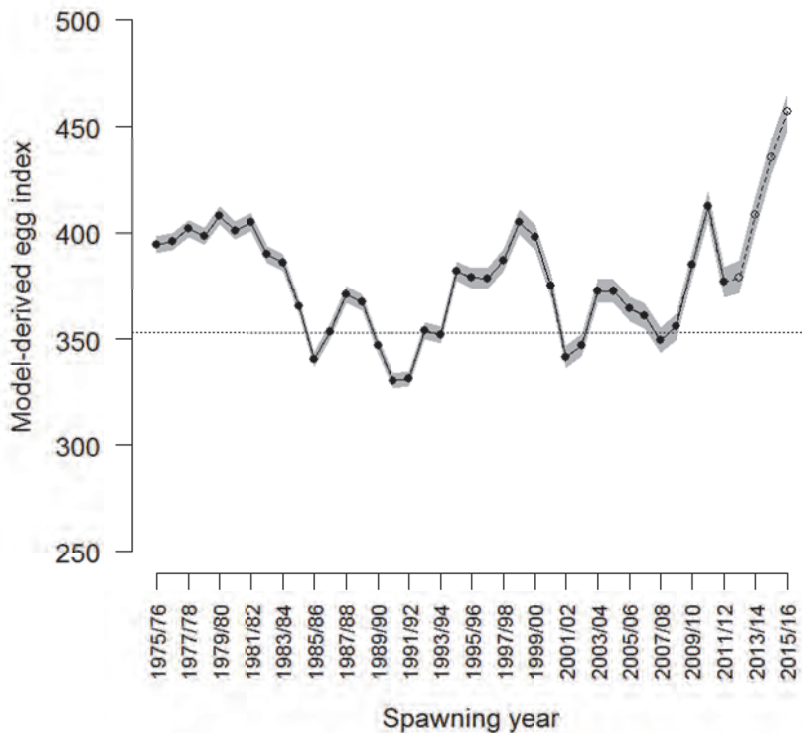
Landings (kg) of by-catch in lobster pots recorded in compulsory Catch and Effort monthly returns (CAES) during 2010/11.

| Bycatch Species | Catch (kg) |
|--------------------------|---------------|
| Bugs | 121.8 |
| Cod | 33.5 |
| Cod, Breaksea | 126.4 |
| Cod, Chinaman | 28.7 |
| Crab, Champagne (Spiny) | 99 |
| Cuttlefish | 225.3 |
| Emperor, Spangled | 6.5 |
| Emperor, Sweetlip | 29.5 |
| Groper, Baldchin | 1140.8 |
| Groper, Blue | 267.4 |
| West Australian Dhufish | 201.2 |
| Leather Jacket | 56 |
| Other Fish Varieties | 375 |
| Parrot Fish | 6 |
| Rock Lobster, Southern | 220.3 |
| Shark, Wobbegong | 16 |
| Snapper, Pink | 636.3 |
| Snapper, Queen | 2 |
| Trevally, Other (Skippy) | 0.7 |
| Trout, Coral | 4 |
| Grand Total | 3596.4 |



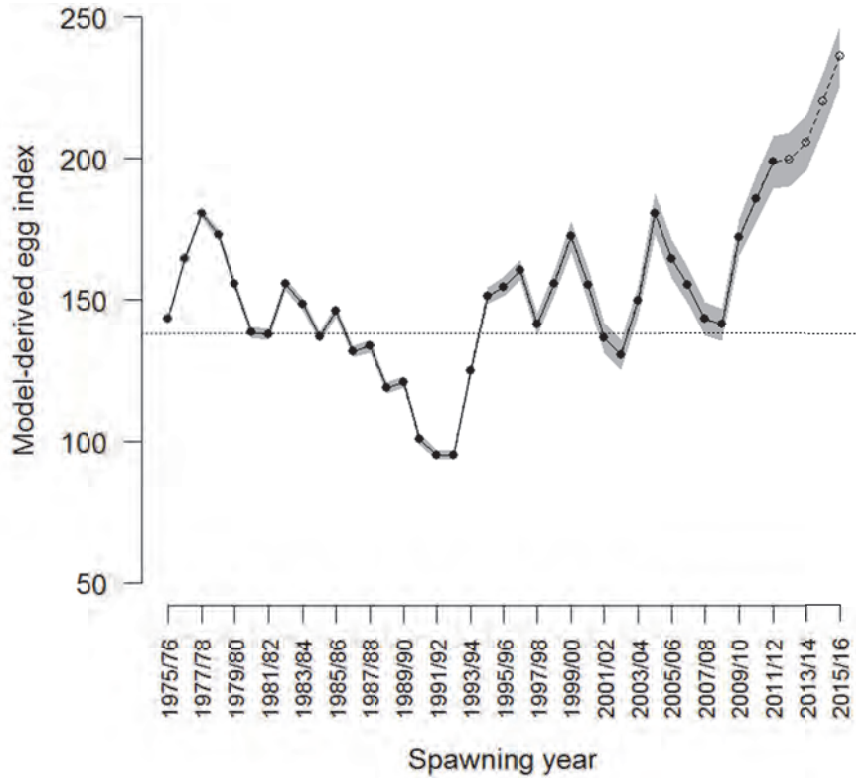
WEST COAST ROCK LOBSTER FIGURE 1

Annual catch (millions of kg) and nominal fishing effort (millions of pot lifts) from fishers' compulsory monthly returns for the West Coast Rock Lobster Managed Fishery from 1975/76 to 2010/11.



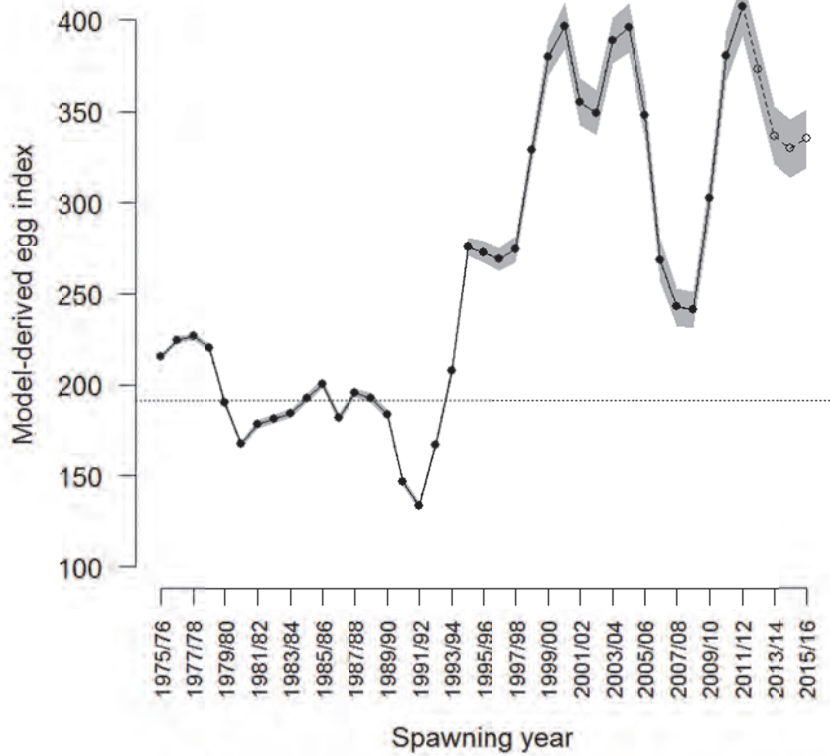
WEST COAST ROCK LOBSTER FIGURE 2

Mean (solid and dashed lines represent historic and future levels) and 50% confidence region (in grey) of model-derived egg production index for the Abrolhos zone of the fishery (A zone). The horizontal dotted line represents the 1980's threshold.



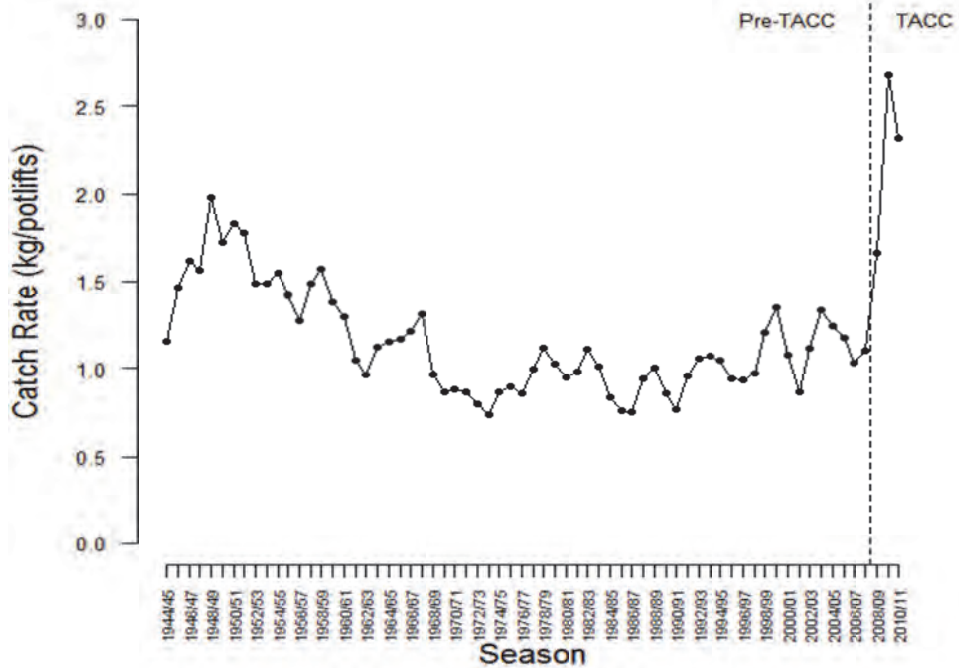
WEST COAST ROCK LOBSTER FIGURE 3

Mean (solid and dashed lines represent historic and future levels) and 50% confidence region (in grey) of model-derived egg production index for the northern coastal zone of the fishery (B zone). The horizontal dotted line represents the 1980's threshold.



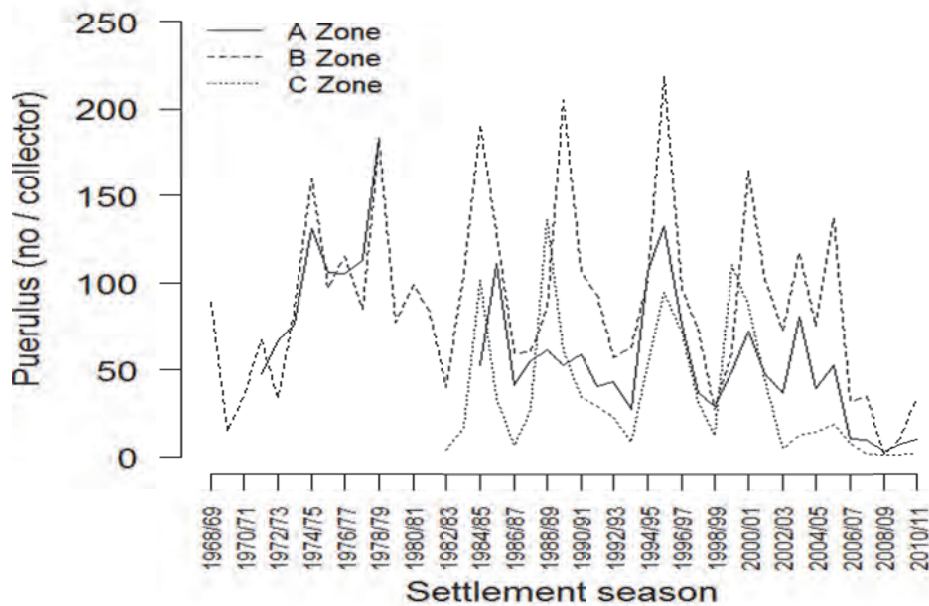
WEST COAST ROCK LOBSTER FIGURE 4

Mean (solid and dashed lines represent historic and future levels) and 50% confidence region (in grey) of model-derived egg production index for the southern coastal zone of the fishery (C zone). The horizontal dotted line represents the 1980's threshold.



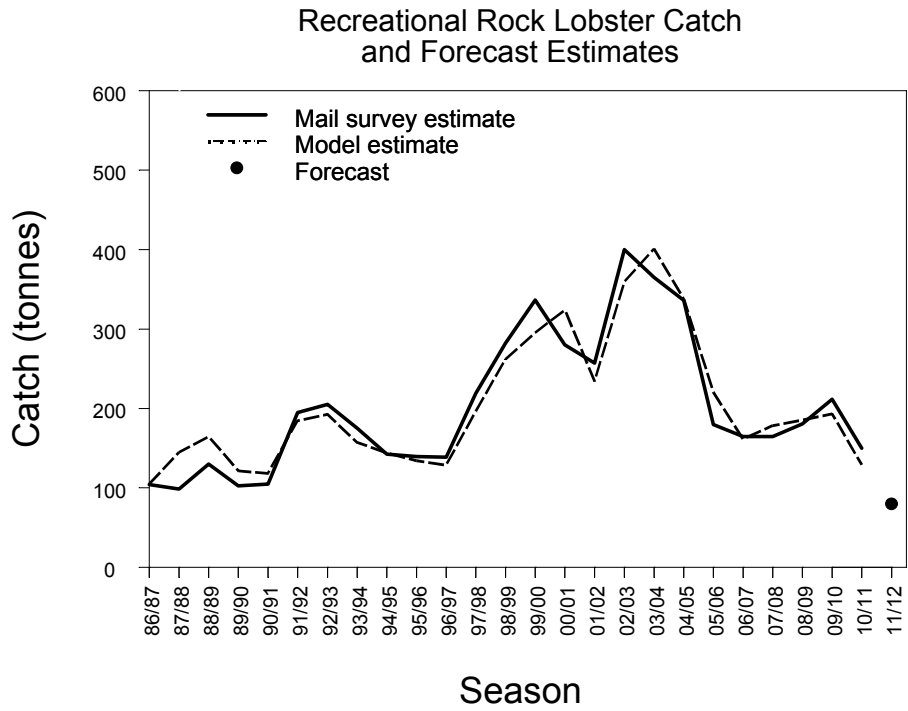
WEST COAST ROCK LOBSTER FIGURE 5

Annual catch rate (kg/pot lift) for the West Coast Rock Lobster Managed Fishery from 1944/45 to 2010/11, showing the period prior to and after the implementation of Total Allowable Commercial Catches (TACC).



WEST COAST ROCK LOBSTER FIGURE 6

Annual indices of puerulus settlement from 1968/69 to 2010/11 for A (Abrolhos, solid line), B (Seven Mile Beach, dashed line) and C (Alkimos, dotted line) zones.



WEST COST ROCK LOBSTER FIGURE 7

Estimates of the recreational rock lobster catch since 1986/87 using adjusted mail survey results, and model estimates of catches in 2008/09 based on puerulus settlement 3 to 4 years earlier and expected licence usage.

Roe's Abalone Fishery Status Report

A. Hart, J. Brown, F. Fabris and A. Warnbrunn

| Main Features | | | |
|---------------|------------|--------------------|------|
| Status | | Current Landings | |
| Stock level | Adequate | Commercial Catch | |
| | | West Coast | 36 t |
| | | Other | 46 t |
| Fishing level | Acceptable | Recreational Catch | |
| | | West Coast | 22 t |
| | | Other | 14 t |

Fishery Description

The Western Australian Roe's abalone (*Haliotis roei*) fishery is a dive and wade fishery, operating in shallow coastal waters along WA's western and southern coasts. Roe's abalone are found in commercial quantities from the South Australian border to Shark Bay, although they are not uniformly distributed throughout this range.

The commercial fishery harvest method is a single diver working off a 'hookah' (surface-supplied breathing apparatus) using an abalone 'iron' to prise the shellfish off rocks. Abalone divers operate from small fishery vessels (generally less than 9 metres in length).

The recreational fishery harvest method is primarily wading and snorkelling, with the main area of focus for the fishery being the Perth metropolitan stocks (West Coast Fishery).

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

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 8 management areas. Commercial fishing for Roe's abalone is managed in 6 separate regions from the South Australian border to Busselton Jetty – Areas 1, 2, 5, 6, 7 and 8 (Roe's Abalone Figure 1).

Recreational

The recreational abalone fishery regulations relate to three zones: the Northern Zone, the West Coast Zone, and the Southern Zone (Roe's Abalone Figure 2). The West Coast Zone is the centre of the fishery and includes the metropolitan fishery.

Management arrangements

Commercial

The commercial Roe's abalone fishery is managed primarily through output controls in the form of total allowable commercial catches (TACCs), set annually for each area and allocated to license holders as individual transferable quotas (ITQs).

The overall TACC for 2011 was 92.8 t whole weight (note this small species is generally landed in the whole condition). This was 9 t lower than 2010 due to the closure of the Area 8 fishery as a result of catastrophic mortalities resulting from exceptionally high water temperatures in early 2011¹. The TACC is administered through 25,180 ITQ units, with a minimum unit holding of 800 units generally applying, although some Roe's abalone licences are permitted to operate below this minimum in recognition of historical fishing practices.

The licensing period (fishing year) runs from 1 April to 31 March of the following year.

¹ Pearce, A., Lenanton, R., Jackson, G., Moore, J., Feng, M. and 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. 40pp.

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The legal minimum length for Roe's abalone is 60 mm shell length in most parts of the fishery. However, industry initiated commercial minimum length for Area 1 (WA/South Australia border to Point Culver) and Area 7 (Cape Bouvard to Moore River) of 70 mm are applied.

A comprehensive Ecologically Sustainable Development assessment of the commercial fishery has been undertaken to identify any potential sustainability risks requiring direct management under the Commonwealth's EPBC Act requirements for export fisheries. The only issue identified as requiring ongoing management to ensure acceptable performance was the breeding stock levels of Roe's abalone. Boxed text in this status report provides the annual assessment of performance for this issue.

Recreational

The recreational Roe's abalone fishery is managed under a mix of input and output controls. Recreational fishers must purchase a dedicated abalone recreational fishing licence. These licences are not restricted in number. The West Coast zone (Perth) of the recreational fishery is managed to an average total allowable recreational catch (TARC) of 40 t.

The fishing season in the Northern and Southern Zones extends from 1 October to 15 May. However, the Northern Zone was closed to fishing for 2011 due to large-scale stock mortalities resulting from exceptionally high water temperatures in early 2011¹. The West Coast Zone is only open for 5 Sundays annually, commencing on the first Sunday in November, followed by the first Sunday of each month until March. This was changed from the previous arrangement of 5 consecutive Sundays from the first Sunday in November. The daily allowed fishing time is 60 minutes (between 7.00 a.m. and 8.00 a.m.). Prior to 2006, daily fishing time was 90 minutes.

These restrictive management controls on the west coast are necessary to ensure the sustainability of an easily accessible (and therefore vulnerable) stock located adjacent to a population in excess of 1.6 million people (including Geraldton).

For Roe's abalone, the minimum legal size is 60 mm shell length, the daily bag limit is 20 per fisher, and the household possession limit (the maximum number that may be stored at a person's permanent place of residence) is 80.

Research summary

Commercial

Commercial abalone divers provide daily catch information on the total weight of abalone collected, the hours fished, the date and location of harvest and the name of the person(s) harvesting. These data are used to assist in research, compliance and management matters.

The main abundance index is an annual standardized catch per unit effort (CPUE) model that takes into account diver, sub-area and month of fishing, as well as technological improvements that aid fishing efficiency. The standardized

CPUE data are used in a decision-rule framework for quota setting for each area of the fishery.

Current research is focused on stock assessment using catch and effort statistics, fishery-independent surveys of Perth metropolitan stocks, and digital video imagery (DVI) surveys by industry divers, who survey selected sites with an underwater video camera. Size and density of Roe's abalone across the near-shore sub-tidal reef habitat is measured annually at 13 indicator sites between Mindarie Keys and Penguin Island. Eleven of these are fished while the other 2 are the Waterman's Reserve Marine Protected Area (MPA), and the Cottesloe Fish Habitat Protection Area (FHPA).

Research translocation trials with funding assistance from the Seafood CRC are underway to see whether they can assist the recovery of abalone stocks in the Kalbarri region affected by the marine heatwave in 2011.

Recreational

Current annual recreational catch and effort estimates are derived from an annual field survey (West Coast Zone / Perth metropolitan fishery), and occasional telephone diary surveys covering all licence holders in the state (last completed in 2007).

The field survey estimates the catch and effort from each distinct Roe's abalone stock within the Perth fishery, and estimates are based on average catch (weight and numbers), catch rates (derived from 800 interviews in 2011), and fisher counts conducted by Fisheries Volunteers and research personnel from shoreline vantage points and aerial surveys. This method provides a comprehensive assessment, but is too resource-intensive to be applied routinely outside of the Perth metropolitan area.

The telephone diary survey estimates the catch of all 3 species on a state-wide basis. In 2007, around 500 licence holders were randomly selected from the licensing database, with selection stratified by licence type (abalone or umbrella-which was available at that time) 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, or at the end of the season for those only involved in the Perth abalone season.

Research is progressing on an in-season catch prediction model based on environmental conditions, for the Perth metropolitan fishery. This model will assist the Department in managing a summer season for the fishery should this option be adopted in the future.

Retained Species

Commercial production

Season 2011: 82 tonnes whole weight

Metro only: 36 tonnes whole weight

The TACC for the 2011 quota year was 92.8 t whole weight for Roe's abalone. The 2011 catch of 81.6 t whole weight (Roe's Abalone Table 1) was 10 tonnes lower than 2010 and about 90% of the TACC. The overall TACC was not caught because Area 1 and Area 8 of the fishery (Roe's Abalone Figure 1) were not fished in 2011, and catches in Area 5 were below the TACC (75% of TACC caught) due to unfavourable weather.

¹ Pearce et al., (2011). The marine heatwave off Western Australia during the summer of 2010/11. *Fisheries Research Report No. 222. Department of Fisheries, Western Australia*. 40pp.

Recreational catch**Season 2011: Roe's Metro Fishery 22 tonnes****(Season 2007): Roe's rest of state 14 tonnes
(31% of total catch)**

The recreational catch for Roe's abalone from the Perth metropolitan area in 2011 was 22.4 t (Roe's Abalone Table 2). This was a decrease of about 50% from 2010, and occurred as a result of poor weather conditions, small average weight of the abalone, and low legal-size densities (Roe's abalone Table 4).

Based on the Perth recreational fishery for 2011 (22 t), and using the 2007 phone diary estimate for the rest of the state (14 t), recreational fishing represented about 31% of the total (commercial and recreational) Roe's abalone catch (118 t) across the state in 2011.

Fishing effort/access level**Commercial**

Total effort for dedicated Roe's abalone divers in 2011 was 426 diver days, lower than last year's effort of 567 diver days (Roe's Abalone Table 1). The low effort in 2011 resulted from a combination of lower quota being set, closures to the Area 8 fishery (which traditionally required between 100 and 150 days) and improved fishing efficiency. For example, the use of Internet weather prediction services to plan the fishing schedule has resulted in fishing efficiency increases of between 10 and 17%.¹

Recreational

For the 2011 season, 17,300 licences were issued allowing abalone fishing (Roe's Abalone Figure 3). This was the first year in which only abalone specific licenses were available to those wishing to fish for abalone. Umbrella recreational licenses, which allow for the catch of multiple species, have been phased out (Roe's Abalone Figure 3).

Effort in the Perth fishery for 2011 was 11,396 hours, a 40 % reduction from 2010 effort of 18,010 hours (Roe's Abalone Table 2) and the lowest in over 10 years. This was primarily due to poor weather conditions and unfamiliarity with the new summer season for 2011. The new summer season was part of ongoing adjustments in management as part of the IFM process. Since 2006, daily season length has been shortened from 1.5 hours to 1 hour, and number of fishing days from 6 to 5. The new monthly Sunday fishing day coincided with high tide on most Sundays this year which contributed to the lower catch rate and effort.

Effort estimates for recreational abalone fishing from the 2007 telephone diary survey were 13,400 days (10,500 – 16,200 days) in the Perth metropolitan area, 6,300 days (3,800 – 8,800 days) on the west coast (excluding the Perth metropolitan area), and 4,900 days (1,700 – 8,000 days) on the south coast (Roe's Abalone Table 3).

Stock Assessment**Assessment complete: Yes****Assessment level and method:****Level 4 - Catch Rates / Direct Survey****Breeding stock levels: Adequate**

CPUE and TACC assessment: The standardised CPUE (SCPUE) for the Roe's abalone fishery is the main performance indicator for the abundance of legal-sized abalone. This indicator replaces the raw CPUE data used historically, however the raw CPUE data has been provided for comparative purposes.

The SCPUE for dedicated Roe's abalone divers in 2011 was 30.7 kg/hr, which was slightly higher than the 2010 catch rate (Roe's Abalone Table 1). This suggests that, overall, stocks are slightly above average levels. The exception is Area 8 commercial (Northern Region for recreational), which has been closed to all fishing to promote stock recovery following an environmentally induced mass mortality².

The catch rate of recreational fishers in the Perth metropolitan fishery of 23 abalone/hour in 2011 was lower than the 2010 catch rate of 26 abalone per hour (Roe's Abalone Table 2).

Stock surveys: Densities of sub-legal animals (less than 60mm in size) on the platform habitat of the fished stocks in 2012 were 49 abalone m⁻², similar to 2011 (Roe's Abalone Table 4). Sub-legal animals are at high levels compared to the historical average of 44 m⁻². Within the subtidal habitat, densities of sub-legal animals were similar between 2011 and 2012, and are also at their highest density since 1997.

Densities of legal-sized animals (60+ mm) on the platform habitat were significantly lower in 2012 (9 m⁻²), compared to 11 m⁻² in 2011 (Roe's Abalone Table 4), and are at their lowest levels since 1997. With the significant decline in recreational catch in 2011, legal-size densities were expected to recover towards historical levels, however there has also been a sharp decline in legal size densities in the Marine Protected Area, which were at their lowest levels in over 15 years (Roe's Abalone Table 4). This suggests there may have been environmentally related mortalities in this habitat.

In the subtidal habitat, legal-sized densities were 10 abalone m⁻² in 2010, which is close to their long-term average (Roe's Abalone Table 4).

Densities of legal-sized Roe's abalone in the MPA are about 60% higher on the platform habitat, compared with the fished stocks (Roe's Abalone Table 4). For sub-legal animals, densities are only about 12% higher in the MPA stocks (Roe's Abalone Table 4). Declines in legal size densities have however, occurred in both the MPA (55%) and fished stocks (44%) since 2009 (Roe's abalone Table 4). This is indicative of environmentally related mortality, possibly the "marine heatwave" experienced in over the 2010/11 summer.

¹ Hart AM, 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. 32p.

² See Pearce, A., Lenanton, R., Jackson, G., Moore, J., Feng, M. and 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. 40pp. for full details.

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Breeding stocks: Size at sexual maturity (50% of animals mature) of Roe's abalone in the Perth metropolitan area is approximately 40 mm (2 to 3 years of age). Preliminary growth data for these same metropolitan Roe's abalone indicate that they have a minimum of 1 year's spawning before reaching 60 mm – the minimum legal size at which Roe's abalone are harvested anywhere in Western Australia.

This is considered to provide adequate protection for the breeding stock under normal environmental conditions, especially since the commercial fishery's legal minimum size in Area 7 (the Perth metropolitan area) is 70 mm – which is 10 mm larger than that used by the recreational sector. In Area 1, the commercial fishery's legal minimum length is 75 mm.

The main performance measure for the fishery relates to the maintenance of adequate breeding stocks in each area of the fishery.

This is assessed using a combination of the level of quota achieved and the effort required to achieve the quota, both of which reflect stock abundance. In 2011, catch and standardised CPUE were within the agreed ranges in most areas fished, indicating that overall breeding stock levels were adequate (Roe's Abalone Table 5). Adverse weather conditions limited the fishing in the remote Area 1 and, to a lesser extent, in Area 5 (75% of TAC caught). In Area 8 the fishery has been closed due to environmentally related mortality.

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 potential protected species interaction in this fishery would be with the white shark (*Carcharodon carcharias*) while fishing in some of the more open-water locations. Some Roe's abalone divers are adopting the 'shark shield' technology generally used by greenlip/brownlip divers for their personal protection.

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.

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. As abalone feed on drift algae, their

removal is unlikely to result in any changes to the algal growth cover in areas fished.

Social Effects

There are 26 vessels commercially fishing for Roe's abalone, employing approximately 50 people across WA. The dispersed nature of the Roe's abalone fishery means that small coastal towns from Kalbarri to Eucla receive income from the activity of divers.

The recreational fishery provides a major social benefit to those sectors of the community that appreciate the abalone as a delicacy, and 17,300 licenses were issued that would have allowed fishers to participate in the recreational abalone fishery (Roe's Abalone Figure 3).

Economic Effects

Estimated annual value (to fishers) for 2011:

Level 2 - \$1 -5 million (\$2.1 million)

The estimated average price for Roe's abalone in 2011 was \$26.00/kg. This value was similar to the value of \$25/kg in 2010. On the basis of the average price, the fishery was worth approximately \$2.1 million. Overall, the price of Roe's abalone has dropped by over 50% since 2000, when it was \$55/kg whole weight. This is due to the value of the Australian dollar, which increased from \$US0.6 in 2000 to >US\$1.00 in 2011. The other factor in the decline in prices is competition from abalone produced by aquaculture.

Fishery Governance

**Commercial
Target SCPUE range:**

28 – 33 kg per hour (all areas combined)

Target effort range: 530 – 640 diver days

To assess whether the catch quota set is appropriate (sustainable) relative to the stock available, Roe's abalone catches should be taken within the range of SCPUE recorded over the 1999 – 2006 fishing years (28 – 33 kg per hour; Roes Abalone Table 1). This range reflects the acceptable variation in catch rates due to weather and recruitment cycles. Roes Abalone Table 5 shows performance measures of each individual area.

The effort value of 426 diver days in 2011 (Roes Abalone Table 1) falls below the expected effort range. This was due primarily to the closing of Area 8, which generally required about 100-150 days fishing, and lowered effort in Area 5 and Area 1 because of weather conditions.

**Recreational (West Coast)
Target Catch range:**

5 year moving average - 40 ± 2 tonnes

The governance range is based on the 5 year moving average of catch in the West Coast Fishery. This range takes in the permitted maximum variations of ± 2t around the TARC (Total Allowable Recreational Catch) of 40 t.

The 5-year (2007-2011) moving average for 2011 was 38.7 t. This was within the governance range.

New management initiatives (2011/12)

The first trial of a summer season for the West Coast Zone of the recreational fishery was undertaken for the 2011/12 summer. The season began on the first Sunday of November 2011 and extended till the first Sunday of March 2012, with fishing taking place between 7 and 8 am on the first Sunday of each month. The trial will continue for another 2 years.

The Northern Zone of the recreational fishery (Roes Abalone Figure 2), and the Area 8 commercial fishery (Roes Abalone Figure 1) were closed indefinitely for the 2011/12 season and beyond. This was to facilitate stock rebuilding following mass mortality from an environmental event (see External Factors).

External Factors

During the summer of 2010/2011, the West Coast experienced a marine heatwave with sea surface temperatures of up to 3 degrees above average¹. This was widespread with fish kills being recorded across many fish species, however the Area 8 Roe's abalone fishery, particularly in the area around Kalbarri, were the most severely impacted. Mortalities on roe's abalone were estimate at 99.9%+ and a complete closure of the commercial and recreational fisheries was implemented. Research translocation trials are underway to see whether they can assist the recovery.

Apart from that the main external factor influencing the Roe's commercial abalone fishery has been the decline in beach price and overall economic value over the last decade. The small size of Roe's abalone means that, as a fishery product, it is in direct competition with small hatchery-produced greenlip abalone. In the recreational fishery, weather conditions have a significant effect on catch rates and total catch of recreational fishers.

WEST COAST BIOREGION

ROE'S ABALONE TABLE 1

Roe's abalone catch and effort¹ by quota period with raw and standardised catch per unit effort (SCPUE)

| Quota period ² | Roe's TACC kg whole weight ³ | Roe's caught kg whole weight | Diver days ⁴ (Roe's divers only) | Raw CPUE (roei divers) kg per day) | SCPUE (kg per hour) |
|---------------------------|--|---------------------------------|---|---|------------------------|
| 1990 | 105,000 | 116,447 | 936 | 112 | |
| 1991 | 101,000 | 109,489 | 832 | 118 | |
| 1992 | 105,000 | 111,341 | 735 | 134 | 27.3 |
| 1993 | 128,000 | 115,281 | 832 | 123 | 29.4 |
| 1994 | 125,960 | 117,835 | 908 | 113 | 27.7 |
| 1995 | 125,960 | 114,501 | 1,047 | 98 | 25.5 |
| 1996 | 125,960 | 118,715 | 1,004 | 106 | 28.8 |
| 1997 | 126,790 | 118,738 | 855 | 120 | 30.2 |
| 1998 | 93,960 ⁵ | 86,425 | 695 | 108 | 27.9 |
| 1999 ⁶ | 119,900 | 112,949 | 659 | 149 | 29.5 |
| 2000 | 115,900 | 107,735 | 647 | 144 | 28.7 |
| 2001 | 107,900 | 99,174 | 685 | 126 | 30.0 |
| 2002 | 107,900 | 100,471 | 700 | 125 | 28.6 |
| 2003 | 110,900 | 96,005 | 723 | 118 | 29.0 |
| 2004 | 110,900 | 107,593 | 736 | 126 | 28.0 |
| 2005 | 112,700 | 96,496 | 672 | 131 | 31.3 |
| 2006 | 112,700 | 98,370 | 625 | 136 | 33.2 |
| 2007 | 109,700 | 90,750 | 585 | 132 | 28.5 |
| 2008 | 106,700 | 93,197 | 580 | 133 | 28.6 |
| 2009 | 101,800 | 92,838 | 554 | 140 | 29.0 |
| 2010 | 101,800 | 91,418 | 567 | 134 | 29.5 |
| 2011 | 92,800 | 81,607 | 426 | 157 | 30.7 |

Notes

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 year.
3. Standard conversion factors for meat weight to whole weight for Roe's abalone were 2.5 prior to 2000 and 3.0 from 2000.
4. Effort (diver days) for dedicated Roe's divers only.
5. Reduced quota for a 6-month season.
6. In 1999, fishing restrictions (100 kg daily catch limit) in the Perth metropolitan area were lifted. This had the immediate effect of doubling the catch rate (kg/day) in that area.

ROE'S ABALONE TABLE 2

Summary of effort (fisher hours), catch rate (abalone per hour), average catch per fisher, catch (number of abalone and tonnes whole weight) and mean whole weight (g) for the Perth recreational Roe's abalone fishery, from annual field surveys.

| Year | Field Survey | | | | | |
|------|----------------|------------|------------------|----------------|----------------|-----------------|
| | Effort (hours) | Catch rate | Catch per fisher | Catch (number) | Catch (tonnes) | Mean weight (g) |
| 1999 | 16,449 | 23 | 17.4 | 383,600 | 35.3 | 92 |
| 2000 | 15,818 | 21 | 16.7 | 330,300 | 30.2 | 91 |
| 2001 | 17,727 | 27 | 18.8 | 481,300 | 44.1 | 92 |
| 2002 | 18,127 | 22 | 17.9 | 401,500 | 36.0 | 90 |
| 2003 | 17,963 | 26 | 18.6 | 442,400 | 42.6 | 96 |
| 2004 | 14,614 | 24 | 19.0 | 342,900 | 31.7 | 93 |
| 2005 | 12,328 | 21 | 17.8 | 262,700 | 24.3 | 92 |
| 2006 | 10,435 | 29 | 18.9 | 297,000 | 30.2 | 101 |
| 2007 | 12,433 | 28 | 18.4 | 338,000 | 34.4 | 102 |
| 2008 | 14,490 | 29 | 18.2 | 420,000 | 44.4 | 106 |
| 2009 | 19,718 | 27 | 17.8 | 517,000 | 48.6 | 94 |
| 2010 | 18,010 | 26 | 18.7 | 468,000 | 43.9 | 94 |
| 2011 | 11,396 | 23 | 17.0 | 266,000 | 22.4 | 84 |

WEST COAST BIOREGION

ROE'S ABALONE TABLE 3

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

| Location | Year | Effort | Roe's | |
|--|------|-----------------------------|------------|----------------|
| | | | Catch Rate | Catch (tonnes) |
| Perth Metro ¹ | 2004 | 17,200 (14,000 – 20,500) | 17.8 | 28 (25 – 31) |
| | 2006 | 12,600 (9,900 – 15,500) | 18.2 | 23 (20 – 26) |
| | 2007 | 13,400 (10,500 – 16,200) | 17.6 | 24 (19 – 29) |
| West Coast ¹ (excluding Metro) | 2004 | 10,100 (6,500 – 13,600) | 11.0 | 10 (7 – 14) |
| | 2006 | 8,000 (4,700 – 11,300) | 14.7 | 12 (7 – 17) |
| | 2007 | 6,300 (3,800 – 8,800) | 14.1 | 9 (6 – 12) |
| South Coast ² | 2004 | 2,700 (1,700 – 3,700) | 6.2 | 2 (1 – 3) |
| | 2006 | 2,800 (1,600 – 3,900) | 6.3 | 2 (1 – 2) |
| | 2007 | 4,900 (1,700 – 8,000) | 10.8 | 5 (1 – 9) |

1. Both areas are within the West Coast bioregion.
2. Survey area is South Coast bioregion (i.e. east of Black Point).

ROE'S ABALONE TABLE 4

Mean densities (abalone/m²) of sub-legal (<60 mm shell length) and legal-sized Roe's abalone (60 mm and over) from 11 monitoring sites (fished stocks) and the Marine Protected Area (MPA) in the Perth fishery. The platform habitat is primarily the recreational fishery, while the sub-tidal habitat is primarily the commercial fishery. Data has been standardised by a GLM (Generalized Linear Models) analysis, as the sites are not the same for all years.

| Year | Platform habitat | | | | Sub-tidal habitat | | | |
|-------------|------------------|----------|--------------------------|-----------|-------------------|-------------|--------------------------|-----------|
| | Fished stocks | | Waterman's Reserve (MPA) | | Fished stocks | | Waterman's Reserve (MPA) | |
| | <60 | 60+ | <60 | 60+ | <60 | 60+ | <60 | 60+ |
| 1997 | 40 | 29 | 44 | 26 | 4.9 | 14.0 | 9.2 | 21 |
| 1998 | 49 | 28 | 51 | 37 | 5.3 | 11.3 | 13.5 | 37 |
| 1999 | 55 | 29 | 52 | 26 | 4.3 | 6.9 | 12.0 | 27 |
| 2000 | 52 | 25 | 29 | 35 | 2.9 | 9.9 | 8.6 | 31 |
| 2001 | 51 | 26 | 38 | 34 | 4.2 | 10.1 | 7.8 | 28 |
| 2002 | 42 | 29 | 42 | 39 | 3.5 | 9.8 | 6.9 | 31 |
| 2003 | 33 | 27 | 34 | 41 | 5.0 | 11.2 | 4.1 | 25 |
| 2004 | 34 | 21 | 33 | 53 | 3.9 | 9.0 | 4.5 | 20 |
| 2005 | 35 | 19 | 43 | 40 | 5.2 | 8.7 | 8.7 | 22 |
| 2006 | 36 | 19 | 49 | 38 | 6.8 | 9.5 | 5.7 | 20 |
| 2007 | 39 | 17 | 42 | 35 | 5.3 | 11.0 | 6.7 | 19 |
| 2008 | 42 | 18 | 69 | 37 | 6.7 | 12.3 | 7.3 | 19 |
| 2009 | 51 | 16 | 67 | 38 | 8.7 | 12.0 | 10.8 | 24 |
| 2010 | 53 | 14 | 77 | 32 | 11.8 | 13.3 | 8.4 | 23 |
| 2011 | 51 | 11 | 66 | 26 | 9.8 | 12.2 | 6.4 | 22 |
| 2012 | 49 | 9 | 62 | 17 | 10.2 | 10.3 | 8.8 | 23 |

ROE'S ABALONE TABLE 5

Assessment against agreed performance measures for 2011.

| Performance Indicator | Performance Measure ¹ | 2011 Values | Assessment/Comments |
|---------------------------|----------------------------------|-------------|---|
| <i>Area 1</i> | | | |
| Total catch (TACC) | 5,000 kg | 0 | Exploratory quota – no fishing in 2011. |
| Effort range (Diver days) | 14 – 43 | 0 | See above. |
| <i>Area 2</i> | | | |
| Total catch (TACC) | 19,800 kg | 19,092 | Met – 97% of quota caught. |
| Standardised CPUE | 20 – 31 | 27 | Met – within agreed ranges. |
| <i>Area 5</i> | | | |
| Total catch (TACC) | 20,000kg | 14,785 | Not Met – 75% of quota caught. |
| Standardised CPUE | 18 – 27 | 25 | Met – within agreed ranges. |
| <i>Area 6</i> | | | |
| Total catch (TACC) | 12,000 kg | 12,005 | Met – 100% of quota caught. |
| Standardised CPUE | 18 – 26 | 24 | Met – within agreed ranges. |
| <i>Area 7</i> | | | |
| Total catch (TACC) | 36,000 kg | 35,726 | Met – 100% of quota caught. |
| Standardised CPUE | 28 – 42 | 37 | Met – within agreed ranges. |
| <i>Area 8</i> | | | |
| Total catch (TACC) | 9,000 kg | | Not assessed – fishery closed. |
| Standardised CPUE | 16 – 24 | | Not assessed – fishery closed. |

1. With the exception of Area 1, the standardised CPUE (SCPUE) performance measure replaces the effort ranges (in diver days) used in previous state of the fisheries reports. The range in SCPUE represents the Target (upper) and Limit (lower) biological reference points as developed in the following document. 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. 32p.

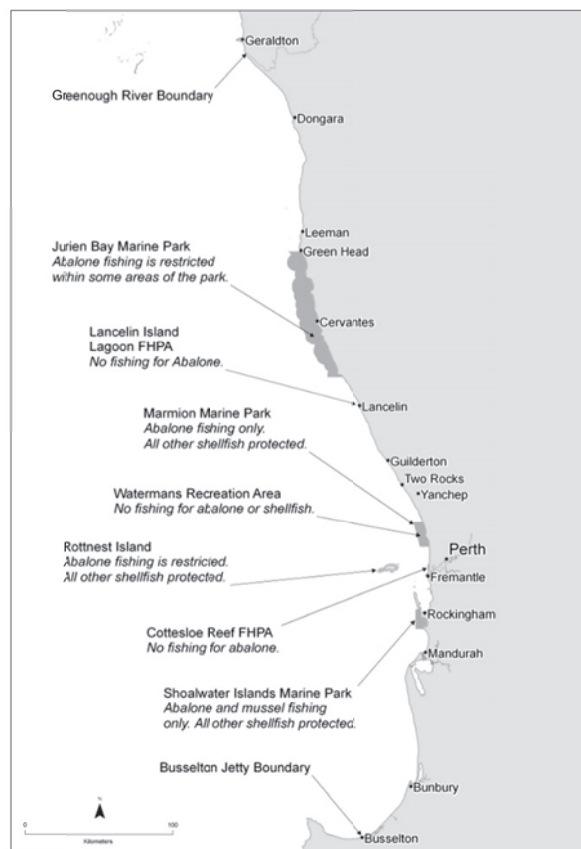


ROE'S ABALONE FIGURE 1

Map showing the management areas used to set quotas for the Roe's abalone commercial fishery in Western Australia.



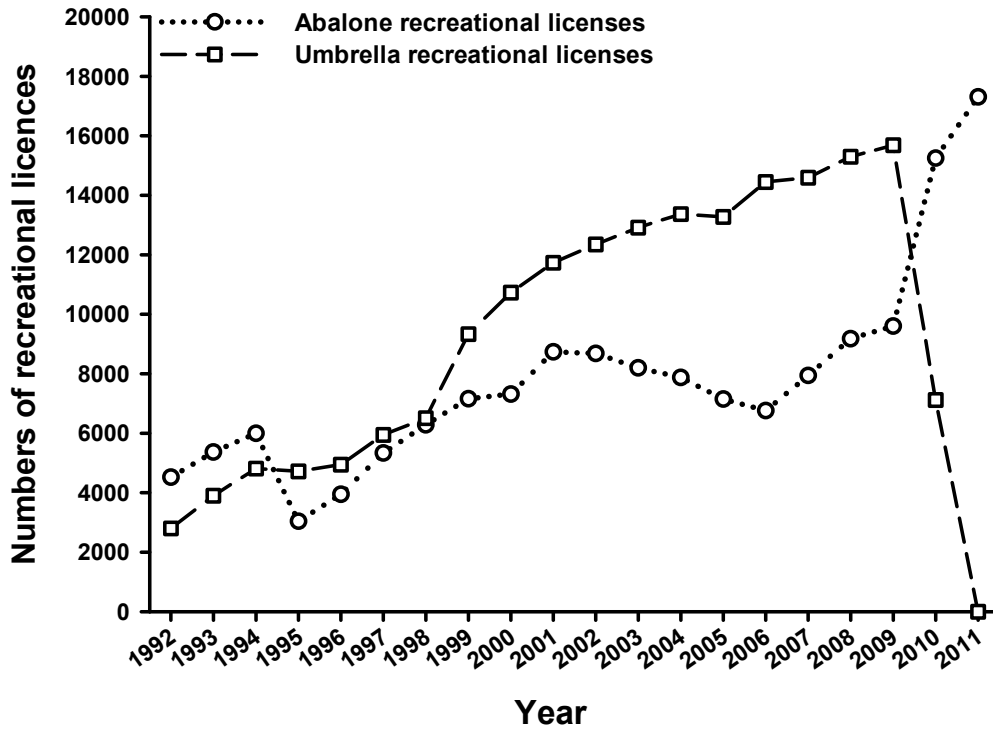
(a)



(b)

ROE'S ABALONE FIGURE 2

Maps showing (a) the recreational fishing boundaries for abalone, and (b) the West Coast (Perth Fishery) zone, showing conservation areas within this zone.



ROE'S ABALONE FIGURE 3

The number of licences issued in the recreational abalone fishery, by licence type, for the period since 1992. Umbrella licences were discontinued in 2010.

Abrolhos Islands and Mid West, South West Trawl Managed Fisheries and South Coast Trawl Fishery Status Report

E. Sporer, M. Kangas, S. Brown, L. Pickles

Main Features

| Status | | Current Landings | |
|---------------|------------|------------------|--------------------------------|
| Stock level | Adequate | AIMWTMF: | Scallops 2203 t (whole weight) |
| | | SWTMF: | Scallops 82 t (whole weight) |
| Fishing level | Acceptable | | Prawns 13 t |
| | | SCTF: | Scallops 176 t (whole weight) |

Fishery Description

The Abrolhos Islands and Mid West Trawl Managed Fishery (AIMWTMF) is based on the take of saucer scallops (*Amusium balloti*), with a small component targeting the western king prawn (*Penaeus latisulcatus*) in the Port Gregory area.

The South West Trawl Managed Fishery (SWTMF) includes two of the State's smaller scallop fishing grounds – Fremantle and north of Geographe Bay. It is a multi-species fishery.

The South Coast Trawl Fishery (SCTF) principally targets scallops (*A. balloti*) and associated by-products, although in years of low scallop catches licensees may use other trawl gear to target fin-fish species. Scallop landings for the fishery have varied dramatically over the years, depending primarily on the strength of recruitment. While the boundaries of the fishery covers a large section of the south coast, the operations of the fleet are effectively restricted to very small areas of higher scallop abundance.

Each of these fisheries operates using low opening otter trawl systems.

Governing legislation/ fishing authority

Abrolhos Islands and Mid West Trawl Management Plan 1993

Abrolhos Islands and Mid West Trawl Managed Fishery Licence

South West Trawl Management Plan 1989

South West Trawl Managed Fishery Licence

Trawling Prohibition (Whole of State) Notice 1992 (Order)

Surface Trawl Net Fishery (South Coast) Notice 1992

Trawling for Scallops (South Coast) Notice 1992

Condition 73 and/or 79 on Fishing Boat Licences

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

Consultation process

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

AIMWTMF

'all the waters of the Indian Ocean adjacent to Western Australia between 27°51' south latitude and 29°03' south latitude on the landward side of the 200 m isobath'.

SWTMF

'all the waters of the Indian Ocean adjacent to Western Australia between 31°43.38'27" south latitude and 115°08.08' east longitude where it intersects the high water mark at Cape Leeuwin, and on the landward side of the 200 m isobath'.

The area is further divided into four management zones, with a limited number of operators (indicated in brackets) permitted access to fish within each zone as follows:

| | | |
|--------|--------------------------------|---------------------------------|
| Zone A | from 31°43'27" S to 32°16' S | (3 MFL's) |
| Zone B | from 32°16' S to 115°08' E | (12 MFL's) |
| Zone C | north-east of Cape Naturaliste | (0 MFL's Closed to trawling) |
| Zone D | Comet Bay off Mandurah | (3 MFL's) |

SCTF: Condition 73 provides for the use of demersal otter trawl nets off the south coast of Western Australia in waters east of 115° E longitude. Condition 79 provides for the use of demersal otter trawl nets for taking scallops within the Recherche Archipelago. The four fishing boat licences have both conditions.

Management arrangements

AIMWTMF

The AIMWTMF operates under an input control and constant escapement based management system. There was initially a maximum total net headrope capacity restriction of 336.5m (184 fathoms), specified net mesh size, along with seasonal closures and significant spatial closures protecting all near-shore waters and sensitive reef areas. Bycatch reduction devices (grids) to release large species are fully implemented in the AIMWTMF as a licence condition. The fishery operates to a catch rate threshold level of 250kg meat weight per 24 hours trawling to cease fishing.

In 2009 one boat was removed from the fishery through a Voluntary Fisheries Adjustment Scheme (VFAS) together with the headrope net entitlement of 21.9 m (12 fathoms). In December 2010, a second VFAS for the AIMWTMF was approved for five licences and removed a total of 91.4 m (50 fathoms) headrope entitlement from the fishery.

The two restructures the fishery have removed 113.4 m (62 fathoms) of headrope, reducing the current permitted overall net headrope capacity to 223.1 m (122 fathoms) with 10 licences. However, the total net headrope used by the 10 boats that remain in the fishery when fishing with two 12.8 m (7 fathom) nets is 256 m (140 fathoms), which is 33 m (18 fathom) in excess of the allowed capacity remaining after the VFAS. An exemption has been approved and there is an amendment sought to remove the current headrope utilisation from the Management Plan and establish standardisation of nets in the AIMWTMF. The same boats fish the AIMWTMF and the Shark Bay Scallop Managed Fishery and use the same nets (two 12.8 m nets) in the Shark Bay scallop fishery and therefore these sized nets will also be the standard net for the AIMWTMF. This will make fishing more cost effective for licensees.

In 2011, the scallop season opened on 25 March and closed on 1 August. Actual fishing commenced 25 March and ceased on 17 June. There was, however, a hiatus from fishing in the AIMWTMF when boats moved to the Shark Bay scallop fishery between 6 and 23 April. The Port Gregory prawn trawl area of the fishery also opened and closed in conjunction with the Abrolhos scallop season.

Because the AIMWTMF area is fished by the rock lobster and the scallop fishing sectors of the fishing industry, the fishery is spatially separated for the scallop sector into two parts: the traditional parts of the fishery which, are divided into nine fish grounds, and non-traditional areas. The traditional parts of the fishery contain known scallop grounds and these are the grounds historically fished by the scallop fleet. The non-traditional areas, comprise parts of the fishery where scallops are not commonly found and have not been traditionally fished by the scallop fleet. Trawl fishing can be undertaken in this area but there are guidelines for exploratory fishing before any commercial trawl fishing can be undertaken.

SWTMF

The SWTMF is a gear based managed fishery that operates under an input control system that limits boat numbers, gear sizes and fishing areas. There is a total of 14 MFLs operating in this fishery, some in more than one zone. The fishing season operates between 1 January and 15 November in Zones A and B. Access to Zone C ceased in 2002. The management plan also includes large closures to protect

sensitive coastal habitats (including seagrass beds) and nursery areas such as Cockburn Sound, Warnbro Sound and inshore Geographe Bay.

SCTF

The SCTF is managed primarily by limited entry with only four licences permitted to operate in the fishery. There are also seasonal closures in specified parts of the fishery under the Trawling for Scallops (South Coast) Notice 1992.

The Department's vessel monitoring system (VMS) monitors the activities of all boats including compliance with the spatial closures.

The Commonwealth Government's Department of Sustainability Environment Water Populations and Communities (SEWPaC), has assessed the AIMWTMF under the provisions of the Environment Protection and Biodiversity Conservation Act 1999. The SEWPaC Minister granted a five year export approval for the fishery until 2013. The comprehensive ESD assessment of this fishery identified that maintaining an acceptable breeding stock level of the target scallop species was the key performance indicator for the fishery. Boxed text in this status report provides the annual assessment of performance against this indicator.

Research summary

Research monitoring of the scallop stocks for all fisheries is undertaken using daily logbooks validated by processor returns. Advice on the status of stocks and appropriate season opening and closing dates is provided to industry and management. In the AIMWTMF there is also an annual pre-season survey that provides the information required for assessing the fishery. This pre-season survey is undertaken in the traditional fish grounds and provides scallop abundance information for each fish ground and an overall catch prediction for the fishery.

Monitoring of the scallop stocks in the SWTMF and the SCTF is through mandatory daily logbooks.

Retained Species

Commercial landings (season 2011)

| | |
|-----------------|---|
| AIMWTMF: | Scallops 2203 tonnes whole weight |
| SWTMF: | Scallops 82 tonnes whole weight Prawns 13 tonnes |
| SCTF: | Scallops 176 tonnes whole weight |

AIMWTMF

The total landings for the 2011 season were 2203 t whole weight (441 t meat weight) of scallops (West and South Coast Scallop Figure 1). Based on the 2010 annual survey, the catch prediction for 2011 was 2785 t whole weight (557 t meat weight) with a range between 2230 and 3345 t whole weight (446 to 669 t meat weight). The total landings were slightly below the predicted catch range. There were two contributing factors for the lower landings; firstly one of the areas where a high abundance of scallops was evident in the survey (the Wallabi area) only provided small sizes and poor quality scallop meat at the time of fishing, therefore, the area was not fished to its potential catch. The other factor was

WEST COAST BIOREGION

ceasing fishing at a catch rate level (250 kg/24 hrs) to provide carry over of stock for spawning, which has been a protocol in this fishery since 2004.

SWTMF

The recorded landings in the SWTMF for the season comprised 13 t of western king prawns and 82 t whole weight of scallops (West and South Coast Scallop Figure 2). Since 2004 annual king prawn landings have been low, in the range of 3 to 19 t. In 2011 the scallop landings were low compared to the high catch in 2010, similar to the decline observed between the very high catch of 1990 and 1991 with similar catches. Being a multi-species fishery other product retained include 13 t of mixed whiting spp., 3 t of blue swimmer crabs (*Portunus armatus*) and 2 t of squid. All other landings were recorded as 1 t or less for each species.

SCTF

The scallop catch was 176 t (whole weight) which was slightly higher than last years catch of 112 t. There is generally low effort expended in the fishery and variable recruitment (West and South Coast Scallop Figure 3). Byproduct species landings were negligible.

Recreational catch: Nil

Fishing effort/access level

AIMWTMF

In 2011, eight of the ten Licensed Fishing Boats fished with twin 12.8 m nets (as in Shark Bay). The boats used a total of 204.8 m of net, slightly less than the permitted 223.1 m net headrope capacity. This has removed the inefficient practise of changing nets because of different size net headropes in each fishery, when these boats move between these two fisheries. A total of 3240 nominal trawl hours (3240 hours standardised effort due to all boats now using standard nets) were recorded for the 2011 season which was higher than the standardised effort for 2010 of 2269 hours. Since 1998, the aim has been to reduce ineffective fishing effort by providing annual survey catch abundance and location reports to fishers to reduce search time and enable fishing effort to be applied where scallop abundance is higher. Scallop fishing ceases at a threshold catch rate level to provide adequate spawning stock and all boats leave the fishery together rather than individual fishers continuing to fish to low catch rate levels.

SWTMF

A total of 242 days were fished in the SWTMF a slight increase compared to 2010 (203 days). This is low compared to the effort levels (between 1990 and 2003) of generally over 400 days because of the focus to value add scallops by providing Rottnest Island fresh scallops to eastern states markets and providing scallops and prawns to the local restaurant trade. Effort (fishing days) in 2010 and 2011 however, represents an increase compared to the previous four years (125-153 days). Low effort also reflects the availability of boats to fish in this fishery, inclement weather conditions restricting fishing time and the rising cost of fishing. There is, however, potential for effort to increase markedly because of latent effort in this fishery.

SCTF

For the 2011 season three boats fished for scallops between April and December recording a total of 130 boat days. This

was similar to the 2010 fishing season (129 days). The annual effort expended in the SCTF is mostly affected by scallop recruitment levels. As a consequence, the level of effort utilised each year closely follows stock abundance and catch levels.

Stock Assessment

Assessment complete:

AIMWTMF: Yes

SWTMF and SCTF: Not assessed

Assessment level and method:

AIMWTMF: Level 4 - Direct survey, catch rate

Breeding stock levels:

AIMWTMF: Adequate

SWTMF and SCTF: Not assessed

Projected catch range next season (2012)

AIMWTMF: Scallops nil tonnes

The annual fishing season arrangements in the AIMWTMF are set so that the majority of the mature scallops are able to spawn before fishing occurs. Breeding stocks are therefore protected to ensure that recruitment is dependent only on environmental conditions each year. This fishery is highly variable, being dependent on sporadic recruitment, which appears to be strongly influenced by environmental conditions, e.g. the Leeuwin Current. A pre-season survey is undertaken annually. The survey index for 2011 was the lowest index since 1997. It is expected that the landings would be less than the target range (95-1830 t) in 2012 and therefore the fishery was not opened.

The main performance measure for the fishery relates to maintaining breeding stocks of scallops. This is done in two ways; by setting the season fishing period according to the catch prediction and by closing the fishery at a threshold catch rate level.

The 2011 fishing season was set at approximately 4 months, consistent with the yield predicted from the survey in November 2011. Also, fishing ceased at the catch rate threshold level of 250 kg/24 hrs. Hence the breeding stock indicator was met.

Non-Retained Species

Bycatch species impact: Low

The AIMWTMF trawl fleet operates over a small portion of the licensed fishing area, focusing on scallop aggregations in several different areas or fish grounds and fishing activity is dependent on how widespread settlement is each season. Scallops settle on relatively bare sand habitats. The overall extent of the fishery is 3808 square nautical miles and of that the permitted trawl area is 2420 square nautical miles, 64% of the extent of the fishery. The area actually fished in the 2011 season was 124 square nautical miles (5.1%). Owing to the focused nature of this fishery, protocols set out when fishing and the confined area fished in 2011 and the large mesh size (100 mm), little bycatch was taken during the fishing season.

In the SWTMF trawling for scallops is focused on a few small offshore areas, while the prawn catch is mainly taken from Comet Bay.

The large-mesh (100 mm) trawl gear used in the SCTF takes minimal bycatch. The areas trawled by the boats for scallops (primarily in waters near Bremer Bay, the Recherche Archipelago and Israelite Bay) represents a very small percentage of the fishing area within the SCTF waters, therefore bycatch species impact is considered to be minimal.

Protected species interaction: Low

While turtles do occur in the Abrolhos Islands, these species are towards the southern extent of their range, and do not breed in the Abrolhos Islands area because water temperatures are too low. Consequently, interactions with turtles were always minimal and now that grids are compulsory in the fishery, their capture should be negligible. No turtles were reported as being caught in the AIMWTMF in 2011. Aside from migrating humpback whales that usually avoid trawl boats, and occasional white sharks few other protected, endangered or threatened species, are sighted in this area. For the SWTMF and SCTF whilst some protected, endangered and threatened species frequent these waters they do not occur regularly in the fishing areas. There were two turtles recorded as caught and returned to the sea alive in the SCTF in 2011.

Ecosystem Effects

Food chain effects: Low

The total biomass taken by these fisheries is generally very small. Moreover, due to the high natural variability of scallop stock abundance it is unlikely that any predators are highly dependent on this species.

Habitat effects: Low

The fishers generally operate over a very small proportion of the licensed area and therefore the total area impacted by trawling is small. Trawling is not extensive and confined to trawl grounds where fishable scallop abundance is significant.

The areas associated with scallops are sandy habitats and trawling activity does not impact these significantly.

Social Effects

The estimated employment of crew for the year 2011 was 90 in the AIMWTMF, not including factory staff based in Perth, 10 in the SWTMF and 10 in the SCTF.

Economic Effects

Estimated annual value (to fishers) for year 2011:

AIMWTMF Level 4 - \$10 - 20 million (\$11 million)

SWTMF: Level 1 - < \$1 million

SCTF: Level 1 - < \$1 million

The estimated value of the AIMWTMF is based on the Shark Bay scallop beach price, which was 5.00/kg whole weight. For the SWTMF and the SCTF the estimated value of the scallop catch is based on wholesale price per kilogram (beach price) obtained from these fisheries, which is \$4.20/kg whole weight. King prawn price was about \$15.00/kg.

Fishery Governance

Target catch range:

AIMWTMF: 95 – 1,830 tonnes whole weight

Current fishing level: Acceptable

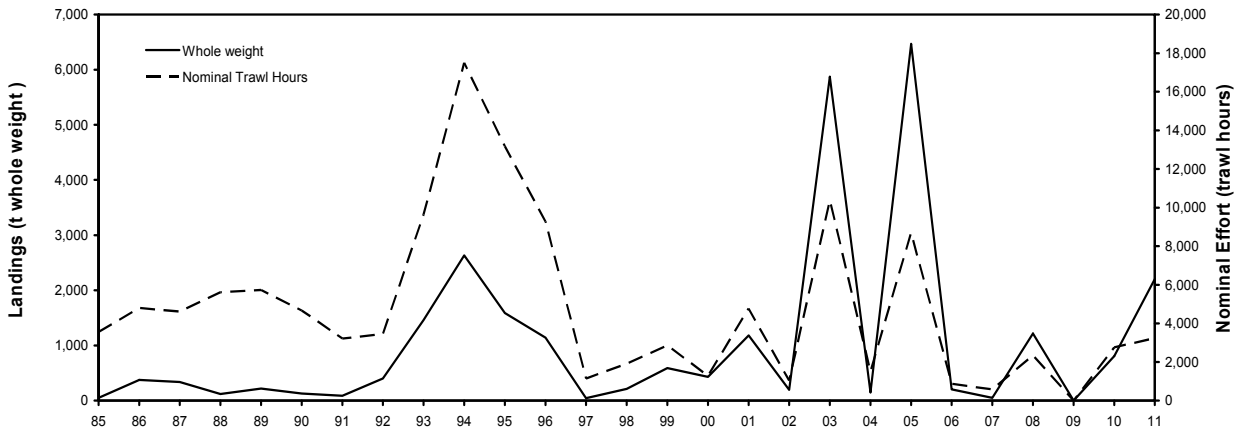
Except for a small number of years (see External Factors for details) the historic catch range for this fishery is 95 – 1,830 tonnes whole weight. The landings in 2011 were slightly below the predicted catch range (see catch section above for reasons) but above target catch range.

New management initiatives (2012) none

External Factors

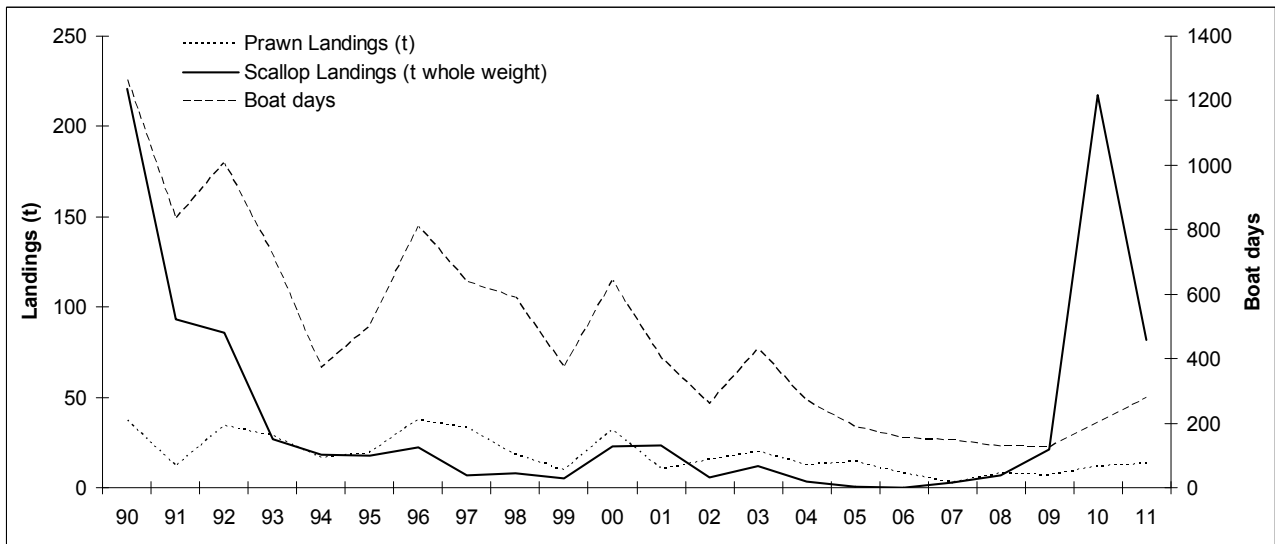
High variability in the level of recruitment highlights the dependence of recruitment success upon environmental conditions, such as the Leeuwin Current, rather than spawning stock levels. The relationship between environmental factors and recruitment success is being evaluated for all these regions. This high variability in recruitment results in a variable level of fishing activity and quantity of catch. Additionally, the high cost of fishing in recent times has affected fishing levels. Meat quality and size (for marketing purposes) are also important in the current economic climate and are factors in determining the amount of effort expended in addition to stock abundance levels.

WEST COAST BIOREGION



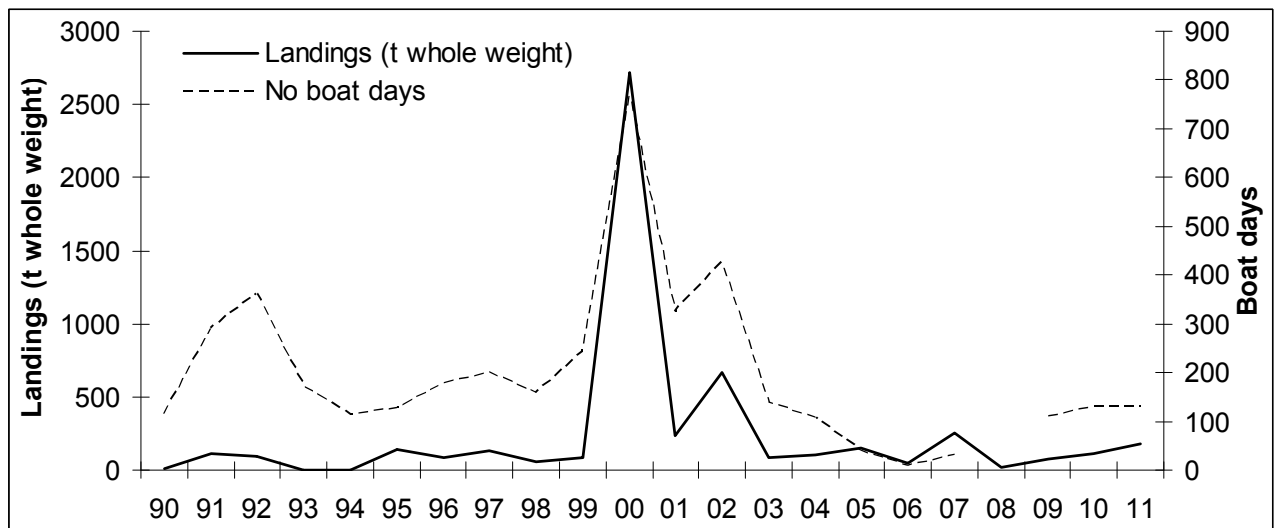
WEST AND SOUTH COAST SCALLOP FIGURE 1

Annual Scallop Landings and Nominal Effort for the Abrolhos Islands and Mid West Trawl Managed Fishery, 1985 – 2011.



WEST AND SOUTH COAST SCALLOP FIGURE 2

Annual Scallop and Prawn Landings and number of boat days for South West Trawl Fishery, 1990 – 2011.



WEST AND SOUTH COAST SCALLOP FIGURE 3

Annual Scallop Landings and number of boat days for South Coast Fishery, 1990 – 2011.



WEST AND SOUTH COAST SCALLOP FIGURE 4

Boundaries of the Abrolhos Islands and Mid West Trawl Managed Fishery, extent of fishery, Port Gregory area, Kidney patch and reef observation area's in 2011.

West Coast Blue Swimmer Crab Fishery Status Report

D. Johnston, D. Harris, J. Fissioli and K. Walshe

| Main Features | | | |
|----------------------|------------|---------------------------------------|---------------------------------------|
| Status | | Current Landings | |
| Stock level | | Total Commercial catch (2010/11) | 161 t |
| Cockburn Sound | Adequate | Cockburn Sound | 53 t |
| Peel-Harvey Estuary | Adequate | Peel-Harvey Estuary | 62 t |
| | | Catch by other commercial fisheries | 46 t |
| Fishing Level | | | |
| Cockburn Sound | N/A | Recreational catch | Approximately 60 - 70% of total catch |
| Peel-Harvey | Acceptable | Peel-Harvey Estuary (Nov 07 - Oct 08) | 107-193 t |

Fishery Description

The blue swimmer crab (*Portunus armatus*) is found along the entire Western Australian coast, in a wide range of inshore and continental shelf areas, from the inter-tidal zone to at least 50 metres in depth. However, the majority of the commercially and recreationally fished stock is concentrated in the coastal embayments between Geographe Bay (in the south) and Port Hedland (in the north).

The commercial blue swimmer crab fisheries within the West Coast bioregion are the Cockburn Sound Crab Managed Fishery, the Warnbro Sound Crab Managed Fishery, Area I (the Swan and Canning Rivers) and Area II (the Peel-Harvey Estuary) of the West Coast Estuarine Managed Fishery and Area I (Comet Bay) and Area II (Mandurah to Bunbury) of the Mandurah to Bunbury Developing Crab Fishery. Originally, commercial crab fishers in WA used set (gill) nets or drop nets, but most have now converted to purpose-designed crab traps. Blue swimmer crabs are also retained as by-product by trawlers operating in Comet Bay (Area D of the South West Trawl Managed Fishery), and occasionally by trawlers operating in the waters from Fremantle to Cape Naturaliste (Area B of the South West Trawl Managed Fishery).

Recreational crabbing in the West Coast bioregion is centred largely on the estuaries and coastal embayments from Geographe Bay north to the Swan River and Cockburn Sound. Blue swimmer crabs represent the most important recreationally fished inshore species in the southwest of WA in terms of participation rate. While the majority of recreational fishers use either drop nets or scoop nets, diving for crabs is becoming increasingly popular.

There are separate reports for crab fisheries in the Gascoyne and North Coast bioregions.

Governing legislation/fishing authority

Commercial

West Coast Estuarine Fishery (Interim) Management Plan 2003

West Coast Estuarine Interim Managed Fishery Permit

Cockburn Sound (Crab) Management Plan 1995

Cockburn Sound Crab Managed Fishery Licence

Warnbro Sound (Crab) Management Plan 1995

South West Trawl Management Plan 1989

South West Trawl Managed Fishery Licence

Exceptions to the *Fish Traps Prohibition Notice 1990* and *Fish Traps Restrictions Notice 1994*

Exemptions under Section 7 of the *Fish Resources Management Act 1994*

Recreational

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

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

The Cockburn Sound (Crab) Managed Fishery encompasses the inner waters of Cockburn Sound, from South Mole at Fremantle to Stragglers Rocks, through Mewstone to Carnac Island and Garden Island, along the eastern shore of Garden Island, and back to John Point on the mainland.

The Warnbro Sound (Crab) Managed Fishery includes Warnbro Sound itself and adjacent waters, extending from Becher Point to John Point.

The West Coast Estuarine Fishery encompasses the waters of the Swan and Canning Rivers and the waters of the Peel Inlet and Harvey Estuary, together with the Murray, Serpentine, Harvey and Dandalup Rivers.

The Mandurah to Bunbury Developing Crab Fishery covers the waters south of the Shoalwater Islands Marine Park (32°22'40" S) to Point McKenna near Bunbury (33°18' S), and offshore to 115°30' E. The fishery is further divided into two zones. A single northern zone (Area 1) 80-pot exemption authorises crab fishing in a specified area of Comet Bay between 32°22'40" S and 32°30' S. A single southern zone (Area 2) 120-pot exemption authorises crab fishing in the waters between Cape Bouvard and the southern boundary of the fishery. The area separating the 2 zones (waters between 32°30' S and Cape Bouvard) is closed to commercial crab fishing.

The Geographe Bay fishery was officially closed on 21 January 2005 to reduce conflict between the recreational and commercial fishing sectors and commercial fishing in the Leschenault Estuary at Australind ceased in 2000.

Management arrangements

Commercial access to blue swimmer crab stocks in WA is governed by a series of separate management arrangements provided for under the legislative framework of the Fish Resources Management Act 1994. Individual fisheries are managed under an input control system, primarily through the regulation of vessel and trap numbers. Supplementary controls cover retainable species and associated minimum size limits, gear specifications and seasonal and daily time restrictions.

The principal management tool employed to ensure adequate breeding stock in the commercial crab fisheries involves maintaining minimum size limits well above the size at sexual maturity. Except for male crabs in Shark Bay, which mature at 115 mm carapace width, blue swimmer crabs become sexually mature below 100 mm carapace width. The legal minimum size range varies between 127 – 135 mm carapace width in the fisheries of the West Coast bioregion – well above the size at sexual maturity (86-98 mm carapace width).

Recreational fishing for blue swimmer crabs in Western Australia is managed through a series of input and output controls. As with commercial fishing, the principal management tool employed to sustain an adequate breeding stock involves maintaining minimum size limits well above the size at sexual maturity. A minimum legal size limit of 127 mm carapace width applies in State waters, along with a bag limit of 10 crabs per person or 20 crabs per boat. A Recreational Fishing from Boat Licence was introduced in March 2010 that restricts catch to 20 crabs per powered boat when there are two or more people on-board holding Recreational Fishing from Boat Licences and 10 crabs if there is only one person on-board holding a Recreational Fishing from Boat Licence regardless of the number of fishers aboard.

Restrictions also govern gear types that can be used to take blue swimmer crabs, along with localised spatial and temporal closures. Management measures were introduced in August 2007 to include a seasonal closure to both commercial and recreational fishers in the Peel-Harvey

Estuary for the months of September and October to protect pre-spawning female crabs.

In 2006, the Cockburn Sound crab fishery was closed to protect crab stocks that were significantly depleted due to fishing pressures and environmental conditions that resulted in poor recruitment. Commercial fishers were prohibited from taking crabs in all waters of the Cockburn Sound Managed Crab Fishery, while recreational fishers were prohibited from taking crabs south of a line from Woodman Point across to Garden Island. The closure remained in place for the 2006/07, 2007/08 and 2008/09 season.

Following a rebuilding of the Cockburn Sound crab stock, the fishery was re-opened on 15 December 2009. A precautionary management approach was adopted under the following management controls:

- a 20% reduction in commercial pot numbers;
- an increased commercial size limit of 140 mm;
- a recreational size limit of 127mm; and
- a limited commercial and recreational season from 15 December 2009 to 31 March 2010.

A precautionary management approach was again adopted for the 2010/11 season, under the following management controls:

- a 20% reduction in commercial pot numbers;
- a commercial size limit of 135 mm;
- a recreational size limit of 127 mm;
- a limited commercial season from 15 December 2010 to 31 March 2011; and
- a limited recreational season from 15 December 2010 to 30 April 2011.

A voluntary Fisheries Adjustment Scheme resulted in the number of licenses in the Swan/Canning River (Area 1 of the West Coast Estuarine Fishery) being reduced from 4 to 2 in July 2005. A further licence was removed from the fishery in early 2008.

Research summary

Data for the assessment of blue swimmer crab stocks in the West Coast bioregion are obtained from a variety of sources. Commercial catch and effort is assessed using fishers' compulsory monthly catch and effort returns, voluntary daily log books from fishers in the Mandurah to Bunbury Developing Crab Fishery, and data from on-board catch monitoring conducted by the Department of Fisheries' research staff in each of the West Coast bioregion's commercial crab fisheries.

In addition, direct surveys generating recruit, residual and breeding stock indices, along with data on the general crab population, have been conducted in Cockburn Sound for 10 years and in the Peel-Harvey for four years.

A stock-recruitment-environment model has been developed for Cockburn Sound, which correlates water temperature in the pre-spawning months of August and September, and the size of the breeding stock, with the following season's commercial catch.

Following the closure of the Cockburn Sound crab fishery in December 2006, research funding (from the Development

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and Better Interest Fund) was granted to assess the reasons for the stock collapse and monitor the recovery of the fishery. The causes of the collapse and description of the recovery have been described in the scientific paper, Decline of a blue swimmer crab (*Portunus pelagicus*) fishery in Western Australia—History, contributing factors and future management strategy (Johnston et al., 2011)¹. The stock status of the Cockburn Sound crab fishery, a description of the stock-recruitment-environment relationship for the Cockburn Sound crab stock, and a summary of the crab fisheries in Warnbro Sound and the Swan River have been presented in the Fisheries Research Report Status of the Cockburn Sound Crab Fishery FRR219 (Johnston et al., 2011)². Reports on the population status of the Peel-Harvey Estuary crab stock, and the 2007/08 recreational crabbing survey in the Peel-Harvey Estuary, are currently being written.

Retained Species

Commercial landings (season 2010/11):

| | |
|--|-------------------------|
| | Total 161 tonnes |
| Cockburn Sound | 53 tonnes |
| Peel-Harvey Estuary | 62 tonnes |
| Other West Coast commercial fisheries | |
| | 46 tonnes |

The total commercial catch from the West Coast bioregion in 2010/11 was 161 t, a 14% decrease on the 184 t taken in 2009/10. This reduction was primarily due to slight declines in catch from the Cockburn Sound crab fishery and from the Peel-Harvey Estuary and no fishing in Area II of the Mandurah to Bunbury trap fishery. This catch accounted for 15% of the state commercial blue swimmer crab catch of 1087 t for 2010/11 (West Coast Blue Swimmer Crab Figure 1).

The commercial catch from the Cockburn Sound Crab Managed Fishery for 2010/11 was 53 t, a 5% decrease from the 56 t caught during the 2009/10 season (West Coast Blue Swimmer Crab Figure 2).

The commercial catch from the Peel-Harvey Estuary (Area II of the West Coast Estuarine Managed Fishery) for 2010/11 was 62 t. This represents a 5% decrease on the 65 t in 2009/10 (West Coast Blue Swimmer Crab Figure 4).

The Mandurah to Bunbury Developing Crab Fishery reported an annual catch for 2010/11 of 11 t, representing a 61% decrease on the 28 t reported for the 2009/10 financial year (West Coast Blue Swimmer Crab Figure 5). This significant decrease was primarily due to the fisher that operates along

the coast between Mandurah and Bunbury not crabbing during the 2010/11 financial year.

Recreational catch estimate:

Peel-Harvey Estuary (Nov 2007 - Oct 2008)

107-193 tonnes

Recreational catch for West Coast Bioregion:

approximately 60-70% of total catch

Most of the recreational blue swimmer crab fishing in Western Australia occurs in the West Coast bioregion. Departmental surveys have estimated that the recreational sector accounts for 60-70% of the total blue swimmer crab catch in this bioregion.

A 12-month recreational catch and effort survey in the Peel-Harvey Estuary was completed in October 2008. This survey covered fishing from boats, shore, canals, and houseboats. Recreational catch for the Peel-Harvey Estuary from November 2007 to October 2008 was estimated to be between 107-193 t, which represents a significant decline in recreational catch estimate of 251-377 t from the last survey undertaken in 1998/99. Boating has become the dominant fishing method, with a decline in the amount of scoop netting undertaken. The majority of fishers are now also Mandurah locals, rather than people from the metropolitan area.

Within Cockburn Sound, recreational crabbing surveys in 1996/97 and 2001/02, and in the 2002, 2003 and 2004 calendar years, produced relatively consistent recreational catch estimates of 24 t, 25 t, 18 t, 23 t and 18 t respectively. However, the recreational catch for the 2005/06 financial year was estimated to be just 4 t. It should be noted that these figures are likely to under-estimate the total recreational blue swimmer crab catch in each of these years, as the surveys commenced at various times between 7am and 9am and finished between 4pm and 8pm so missed any crabbing activity that potentially occurred before or after the survey began or finished.

The Minister for Fisheries closed the Cockburn Sound crab fishery to recreational fishing in December 2006, south of a line between Woodman Point and the northern end of Garden Island. The closure remained in effect until November 2009.

The whole of Cockburn Sound was re-opened to recreational crabbing for the 2009/10 season from December 15th 2009 to March 31st 2010, at which point the area south of Woodman Point was again closed to continue rebuilding crab stocks in this area. A survey quantifying recreational catch and effort in the West Coast bioregion was conducted over a two-year period between July 2008 and June 2010. The survey provided a recreational catch estimate for the 3½ months of the 2009/10 season of 15.4 t (S.E.±3.3 t) of blue swimmer crabs, for an area covering Cockburn Sound (south of latitude 32°05'S), Shoalwater Bay and the northern half of Warnbro Sound (north of latitude 32°20'S). However, the survey covered only the period during the day between 9am and 5pm. As there is a significant level of early morning recreational crabbing in Cockburn and Warnbro Sounds, an additional survey was conducted between 5.30 am and 9am during the 2009/10 crabbing season. This survey provided an additional recreational catch estimate for this area of 18.8 t (S.E.±5.5 t) of blue swimmer crabs for the 3½ months of the 2009/10 season.

¹ Johnston, D., Harris, D., Caputi, N. and Thomson, A. 2011. Decline of a blue swimmer crab (*Portunus pelagicus*) fishery in Western Australia—History, contributing factors and future management strategy. Fish. Res. **109**(1), 119-130 doi:10.1016/j.fishres.2011.01.027

² Johnston, D., Harris, D., Caputi, N., de Lestang, S. and Thomson, A. 2011. Status of the Cockburn Sound Crab Fishery. Fisheries Research Report No. 219. Department of Fisheries, Western Australia. 104pp.

All of Cockburn Sound was again re-opened to recreational crabbing for the 2010/11 season from December 15th 2010 to April 30th 2011, after which the area south of Woodman Point was closed.

A 12-month survey of recreational fishing in the Swan/Canning Estuary Basin between August 1998 and July 1999 estimated the total recreational blue swimmer crab catch to be 7.3 t. This compares with a commercial catch during the 1998/99 financial year of 24 t. In subsequent years, commercial catches have ranged between 10 t and 20 t, but no further recreational surveys have been undertaken specifically in the Swan-Canning Estuary.

Both the Leschenault Inlet and Geographe Bay are now exclusively for recreational use. Previous surveys have found the annual recreational blue swimmer crab catch from Geographe Bay to be between 7 – 11 t per year.

A statewide survey of boat-based recreational fishing was conducted during 2011/12 and was a collaboration between the Department of Fisheries, Edith Cowan University and Recfishwest. Approximately 3,000 fishers from the “Recreational Fishing from Boat” licence database participated in a 12 month phone-diary survey in conjunction with boat ramp surveys of boat-based fishers. Estimates of catch and effort will be available in late 2012.

Fishing effort/access level

After three years of closure due to declining crab stocks, the Cockburn Sound (Crab) Managed Fishery partially re-opened for the 2009/10 and 2010/11 fishing season. Commercial fishers in Cockburn Sound reported a total of 55,294 trap lifts for the 2010/11 season, a 6% decrease on the 58,747 trap lifts reported during the 2009/10 season (West Coast Blue Swimmer Crab Figure 2).

Commercial fishers in the Peel-Harvey Estuary reported 58,119 trap lifts during the 2010/11 season – a 4% increase on the 55,595 trap lifts reported the previous year (West Coast Blue Swimmer Crab Figure 4).

Commercial effort in the Mandurah to Bunbury Developing Crab Fishery also fell in 2010/11, with a total of 13,186 trap lifts reported compared to 22,520 trap lifts the previous year (West Coast Blue Swimmer Crab Figure 5), primarily because the Mandurah to Bunbury fisher did not operate during this period.

Stock Assessment

Assessment complete: **Yes**

Assessment level and method:

Cockburn Sound **Level 4 - Direct survey**

Peel-Harvey **Level 2 - Catch rate**

Other West Coast fisheries **Level 2 - Catch rate**

Breeding stock levels:

Cockburn Sound **Adequate**

Peel-Harvey **Adequate**

Other West Coast fisheries **Adequate**

Catch rates from fisheries within the West Coast bioregion generally provide an index of abundance that can be used to assess individual fishery performance from year-to-year. In addition, direct surveys generating recruit, residual and breeding stock indices, along with data on the general crab population, have been conducted in Cockburn Sound for 10 years and in the Peel-Harvey for four years.

Cockburn Sound: Historically, natural variations in stock abundance have resulted in large fluctuations in the annual commercial blue swimmer crab catch from Cockburn Sound. This fluctuation relates largely to variable recruitment dependent on environmental conditions, although the shift by commercial fishers from set nets to crab traps in the mid-1990s initiated a marked increase in effective effort and mean annual crab landings.

Following the second highest annual catch on record in 2000 (340 t) the catch declined over the next few years to the point where the low stock abundance required closure of the fishery (in December 2006).

Adequate protection of the breeding stock of blue swimmer crabs in Cockburn Sound had been assumed to occur if the minimum legal size was set well above the size at sexual maturity, which would allow female crabs to spawn at least once before entering the fishery. While this is a common strategy for this species, a combination of biological, environmental and fishery-dependent factors contributed to the collapse and include: 1) vulnerability to environmental fluctuations as this species is at the southern extreme of its temperature tolerance, 2) a life cycle contained within an embayment and is self-recruiting, 3) a change in fishing method from gill nets to traps which increased fishing pressure on pre-spawning females in winter and reduced egg production to one age class, 4) four consecutive years of cooler water temperatures resulting in poor recruitment and 5) continued high fishing pressure during years of low recruitment resulting in low breeding stock.

Despite an absence of fishing pressure, the recovery of the breeding stock and subsequent recruitment has been slow. While catch estimates reflected a slow improvement in the stocks, they were well below the historic catch range of the fishery. Consequently, the closure was extended to November 2009.

Fishery-independent trawl and commercial monitoring surveys conducted during 2009 suggested the strength of both recruitment and breeding stock in Cockburn Sound had improved sufficiently to re-open the crab fishery for the 2009/10 fishing season. However, it was considered prudent to adopt a precautionary approach to the management of the fishery (see Management arrangements above).

Given the relatively low commercial catch in 2009/10, and lower than expected 2010 breeding stock and recruitment indices, it was again considered prudent to maintain a precautionary approach to fishing for the 2010/11 season in Cockburn Sound.

Despite the reduction in the minimum size, the commercial catch in 2010/11 of 53 t (from 55,000 pot lifts) was marginally lower than the previous year’s catch and effort. This low outcome was partly due to a large cohort of unusually small-sized juveniles recruiting into the fishery during 2010. These juveniles were on average 78 mm CW during July 2010, the smallest carapace width since data was first collected in 2005. These small-sized crabs did not moult

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to legal size until late in the fishing season, as evidenced by the largest catch occurring in March 2011 when January is typically the peak catch month.

Breeding stock (egg production) levels during 2011, based on the relationship between egg production and recruitment (0.63), were above the acceptable breeding stock index that is currently set at a precautionary level (0.4) (West Coast Blue Swimmer Crab Figure 3). The strength of recruitment of juvenile crabs within Cockburn Sound improved significantly during 2011, with an increased juvenile (0+) index from research trawls of 3.1 compared with 1.4 in 2010. In addition, the average size of recruits in July 2011 of 82 mm CW was larger than in 2010 (78 mm CW). The good abundance of residual crabs (1+) seen in 2010 (7.9) was maintained in 2011 (8.8), as this residual cohort did not contribute significantly to the 2010/11 season with the fishery stopping in March.

Peel Harvey: The mean annual catch rate for 2010/11 in the Peel-Harvey Estuary was 1.07 kg/trap lift, marginally lower than the 2009/10 catch rate of 1.17 kg/trap lift (West Coast Blue Swimmer Crab Figure 4). This catch rate, however, remains acceptable for this fishery.

A recreational survey conducted in the Peel-Harvey Estuary during 2007/08 estimated that the recreational take accounted for approximately 60 % of the total catch. Consequently, it is recognized that commercial catch data alone may not provide an accurate indication of the status of crab stocks in this estuary.

Mandurah to Bunbury: Mean annual trap catch rates in the Mandurah to Bunbury Developing Crab Fishery have increased steadily since the commencement of exploratory fishing along the coast south of Mandurah to Bunbury in 2002. This increase reflects more efficient fishing of the region as the commercial operators' knowledge of the spatial and temporal distribution of resident stocks and localized environmental influences increased over time. The mean catch rate for 2010/11 in the Mandurah to Bunbury fishery was 0.81 kg/trap lift – a 36% decrease on the 2009/10 catch rate of 1.26 kg/trap lift (West Coast Blue Swimmer Crab Figure 5). The reduction in catch rate in this fishery was primarily because the fisher that operates along the coast between Mandurah and Bunbury did not fish during the 2010/11 financial year. The catch rate for Area 1 of the Mandurah to Bunbury Developing Crab Fishery actually increased from 0.71 kg/traplift in 2009/10 to 0.81 kg/traplift in 2010/11.

Monthly monitoring surveys conducted aboard commercial vessels in the Mandurah to Bunbury fishery have indicated a high percentage of female crabs in the catch from this fishery, especially during the peak period of commercial fishing from April to August, and this will need to be closely monitored to avoid overfishing the breeding stock.

Non-Retained Species

Bycatch species impact: Negligible

The shift from using set nets to traps in most blue swimmer crab fisheries has resulted in a substantial reduction in bycatch from dedicated crab fishing. Pots are purpose-designed to minimise the capture of non-target species and are therefore an inefficient way to capture fish, the majority

of which are able to escape through the entrance gaps when the pot is soaking or being hauled.

Small numbers of fish are infrequently captured in crab pots, but the fishers are not permitted to retain them. The low number of fish caught and returned by crab fishers is considered to pose a negligible risk to these stocks.

Discarded bycatch from trawl fisheries taking crabs as a by-product is dealt with in the status reports that are specific to each trawl fishery.

Protected species interaction: Negligible

The crab trap longline system used in the targeted crab fisheries has little possibility of interacting with protected species. The fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species and avoids or minimises impacts on threatened ecological communities.

Ecosystem Effects

Food chain effects: Low

As the commercial take of crabs represents a relatively small portion of the biomass, which is effectively renewed annually and subject to high levels of natural variation in abundance, secondary food chain effects are likely to be minimal in these fisheries.

Habitat effects: Negligible

Fishing with traps results in limited habitat disturbance, with only minor dragging of traps on the bottom occurring during trap retrieval. Sand and associated biota do not get brought to the surface in commercial blue swimmer crab traps, as the mesh used on traps is sufficiently large to allow the escape of any sand-dwelling macro-benthos.

Although seagrasses are occasionally brought to the surface with the trap, the infrequent nature of this occurrence, and the small amount of living seagrass removed, results in minimal habitat damage.

Social Effects

During 2010/11, approximately 28 people were employed as skippers and crew on vessels targeting blue swimmer crabs in the West Coast bioregion.

Blue swimmer crabs also provide a highly popular recreational fishery, particularly in the Swan River, Cockburn Sound, Warnbro Sound, the Peel-Harvey Estuary and the Geographe Bay region, where they dominate the inshore recreational catch.

Economic Effects

Estimated annual value (to fishers) for 2010/11:

Level 2 - \$1 - 5 million (\$1.15 million)

The commercial blue swimmer crab catch in the West Coast bioregion for 2010/11 was valued at around \$1.15 million, down 10% on the \$1.21 million generated in 2009/10. Most

of the catch from the West Coast bioregion was sold through local markets.

The economic value of commercial blue swimmer crab fishing to the State of Western Australia for the 2010/11 financial year was estimated to be \$6.35 million – a 15% increase on the estimated \$5.37 million generated in 2009/10.

Fishery Governance

Current fishing level

| | |
|------------------------------------|-----------------------|
| Cockburn Sound: | Under review |
| Peel Harvey: | 40 - 90 tonnes |
| Other West Coast fisheries: | Under review |

The new catch range for Cockburn Sound crabs will need to be developed once the spawning stock and recruitment levels return to normal levels and the management arrangements are stabilised. The acceptable catch range for Peel Harvey is now determined to be within the last 10 years of catch values. The other west coast crab fisheries are yet to develop a sufficiently stable catch history or set of management arrangements to develop a definitive catch range.

New management initiatives (2011/12)

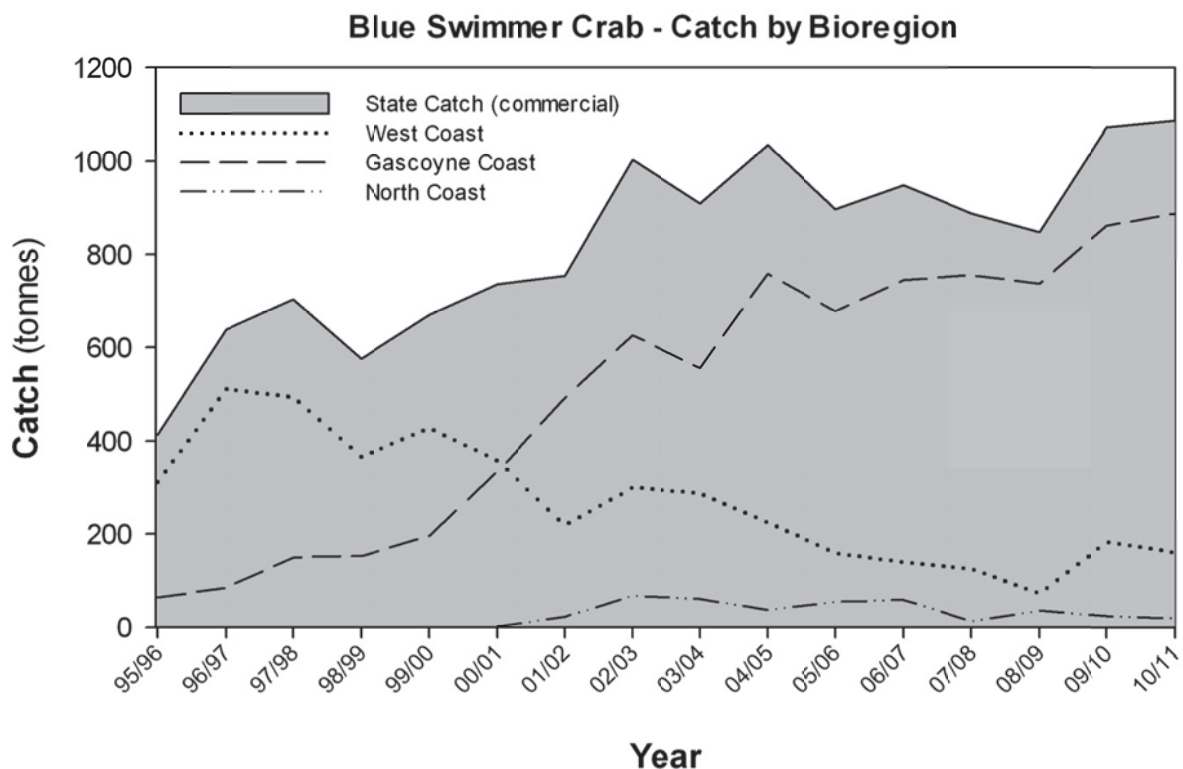
As an outcome of the review into the management arrangements for Cockburn Sound the following changes were implemented in December 2011 for this fishery.

- Extension of the commercial fishing season from 15 Dec to 15 June
- Extension of the recreational fishing season from 15 Dec to 30 July
- A decrease in commercial size limit for male blue swimmer crabs from 135 to 130 mm CW
- Retention of the commercial size limit for female blue swimmer crabs at 135 mm CW
- Maintenance of the current 20% pot reduction in the commercial fishery

The Mandurah to Bunbury Developing Fishery underwent its final review by the Developing Fisheries Assessment Committee (DFAC) in mid-2007 as part of the ‘Developing New Fisheries’ process. The Department of Fisheries is considering the recommendations of the DFAC.

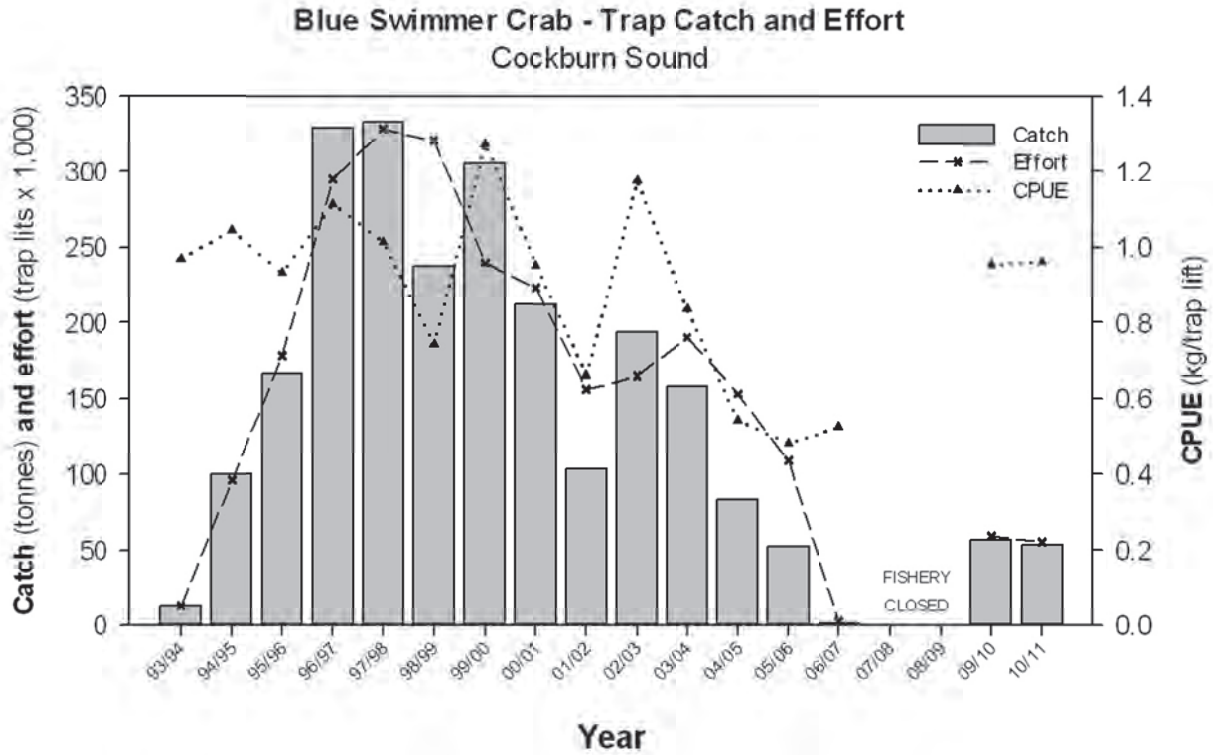
External Factors

Levels of recruitment to many of the crab fisheries fluctuate considerably. While the causes of these variations are not fully understood, it is considered most likely due to environmental influences (e.g. water temperature) both on spawning success and larval survival through to recruitment. The relationship between environmental factors, recruitment and catch is being further evaluated as data becomes available.



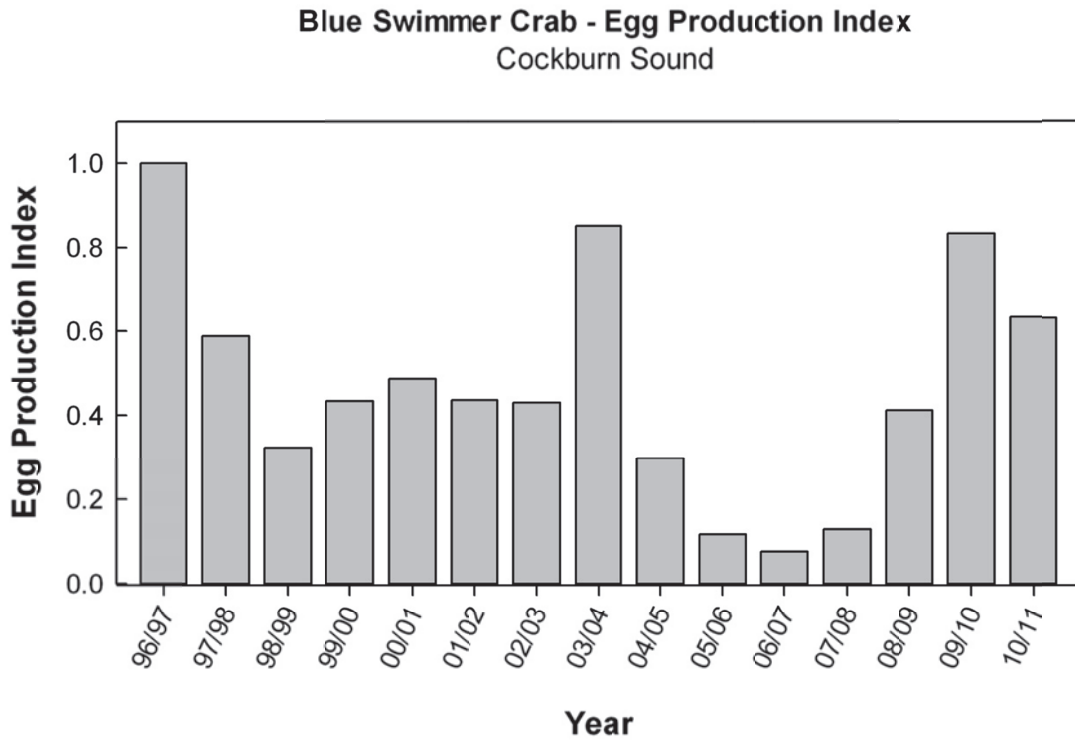
WEST COAST BLUE SWIMMER CRAB FIGURE 1

State and bioregion commercial catch history for the blue swimmer crab in Western Australia since 1995/96.



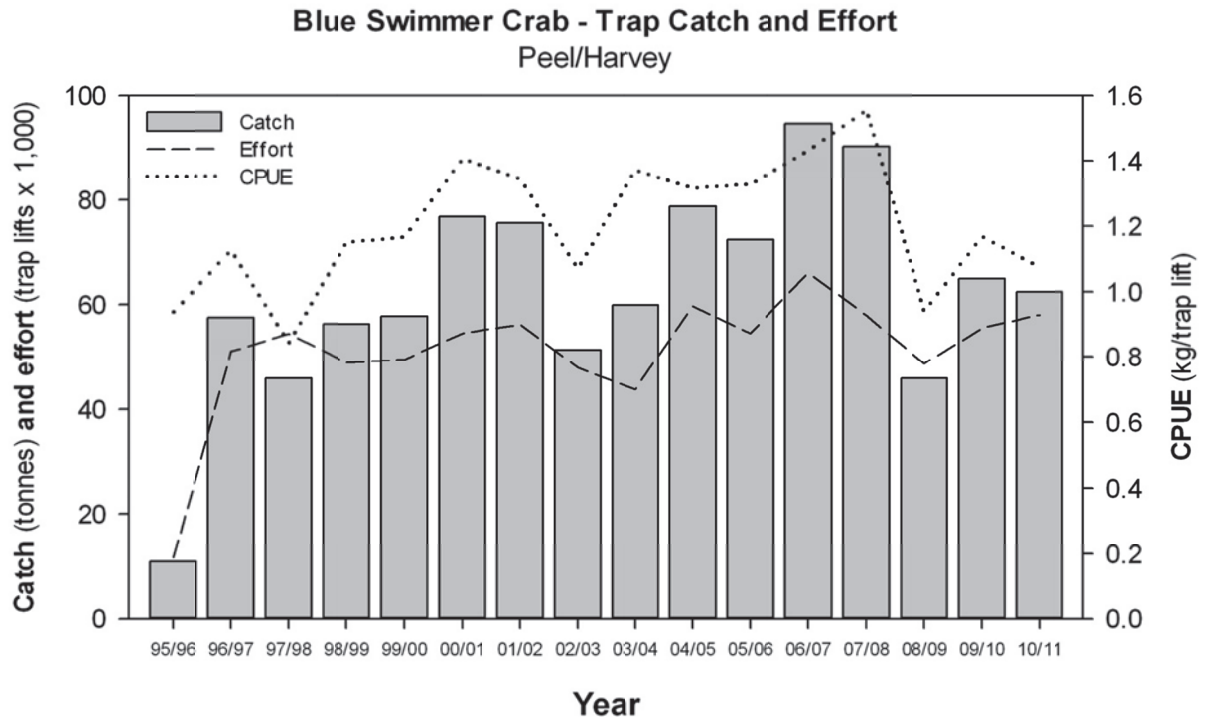
WEST COAST BLUE SWIMMER CRAB FIGURE 2

Blue swimmer crab catch (t), effort (trap lifts x 1,000) and catch per unit effort (kg/trap lift) in the Cockburn Sound Crab Fishery using traps since 1993/94.



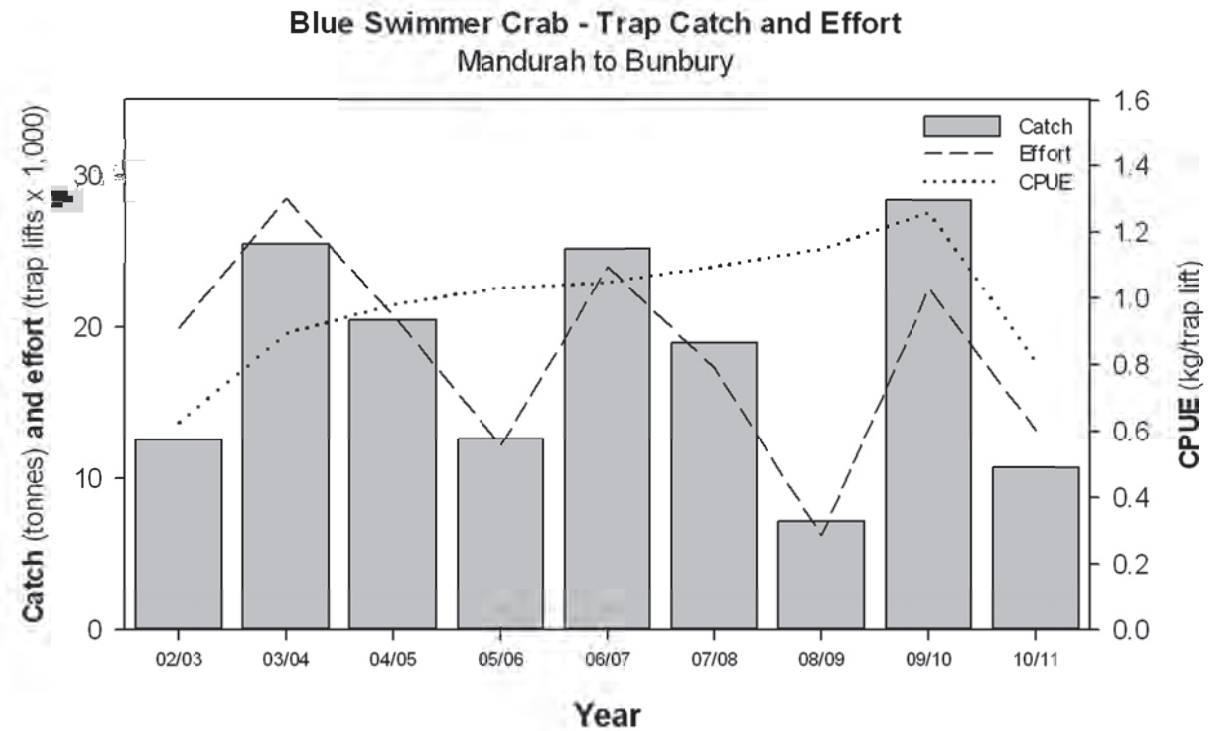
WEST COAST BLUE SWIMMER CRAB FIGURE 3

Annual standardized egg production index based on numbers and carapace widths of sexually mature female blue swimmer crabs captured during all juvenile trawl surveys between 1996 and 2011, all trawl surveys aboard the Fisheries Research trawlers *RV Flinders* (1999 –2001) and *RV Naturaliste* (2001-2011), and all catch monitoring surveys aboard commercial crab vessels in Cockburn Sound (1999-2011).



WEST COAST BLUE SWIMMER CRAB FIGURE 4

Blue swimmer crab catch (t), effort (trap lifts x 1,000) and catch per unit effort (kg/trap lift) in Area 2 of the West Coast Estuarine Fishery (the Peel-Harvey Estuary) using traps since 1995/96.



WEST COAST BLUE SWIMMER CRAB FIGURE 5

Blue swimmer crab catch (t), effort (trap lifts x 1,000) and catch per unit effort (kg/trap lift) in the Mandurah to Bunbury Developing Crab Fishery since 2002/03.

West Coast Deep Sea Crab (Interim) Managed Fishery Status Report

J. How and K. Nardi

Main Features

| Status | | Current Landings | |
|---------------|------------|------------------|-------|
| Stock level | Adequate | Crystal Crabs | 140 t |
| Fishing Level | Acceptable | Champagne Crabs | 5.4 t |

Fishery Description

The West Coast Deep Sea Crustacean (Interim) Managed Fishery targets Crystal (Snow) crabs (*Chaceon albus*), Giant (King) crabs (*Pseudocarcinus gigas*) and Champagne (Spiny) crabs (*Hypothalassia acerba*) using baited pots operated in a long-line formation in the shelf edge waters (>150m) of the West Coast.

Governing legislation/fishing authority

West Coast Deep Sea Crustacean Fishery (Interim) Management Plan 2007

West Coast Deep Sea Crustacean Interim Managed Fishery Permit

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

Consultation process

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 boundaries of this fishery include all the waters lying north of latitude 34° 24' S (Cape Leeuwin) and west of the Northern Territory border on the seaward side of the 150m isobath out to the extent of the Australian Fishing Zone.

Management arrangements

The West Coast Deep Sea Crustacean (Interim) Managed Fishery is a quota based 'pot' fishery. The fishery mostly operates in depths of 500-800 metres, with the only allowable method for capture being baited pots ('traps'). These are operated in 'long-lines', which have between 50 and 150 pots attached to a main line marked by a float at each end.

The Department of Fisheries has minimum size limit regulations to protect breeding females. A minimum carapace length of 120 mm applies for the principal target

species Crystal Crab, and 92 and 140 mm carapace minimum lengths applying respectively for the lesser targeted species-Champagne and Giant crabs.

The interim management plan came into effect on 1 January 2008. This plan introduced a number of key management changes such as the removal of management zones in the fishery, removing part-time permits and initiating a quota management system, with individual transferable quota for each existing permit holder. There are currently seven permits operating in the fishery. Each permit has a 2 tonne limit for Giant and Champagne crabs combined (annual combined quota of 14 tonnes), while the TAC for crystal crabs (across all permits with Crystal Crab entitlement) totals 140 tonnes.

Research summary

Research for this fishery has involved assessing the current status of the west coast deep sea crab stocks based on commercial catch returns, log book information and at-sea research monitoring of the catch. The annual total Crystal crab catch from 2000 to 2008 have been historically used to monitor this fishery for ecologically sustainable development assessment. However, since the quota system has come into operation in 2008, performance measures based on whether the quota is achieved and the catch rate and effort required to achieve the catch will now need to be established.

Retained Species

Commercial landings (season 2011):

| | |
|-----------------------|-------------------|
| Crystal crab | 140 tonnes |
| Champagne crab | 5.4 tonnes |

The catch of 140 tonnes of Crystal crab in 2011 was similar to the previous three years where catches have been just below the 140 tonne quota which was introduced in 2008 (Deep Sea Crab Figure 1). The catch of 5.4 t of Champagne crab taken in 2011 was similar to the last two seasons where catches were between 5 and 6.3 tonnes. The catch records are based on mandatory monthly catch and effort returns prior to 2008, with the more accurate trip catch disposal records from 2008 onwards. No Giant crab was landed in 2011.

Recreational catch estimate (season 2011) Nil

Fishing effort/access level

Commercial nominal effort decreased by 12 % from an estimated 66,003 pot lifts in the 2010 season to 58,356 pot lifts in the 2011 season. The catch of the fishery (see above) is divided by the average logbook catch rates to provide an estimate of nominal effort for the fishery.

Stock Assessment

Assessment complete **Yes**

Assessment level and method:

Level 2 - Catch rate

Breeding stock levels **Adequate**

Catch rates increased by 20% in 2011 with a standardised catch rate of 1.88 kg/pot compared with 1.56 kg/pot in 2010 (Deep Sea Crab Figure 2). The standardised catch rate for 2010 differs from that reported last year, of 1.34 kg/pot. This is due to errors found during further data validation associated with the conversion of landed baskets to weights. The 2011 standardised catch rate represents the highest standardised catch rate in a decade (Deep Sea Crab Figure 2).

Crystal crabs are known to be very slow growing as are most other deep-water species. Preliminary estimates suggest that the males attain maturity at around 12 years and reach legal minimum size at about 14 years. Ageing estimates are not available for females, but size at maturity information shows that they mature well below the legal size limit and probably moult once after reaching maturity, which means that their contribution to the fished biomass is small and that egg production in the fishery is well protected by the legal size limit provided that there are sufficient males. After a drop in the standardised catch rate of ovigerous females in 2008, presumably due to a shift in effort with the removal of zone restrictions, it has remained steady from 2008 to 2011.

The original performance measure is whether the catch remains within the range 100-250 t which was met. Given that the fishery has moved to catch quota, the performance measure needs to be revised to include whether the quota has been achieved and if the effort required to achieve the quota is acceptable.

Non-Retained Species

Bycatch species impact **Low**

The gear used in this fishery generates minimal bycatch and the design of the pots is such that they do not 'ghost fish' if lost.

Protected species interaction **Negligible**

The pots and ropes used in crab longlines have minimal capacity to interact with protected species in this fishing area.

Ecosystem Effects

Food chain effects **Negligible**

Total landings of the 3 species of deep sea crabs represent a very small biomass, and any impact of fishing on the general food chain is expected to be minimal. Most of the commercial Crystal crab catch is taken in depths between 500 to 800 metres. An estimate of the amount of ground between 500–1,000 m over the distributional range of Crystal crabs is about 50,600 km². Assuming that all the ground is equally productive, at catch levels experienced in the past seasons about 3 kilograms of crabs are being removed each year per square kilometre of ground.

Habitat effects **Low**

Crab potting is considered to have a low impact on the largely soft mud habitat over which the fishery operates.

Social Effects

This fishery is based on mobile vessels that employ a skipper and two or three crew. The product is landed live at ports between Carnarvon and Fremantle, generating some additional economic activity and benefits. There were four vessels operating in 2011.

Economic Effects

Estimated annual value (to fishers) for 2011

Level 2 - \$1 - 5 million (\$2.9 million)

The beach value of the fishery was about \$2.9 million in 2011 with the majority of the catch exported live to SE Asia.

Fishery Governance

Target catch range **100-140 tonnes**

Revised Effort range **50-80,000 pot lifts**

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

The TAC for the fishery has been set well below landings of recent years and is at the lower end of the target catch range for the WTO assessments. A preliminary effort range to achieve the TAC had been generated as 70,000–100,000 pot lifts but with the current nominal effort (2009-11) of 76,370-58,356 pot lifts all below this level, a revised effort range of 50,000-80,000 pot lifts will be used until more data become available from this fishery whilst under quota management.

New management initiatives for 2012

The West Coast Deep Sea Crustacean Fishery (Interim) Management Plan (2007) was amended in 2011 to facilitate the full unitisation of the Fishery, with seven permit holders permitted to take a share of the TAC depending upon the number of units conferred on their permit.

There are separate units for Crystal Crabs (A Units) and Champagne and Giant crabs (B Units) with all units intended to be fully transferable between permit holders. This provides flexibility to trade and/or amalgamate units to optimise

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economic and operational efficiencies in the Fishery. The two tonnes combined quota for champagne and giant crabs is now transferable in its own right. This will allow better access to the fishery and enable the continued expansion of the giant and champagne crab fishery which is spatially separate from the crystal crab fishery as it occurs in different depth ranges.

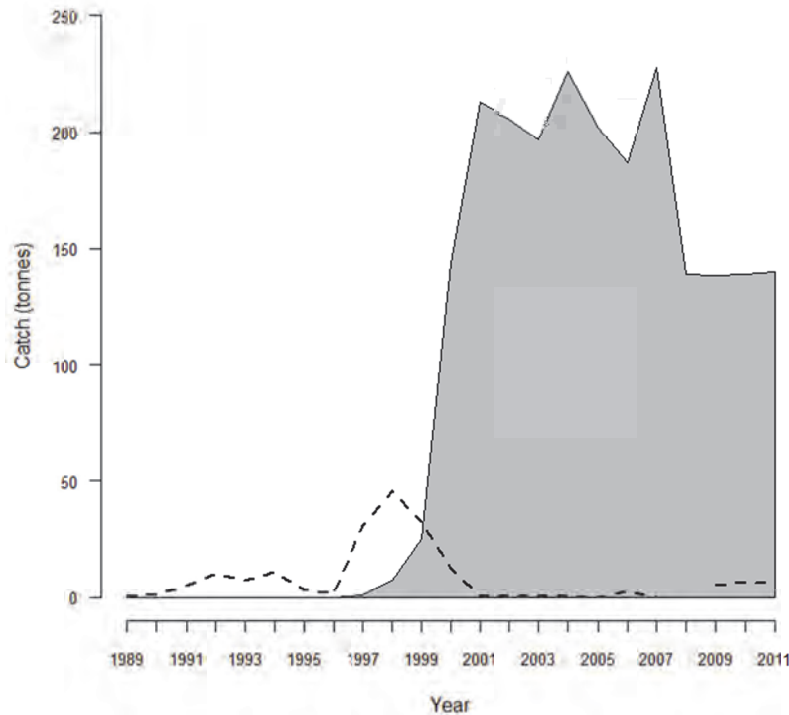
Other Management Initiatives introduced for the 2012 fishing season and beyond included:

- The use of wood batten traps to target champagne crabs;
- The use of experimental traps to target crystal crabs at a rate no greater than two traps per 100-trap line;
- The use of bait as defined in the West Coast Rock Lobster Managed Fishery Plan; and

- The inclusion of Hamelin Bay and Augusta as additional ports for fishers to land deep sea crustaceans at the southern boundary of the Fishery.

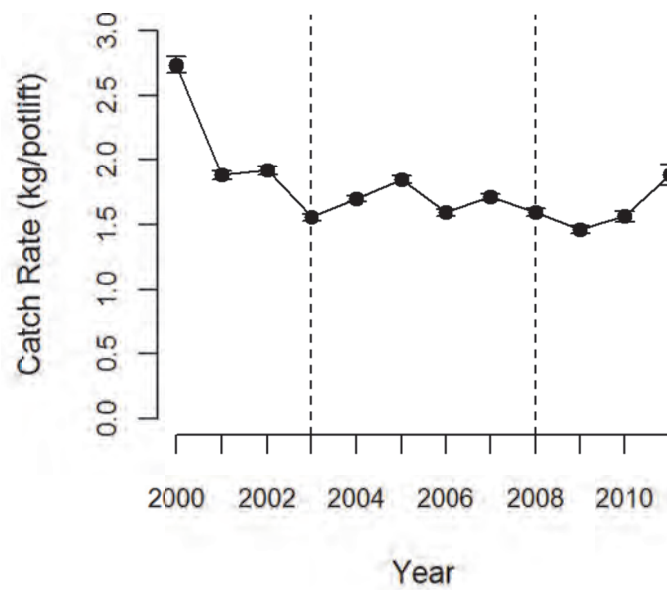
External Factors

Given a large export market, fluctuation in the Australian dollar can have impacts on the economic performance of the fishery.



WEST COAST DEEP SEA CRAB FIGURE 1

Annual catches of Crystal (grey) and Champagne (dashed) crabs since 1989. Annual giant crab catches have always been small, and they have therefore been excluded.

**WEST COAST DEEP SEA CRAB FIGURE 2**

Standardised catch per unit (\pm SE) effort since 2000 for crystal crabs. Area between vertical dashed lines indicate period when management required fishing in all zones.

West Coast Nearshore and Estuarine Finfish Resources Status Report

K. Smith, J. Brown, A. Howard, K. Walshe and J. Fissioli

| Main Features | | | |
|----------------------------|------------------|--|--------------------------------|
| Status | | Current Landings (2011) | |
| Stock level: | | Commercial total | 215 t (finfish only) |
| Australian herring | Uncertain | South West Coast Salmon Fishery | 6 t (salmon only) |
| Tailor | Acceptable | West Coast Beach Bait & South West Beach Seine Fisheries | 35 t (whitebait only) |
| Southern garfish | Acceptable | West Coast Estuarine Fishery | 74 t (finfish only) |
| Sea mullet | Acceptable | Recreational | not available for current year |
| Whitebait | Acceptable | Most recent survey 2000/01 | 940 t (key species only) |
| Black bream (Swan-Canning) | Acceptable | | |
| Cobbler (Peel-Harvey) | Acceptable | | |
| Fishing level: | | | |
| Australian herring | Under assessment | | |
| Other stocks | Acceptable | | |

Fishery Description

Commercial - Nearshore

Commercial fishers target a large number of finfish species in nearshore and estuarine waters of the West Coast Bioregion using a combination of gill nets and beach seine nets.

The Cockburn Sound (Fish Net) Managed Fishery uses gill nets in Cockburn Sound. The main target species are southern garfish (formerly southern sea garfish) (*Hyporhamphus melanochir*) and Australian herring (*Arripis georgianus*).

The South West Coast Salmon Managed Fishery operates on various beaches south of the metropolitan area. This fishery uses seine nets, to take western Australian salmon (*Arripis truttaceus*).

The West Coast Beach Bait Managed Fishery operates on various beaches from Moore River (north of Perth) to Tim's Thicket (south of Mandurah). The South West Beach Seine Fishery operates on various beaches from Tim's Thicket southwards to Port Geographe Bay Marina. These seine net fisheries both target whitebait (*Hyperlophus vittatus*), but blue sprat (*Spratelloides robustus*), sea mullet (*Mugil cephalus*), yellowfin whiting (*Sillago schomburgkii*), southern garfish and yelloweye mullet (*Aldrichetta forsteri*) are also taken in small quantities.

A number of commercial beach net fishers currently operate outside the metropolitan area under an Exemption that allows them to fish in the waters of the West Coast Demersal Scalefish (Interim) Managed Fishery. These fishers mainly use beach seine nets to target sea mullet, mulloway (*Argyrosomus hololepidotus*), Australian herring, yellowfin whiting and southern garfish.

Commercial - Estuarine

West Coast Estuarine (Interim) Managed Fishery (WCEF) operates in the Swan/Canning and Peel/Harvey estuaries. It is a multi-species fishery targeting blue swimmer crabs (*Portunus pelagicus*) and numerous finfish species. The blue swimmer crab component of the fishery is reported in the West Coast Blue Swimmer Crab Fishery status report. The finfish component is described in this report. The methods used by commercial fishers to target finfish in West Coast Bioregion estuaries are gill nets and seine nets.

A small number of operators have a condition on their Fishing Boat Licence to operate in other West Coast Bioregion estuaries (Hardy Inlet: 1 operator; Vasse/Wonnerup and Toby Inlet: 5 operators). The latter estuary system is only occasionally fished, yielding small quantities of sea mullet. These estuaries are not included in the WCEF interim management plan.

Recreational

Most finfish caught recreationally in West Coast Bioregion estuaries and nearshore waters are taken by shore or boat-based line fishing. The most commonly targeted recreational species include Australian herring, tailor (*Pomatomus saltatrix*), whiting (various species) (Sillaginidae), southern garfish, silver trevally (*Pseudocaranx* sp.) and black bream (*Acanthopagrus butcheri*) (estuaries only).

A relatively small amount of recreational net fishing occurs in the West Coast Bioregion, mainly to target sea mullet.

Governing legislation/fishing authority**Commercial**

West Coast Estuarine Fishery (Interim) Management Plan 2003

West Coast Estuarine (Interim) Managed Fishery Permit

Cockburn Sound (Fish Net) Management Plan 1995

Cockburn Sound Fish Net Managed Fishery Licence

Cockburn Sound (Line and Pot) Management Plan 1995

West Coast Demersal Scalefish Fishery (Interim) Management Plan 2007

West Coast Demersal Scalefish (Interim) Managed Fishery Permit

West Coast (Beach Bait Fish Net) Management Plan 1995

West Coast (Beach Bait Fish Net) Managed Fishery Licence

South-West Coast Salmon Fishery Management Plan 1982

South-West Coast Salmon Managed Fishery Licence

Proclaimed Fishing Zone Notice (South-West Coast) 1975

Salmon Block Net Prohibition Notice 1996

Closed waters and Permitted Gear Orders under Section 43 of the Fish Resources Management Act 1994

Condition 19 on a Fishing Boat Licence

Condition 65 and 66 on a Fishing Boat Licence

Condition 68 on a Fishing Boat Licence

Condition 84 on a Fishing Boat Licence

Condition 17 on a Commercial Fishing Licence

Salmon and Snapper Purse Seining Prohibition Notice 1987

Directions to Licensing Officers

Recreational

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

Recreational Net Fishing Licence

Consultation processes**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 - Estuarine**

WCEF: The management plan encompasses all estuaries in the West Coast Bioregion between 27° S and 33°11' S.

Complex closures exist for both the Swan/Canning and Peel/Harvey commercial fisheries (refer to management plans, related legislation and regulations).

Leschenault Estuary is closed to commercial fishing. The waters of the Vasse/Wonnerup Estuary and Toby's Inlet and all estuaries and canals located in between are open to commercial fishing.

Waters of Hardy Inlet and the Blackwood River are open to commercial fishing upstream from a line connecting Point Irwin to the Irwin Street boat ramp to a line drawn across the river from the eastern boundary of Sussex Location 133 (approximately Great North Road).

Commercial - Nearshore

Cockburn Sound (Fish Net) Managed Fishery and Cockburn Sound (Line & Pot) Managed Fishery operates within Cockburn Sound.

West Coast Beach Bait Managed Fishery covers WA waters from Moore River (north of Perth) to Tim's Thicket (south of Mandurah).

South West Beach Seine Fishery covers WA waters from Tim's Thicket south to Port Geographe marina.

South-West Coast Salmon Managed Fishery includes all WA waters north of Cape Beaufort except Geographe Bay.

Recreational

Recreational line fishing is permitted in most areas within estuaries and nearshore waters of the West Coast Bioregion. Some spatial closures exist, including closures in marine reserves and around industrial structures.

A small number of areas within estuaries and nearshore waters of the West Coast Bioregion are open to recreational netting. Recreational net fishers must hold a licence. Recreational net fishing regulations are complex – please refer to the 'Recreational Net Fishing Guide' for details.

Management arrangements**Commercial**

The West Coast Bioregion 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. Finfish fishing methods are restricted to gill nets, seine nets and haul nets.

Recreational

Recreational fishers in West Coast Bioregion nearshore and estuarine waters take a diverse array of finfish species. Size and possession limits apply to these species when caught recreationally in the West Coast Bioregion. Refer to the 'Recreational Fishing Guide - West Coast Bioregion' for details. A State-wide Recreational Fishing from Boat Licence (RFBL) was introduced on 2 March 2010. A RFBL is required to undertake any general fishing activity (including crabbing) conducted with the use of a powered boat anywhere in the State.

As many recreationally targeted species are also targeted by the commercial sector, resource-sharing issues are a major consideration in future management arrangements.

Indicator species

The Department of Fisheries has selected several key species as indicators for monitoring and assessing the status of the

WEST COAST BIOREGION

finfish resources in the West Coast Bioregion (DoF 2011¹) Australian herring, tailor, southern garfish and whiting species are indicators for this Bioregion's nearshore finfish suite and black bream, Perth herring (*Nematalosa vlaminghi*) and cobbler (*Cnidoglanis macrocephalus*) are indicators for the estuarine finfish suite. Although not an indicator, the status of sea mullet (*Mugil cephalus*) is also reported here because it is a significant component of nearshore fishery landings in this Bioregion.

Tailor, black bream and King George whiting (*Sillaginodes punctata*) are currently assigned to the 'medium risk' category (individual species daily bag limits of 8, 4 and 8, respectively, apply to recreational fishers). Australian herring, southern garfish, sea mullet, southern school whiting (*Sillago bassensis*) and Perth herring are assigned to the 'low risk' category (mixed species daily bag limit of 30 fish). Cobbler (*Cnidoglanis macrocephalus*) is assigned to the 'medium risk' category (daily bag limit of 4), except in the Swan-Canning Estuary, where a total fishing ban is in effect until 2017.

Research summary

Monitoring of fisheries and fish stocks in West Coast Bioregion nearshore and estuarine waters is based on commercial catch and effort statistics (CAES) from compulsory monthly returns, recreational catch and effort data from voluntary recreational fisher log books (Research Angler Program) and recreational fishing surveys, fishery-independent surveys using beach seine nets to monitor annual juvenile recruitment by various fish species (including Australian herring, whiting and mullet) and research angling to monitor annual juvenile tailor recruitment. Rates of fishing mortality (F) will be used to monitor the status of Australian herring, commencing in 2012.

While commercial catch levels are determined annually from data reported in compulsory monthly commercial returns, recreational catch levels are estimated only occasionally when recreational fishing surveys are conducted.

A state-funded NRM research project designed to provide more rigorous monitoring and assessment of the status of West Coast Bioregion nearshore indicator species (Australian herring, tailor, whiting species and southern garfish) commenced in mid-2009 and is due to be completed in late 2012. Volunteer anglers and commercial fishers provided samples of these species to enable researchers to determine the age structure of recreational and commercial catches in the West Coast Bioregion. This information will enable development of methods to monitor levels of fishing mortality for Australian herring.

The NRM-funded project is also examining aspects of stock structure, including sources of recruitment to the West Coast Bioregion Australian herring and tailor stocks. The majority of West Coast Bioregion tailor landings are taken by recreational fishers in the metropolitan area. Monitoring of juvenile tailor recruitment since the mid-1990s has identified

two significant 'pulses' of 0+ recruits that arrive each year. Limited data suggests that these pulses are products of both local and remote (i.e. outside Perth metropolitan waters) spawning events. Research is currently underway to examine source(s) of recruitment to the metropolitan tailor fishery, which may also assist in explaining the highly variable annual recruitment to this fishery. The proportions of Australian herring in the West Coast Bioregion fishery that originate from nursery sites in the West Coast and South Coast Bioregions is also being examined.

As an extension of the NRM-funded project, a tagging study of Australian herring commenced in 2012. Recaptures of tagged fish will provide detailed information about movement within the WCB to aid interpretation of other data and ensure effective future management for herring. Tagging and recaptures over successive years will also provide an independent estimate of mortality for comparison with estimates obtained from the analysis of age structure. This will provide an alternative estimate of F.

Retained Species

Total commercial finfish landings (2011):

132 tonnes in nearshore waters

89 tonnes in estuarine waters

Commercial landings by fishery (2011):

South West Coast Salmon: 6 tonnes (salmon)

WC Beach Bait + SW Beach Seine:

35 tonnes (whitebait)

West Coast Estuarine: 74 tonnes (finfish)

Commercial catches (West Coast Nearshore and Estuarine Table 1) are taken by estuarine fisheries and beach-based fisheries using gill nets, haul nets and beach seines. Minor quantities of the same species that are taken by other methods (e.g. purse seine, demersal gill nets and long-lines) 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 2011, the total commercial catch of finfish by estuarine and beach-based fisheries in the West Coast Bioregion included approximately 25 species. The majority of the catch consisted of sea mullet (28% by weight), Australian herring (16%), whitebait (16%) and southern garfish (9%).

Key finfish species:

Commercial nearshore species

Australian herring: Australian herring comprise a single stock across southern Australian waters. This species is targeted commercially in Western Australia (WA) and South Australia (SA). Negligible quantities are also taken commercially in Victoria. The proportion of total commercial landings taken in South Australia was relatively constant, typically 20-30% per year, from the early 1970s until 2007. However, in the past 3 years (2008-2011), SA landings comprised 43% of the national catch.

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.

In WA, 83% of total commercial landings of Australian herring since 2000 were taken in the South Coast Bioregion, with the remaining 17% taken in the West Coast Bioregion. Within the South Coast Bioregion, 90% of landings since 2000 were taken by the ocean beach-based herring trap net fishery (see South Coast Nearshore and Estuarine Finfish Resources Report), 6% taken in estuaries and the remainder taken by other fishers in nearshore waters. All trap net fishery landings were taken in the Albany area. Within the West Coast Bioregion, 60% of landings since 2000 were taken in the Geographe Bay/Bunbury area, 23% taken in Cockburn Sound and 9% taken in the Peel-Harvey Estuary.

Nationally, commercial landings of Australian herring peaked at approximately 1800 t per year in the late 1980s and early 1990s and steadily declined thereafter (West Coast Nearshore and Estuarine Figure 1). National landings were approximately 265 t in 2011, the lowest level since the start of reliable catch records in 1950. Commercial landings within WA and in SA each followed this trend. In WA, landings peaked at 1,537 t in 1991 and reached an historical low of 147 t in 2011. In SA, landings peaked at 498 t in 1987/88 and reached an historical low of 105 t in 2006/07. In 2010/11, 118 t of herring was landed in SA¹.

In the South Coast Bioregion of WA, the total annual commercial catch reached an historical peak of 1,427 t and then steadily declined to an historical low of 110 t in 2011. Recent low catches in the South Coast Bioregion reflects declining catches by the trap net fishery. The decline is believed to be due a combination of factors – reduced availability of fish due to multiple recent years of low recruitment and lack of targeting by the trap net fishery in response to low market demand.

In the West Coast Bioregion, the total annual commercial catch of Australian herring reached an historical peak of 211 t in 1988 and attained a similar level of 191 t in 1992. Annual landings then steadily declined to reach an historical low of 31 t in 2010. In 2011, the catch remained low at 37 t. The downward trend in the West Coast Bioregion mainly reflected declining catches in the Geographe Bay/Bunbury area. Landings of Australian herring in Cockburn Sound declined only slightly. Declines in the Geographe Bay/Bunbury area were partly due to a substantial decline in fishing effort (i.e. decline in targeting) after 2005. Prior to 2005, annual effort was stable/increasing and the decline in catch was mainly attributable to the reduced availability of fish.

Tailor: In WA, tailor is found in coastal waters from Onslow to Esperance and is likely to constitute a single stock over this range. Incomplete records prior to 1976 suggest the total WA annual commercial catch of tailor probably peaked in 1965 at approximately 90 t. Since 1976, annual landings have fluctuated between 19 and 59 t and the overall trend was stable (non-directional) (West Coast Nearshore and Estuarine Figure 2). In 2011, the total WA catch of tailor was 25 t,

which was mostly caught in the Gascoyne Coast Bioregion. Since 2000, 84% of total WA commercial landings of tailor have been taken in the Gascoyne Coast Bioregion, 15% in the West Coast Bioregion and 1% in the South Coast Bioregion.

In the Gascoyne Coast Bioregion, total landings of tailor were typically 20-30 t per year during the period 1976-1990. Annual landings were markedly higher (>30 t per year) during the period 1990-2000, including an historical peak of 49 t in 1999. Elevated catches in this period probably reflect a higher availability of fish due to strong recruitment. After 2000, annual landings returned to levels similar to those reported prior to 1990. In 2011, the Gascoyne catch was 18 t, virtually all of which was taken in Shark Bay.

In the West Coast Bioregion, total landings of tailor declined from 28 t in 1976 to reach an historical minimum of 2 t in 2008. Subsequent landings have increased slightly, reaching 6 t in 2011. Since 2000, the majority (55%) of West Coast landings were taken in the Peel-Harvey Estuary.

Whiting: From 2000 to 2011, 67% of total commercial landings of whiting (all species) in WA were taken in the Gascoyne Coast Bioregion, 23% were taken in the West Coast Bioregion, 7% in the South Coast Bioregion and 3% in the North Coast Bioregion. Since 2000, the Hardy Inlet and the Peel-Harvey Estuary each contributed about 25% of total commercial whiting landings in the West Coast Bioregion.

Within the West Coast Bioregion, total landings over this period were reported to be mainly yellowfin whiting (86%) and King George whiting (9%). However, with the exception of King George whiting, there may be misidentification of some commercial landings of whiting. At least five species of *Sillago* are known to be taken commercially in the West Coast Bioregion. The species composition of whiting landings (commercial and recreational) is currently being investigated by the Department.

The total annual commercial catch of whiting in the West Coast Bioregion was 27 t in 2011. The whiting catch has been gradually declining due to an ongoing reduction in commercial effort in estuarine and nearshore waters as a result of various fishery adjustment schemes (licence buy-backs) operating since 1990.

Southern garfish: There are possibly five species of garfish landed in WA waters. However, the vast majority of commercial garfish landings are believed to be southern garfish (*Hyporhamphus melanochir*) with small quantities of river garfish (*H. regularis*) and robust garfish (*H. robustus*) also landed. Since 2000, 54% of total commercial landings of garfish in WA have been taken in the West Coast Bioregion, with 31% from the South Coast, 13% from the Gascoyne Coast and 1% from the North Coast Bioregions.

In the West Coast Bioregion, total annual garfish landings peaked at 44 t in 1999. Subsequently, annual landings were quite variable but the overall trend was downward until 2007, when 11 t was taken. The decline was partly due to a reduction in commercial effort. Since 2007, West Coast Bioregion total annual garfish landings have been increasing gradually. In 2011, 19 t of garfish was taken in the West Coast Bioregion.

Since 1995, 82% of total commercial landings of garfish in the West Coast Bioregion have been taken in Cockburn Sound. The historical peak in annual landings within Cockburn Sound was 37 t in 1999. Since 2000, annual

¹ Knight MA and Tsolos A. 2012. South Australian Wild Fisheries Information and Statistics Report 2010/11. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2008/000804-4. SARDI Research Report Series No. 612. 57pp.

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landings of garfish in Cockburn Sound have been relatively stable, ranging between 10 and 20 t.

Whitebait: In WA, whitebait occurs from Kalbarri southwards but is relatively rare along the south coast. All commercial landings of whitebait in WA are taken in the West Coast Bioregion, between Perth and Busselton. Fishing occurs in two areas: Area 1 (Tim's Thicket to Busselton) is fished by the West Coast Beach Bait Managed Fishery and Area 2 (Perth to Tim's Thicket) is fished by the South West Beach Seine Managed Fishery. Total landings have declined since the 1990s when historic peaks of about 330 t occurred in 1990 and 1997 (West Coast Nearshore and Estuarine Figure 3). The decline partly reflects declines in landings in Area 1 following effort reductions in this area. Annual landings in Area 2 have been relatively stable (with the exception of 2011) and virtually all (97%) landings since 2004 have been in this area. In 2011, the total commercial catch of whitebait was 35 t, all of which was landed by the South West Beach Seine Fishery. This was the lowest catch since the commencement of the fishery in the early 1970s. It coincided with very unusual oceanographic conditions associated with a 'heatwave' event along the west coast (Pearce et al. 2011¹). Substantial variations in whitebait landings appear to occur in response to environmental factors including El Niño-Southern Oscillation (ENSO) and Leeuwin Current fluctuations.

Sea mullet: Sea mullet occurs in coastal waters in all WA Bioregions. There is likely to be connectivity between Bioregions due to adult migration and larval dispersal, which could result in a shared sea mullet stock across some/all Bioregions. There may also be connectivity between sea mullet along the south coast of WA and in SA. The total WA annual catch of sea mullet peaked at 694 t in 1988 and then gradually declined (West Coast Nearshore and Estuarine Figure 4). The decline was mainly due to widespread reductions in commercial fishing effort in nearshore and estuarine waters. In 2011, the WA total catch was 213 t.

Historically, annual landings of sea mullet were higher in the WCB than in the GCB but, since 2000, GCB landings have been slightly higher each year. From 2000 to 2011, 45% of total commercial landings of sea mullet in WA were taken in the Gascoyne Coast Bioregion, with 43% from the West Coast, 11% from the South Coast and <1% from the North Coast Bioregions.

In the West Coast Bioregion, commercial landings of sea mullet were highest during the 1970 and 1980s, including an historical peak of 429 t in 1988. Between 1988 and 2004, the total annual catch in the West Coast Bioregion steadily declined. The decline was partly due to an ongoing reduction in commercial effort in estuarine and nearshore waters as a result of various Voluntary Fisheries Adjustment Schemes (VFAS) (licence buy-backs) operating since 1990. From 2004 to 2011, total landings were stable at 100-120 t per year. In 2011, landings declined to 62 t. Since 2000, 49% of total commercial landings of sea mullet in the West Coast

Bioregion were taken in the Peel-Harvey Estuary and 16% from ocean waters near Jurien Bay (latitude 30-31°S).

In the South Coast Bioregion, commercial landings of sea mullet have been stable (non-directional) over a long period. Since 1976 the annual catch has averaged 36 t (range 11-94 t per year). In 2011, the catch was 31 t. Historically, the vast majority (>90%) of annual landings of sea mullet in the South Coast Bioregion have been from estuaries. Since 2000, 30% of total commercial landings of sea mullet in the South Coast Bioregion have been taken in Wilson Inlet, 18% in Oyster Harbour, 17% in Beaufort Inlet, and 14% in Gordon Inlet. Minor sea mullet landings were reported in all other estuaries open to commercial fishing over this period.

In the Gascoyne Coast Bioregion, commercial landings of sea mullet peaked at 266 t in 1982, and have since gradually declined. Since 2000, the annual commercial catch has fluctuated between 64 and 165 t. Virtually all landings were taken in Shark Bay. In 2011, 100 t of sea mullet was caught commercially in the Gascoyne Coast Bioregion.

Commercial estuarine species

Perth herring: Perth herring is endemic to the West Coast Bioregion of WA and constitutes a single stock over this range. 'Perth herring' previously reported from the Gascoyne Coast Bioregion are now believed to be a different species. Historically, the majority of landings of this species were caught in the Swan-Canning Estuary. Commercial targeting of Perth herring in this estuary ceased in 2007. The minor quantities taken in subsequent years were predominantly from the Peel-Harvey Estuary. Since 2000, <3 t of Perth herring per year has been reported from the Peel-Harvey Estuary.

Recent landings of Perth herring are very low compared to historical landings. From 1963 to 1988, annual commercial catches of Perth herring in the Swan-Canning Estuary were consistently >40 t, including a historical peak of 178 t in 1968. Total West Coast Bioregion landings peaked at 239 t in 1978. Declining landings are partly due to an ongoing reduction in commercial effort in estuarine and nearshore waters as a result of VFAS (licence buy-backs) operating since 1990. However, decreasing stock abundance as a result of deteriorating environmental conditions in West Coast Bioregion estuaries and historical overfishing are believed to be the main factors contributing to the current low stock level.

Cobbler: In WA, commercial targeting of cobbler is essentially 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. Since 2000, 95% of commercial landings of cobbler have been caught in estuaries of the South Coast Bioregion, with the remaining 5% in estuaries of the West Coast Bioregion. Virtually all West Coast landings over this period were in the Peel-Harvey Estuary.

Historically, commercial catches of cobbler in West Coast Bioregion estuaries were much higher. Landings peaked at 298 t in 1961 in the Peel-Harvey Estuary, at 158 t in 1958 in Leschenault Estuary and at 56 t in 1960 in the Swan-Canning Estuary. Landings in the Hardy Inlet have always been relatively low.

¹ Pearce, A., Lenanton, R., Jackson, G., Moore, J., Feng, M. and 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. 40pp.

In the Peel-Harvey Estuary, cobbler landings during the 1950s, 1960s and 1970s were frequently >100 t. Landings in the 1970s (1970-79) averaged 127 t per year. However, annual landings fell dramatically from 233 t to 49 t between 1980 and 1982. From 1983 to 1996, annual landings ranged from 3 to 74 t. Since 1996, annual landings have ranged from <1 t to 10 t. In 2011, 7 t of cobbler was reported in this estuary.

In the Swan-Canning Estuary, annual cobbler landings during the 1960s and 1970s were frequently >20 t (average catch 31 t per year for period 1959-1977). However, landings fell dramatically from 76 t to 7 t between 1976 and 1978. From 1978 to 1996, annual landings ranged from 1 to 10 t. After 1997, annual catches in the Swan-Canning Estuary were <800 kg. A prohibition to catch cobbler in the Swan-Canning Estuary was introduced on 6 July 2007 in order to protect the stock.

In the Leschenault Estuary, a period of relatively high cobbler landings occurred from 1955 to 1965 (average 45 t per year, 1955-65). Landings declined from 17 t in 1978 to 2 t in 1979. From 1979 until the closure of the commercial fishery in 2000/01, annual catches of cobbler ranged from <1 t to 6 t.

Declining landings are partly due to an ongoing reduction in commercial effort in estuaries since 1990. However, decreasing stock abundance as a result deteriorating environmental conditions in West Coast Bioregion estuaries and historical overfishing are believed to be the main factors contributing to the current low stock levels.

Black bream: Black bream is a true estuarine species, spending its entire life cycle in these waters. 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. Since 2000, 93% of commercial landings of black bream have been in the South Coast Bioregion, with the remaining 7% from the West Coast Bioregion.

In the West Coast Bioregion, commercial landings of black bream have always been relatively low compared to landings of other estuarine target species. Historically, the Swan-Canning Estuary and Hardy Inlet contributed the vast majority of commercial black bream landings. Landings peaked at 8 t in 1996 in the Swan-Canning Estuary and peaked at 4 t in 1983 in Hardy Inlet. Occasional landings were taken in the Leschenault Estuary (<2 t per year), prior to the closure of that fishery. Annual landings of bream in the Peel-Harvey Estuary have always been negligible. Commercial targeting of black bream in the Swan-Canning Estuary has been negligible since 2007, resulting in the Hardy Inlet now being the only (albeit minor) commercial bream fishery in the West Coast Bioregion.

Since 2000, total West Coast Bioregion commercial landings of black bream have ranged from <1 to 5 t per year.

Recreational catch estimate (2011): N/A

Most recent catch estimate (2000/01):
940 tonnes (key species only)

The recreational catch levels of finfish in nearshore and estuarine waters of the West Coast Bioregion were not estimated for 2011. The most recent estimates are from the

National Recreational and Indigenous Fishing Survey conducted in 2000/01 (West Coast Nearshore and Estuarine Table 2). The exception is Hardy Inlet, where a creel survey was conducted in 2005/06¹. While the dominant species in the nearshore catch are probably similar to those caught in 2000/01, the current catch and effort levels by nearshore recreational fishers may have changed substantially since this survey. Therefore, current total catch level cannot be estimated.

Overall, the most abundant species in the retained catch (nearshore and estuarine combined) in 2000/01 were Australian herring (48% by number), whiting (various species, excluding King George) (24%), tailor (9%), southern garfish (3%), King George whiting (2%) and trevally (*Pseudocaranx* spp.).

The regions of highest catches were southern metropolitan, Mandurah and Geographe Bay/Bunbury, each of which contributed about 20% of all retained fish. In nearshore waters, 61% of retained fish were taken by shore fishers.

Surveys of boat-based recreational fishing in the West Coast Bioregion estimated catches of key nearshore species in 1996/97 and 2005/06 (West Coast Nearshore and Estuarine Table 3). Boat-based landings of many nearshore species typically declined between these surveys. This trend could indicate a decline in abundance of nearshore species. However, since landings of demersal species typically increased between surveys, it may also reflect a shift in effort by boat-based fishers towards targeting of demersal species instead of nearshore species.

Additional West Coast Bioregion boat-based surveys were conducted in 2008/9 and 2009/10. A comprehensive Statewide Recreational Boat Fishing Survey was conducted in 2011/12, with results due in late 2012 (Department of Fisheries, unpub. data).

Total landings of nearshore and estuarine species cannot be estimated from the results of these boat-based surveys because shore-based fishers, who are believed to take the majority of the recreational nearshore and estuarine finfish catch, were not surveyed.

The Department of Fisheries recently conducted a pilot study of shore-based fishers in the Perth Metropolitan area from April to June 2010 in an attempt to determine the best method to quantify recreational fishing catch and effort from this sector (Smallwood et al. 2011²). During this three-month pilot study, the most frequently retained species were Australian herring, southern garfish and whiting (combined species).

¹ Prior SP and Beckley LE. 2006. Creel survey of the Blackwood Estuary, 2005-06. Final report to South West Catchments Council (Project C3-01).

² Smallwood CB, Pollock KH, Wise BS, Hall NG and Gaughan DJ. 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.

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Recreational catch share

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

Fishing effort/access level

Commercial

Since the early 1990s, the number of licences in nearshore and estuarine commercial fisheries has been substantially reduced via VFAS. 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 sometimes reported as the number of units of access (vessels, licensees, teams, etc). These measures of effort provide a general indication of effort changes over time and are often the only types of effort data available throughout the history of each fishery. Where possible, effort is also calculated as the number of days fished by each method. It is considered that 'method days fished' generally provides a more accurate measure of the effort undertaken in each fishery.

Licence holders in the West Coast Bioregion estuaries that are open to commercial fishing are endorsed to fish a single estuary system only.

Peel-Harvey Estuary: A substantial proportion of fishing effort in this estuary is directed towards the capture of blue swimmer crabs (50-60% of method days per year since 2000). The vast majority of crabs are taken by crab pots, whereas finfish are taken by gill and haul nets. Since 2000, the effort spent targeting finfish in this estuary (i.e. days spent gill and haul netting) has been stable, fluctuating between 600 and 1200 method days per year. Since 2000, the mean number of active fishing units per month has been about 8. There are currently 11 licences in the fishery.

Swan-Canning Estuary: The mean number of active fishing units per month declined from about 25 in the mid-1970s to 1 in 2009 and subsequent years. The majority of total commercial effort in 2011 and other recent years was spent targeting blue swimmer crabs.

Hardy Inlet: The mean monthly number of fishing units declined from 3 in the 1970s to 1 in 2000 and subsequent years, including 2011. Virtually all commercial effort in recent years was spent targeting a limited number of finfish species.

Cockburn Sound (Fish Net) fishery: Since the early 1990s, there has been a progressive decline in the number of commercial licences operating in Cockburn Sound as a result of VFAS. In the Cockburn Sound (Fish Net) fishery, the number of licences fell from six in the early 1990s to one in 2003 and subsequent years. All effort by this fishery is spent targeting finfish.

Moore River to Kalbarri: The total number of method days fished in this region by shore-based net fishers (gill nets, haul nets and beach seines only) in 2011 was 318. In 2011, 6 licensees reported finfish landings by netting methods in this region.

South West Coast Salmon Fishery: From 1997 to 2005, 15 teams were licenced to capture western Australian salmon in the West Coast Bioregion. This number was

reduced via VFAS to 12 teams in 2006 and then to 8 teams in 2010 and subsequent years. Only 3 of the 8 teams reported salmon catches in 2011.

West Coast Beach Bait and South West Beach Seine Fisheries: In 2011, 5 licensees reported landings of whitebait.

Recreational

Twelve month surveys of boat-based fishing in the West Coast Bioregion were conducted in 1996/7, 2005/6, 2008/9 and 2009/10. The 2011/12 Statewide Recreational Boat Fishing Survey will provide recreational boat fishing effort data for the West Coast Bioregion in 2012. These surveys estimated the total effort expended by boat-based recreational fishers in the West Coast Bioregion, including effort expended on all species. However, the proportion of boat-based effort spent targeting nearshore finfish during these surveys is unknown.

Recent estimates of effort by shore-based recreational fishers, who are believed to capture the majority of nearshore and estuarine finfish in the West Coast Bioregion, are unavailable. Effort data from the recently conducted pilot study of shore-based fishers (Smallwood *et al.* 2011¹) is not included here as this study's aim was to examine the relative benefits of different survey techniques and only investigated 3 months of metropolitan recreational fishing.

The 2000/01 National Recreational and Indigenous Fishing Survey, which included all methods and Bioregions, provided the most recent comprehensive information on recreational fishing effort in the West Coast Bioregion. About 95% of the nearshore and estuarine 'fishing events' that were targeting finfish during the survey used line fishing (bait or lure). About 75% of line fishing events in both nearshore and estuarine waters were shore-based. In nearshore waters, the estimated line fishing effort (either bait or lure) in 2000/01 comprised 946,841 shore-based and 308,673 boat-based fishing events during the 12-month survey period.

Stock Assessment

Assessment complete: Not all

Assessment level and method:

Level 2 - Catch rates

Breeding stock levels:

| | |
|--|---------------------|
| Australian herring | Uncertain |
| Tailor | Adequate |
| Southern garfish (Cockburn Sound) | Adequate |
| Whiting species | Not assessed |
| Sea mullet | Adequate |
| Whitebait | Adequate |
| Black bream (Swan-Canning) | Adequate |

¹ Smallwood CB, Pollock KH, Wise BS, Hall NG and Gaughan DJ. 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.

| | |
|--------------------------------------|---------------------|
| Black bream (other estuaries) | Not assessed |
| Cobbler (Peel-Harvey) | Adequate |
| Cobbler (other estuaries) | Not assessed |
| Perth herring | Not assessed |

Indicator species - nearshore

Australian Herring (Uncertain): Australian herring form a single, genetically homogeneous breeding stock across southern Australia. Spawning occurs mainly in the lower West Coast Bioregion (Perth to Augusta) in WA during May-June. Eggs and larvae are dispersed by the Leeuwin Current to coastal nurseries distributed from the West Coast Bioregion to Victoria. A strong Leeuwin Current associated with a *La Niña* event can result in high annual recruitment outside the West Coast Bioregion due to greater larval dispersal. Australian herring caught by the trap net commercial fishery in the South Coast Bioregion are mainly pre-spawning fish undergoing a westward migration to the West Coast Bioregion to spawn. These fish originate from juvenile nurseries in the South Coast Bioregion, SA and (to a lesser extent) Victoria. Australian herring caught in the West Coast Bioregion are a combination of these fish, plus fish originating from local juvenile nurseries in the West Coast Bioregion. There is no reverse migration after spawning – all adult fish remain in the West Coast Bioregion after spawning. Adult fish (the spawning stock) are primarily targeted by the West Coast Bioregion recreational fishery.

Declining commercial catch and catch rates suggest declining availability of Australian herring since 2000 in the South Coast Bioregion and in southern parts of the West Coast Bioregion (Capes, Geographe Bay and Bunbury regions) (Figure 1 and 5) but stable availability in Perth and in areas north of Perth. The catch rates of voluntary recreational logbook fishers also suggest a relatively stable trend in the availability of Australian herring in Perth from 2006 to 2011, albeit with a slight decline in 2011 (West Coast Nearshore and Estuarine Figure 6). Declining catches in southern areas reflect a reduced availability of fish, probably due to low recruitment in these areas since 2000 (West Coast Nearshore and Estuarine Figure 7). Stable Perth catch rates possibly reflect more stable levels of annual recruitment in this area. Alternatively, catchability could have been maintained in this area due to the aggregation of spawning fish, despite a decline in overall stock abundance.

The cause of low recruitment in recent years appears to be partly due to environmental factors including the strength of the Leeuwin Current (weak south coast recruitment tends to occur in years of weak current). Very low recruitment was observed in 2011 during extremely unusual oceanographic conditions along the west coast, including summer temperatures $>3^{\circ}\text{C}$ above average in some areas (a ‘heatwave’ event, Pearce *et al.* 2011¹) (West Coast Nearshore and Estuarine Figure 7).

An extensive analysis of Australian herring sampled from

¹ Pearce, A., Lenanton, R., Jackson, G., Moore, J., Feng, M. and 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. 40pp.

commercial and recreational landings since the 1970s was completed in 2011/12. The analyses of these data are currently undergoing external review which is expected to be completed by the end of 2012.

Tailor (Acceptable): Catch rates from a volunteer fishing program in the Swan-Canning Estuary provide an indicator of the strength of annual recruitment by juvenile (age 0) tailor to the West Coast Bioregion. Since this recruitment index began in 1996 there have been highly variable levels of annual recruitment (West Coast Nearshore and Estuarine Figure 8). Recruitment has followed an increasing trend since 2003. Anecdotal reports by West Coast recreational fishers of increasing catch rates of adult tailor over the past 3 years are consistent with the increases in the recruitment index over this period. Catch and catch rates of tailor in the main commercial fishery, the Shark Bay Beach Seine and Mesh Net Fishery, are within the historical range and are considered acceptable.

Southern garfish (Acceptable): Southern garfish are distributed across southern Australia from Kalbarri (WA) to Eden (NSW), and Tasmania. Southern garfish populations on the west and south coasts of WA are genetically distinct (Donnellan *et al.* 2002²) and are managed as separate stocks. Population structuring at finer scales has not been examined in WA, but evidence from elsewhere indicate that garfish populations are comprised of numerous sub-populations which are separated by small (<60 km) distances (Steer *et al.* 2009³, 2010⁴). On this evidence, garfish caught in Cockburn Sound are assumed to belong to a distinct sub-population and treated as a discrete management unit.

Cockburn Sound provides the majority of commercial landings of southern garfish. Recreational landings in this area are also believed to be substantial, although the total recreational catch is unknown due to lack of information about the shore-based component of the catch. Southern garfish are dependent on seagrass and other marine vegetation for reproduction and feeding. Seagrass area in Cockburn Sound has declined by around 80% since the 1950s and continues to be under threat due to ongoing development (e.g. dredging) (Cockburn Sound Management Council 2005⁵). For these reasons, the sustainability of garfish in

² Donnellan S, Haigh L, Elphinstone M, McGlennon D & Ye Q. 2002. Genetic discrimination between southern sea garfish (*Hyporhamphus melanochir*) stocks of Western Australia South Australia, Victoria and Tasmania. In Fisheries Biology and Habitat Ecology of Southern Sea Garfish (*Hyporhamphus Melanochir*) in Southern Australia (Jones GK, Ye Q, Ayvazian S & Coutin P, eds), pp. 9-34. FRDC Project 97/133. Canberra: Fisheries Research and Development Corporation.

³ Steer M, Fowler AJ and Gillanders BM. 2009. Age-related movement patterns and population structuring in southern garfish, *Hyporhamphus melanochir*, inferred from otolith chemistry. Fisheries Management and Ecology. 16:265–278.

⁴ Steer M, Halverson GP, Fowler AJ and Gillanders BM. 2010. Stock discrimination of Southern Garfish (*Hyporhamphus melanochir*) by stable isotope ratio analysis of otolith aragonite. Environmental Biology of Fish 89:369–381.

⁵ Cockburn Sound Management Council. 2005. Environmental Management Plan for Cockburn Sound and its Catchment. Department of Environment, Perth.

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Cockburn Sound is at higher risk than other populations in WA.

Commercial catch rates suggest the abundance of garfish in Cockburn Sound varies annually although the overall trend suggests long term stability in abundance since 1996 (West Coast Nearshore and Estuarine Figure 9).

Sea mullet (Acceptable): A single breeding stock of sea mullet is believed to occur in each Bioregion. It is not known whether the same breeding stock occurs in the Gascoyne Coast, West Coast and South Coast Bioregions, although there is likely be connectivity between Bioregions due to adult migration and larval dispersal, which could result in a single stock across some/all Bioregions. Adult sea mullet typically occur in estuaries, except in winter when they migrate to ocean waters to spawn. Juveniles recruit to estuaries, where they remain until maturity. Trends in catch rates of sea mullet in Oyster Harbour and the Peel-Harvey Estuary are assumed to be indicative of abundance trends in the South Coast and West Coast Bioregions, respectively. These estuaries are permanently open to the sea. Catch rates of sea mullet in other estuaries that are seasonally closed can vary according to the extent of connectivity to the sea (i.e. sand bar openings) rather than regional abundance. In the Gascoyne Coast Bioregion, catch rates in Shark Bay are assumed to be indicative of regional abundance trends.

The annual commercial catch rate of sea mullet since 1980 in Shark Bay, Peel-Harvey Estuary and Oyster Harbour suggest a stable long-term trend in the availability of sea mullet in the Gascoyne Coast, West Coast and South Coast Bioregions, respectively (West Coast Nearshore and Estuarine Figure 10).

Whitebait (Acceptable): Highly variable annual catches and catch rates are characteristic of this fishery. Variations in catch level are correlated with the strength of the Leeuwin Current in the previous year and with rainfall (Gaughan *et al.* 1996¹). The total commercial catch of 35 t in 2011 was the lowest since the commencement of the commercial whitebait fishery in the early 1970s. Highly unusual oceanographic conditions, resulting in a 'heatwave' event along the west coast of WA (Pearce *et al.* 2011²), occurred in 2011 and are likely to be the main reason for the low catch level.

Anecdotal reports and fishery-independent recruitment surveys by the Department in the Perth area are in agreement with local commercial catch and catch rate trends, all suggesting low abundance of whitebait in the Perth area in recent years due to poor juvenile recruitment (West Coast Nearshore and Estuarine Figures 3 and 11). An increase in juvenile recruitment was observed in 2011/12, which is expected to result in an increase in adult abundance in the Perth area in the following year. The annual catch and catch rate trends of whitebait in the Bunbury area suggest relatively stable long term abundance of whitebait in this area.

¹ Gaughan, D., Fletcher WJ, Tregonning RJ, and Goh J. 1996. Aspects of the biology and stock assessment of the whitebait, *Hyperophus vittatus*, in south western Australia. Fisheries Research Report No. 108. Department of Fisheries, Western Australia. 127pp.

² Pearce A, Lenanton R, Jackson G, Moore J, Feng M and 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. 40pp.

Indicator species - estuarine

Black bream (Acceptable - Swan-Canning; Not assessed - other estuaries):

In the Swan-Canning Estuary, commercial and recreational catch rates suggested an increase in black bream availability between 1990 and 2000, followed by a slight decline from 2000 to 2006 (Smith 2006). Voluntary recreational logbook fisher catch rates suggest a slight decline in the availability of black bream in this estuary from 2005/6 to 2010/11 (West Coast Nearshore and Estuarine Figure 12). Black bream in other West Coast estuaries are not assessed.

Cobbler (Acceptable - Peel-Harvey; Not assessed - Swan-Canning and Leschenault):

Commercial catch rates suggest a stable trend in the availability of cobbler in the Peel-Harvey Estuary from 1990 until 2010. An increase in the catch rate in 2011 suggests the highest level of abundance since 1990 (West Coast Nearshore and Estuarine Figure 13). Cobbler in the Swan-Canning Estuary was assessed via catch rate trends until a fishing ban was imposed in 2007. Anecdotal information suggests ongoing low abundance of the estuarine stock. Cobbler in Leschenault Estuary has not been assessed since the commercial fishery closure in 2000.

Perth herring (Not assessed): Perth herring was assessed via commercial catch rate trends in the Swan-Canning Estuary until cessation of fishing for this species in 2007. Catch rates suggested a major decline in the availability of Perth herring after 1980. A single breeding stock of Perth herring occurs in the West Coast Bioregion. Swan-Canning catch rates are assumed to be representative of regional availability. Limited fishery-independent evidence suggests regional abundance remains relatively low compared to historical levels. However, insufficient information is available to assess current stock status. The development of fishery-independent monitoring methods is required for this species. Low spawning success due to environmental degradation in the upper reaches of West Coast estuaries and low rainfall are believed to be the main causes of low stock abundance.

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.

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consecutive years. The West Coast herring catch in 2011 (37 t) was below the target range. The West Coast herring catch has been below the target range for 7 of the past 8 years (similar to the trend in the South Coast herring catch, which has been below the target range for 8 consecutive years). In 2011, the commercial catch of whitebait (35 t) was below the target range. This is only the second year that the whitebait catch has been outside the target range (2006 was the first).

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

New management initiatives

The Department will be considering the results of recently completed research on the status of key nearshore species stocks and examining their implications for current management arrangements.

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.

Many nearshore species are known to have their abundance levels affected by annual variation in coastal currents (particularly the Leeuwin and Capes Currents). These currents appear to influence the recruitment patterns of larvae of species such as whitebait, tailor, Australian herring and western Australian salmon and thus their subsequent recruitment into each fishery (Lenanton *et al.* 2009²).

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. This 'heatwave' event caused widespread fish kills in the West Coast Bioregion. During and after this event there were reports of 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 many nearshore finfish species, which is likely to have affected the catch levels of these species in 2011 and may continue to affect them in subsequent years.

The abundance of nearshore and estuarine species is likely to be affected by the quantity and quality of habitats that are available for spawning, feeding and/or nursery areas. Habitat loss is ongoing due to coastal development in the West Coast Bioregion and this is likely to result in further reductions in the abundance of nearshore and estuarine species. For example, loss of seagrass in Cockburn Sound is likely to have reduced garfish abundance. Since the 1950s, approximately 80% of the seagrass meadows in Cockburn Sound have been lost as a result of environmental degradation (Cockburn Sound Management Council 2005³). Juveniles of King George whiting are also strongly associated with seagrass and so may be impacted by habitat loss in Cockburn Sound.

West Coast Bioregion estuaries are highly modified, and often degraded, environments. In these estuaries, the impacts of environmental factors on stock abundances are likely to be at least as important as fishing pressure. Anecdotal reports suggest that habitat and climatic changes have altered the composition and abundance of fish communities in West Coast Bioregion estuaries, although lack of historical monitoring makes many of these changes difficult to quantify. However, in the Swan-Canning Estuary, abundant fishery data provides evidence of marked declines in fish abundance since 1990 or earlier (Smith 2006⁴). Stock declines in West Coast Bioregion estuaries are most pronounced among 'estuarine-dependent' species, i.e. those that rely on estuarine habitats for spawning, feeding and/or nursery areas (e.g. cobbler, Perth herring, black bream). Whilst not strictly estuarine-dependent, sea mullet and yelloweye mullet exhibit a strong preference for estuarine habitats when available. The status of these species may also be affected by the availability and quality of estuarine habitats. A variety of barriers to fish passage occur in estuaries (e.g. weirs, dredge plumes) which can disrupt the life cycle of migratory species (e.g. mullet, Perth herring).

Fluctuating market demand is a significant factor affecting the annual commercial catch level of many species.

¹ Hobday AJ, Poloczanska ES and Matear RJ (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.

² Lenanton RC, Caputi N, Kangas M & Craine M 2009 The ongoing influence of the Leeuwin Current on economically important fish and invertebrates off temperate Western Australia - has it changed? *Journal of the Royal Society of Western Australia* 92: 111-127.

³ Cockburn Sound Management Council. 2005. Environmental Management Plan for Cockburn Sound and its Catchment. Department of Environment, Perth.

⁴ Smith KA. 2006. Review of fishery resources and status of key fishery stocks in the Swan-Canning Estuary Fisheries Research Report 156. Department of Fisheries, Perth.

WEST 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 West Coast Bioregion, 2007 to 2011.

| Species | Scientific name | Catch (tonnes) | | | | |
|---------------------------|----------------------------------|----------------|--------------|--------------|--------------|--------------|
| | | 2007 | 2008 | 2009 | 2010 | 2011 |
| Western Australian salmon | <i>Arripis truttaceus</i> | 622.9 | 333.4 | 494.6 | 69.0 | 6.3 |
| Whitebait | <i>Hyperlophus vittatus</i> | 99.1 | 57.9 | 139.6 | 100.6 | 34.8 |
| Sea mullet | <i>Mugil cephalus</i> | 99.6 | 94.8 | 103.0 | 102.1 | 56.8 |
| Australian herring | <i>Arripis georgianus</i> | 41.5 | 34.7 | 34.6 | 30.6 | 36.9 |
| Yelloweye mullet | <i>Aldrichetta forsteri</i> | 37.0 | 26.2 | 26.1 | 24.7 | 11.5 |
| Whiting species | <i>Sillago</i> spp. | 22.9 | 21.7 | 23.9 | 22.5 | 21.6 |
| Southern garfish | <i>Hyporhamphus melanochir</i> | 11.5 | 11.0 | 15.7 | 15.8 | 19.2 |
| Cobbler | <i>Cnidoglanis macrocephalus</i> | 0.8 | 6.9 | 9.3 | 5.4 | 7.1 |
| Perth herring | <i>Nematalosa vlahmingi</i> | 5.6 | 0.7 | 1.6 | 0.1 | 0.4 |
| Tailor | <i>Pomatomus saltatrix</i> | 1.7 | 1.5 | 7.1 | 4.8 | 6.3 |
| King George whiting | <i>Sillaginodes punctata</i> | 0.9 | 5.1 | 2.0 | 5.9 | 4.4 |
| Trevally | Carangidae | 2.0 | 1.2 | 2.1 | 3.5 | 2.1 |
| Yellowtail scad | <i>Trachurus novaezelandiae</i> | 2.2 | 2.5 | 1.2 | 0.9 | 1.2 |
| Black bream | <i>Acanthopagrus butcheri</i> | 0.9 | 1.0 | 1.1 | 2.6 | 0.7 |
| Blue sprat | <i>Spratelloides robustus</i> | 14.5 | 13.7 | 7.1 | 0.1 | 0.3 |
| Other finfish | Teleostei | 4.1 | 1.3 | 0.2 | 5.7 | 5.9 |
| TOTAL | | 967.2 | 613.6 | 869.2 | 394.3 | 215.5 |

WEST COAST NEARSHORE AND ESTUARINE TABLE 2

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

| Species | Scientific name | 2000/01 Catch (tonnes) |
|---------------------|--------------------------------|------------------------|
| Australian herring | <i>Arripis georgianus</i> | 438 |
| Tailor | <i>Pomatomus saltatrix</i> | 187 |
| Whiting | <i>Sillago</i> spp. | 154 |
| King George whiting | <i>Sillaginodes punctata</i> | 60 |
| Trevally | <i>Pseudocaranx</i> spp. | 42 |
| Southern garfish | <i>Hyporhamphus melanochir</i> | 35 |
| Black bream | <i>Acanthopagrus butcheri</i> | 24 |
| TOTAL | | 940 |

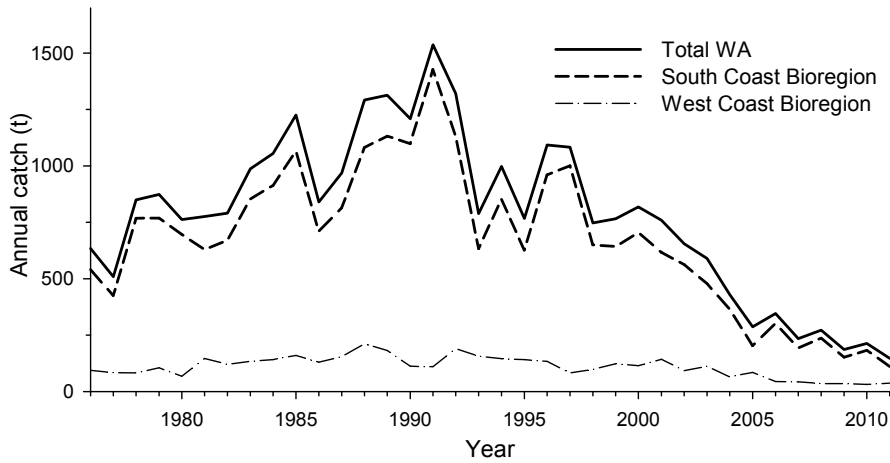
WEST COAST NEARSHORE AND ESTUARINE TABLE 3

Total annual catch estimates (+ standard error) (tonnes) of key nearshore species by boat-based recreational fishers in the West Coast Bioregion in 1996/97 and 2005/06 (Sumner *et al.* 2008²).

| Species | Scientific name | 1996/07 Catch (se) | 2005/06 Catch (se) |
|---------------------------|---------------------------------|--------------------|--------------------|
| Whiting | <i>Sillago</i> spp. | 58 (9) | 46 (3) |
| Australian herring | <i>Arripis georgianus</i> | 46 (7) | 40 (2) |
| Trevally | <i>Pseudocaranx</i> spp. | 38 (10) | 34 (4) |
| King George whiting | <i>Sillaginodes punctata</i> | 28 (4) | 19 (1) |
| Snook | <i>Sphyræna novaehollandiae</i> | 23 (11) | 9 (2) |
| Western Australian salmon | <i>Arripis truttaceus</i> | 12 (5) | 17 (3) |
| Tailor | <i>Pomatomus saltatrix</i> | 14 (4) | 3 (0.7) |
| Southern garfish | <i>Hyporhamphus melanochir</i> | 7 (2) | 2 (0.2) |

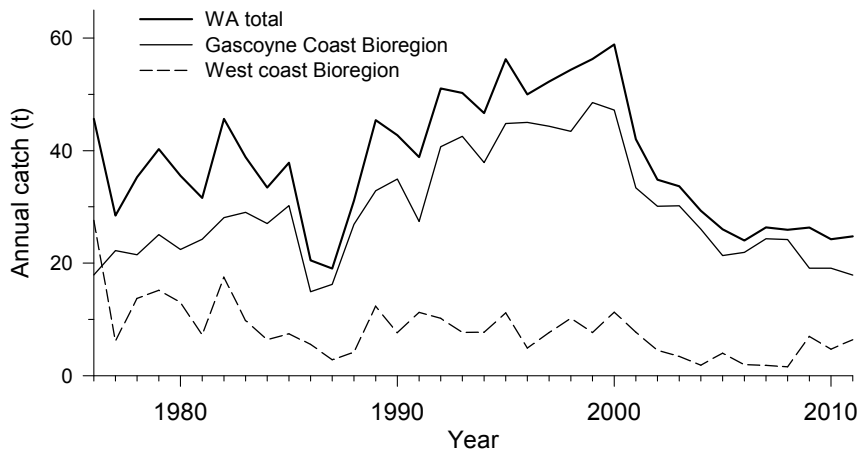
¹ Henry GW and Lyle JM. 2003. The National Recreational and Indigenous Fishing Survey. FRDC Project No. 99/158. NSW Fisheries Final Report Series No. 48.

² Sumner NR, Williamson PC, Blight SJ and Gaughan DJ. 2008. A 12-month survey of recreational boat-based fishing between Augusta and Kalbarri on the West Coast of Western Australia during 2005-06. Fisheries Research Report 177. Department of Fisheries, Perth.



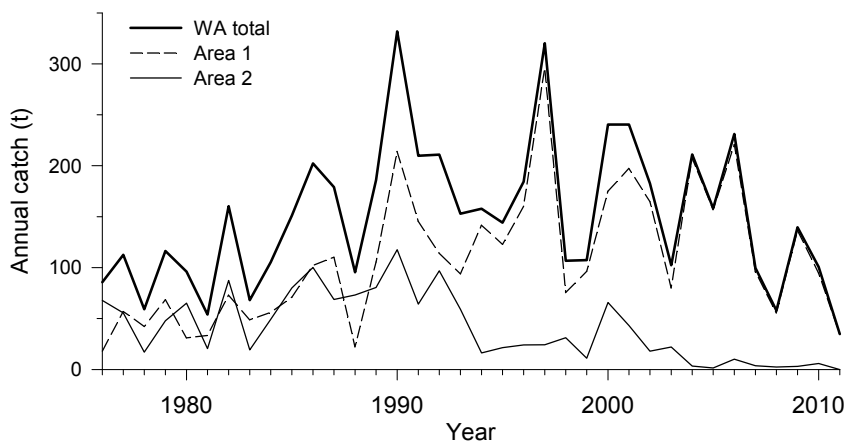
WEST COAST NEARSHORE AND ESTUARINE FIGURE 1

Annual commercial catches of Australian herring, by Bioregion, 1976 –2011.



WEST COAST NEARSHORE AND ESTUARINE FIGURE 2

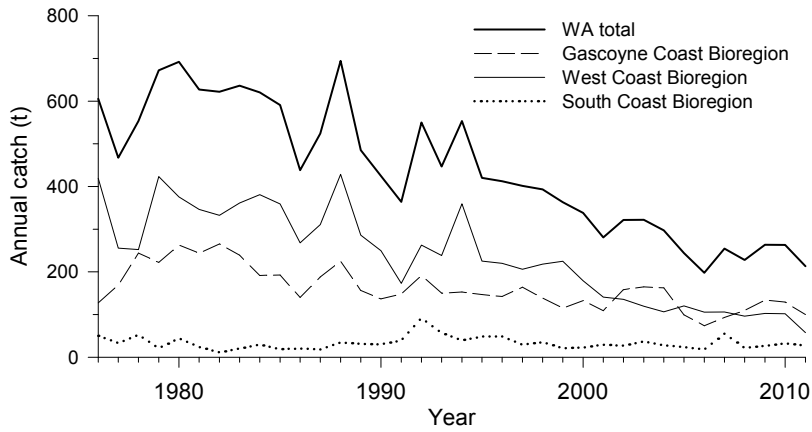
Annual commercial catches of tailor, by Bioregion, 1976 –2011. Minor catches in South Coast Bioregion are not shown, but are included in WA total.



WEST COAST NEARSHORE AND ESTUARINE FIGURE 3

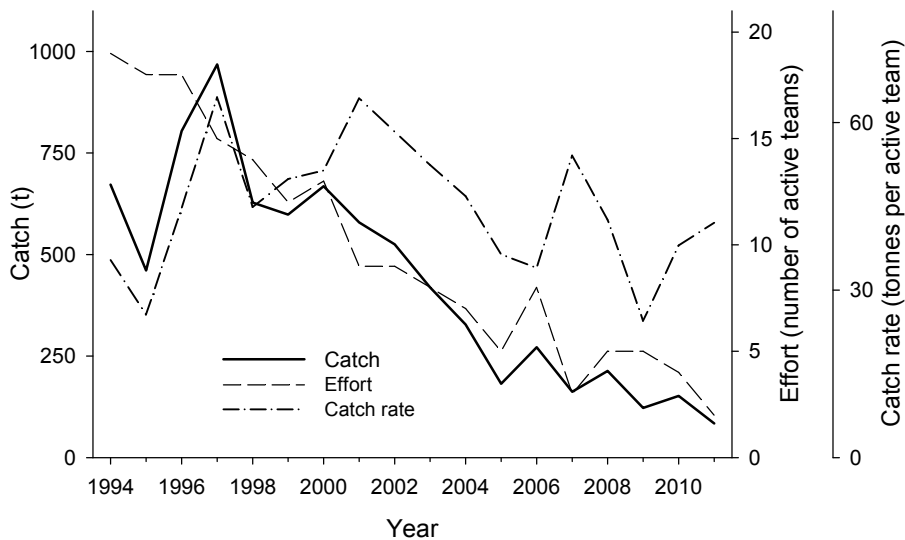
Annual commercial catches of whitebait in West Coast Bioregion, by fishing area, 1976 –2011. Area 1 = Bunbury; Area 2 = Perth/Mandurah.

WEST COAST BIOREGION



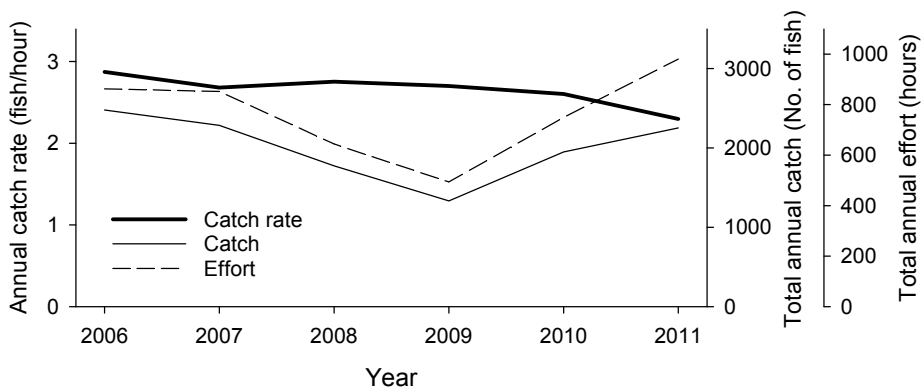
WEST COAST NEARSHORE AND ESTUARINE FIGURE 4

Annual commercial catches of sea mullet, by Bioregion, 1976 –2011. Minor catches in North Coast Bioregion are not shown, but are included in WA total.



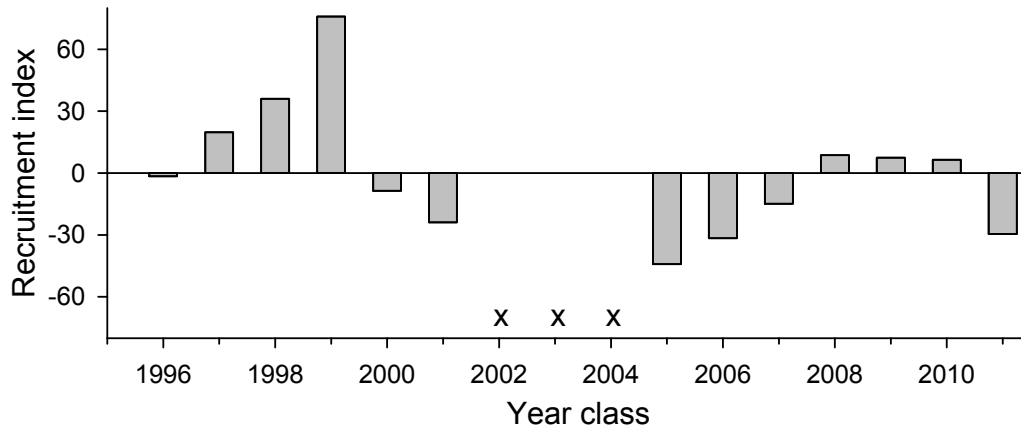
WEST COAST NEARSHORE AND ESTUARINE FIGURE 5

Total annual catch, effort and catch rate of Australian herring by the South Coast commercial trap net fishery, 1994 – 2011.



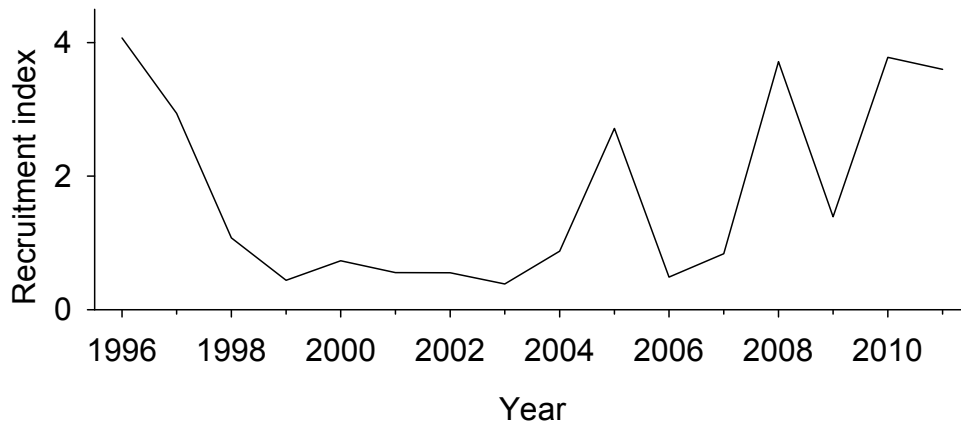
WEST COAST NEARSHORE AND ESTUARINE FIGURE 6

Total annual catch, effort and catch rate of Australian herring by voluntary recreational logbook fishers in Perth metropolitan area (shore fishing only), 2006 – 2011.



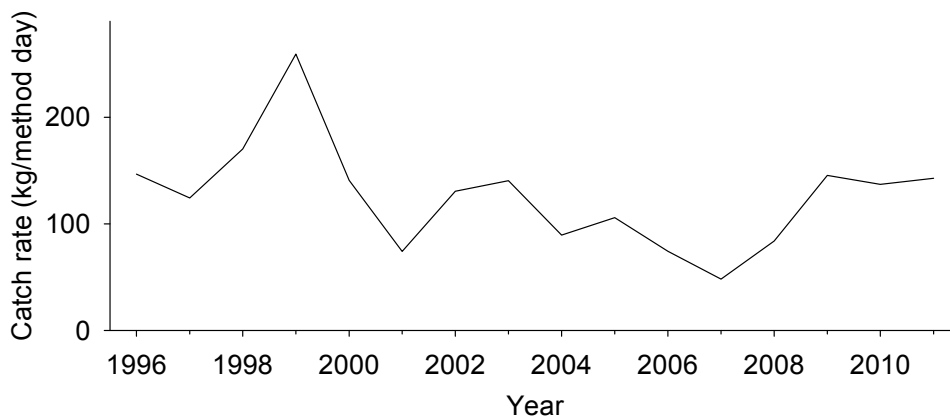
WEST COAST NEARSHORE AND ESTUARINE FIGURE 7

Annual fishery-independent relative recruitment index for Australian herring in the South Coast Bioregion, 1996 – 2011. (x – no sampling conducted in that year). (Normalised data. Bars above the line reflect better than average number of recruits. e.g. a value of "6" represents six times higher than the average level).



WEST COAST NEARSHORE AND ESTUARINE FIGURE 8

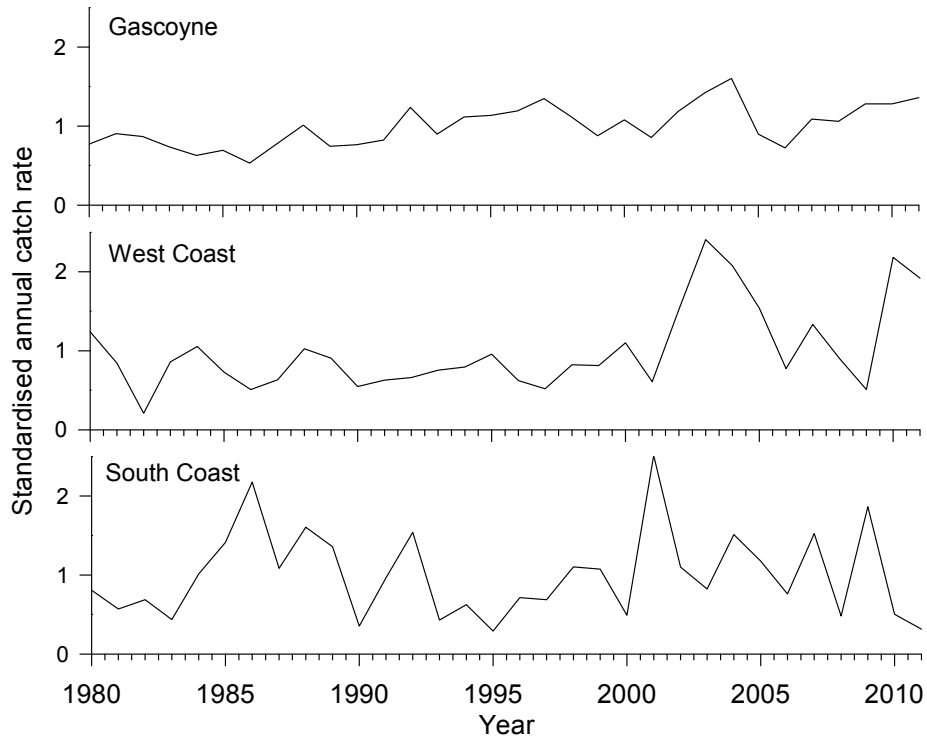
Annual recruitment index for tailor in the West Coast Bioregion, 1996 – 2011, derived from volunteer fisher catch rates of age 0+ juveniles in the Swan-Canning Estuary.



WEST COAST NEARSHORE AND ESTUARINE FIGURE 9

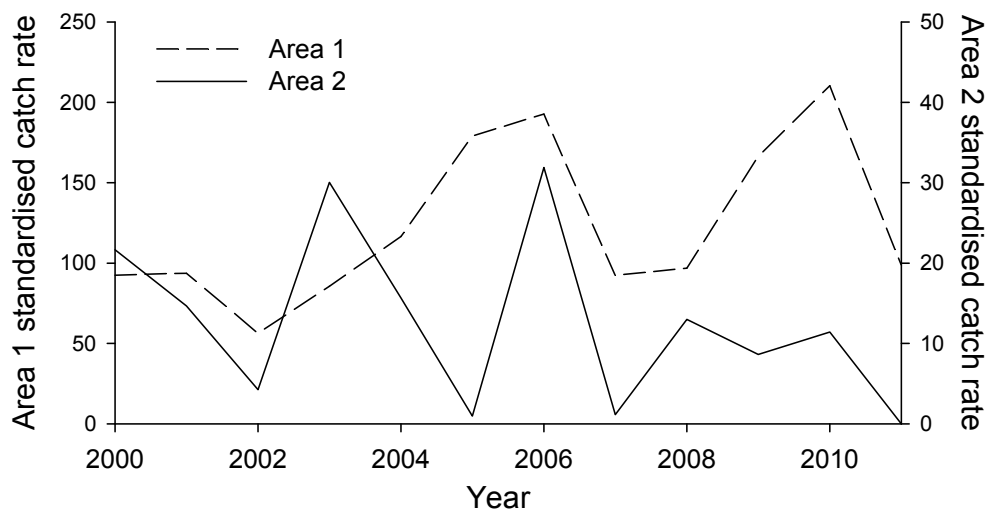
Standardised annual commercial catch rate of southern garfish in Cockburn Sound, 1996 – 2011.

WEST COAST BIOREGION



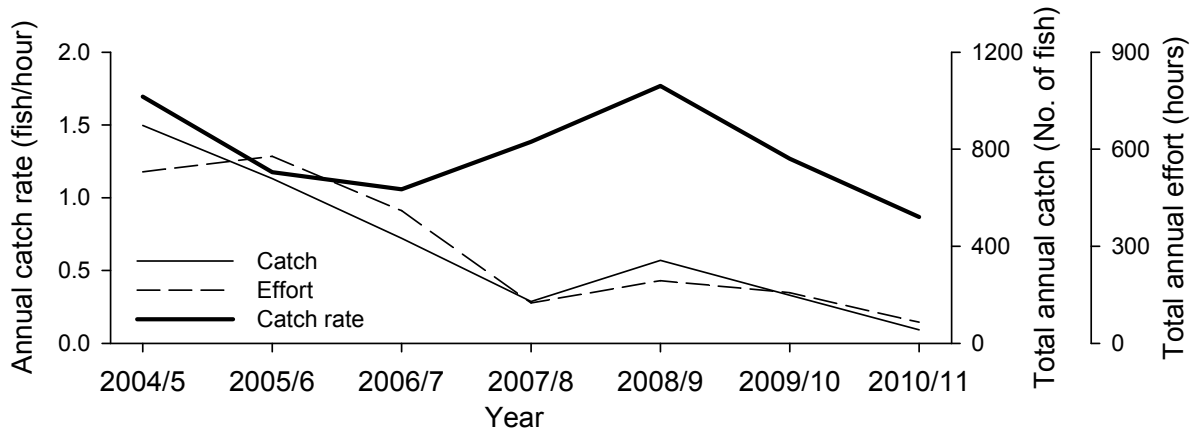
WEST COAST NEARSHORE AND ESTUARINE FIGURE 10

Standardised annual commercial catch rates of sea mullet in Gascoyne, West Coast and South Coast Bioregions, 1996 – 2011.



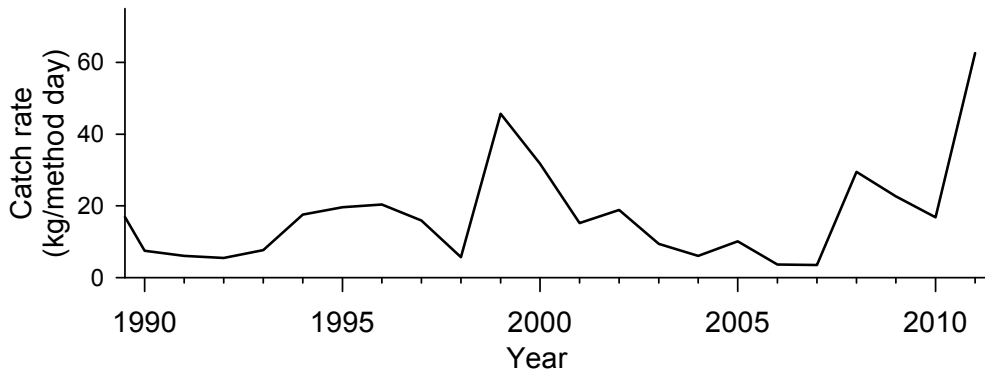
WEST COAST NEARSHORE AND ESTUARINE FIGURE 11

Standardised annual commercial catch rate (kg/method day) of whitebait in Area 1 (Bunbury) and Area 2 (Perth/Mandurah), 2000 – 2011.



WEST COAST NEARSHORE AND ESTUARINE FIGURE 12

Total annual catch, effort and catch rate of black bream by voluntary recreational logbook fishers in the Swan-Canning Estuary, 2004/5 – 2010/11.



WEST COAST NEARSHORE AND ESTUARINE FIGURE 13

Standardised annual commercial catch rate of cobbler in the Peel-Harvey Estuary, 1990 – 2011.

West Coast Purse Seine Fishery Report: Statistics Only

B. Molony, E. Lai and M. Holtz

Fishery Description

The West Coast Purse Seine Fishery mainly captures pilchards (*Sardinops sagax*) and the tropical sardine (or scaly mackerel) *Sardinella lemuru* (referred to as sardinella) by purse seine in the West Coast Bioregion. Smaller catches of Perth herring (*Nematalosa vlaminghi*), yellowtail scad (*Trachurus novaezelandiae*), Australian anchovy (*Engraulis australis*), maray (*Etrumeus teres*) and other species are also reported.

Boundaries

There are three defined fisheries. The Perth metropolitan fishery operates between 31° S and 33° S latitude (West Coast Purse Seine Figure 1). The Southern Development Zone covers waters between 33° S and Cape Leeuwin. The Northern Development Zone covers waters between 22° S and 31° S.

Management arrangements

This fishery is managed through a combination of input and output controls incorporating limited entry, capacity setting and controls on gear and boat size.

Access to the Perth Metropolitan fishery is limited to 12 licences that must fish in accordance with the *West Coast Purse Seine Management Plan 1989*. Both pilchards and sardinella are the main target species in the Metropolitan fishery. There are three fishing boat licences with a specific condition that permits the taking of fish using a purse seine net that is hauled by the use of a power block within specific waters of the Southern Development Zone. Two of those fishing boat licences may also retain pilchards. A further three fishing boat licences permit the taking fish using a purse seine net that is hauled by the use of a power block in the Northern Development Zone and sardinella is the main target species.

Currently, a notional combined total allowable catch (TAC), covering both the Perth metropolitan fishery and the Southern Development Zone, is set for pilchards and another for other small pelagic species. For the 2010/11 licensing period (1 April 2010 – 31 March 2011) a notional TAC of 2,328 t for pilchards, with separate TAC of 672 t for the other small pelagic species (including sardinella) is in place. The notional TAC for pilchards has been in place since 2006/07, and is based on approximately 10% of the west coast pilchard stock. The Northern Development Zone has a separate notional TAC. Reaching or exceeding the notional TACs will trigger a management response.

Landings and Effort

Effort levels increased in 2011 to more than 200 fishing days (less than 60 days in 2010). However, fewer than five vessels reported fishing during the 2011 season. Total catches of pilchards and sardinella exceeded 175 t in 2011, up from approximately 10 t in 2010. The 2011 catch is the highest reported since 2009 (45.2 t in 2009, less than 10 t in 2010) but well below catches recorded in the mid to late 1990s (West Coast Purse Seine Figure 2).

Fishery Governance

Target commercial catch range: 0 – 3,000 tonnes

Current Fishing (or Effort) Level: Acceptable

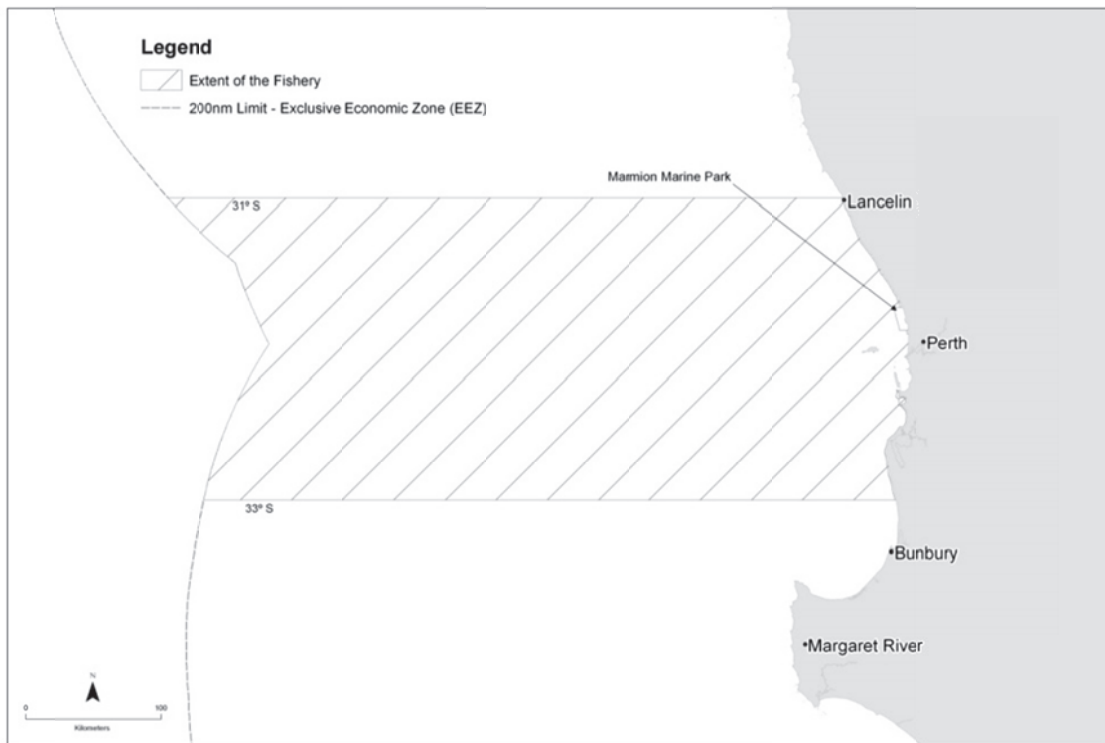
Total effort and catch have declined in recent years due to factors other than stock size (e.g. demand, economics). In addition, fishers have reported that the presence of schools is not as predictable as in previous years. Warmer oceanic conditions may influence the behaviour and distribution of schooling pelagic species, making them less available in traditional fishing grounds.

No future pilchard spawning biomass estimates are scheduled for West Coast pilchard stocks. The most recent pilchard spawning biomass estimate (2004) indicated that pilchard stocks on the west coast had recovered to pre-virus levels of approximately 20,000 – 30,000 tonnes.

New management initiatives (2011/12)

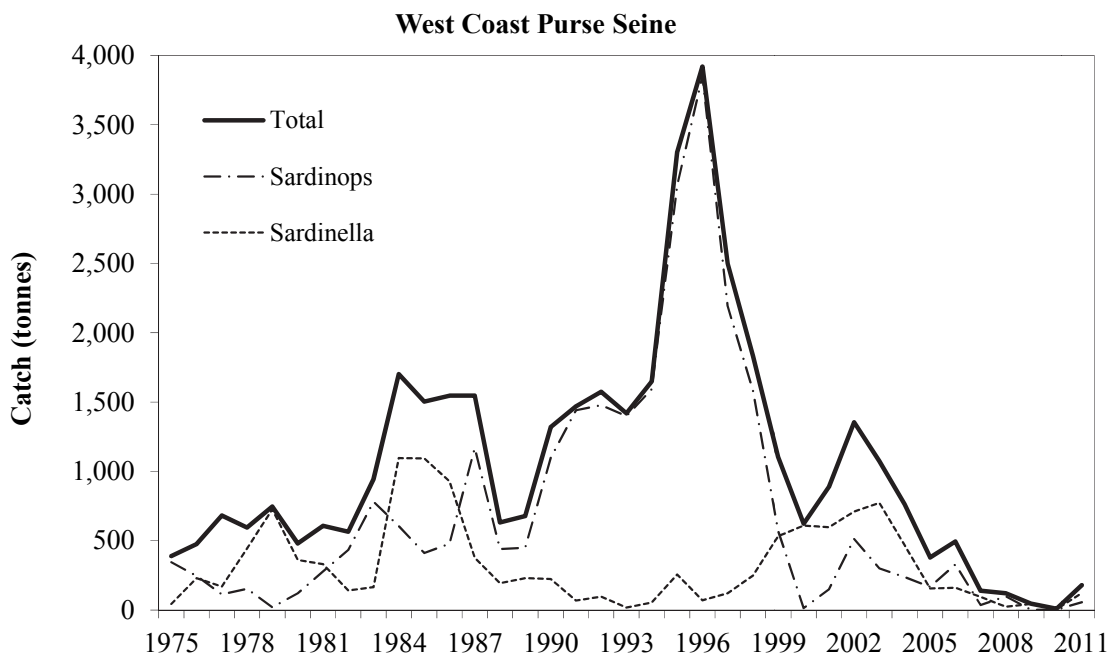
The implementation of a formal quota system with tradeable, individually transferable quota (ITQ) units and a TAC has been a consideration for this fishery for the past ten years. However the implementation of quota for this fishery is considered to be on hold indefinitely, given that catch of pilchards and the effort expended in this fishery has not returned to normal levels since the second pilchard mass mortality event in 1999.

Depending on priorities, the Department may in the future develop a new management plan for this fishery which will incorporate the Southern and Northern Development zones along with the Perth metropolitan fishery into a single West Coast Purse Seine fishery.



WEST COAST PURSE SEINE FIGURE 1

Map of the extent of the West Coast Purse Seine Managed Fishery.



WEST COAST PURSE SEINE FIGURE 2

Annual catches of pilchards (*Sardinops*) and sardinella in the West Coast Purse Seine Fishery, 1975 –2011.

West Coast Demersal Scalefish Resource Status Report

D. Fairclough, E. Lai, M. Sawyer, M. Holtz, T. Nicholas

| Main Features | | | | | | | | | | | | | | | | | |
|-------------------------|------------|--|--|---------|-------|-------------------|--------|-------------------|-------------------------|------|------|---------|-------|-----|-----------------|------|-----|
| Status | | Current Landings | | | | | | | | | | | | | | | |
| Stock level | Recovering | Commercial sector | | | | | | | | | | | | | | | |
| Fishing Level | | All scalefish: | | | | | | | | | | | | | | | |
| Commercial: | Acceptable | WCDSIMF (2011) 411 t | | | | | | | | | | | | | | | |
| Recreational: | Acceptable | Demersal suite: | | | | | | | | | | | | | | | |
| | | WCDSIMF (2011) 382 t | | | | | | | | | | | | | | | |
| | | Other (DGDLF, WCRLF, CSLPF, SWTMF; 2011 or 2010/11) 56 t | | | | | | | | | | | | | | | |
| | | Total demersal suite 438 t | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th></th> <th>WCDSIMF</th> <th>Other</th> </tr> <tr> <th>Indicator species</th> <th>(2011)</th> <th>(2011 or 2010/11)</th> </tr> </thead> <tbody> <tr> <td>West Australian Dhufish</td> <td>67 t</td> <td>13 t</td> </tr> <tr> <td>Snapper</td> <td>182 t</td> <td>8 t</td> </tr> <tr> <td>Baldchin Groper</td> <td>15 t</td> <td>3 t</td> </tr> </tbody> </table> | | WCDSIMF | Other | Indicator species | (2011) | (2011 or 2010/11) | West Australian Dhufish | 67 t | 13 t | Snapper | 182 t | 8 t | Baldchin Groper | 15 t | 3 t |
| | WCDSIMF | Other | | | | | | | | | | | | | | | |
| Indicator species | (2011) | (2011 or 2010/11) | | | | | | | | | | | | | | | |
| West Australian Dhufish | 67 t | 13 t | | | | | | | | | | | | | | | |
| Snapper | 182 t | 8 t | | | | | | | | | | | | | | | |
| Baldchin Groper | 15 t | 3 t | | | | | | | | | | | | | | | |
| | | Recreational sector (last available estimate, 2009/10) | | | | | | | | | | | | | | | |
| | | Indicator species: | | | | | | | | | | | | | | | |
| | | West Australian Dhufish 85 t | | | | | | | | | | | | | | | |
| | | Snapper 24 t | | | | | | | | | | | | | | | |
| | | Baldchin Groper 19 t | | | | | | | | | | | | | | | |
| | | Charter sector (2010/11) | | | | | | | | | | | | | | | |
| | | Indicator species: | | | | | | | | | | | | | | | |
| | | West Australian Dhufish 12 t | | | | | | | | | | | | | | | |
| | | Snapper 8 t | | | | | | | | | | | | | | | |
| | | Baldchin Groper 9 t | | | | | | | | | | | | | | | |

Fishery Description

The West Coast Demersal Scalefish Resource comprises inshore and offshore suites of demersal scalefish species that are exploited by different commercial fisheries and recreational and charter fishers that operate in the West Coast Bioregion (WCB). The West Coast Inshore Demersal suite occurs in waters 20-250 m deep with approximately 100 species of this suite caught by these fisheries. The most important species are the West Australian Dhufish (*Glaucosoma hebraicum*) and Snapper (*Pagrus auratus*) with other species captured including Redthroat Emperor (*Lethrinus miniatus*), Bight Redfish (*Centroberyx gerrardi*) and Baldchin Groper (*Choerodon rubescens*). The West Coast Offshore Demersal suite, which occurs in waters > 250 m deep, includes Eightbar Grouper *Hyporthodus octofasciatus*, Hapuku *Polyprion oxygeneios*, Blue-eye Trevalla *Hyperoglyphe antarctica* and Ruby Snapper *Etelis carbunculus*.

Commercial

The West Coast Demersal Scalefish (Interim) Managed Fishery (WCDSIMF) is a handline and drop line fishery and it is the main commercial fishery that targets demersal species in the WCB. The West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery (WCDGDLF) and Zone 1 of the Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery (JASDGDLF), referred to collectively as the temperate Demersal Gillnet and Demersal Longline Fisheries (DGDLF), target sharks and rays but also retain demersal scalefish. Other commercial fisheries that may take a small amount of demersal species in the WCB include the West Coast Rock Lobster Managed Fishery (WCRLF), the Cockburn Sound Line and Pot Managed Fishery (CSLPF) and the South-West Trawl Managed Fishery (SWTMF). The Commonwealth Western Deepwater Trawl Fishery and the Great Australian Bight

Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery, that operate in waters of the WCB deeper than 200 metres, also catch demersal species.

Fishing and Aquatic Tour Industry (Charter)

Demersal scalefish are targeted by the fishing activities of the charter boat industry in the WCB. Line fishing is the main method used by operators licensed to fish in that sector. A small number of fishing tour operators also cater for recreational diving charters.

Recreational

Recreational fishers that target demersal species in the WCB are almost exclusively boat-based. Line fishing is the main method used by recreational fishers, although spear fishing also occurs, but mainly in shallow waters, i.e. < 20 m deep.

Note - The WCDSIMF and the charter and recreational sectors in the WCB are collectively referred to as the West Coast Demersal Scalefish Fishery (WCDSF).

Governing legislation/fishing authority

Commercial

West Coast Demersal Scalefish (Interim) Management Plan 2007

West Coast Demersal Interim Managed Fishery Permit

West Coast Demersal Gillnet and Demersal Longline Interim Management Plan 1997

West Coast Demersal Gillnet and Demersal Longline Interim Managed Fishery Permit

Joint Authority Southern Demersal Gillnet and Demersal Longline Management Plan 1992

Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery Licence

Cockburn Sound (Line and Pot) Management Plan 1995

Cockburn Sound (Line and Pot) Managed Fishery Licence

South West Trawl Management Plan 1989

South West Trawl Managed Fishery Licence

Recreational

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

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 fishery

The WCDSIMF encompasses the waters of the Indian Ocean just south of Shark Bay (at 26°30'S) to just east of Augusta (at 115°30'E) and extends seaward to the 200 nm boundary of the Australian Fishing Zone (AFZ). The commercial fishery is divided into five management areas comprising four inshore areas and one offshore area. The inshore areas, i.e. Kalbarri, Mid-West, Metropolitan and South-West, extend outwards to the 250 m depth contour, while the Offshore Area extends the entire length of the fishery from the 250 m depth contour to the boundary of the AFZ (West Coast Demersal Scalefish Figure 1). The Metropolitan Inshore Area was closed to commercial operators in the WCDSIMF and WCDGDLF in November 2007 (West Coast Demersal Scalefish Figure 1).

The boundaries of each of the other fisheries that catch demersal species in the WCB are given in their separate sections of this State of the Fisheries report.

Fishing and Aquatic Tour Industry (Charter) and Recreational fishery

The boundaries applicable to the charter and recreational sectors in the WCB encompass the waters of the Indian Ocean just south of Shark Bay (at 27°S) to just east of Augusta (at 115°30'E) and extend seaward to the 200 nm boundary of the AFZ (West Coast Demersal Scalefish Figure 1).

Management arrangements

Commercial

The WCDSIMF was established in January 2008, following the introduction of the *West Coast Demersal Scalefish (Interim) Management Plan 2007*. Permit holders are permitted to retain all scalefish (other than a number species that are under specific State or Commonwealth management) and are not permitted to take sharks and rays.

Access to the Fishery is restricted to 60 Interim Managed Fishery Permit holders. Gear and other restrictions apply (in the form of maximum numbers of lines and hooks and arrangements regulating the carriage of lines and fish) and boats are monitored under the Vessel Monitoring System (VMS).

Each of the four inshore management areas is allocated a maximum number of hours of fishing time that may be fished on an annual basis, with the Metropolitan Area currently allocated zero hours. Units are allocated to permits and provide entitlement in "hours" of fishing time. The use of VMS allows fishing effort to be monitored and entitlement use acquitted accordingly. The total capacity of the Fishery restricts fishing effort at a level to ensure that catches of all scalefish and also of the suite of demersal species do not exceed catch objectives (see below). The capacity can be adjusted as required.

The primary management objective for the WCDSIMF is to maintain catches of all scalefish and the suites of demersal species below 50 % of those recorded in the WCB during 2005/06 to reduce fishing mortality to a level that will enable recovery of all of these stocks. The status of the three indicator species (Snapper, Western Australian Dhufish and Baldchin Groper) is used to indicate the status of the entire West Coast Inshore Demersal Suite of scalefish species.

WEST COAST BIOREGION

The catch in each management area should also not exceed 50 % of the 2005/06 catch in that area. The average annual catch for each indicator species in the WCDSIMF and in each of the areas where they are an indicator should also remain below 50 % of their 2005/06 level.

The other commercial fisheries that take demersal scalefish in the WCB (DGDLF, WCRLF, CSLPF and SWTMF) are subject to limited entry and input and/or output controls and the same management objective of maintaining catches of the suite of demersal species below 50 % of those recorded by those fisheries during 2005/06.

The detailed management arrangements of each of the other fisheries that catch demersal species in the WCB are given in their separate sections of this State of the Fisheries report.

Since 2008, fishers in the WCRLF have been permitted to retain for personal consumption only demersal species that have been caught in rock lobster pots. These fish are not permitted to be sold.

Fishing and Aquatic Tour Industry (Charter)

There are two types of fishing tour licence categories.

Fishing Tour Operators Licence: The focus is on fishing activities, where fish can be taken home at the end of the tour.

Restricted Fishing Tour Operators Licence: The focus is on eco-tourism activities, such as snorkelling or scuba diving, with fishing only allowed for the purpose of a meal eaten during the course of the tour. No fish can be taken home at the end of the tour and any fishing for a meal must be done with a handline. Fishing rods are not permitted on this tour category.

Within each category, there is the provision for a boat-based operation (boat size larger than 7.5 m), a combination land/aircraft/boat (boat size less than 7.5 m) based operation and a land-based operation. Except where extraordinary circumstances can be demonstrated by the applicant, new Fishing Tour Operators Licences are no longer granted. Applications for Restricted Fishing Tour Operators Licences are still considered. Currently, the consideration of any Tour Operator's Licence Application is carried out in accordance with Regulation 128J of the Fish Resources Management Regulations 1995 and Ministerial Policy Guideline No. 12 'Assessment of Applications for the Granting, Renewal or Transfer of Fishing Tour Operators Licences and Aquatic Eco-Tourism Operators Licences'.

All fishing is subject to recreational fishing regulations (see below), however passengers onboard a fishing tour are not required to hold an individual Recreational Fishing from Boat Licence.

Recreational

The recreational fishery for demersal scalefish in the WCB is managed using input (e.g. size limits, seasonal closures and spatial closures) and output controls (e.g. daily bag limits, boat limits and possession limits).

A suite of new management arrangements was introduced during 2009/10 aimed at reducing the recreational take of demersal scalefish in the WCB by at least 50 % from 2005/06 levels. These arrangements included changes to bag, boat and size limits for demersal scalefish species, a requirement to carry a release weight (to assist in minimising the effects of barotrauma) and the implementation of a closure prohibiting

fishing for "high risk" demersal scalefish for two months between 15 October and 15 December.

Since 2 March 2010, all persons fishing from a powered boat anywhere in the state have been required to hold a Recreational Fishing from Boat Licence or fish in the company of a licence holder. The Recreational Fishing from Boat Licence will provide a state-wide database of recreational boat fishers for survey purposes.

Research summary

Research on demersal species in the WCB focuses on monitoring the status of indicator species. Level 3 stock assessments based on fishing mortality are conducted at periodic intervals for each of the indicator species (West Australian Dhufish, Snapper and Baldchin Groper) within the West Coast Inshore Demersal Suite. Annual Level 1 assessments of catch are also used to monitor these species and the indicator species for the West Coast Demersal Offshore Suite (Hapuku, Blue-eye Trevalla, Bass Groper). See Fisheries Occasional Publication No. 85 http://www.fish.wa.gov.au/Documents/occasional_publications/fop085.pdf.

To enable the Level 3 assessments, fish frames of the indicator species are collected annually from both recreational and commercial fishers across the different areas of the WCB (West Coast Demersal Scalefish Figure 1). Otoliths obtained from these frames are used to determine age compositions for species in relevant management areas, from which estimates of fishing mortality are calculated and stock status determined. The next stock assessment of the three inshore demersal indicators will be conducted in 2012/13.

Catch and effort data both for the commercial and charter sectors are obtained annually from fishers' daily/trip logbooks, which provide fine-scale data from 10 nm × 10 nm and 5 nm × 5 nm blocks, respectively.

A Statewide survey of boat-based recreational fishing was conducted during 2011/12 through a collaboration between the Department of Fisheries and Edith Cowan University. Approximately 3,000 fishers from the "Recreational Fishing from Boat" licence database took place in phone-diary surveys in conjunction with validation surveys of boat-based fishers at ramps. Estimates of catch and effort for this fishery will be available in late 2012.

Estimates of the catch of demersal species in this bioregion by other fisheries (DGDLF, WCRLF, CSLPF, SWTMF) are determined annually from compulsory logbook data. Full details are reported in the relevant fisheries reports.

WA Marine Science Institute-funded research on the stock structure of West Australian Dhufish, Snapper and Baldchin Groper in the WCB is complete. This was a collaborative project between the Department of Fisheries, Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Murdoch University. The methods used included both genetic and otolith microchemistry techniques plus an examination of oceanographic influences on larval dispersal. Scientific papers have been published on the stock structure of West Australian Dhufish and Baldchin Groper.

Acoustic telemetry is being used to investigate site-fidelity of adult Snapper to Cockburn Sound spawning aggregations. Data on the movements of tagged Snapper will be collected by remotely deployed receivers until 2013. These data will be used to assess the risks associated with targeting Snapper that are either migrating to or aggregating in Cockburn Sound.

Surveys of the numbers of Snapper eggs in Cockburn Sound were conducted in 2011 to produce an estimate of spawning stock biomass using a daily egg production model. Results will be available as part of the 2012/13 stock assessment.

A State Natural Resource Management-funded project, focused on small juvenile West Australian Dhufish (< 150 mm in length), is investigating the habitat types that are important for newly-recruited juvenile dhufish and the feasibility of developing a recruitment index.

A collaborative FRDC-funded project between Curtin University and the Department of Fisheries is almost complete. This study is determining whether West Australian dhufish and Snapper produce sound and thus the feasibility of using passive acoustic monitoring of these species.

A collaborative project between CSIRO and the Department of Fisheries commenced in late 2011. This one year pilot study is investigating the temporal and spatial occurrence of West Australian dhufish eggs and larvae in the South-west and Metropolitan Areas of the WCB. The project combines traditional plankton collection and analysis with rapid DNA screening of samples to investigate the occurrence of dhufish in samples, in conjunction with current modelling to guide the plankton sampling regime. The project may be extended to three years if the pilot project is successful.

Retained Species

Commercial production

All scalefish

WCDSIMF (2011) 411 tonnes

Demersal suite

WCDSIMF (2011) 382 tonnes

DGDLF, WCRLF, CSLPF, SWTMF

(2011 or 2010/11) 56 tonnes

Total 438 tonnes

Indicator species

WCDSIMF (2011)

West Australian Dhufish 67 tonnes

Snapper 182 tonnes

Baldchin Groper 15 tonnes

DGDLF, WCRLF, CSLPF, SWTMF

(2011 or 2010/11)

West Australian Dhufish 13 tonnes

Snapper 8 tonnes

Baldchin Groper 3 tonnes

Total

West Australian Dhufish 80 tonnes

Snapper 190 tonnes

Baldchin Groper 18 tonnes

Landings

Catches are reported from the most recent complete season of logbook data, which differ among the commercial fisheries that catch demersal species in the WCB. Thus, catches are reported for 2011 for the WCDSIMF and SWTMF and for 2010/11 for the DGDLF and WCRLF.

Catches by commercial fishers in the WCDSIMF increased by 46 t from 365 t in 2010 to 411 t in 2011. The majority of the increase could be attributed to catches of demersal species, which increased to 382 t in 2011 from 340 t in 2010. In 2011, catches of demersal species comprised 375 t and 7 t of inshore and offshore demersal species, respectively. While the catches of demersal species by the WCDSIMF in 2011 remained similar to 2010 in the Kalbarri area (144 vs 146 t), the South-west (50 vs 59 t) and Offshore areas (7 vs 13 t), the catch for the Mid-west area increased by 58 t.

The WCDSIMF catch in 2011 comprised 79 scalefish species or species groups. Fifty three of those belonged to the inshore and offshore demersal suites and 26 belonged to the pelagic and nearshore suites. Six species/species groups comprised 88 % of the total catch of scalefish, with the largest catches being of Snapper (182 t), West Australian Dhufish (67 t) and Redthroat Emperor (54 t). Other significant catches were of Redfish species (*Centroberyx* spp., 29 t), Samson Fish (16 t) and Baldchin Groper (15 t). Catches of offshore demersal species were low, e.g. Eightbar Grouper (4 t), Hapuku (1 t), Bass Groper (< 1 t) and Blue-eye Trevalla (< 1 t).

Catches of demersal scalefish by temperate demersal gillnet and longline fisheries in the WCB decreased in 2010/11 to 53 t, 22 t less than in 2009/10, while 3 t were taken by other commercial fisheries combined (WCRLF, CSLPF and the SWTMF).

West Australian Dhufish: The total catch of West Australian dhufish by the WCDSIMF increased from 54 t in 2010 to 67 t in 2011. The catch in the Kalbarri (5 t) and South-west areas (19 t) were similar in 2011 to those in 2010. However, in the Mid-west area, 44 t of dhufish were caught in 2011, an increase of 13 t from 2010 (West Coast Demersal Scalefish Figure 2). Catches of dhufish by the DGDLF decreased from 16 t in 2009/10 to 13 t in 2010/11, while < 0.5 t was taken by the other commercial fisheries.

Snapper: In 2011, the WCDSIMF catch of Snapper (182 t) was substantially greater than in 2010 (156 t) and 2009 (110 t). While catches in the Kalbarri area in 2011 (88 t) declined by 8 t from those in 2010, those in the Mid-west area increased by 33 t to 91 t. As in previous years, only 3 t was landed in the South-west Area (West Coast Demersal Scalefish Figure 3). While Snapper catches of the DGDLF in the WCB decreased from 11 to 7 t between 2009/10 and 2010/11, other fisheries retained a similar total amount to previous years, i.e. ca 1 t.

Baldchin Groper: The WCDSIMF caught 15 t of Baldchin Groper in 2011, 3 t more than 2010 (West Coast Demersal Scalefish Figure 4). The majority was obtained from the Mid-west area (13 t) and primarily in the Abrolhos Zone A of the

WEST COAST BIOREGION

WCRLF (9.5 t), with the remainder being caught in the Kalbarri Area. Baldchin Groper catches by other fisheries in the WCB in 2010/11 remained low (ca 2.5 t).

Charter fishing (2010/11)

| | |
|--|------------------|
| Top 15 demersal scalefish species | 39 tonnes |
| Indicator species | |
| West Australian Dhufish | 12 tonnes |
| Snapper | 8 tonnes |
| Baldchin Groper | 9 tonnes |

The total catch of the demersal species/species groups that comprise the top 15 by weight typically caught by the charter sector was approximately the same in 2010/11 (39 t) as the previous year (based on 94 % of logbook returns at the time of this report; see West Coast Demersal Scalefish Figure 5). The catch of West Australian Dhufish and Baldchin Groper increased slightly from 2009/10 to 2010/11, while that of Snapper decreased (West Coast Demersal Scalefish Figure 5). Species in the West Coast Offshore Demersal Suite comprised less than 1 t of charter catches.

Recreational fishing

(last available estimate 2009/10)

| | |
|--|-------------------|
| Top 15 demersal scalefish species | 155 tonnes |
| Indicator species | |
| West Australian Dhufish | 85 tonnes |
| Snapper | 24 tonnes |
| Baldchin Groper | 19 tonnes |

About 155 t of the top 15 demersal species/species groups were estimated to have been caught by boat-based fishers in the WCB in 2009/10, which is thus approximately half of the catch of those species in 2005/06 (303 t; West Coast Demersal Scalefish Figure 5). Estimates of catches of West Australian Dhufish (85 t), Snapper (24 t) and Baldchin Groper (19 t) retained in 2009/10 were also less than those in 2005/06, i.e. 181 t, 40 t and 26 t, respectively (West Coast Demersal Scalefish Figure 5).

Fishing effort/access level

Commercial

In 2011, 51 vessels fished in the WCDSIMF. Fifteen vessels fished in the Kalbarri Area, 40 in the Mid-west, 7 in the South-west and 10 in the Offshore Area. Note that some vessels have entitlements to fish in more than one inshore area, while all can access the Offshore Area.

The total number of days fished in 2011 (1,572) increased from 1,502 in 2010 and was commensurate with an increase in the number of hours fished (hours searching + hours fishing) from 15,500 h in 2010, to 16,000 h in 2011.

Effort recorded by other fisheries that catch demersal species in the WCB is given in their separate sections of this State of the Fisheries and Aquatic Resources Report.

Recreational

Effort in the recreational sector has not been estimated for 2009/10.

Fishing and Aquatic Tour Industry (Charter)

Based on 94 % of logbook returns having been submitted at the time of this report, the number of charter licences reported to have undertaken charter fishing operations in 2010/11 (57) declined from that of 2009/10 (63). However, the number of fisher days increased from 18,963 to 21,478.

Stock Assessment

Assessment complete **Yes**

Assessment level and method:

Level 3 - Fishing mortality
(Periodic - next due in 2012/13)

Level 1 - Catch by sector (Annually)

Breeding stock levels

| | |
|---------------------------------|-------------------|
| West Australian Dhufish: | Recovering |
| Snapper: | Recovering |
| Baldchin Groper: | Recovering |

Inshore Demersal: The last level three assessment of the status of stocks of inshore demersal species in the different management areas of the WCB was conducted on data collected in 2007/08. The assessment estimated fishing mortality rates (*F*) for each of the indicator species (West Australian Dhufish, Snapper and Baldchin Groper), which reflect the status of the entire West Coast Inshore Demersal suite of species in the WCB. The above assessment was independently reviewed and supported the view that at that time the breeding stocks for both West Australian Dhufish and Baldchin Groper were declining, while that of Snapper was considered to be inadequate. The assessment confirmed the results of a previous assessment in 2007, which recommended that management action was required to achieve at least a 50% reduction in catches of that suite across all sectors, in order to initiate recovery of stocks in the suite.

Level one monitoring of resource status is conducted annually by comparing the catch of the demersal suite (where available) for each fishery and sector of the WCDSF with acceptable catch levels (50 % of 2005/06). As the current or most recent catch levels for this suite and the indicator species are below the acceptable catch range, the stocks are assessed as recovering.

The next detailed assessment of fishing mortality rates is scheduled for completion in 2012/13, based on fishery-dependent samples of the three indicator species collected between 2008/09 and 2010/11. This will provide information on whether reduced catches are resulting in a greater proportion of older fish in stocks. The assessment will also evaluate the most appropriate measure of effort and catch per unit effort (CPUE) in the WCDSIMF.

Offshore Demersal: A level one assessment of catch is conducted annually for the offshore demersal suite, including Eightbar Grouper, Bass Groper, Hapuku, Blue-eye Trevalla and Ruby Snapper. These species are particularly vulnerable

to overfishing, as their biological characteristics indicate that they are long-lived and would therefore have low rates of natural mortality and productivity (Wakefield and Newman, 2008¹; Wakefield et al., 2010²). In addition, some aggregate to spawn and most suffer barotrauma when caught, due to the depths in which they are fished (> 250 m). Given the current low level of catches, risks to the biological sustainability of the stocks of these species in the WCB are considered to be medium.

Using the assessments of the indicator species as outlined above, the additional management actions have reduced the ecological risks to the suites of inshore and offshore demersal species in the WCB (see Fletcher et al., 2010³). The inshore suite still has high risks associated with meeting social and economic objectives for the community. This combination of factors means that this suite of species still has a high priority for the Department with the inshore demersal suite requiring continued close monitoring and assessment. The offshore demersal suite is currently considered to have a medium level priority.

Non-Retained Species

Bycatch species impact Medium

Line fishing for demersal species using baited hooks is highly selective⁴. Other demersal species that are caught but not normally retained during demersal fishing activities (including inedible species, e.g. Silver Toadfish, and small species, such as wrasses) are often susceptible to the effects of barotrauma and may not survive. Note that while they are not bycatch species, post-release survival of target species, such as West Australian Dhufish and Snapper decreases when caught in waters > about 30 m deep⁵, but this is likely to be indicative of many species caught but not retained in this fishery.

Protected species interaction Negligible

As line fishing is highly selective, interactions with protected species by commercial, charter and recreational fishers in the WCDSF are low. Commercial WCDSIMF and charter fishers

are required to record protected species interactions in their logbooks. During 2011, commercial fishers in the WCDSIMF caught two grey nurse sharks, which were released alive. In 2010/11, three interactions with protected species (grey nurse sharks) were reported by charter fishers, each animal being released alive.

Ecosystem Effects

Food chain effects Low

An FRDC study⁶ examined the last 30 years of catch data by commercial wetline, gillnet and longline fisheries in the WCB and found that while the species composition in catches had changed over time, which may be a function of changes in targeting or differences in reporting methods, there was no evidence of a decline in the trophic level or mean size in catches.

Habitat effects Negligible

The main fishing method used in the commercial and recreational fishery for demersal species (line fishing), has little physical impact on the benthic environment.

Social Effects

Commercial

The total number of crew members employed per trip by the 51 permitted vessels that fished in the WCDSIMF in 2011 ranged from zero to four, while the majority employed was two.

Fishing and Aquatic Tour Industry (Charter)

In 2010/11, 111 charter operators were licensed to operate in the WCB via a Fishing Tour Operators Licence, compared with 125 in 2009/10. Twenty one held a Restricted Fishing Tour Operators Licence. The number of people employed in the charter industry has not been estimated.

Recreational Fishing

Over 123,000 Recreational Fishing from Boat Licenses have been issued in Western Australia as at 2nd March 2012.

Economic Effects

Estimated annual value (to fishers) for 2011:

Level 2 - \$1-5 million

The estimated economic value of the WCDSIMF in 2011 was in the range of \$1-5 million, as it was in 2010.

¹ Wakefield, C.B., & Newman, S.J. (2008) Age estimation and reproductive status of an exceptionally large blue-eye trevalla (*Hyperoglyphe antarctica*, Centrolophidae) captured off the south coast of Western Australia. *Cybius*, 32, 321-324.

² Wakefield, C.B., Newman, S.J. & Molony, B.W. (2010) Age-based demography and reproduction of hapuku, *Polyprion oxygeneios* (Polyprionidae), from the south coast of Western Australia: implications for management. *ICES Journal of Marine Science*, 67, 1164-1174.

³ W.J. Fletcher, J. Shaw, S.J. Metcalf & D.J. Gaughan (2010) An Ecosystem Based Fisheries Management framework: the efficient, regional-level planning tool for management agencies. *Marine Policy* 34 (2010) 1226-1238

⁴ Bycatch interactions of the gillnet and longline sector are presented in the relevant report.

⁵ see Fisheries Research Report No. 191 http://www.fish.wa.gov.au/Documents/research_reports/fr191.pdf

⁶ 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.

Cockburn Sound is the only known spawning aggregation location for Snapper in the WCB. Juveniles also use the area as a nursery for approximately one and a half years following settlement, before leaving Cockburn Sound. Ongoing industrial development in the area may have detrimental effects on the environmental conditions that are important for both spawning and juvenile survival and thus influence future recruitment success from Cockburn Sound to the WCB.

The Commonwealth Western Deepwater Trawl Fishery and Great Australian Bight Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery fish in waters of the WCB from the 200 m isobath to the boundary of the AFZ. These fisheries target species such as Deepwater Flathead *Platycephalus conatus* and Bight Redfish *Centroberyx gerrardi*. The geographical overlap of these fisheries with the WCDSF indicates that they are likely to be fishing the same stocks.

The Commonwealth's South-West Marine Bioregional Plan incorporates the aim of introducing marine reserves, which have proposed areas closed to fishing. This has the potential to restrict access to fishing in parts of the WCB to all sectors, i.e. commercial, recreational and charter.

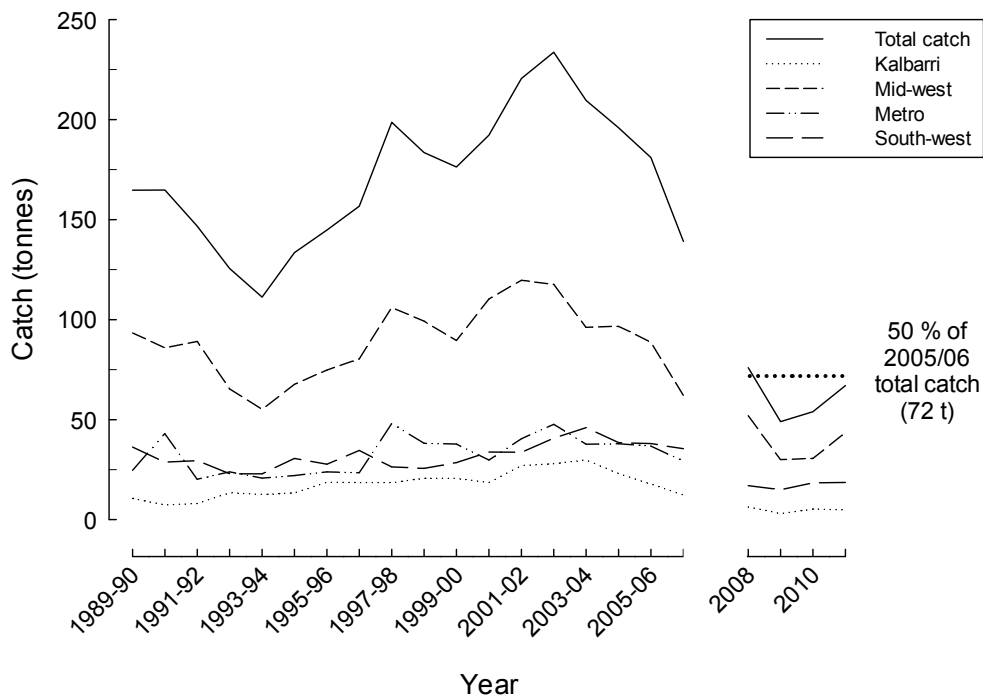
The changing climate may lead to increased average water temperatures or acidification from absorption by the ocean of increased atmospheric CO₂, which in turn could influence aspects of the biology of demersal species, such as spawning success and thus recruitment patterns. Extreme events, such as the marine heatwave recently reported, may have severe negative effects, including increased mortalities (http://www.fish.wa.gov.au/Documents/research_reports/frr222.pdf).

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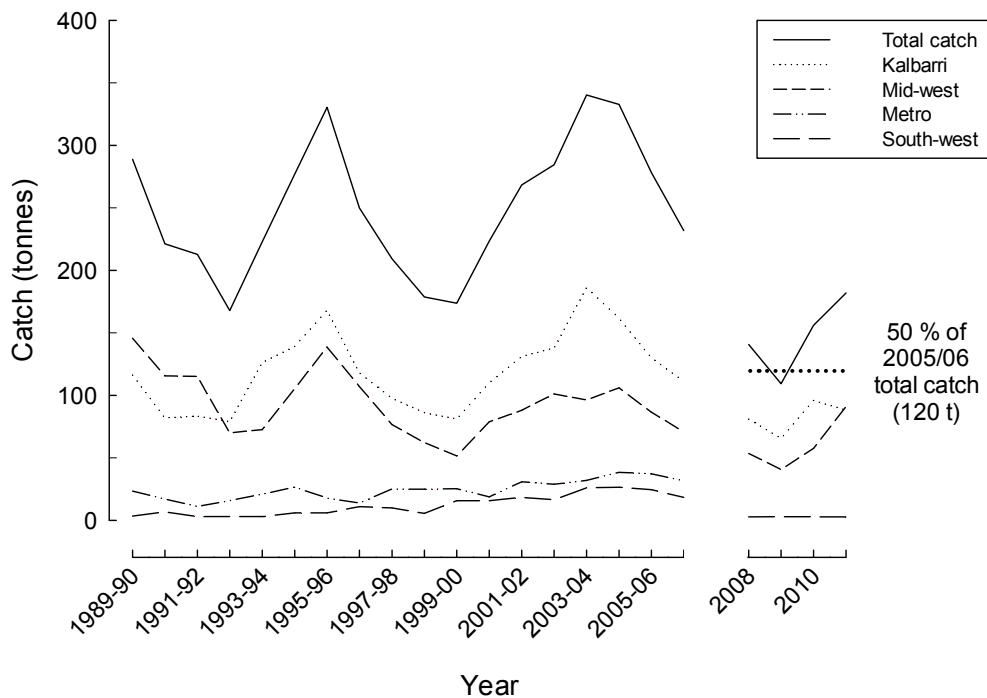
WEST COAST DEMERSAL SCALEFISH FIGURE 1

Map of the boundaries of the West Coast Demersal Scalefish Fishery extending from 26°30' S to 115°30' E. The northern boundary shown applies to the West Coast Demersal Scalefish (Interim) Managed Fishery (WCDSIMF) and is the proposed future boundary for the charter and recreational fishery. The Kalbarri, Mid-west, Metropolitan and South-west areas apply only to the WCDSIMF and extend from the coast to the 250 m depth contour, while the offshore area encompasses the waters from the 250 m depth contour outwards to the boundary of the 200 nm Australian Fishing Zone boundary (AFZ) and from 26°30' S to 115°30' E. Note the Metropolitan Area is currently closed to fishing by the WCDSIMF.



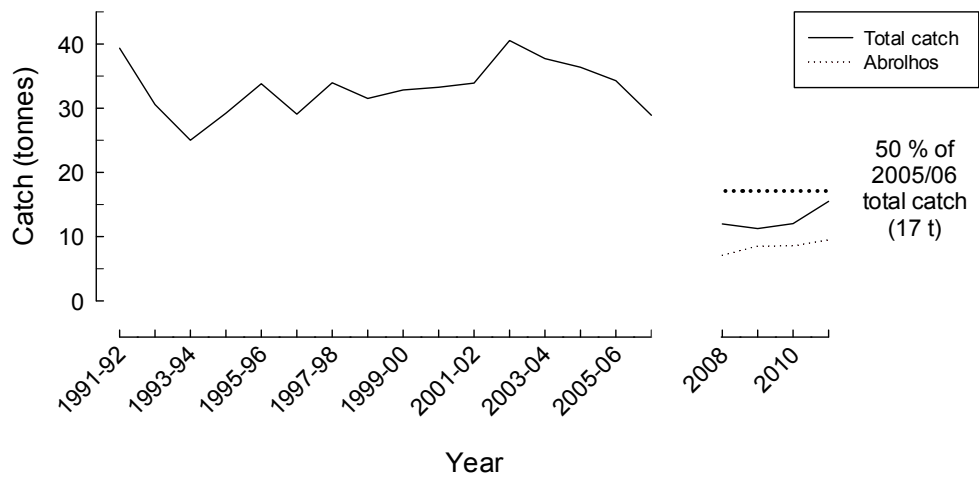
WEST COAST DEMERSAL SCALEFISH FIGURE 2

Total catch and catch by area of West Australian Dhufish *Glaucosoma hebraicum* by commercial wetline fishers in the West Coast Bioregion between 1989/90 and 2006/07 and in the West Coast Demersal Scalefish (Interim) Managed Fishery between 2008 and 2011.



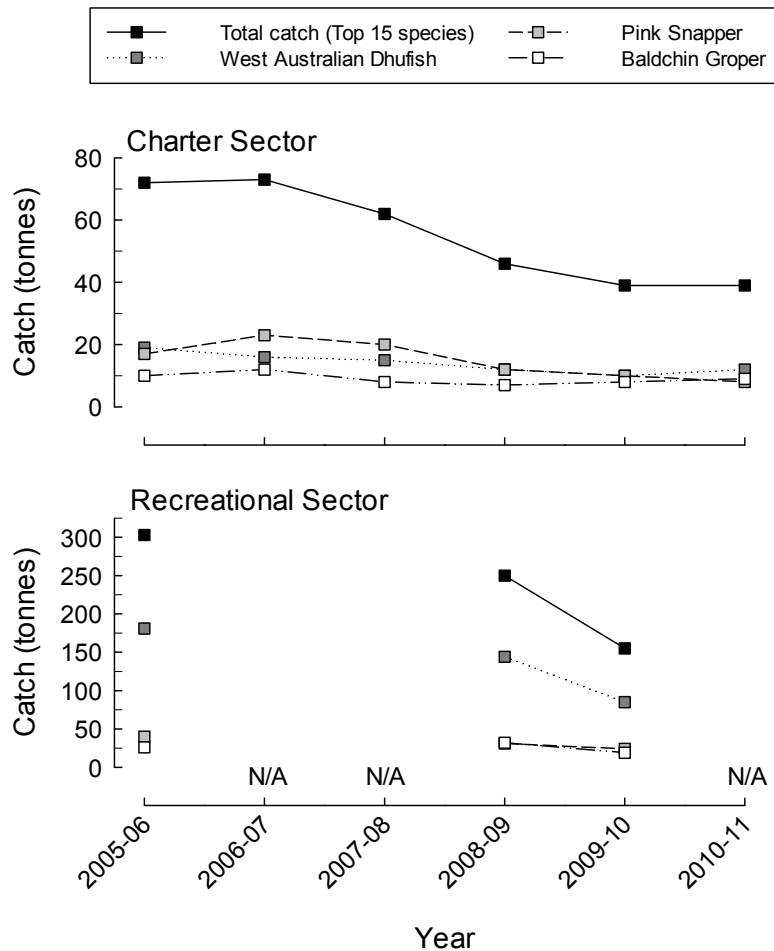
WEST COAST DEMERSAL SCALEFISH FIGURE 3

Total catch and catch by area of Snapper *Pagrus auratus* by commercial wetline fishers in the West Coast Bioregion between 1989/90 and 2006/07 and in the West Coast Demersal Scalefish (Interim) Managed Fishery between 2008 and 2011.



WEST COAST DEMERSAL SCALEFISH FIGURE 4

Total catch of Baldchin Groper *Choerodon rubescens* by commercial wetline fishers in the West Coast Bioregion (WCB) between 1991/92 and 2006/07 and by the West Coast Demersal Scalefish (Interim) Managed Fishery in the WCB and the Abrolhos Zone A of the Western Rock Lobster fishery between 2008 and 2011.



WEST COAST DEMERSAL SCALEFISH FIGURE 5

Catch of the top fifteen demersal species and of West Australian Dhufish, Snapper and Baldchin Groper caught by the Charter and Recreational sectors in the West Coast Bioregion between 2005/06 and 2010/11. N/A, catch estimates not available.

Octopus Fishery Status Report

A. Hart, D. Murphy, S. Leporati, L. Joll

| Main Features | | | |
|---------------|------------|--|-------|
| Status | | Current Landings | |
| Stock level | Adequate | Commercial – Statewide | 166 t |
| Fishing level | Acceptable | Recreational – Statewide (2001 estimate) | 17 t |

Fishery Description

The octopus fishery in Western Australia primarily targets *Octopus cf. tetricus*, with occasional bycatch of *O. ornatus* and *O. cyanea* in the northern parts of the fishery, and *O. maorum* in the southern and deeper sectors.

Fishing activities targeting octopus in Western Australia can be divided in four main categories. The West Coast Rock Lobster Managed Fishery (WCRLF) harvests octopus as a by-product, and historically accounted for the majority of total octopus landings, although the Developing Octopus Fishery (DOF) is now the major octopus fishery. The Cockburn Sound (Line and Pot) Managed Fishery (CSLPF), uses unbaited or passive (shelter) octopus pots; the DOF uses both passive shelter pots and active (trigger pots) traps to selectively harvest octopus. Recreational octopus fishing consists of by-catch from recreational lobster pots, and targeted octopus fishing, mostly by SCUBA divers. In addition to these 4 main sectors, numerous trawl and trap fisheries land small amounts of octopus as a by-product.

Governing legislation/fishing authority

Commercial

Cockburn Sound (Line and Pot) Management Plan 1995

Cockburn Sound (Line and Pot) Managed Fishery Licence

Exemptions under Section 7 of the *Fish Resources Management Act 1994*

West Coast Lobster Management Plan 1993

West Coast Rock Lobster Managed Fishery Licence

Recreational

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

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

Recreational octopus fishing is permitted to operate throughout Western Australian waters, with the exception of reserves and sanctuaries. Each commercial fishing sector is limited spatially to the boundaries inherent in their legislative instruments. Octopus caught in the WCRLF are restricted to the boundaries of that fishery (between latitude 21° 44' S and 34° 24' S). Octopus catch in the CSLPF is limited to Cockburn Sound. Octopus caught in the DOF are limited to the boundaries of the developmental fishery, which is an area bounded by the Kalbarri Cliffs (26°30'S) in the north and Esperance in the south. Within the DOF there is also spatial separation of the areas fished by "Exemption holders".

Management arrangements

The keeping of octopus as a by-product in the WCRLF is permitted without catch restrictions or size-limits, however the catch rate of octopus within the fishery is monitored as a performance indicator to ensure it is maintained within historical levels (see WCRLF status report).

The CSLPF is managed through input controls in the form of limited entry and boat size restrictions. In 2011 explicit pot allocations were put in place, with total allowable pot number of 13,000 allocated to the fishery. This allocation has been designed to achieve an average target catch of 25 tonnes for the fishery.

The DOF is also managed through limited entry (currently only 5 exemption holders) and limits on octopus pot allocations specific for passive (shelter) and active (trigger) octopus traps. Effort is spatially controlled, with each exemption holder allocated a specific area of coast. Sustainable harvest levels and pot allocations in the DOF are currently being examined through a combination of exploration of new areas, and associated biological and stock assessment research.

The current recreational bag limit for octopus is 15 octopus, with a boat possession limit of 30 octopus. The Recreational Fishing (Permitted Fishing Methods) Notice (527) currently permits recreational fishers to use unbaited octopus traps when fishing from a boat (note that recreational fishers cannot dive from shore using traps to take octopus). However, the Fish Traps Prohibition Notice 1994 (677)

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prohibits all persons from taking fish by means of fish traps, with the exception of those persons that hold a recreational fishing licence and are using a rock lobster trap. No minimum size currently applies to octopus as the animals are not amenable to management by this method.

A comprehensive Ecologically Sustainable Development assessment of this fishery has also been undertaken to identify any potential sustainability risks requiring direct management. Boxed text in this status report provides the annual assessment of performance for this issue.

Research summary

Current stock assessment is focused on reporting of annual catch and effort statistics from commercial fisheries, reported on a monthly basis. In the DOF, additional reporting of daily catch and effort statistics by spatial location is also undertaken. The daily logbook provides details of the octopus fishing operations such as the depth, habitat, pot types used and soak times (the period of time pots remain in the water until next pull). Details on catch include catch size categories and estimates of undersize catch. The location of the fishing gear is recorded with a GPS position to enable a more precise spatial breakdown of fishing activities and the identification of fishing zones. In 2008 and 2009, two student projects investigating aspects of biology and ecology of *Octopus cf. tetricus* were also completed.

The Department has obtained a research grant from the Fisheries Research and Development Corporation (FRDC) for a project titled "Innovative development of the *Octopus tetricus* fishery in Western Australia". Results from this project will inform industry and management on the potential for expansion of the DOF and project completion is scheduled for October 2013.

Retained Species

Commercial landings (season 2011):

166 tonnes (live weight)

Recreational catch estimate (season 2001):

17 tonnes (live weight)

Landings

Commercial: In 2011 the total commercial octopus catch was 166 t live weight, a decrease of 7% over last year's catch of 178 t (Octopus Figure 1).

On a sector-specific level, octopus catch from the WCRLF increased 26% (from 27 to 34 tonnes) from 2010, catch from the CSLP has remained stable with 24 t, compared to 25 t in 2010, while the catch from the DOF decreased 10% from 119 tonnes to 107 tonnes (Octopus Figure 1).

The DOF has steadily risen from 4% of the total catch in 2001 to 65% in 2011 (Octopus Table 1). At the same time, share of catch from the lobster fishery has declined from 86% to 20%, primarily as a result of effort reductions, which have occurred in that fishery.

Recreational: No annual estimate of recreational catch exists for octopus. In 2001, the national recreational and

indigenous fishing survey¹ estimated a total catch of 25,600 octopus in WA. Using an average weight of 0.7 kg, this amounts to a total catch 17 tonnes.

Fishing effort/access level

Commercial: Fishing effort in the commercial octopus fishery is measured as the amount of days fishing in which octopus was caught. Total octopus effort (days on which octopus were landed) in the WCRLF in 2011 was 7,063 days, a 12% reduction from 8,071 days in 2010 (Octopus Table 1). Days fished in the CSLP and DOF were 218 and 522 respectively, a decrease of 20% and 28% respectively, from 2010 (Octopus Table 1).

Stock Assessment

Assessment complete: Preliminary

Assessment level and method:

Level 2 - Catch rate

Breeding stock levels: Adequate

Catch per unit effort: The catch per unit effort (CPUE) from the three main sectors (WCRLF, CSLPF, DOF) are the principal indicator of abundance of octopus.

The CPUE for octopus from the WCRLF was 4.8 kg/day, which was a 90% increase over the long-term average (2001-2009) of 2.5 kg/day (Octopus Figure 2). Otherwise it has been fairly stable between 2001 and 2010, varying between 2.3 and 3.4 kg/day. The increase in the last two years probably reflects the reduced level of fishing and the changing pattern of fishing with multiple day pulls being used

The CPUE for octopus in the CSLPF and DOF sectors was 110 and 206 kg/day respectively. CPUE has increased over time in both these sectors, from 30 kg/day in 2001 (Octopus Figure 2). This pattern is assumed to reflect increases in fishing efficiency, rather than abundance increases, primarily as a result of the developmental nature of these sectors, and the move to more efficient trigger traps.

A standardised CPUE (SCPUE) analysis for the CSLPF and DOF was also undertaken, based on daily catch and effort logbook data which provide more precise estimates of effort. This methodology is still under development, however preliminary trends have been estimated and are compared with the raw CPUE.

SCPUE for shelter pots has shown an increasing trend between 2008 and 2011 (Octopus Figure 3). SCPUE for trigger pots was similar in 2008, 2009 and 2011 at 1.2 kg / pot. In 2010 there was a sharp increase up to 1.9 kg / pot. This was the first year of major development of the fishery, with catch increasing from 30 to 110 t as the fishery expanded into areas which previously had little effort applied to them and the experience of operators with new gear increased.

¹ Henry, G.W. and Lyle, J.M. (eds). 2003. The national recreational and indigenous fishing survey. FRDC project no. 99/158. NSW Fisheries Final Report Series No. 48.

The initial performance measures for the fishery relate to breeding stock maintenance as indicated by catches remaining in the range 50 – 250 t and catch rate remaining above 70 kg/ day in the CSLP and DOF sectors. Both the catch and catch rate measure was met. Target catch ranges and performance indicators will be reviewed as more information becomes available.

Non-Retained Species

Bycatch species impact: **Negligible**

For the WCRLF, octopus are bycatch. The selective method of fishing used for the CSLPF and DOF results in a minimal level of bycatch of other species.

Protected species interaction: **Negligible**

There are currently no protected species known to be taken in this fishery.

Ecosystem Effects

Food chain effects: **Negligible**

This fishery harvests only a small amount of octopus per annum. The effect from this harvesting on the rest of the ecosystem, given that the catch is spread over a wide region, is likely to be insignificant.

Habitat effects: **Negligible**

Rock lobster potting in the WCRLF occurs primarily on sand areas around robust limestone reef habitats covered with coralline and macro-algae, and these habitats are considered resistant to lobster potting due to the hard nature of the bottom substrate. In the CSLPF and DOF, octopus-specific pots are set in similar habitats to those fished in the WCRLF, as well as sandy and seagrass areas, particularly in Cockburn sound. These are not expected to impact on benthic habitats as the soak times are at long-intervals, averaging 14 days in the DOF and 25 days in the CSLP.

Social Effects

Each dedicated octopus fishing vessel employs between 2 and 3 people. In 2011, ~ 187 vessels caught octopus, although the vast majority of these landings were small (< 100 kg), as they were by-catch in the WCRLF. Within the octopus specific fisheries, 6 vessels fished in the CSLP, and 11 vessels in the DOF. There is also a substantial processing and value-added component to the octopus catch with factories in Fremantle and Geraldton.

Economic Effects

Estimated annual value (to fishers) for 2011:

Level 2 - \$1 - 5 million (\$1.2 million)

The estimated annual value for 2011 was ~ \$1.2 million based on an average product price of \$10/kg (head off) or \$7/kg live weight.

Fishery Governance

Target catch range: **50 – 250 tonnes**

This is a preliminary target range due to the developing nature of the fishery. Current fishing level of 166 tonnes is within the target range.

New management initiatives (2011/12)

The DOF moved into a new phase in its management arrangements during 2011/12. While one operator had pioneered the development and usage of trigger traps, the opportunity to use this gear was provided to other Exemption holders in the fishery during the year. In conjunction with this change the spatial management framework of the fishery was also modified to align it with the northern and southern zones of the West Coast rock lobster fishery. Permitted gear usage levels (both trigger traps and shelter pots) were set at levels designed to ensure sustainability while exploring the scope for an increased level of catch. The movement to increased use of trigger traps and a broadening of the geographic scale of the fishery have necessitated keeping the management arrangements within an Exemption framework while the fishery establishes a new equilibrium. A move to a more formal management framework is unlikely to occur for at least two years.

The CSLP management plan is currently under review and discussions were being held between Industry and the Department of Fisheries to sort out the octopus fishing gear usage and entitlement levels. It is likely that changes to this plan will be made in 2012/2013.

External Factors

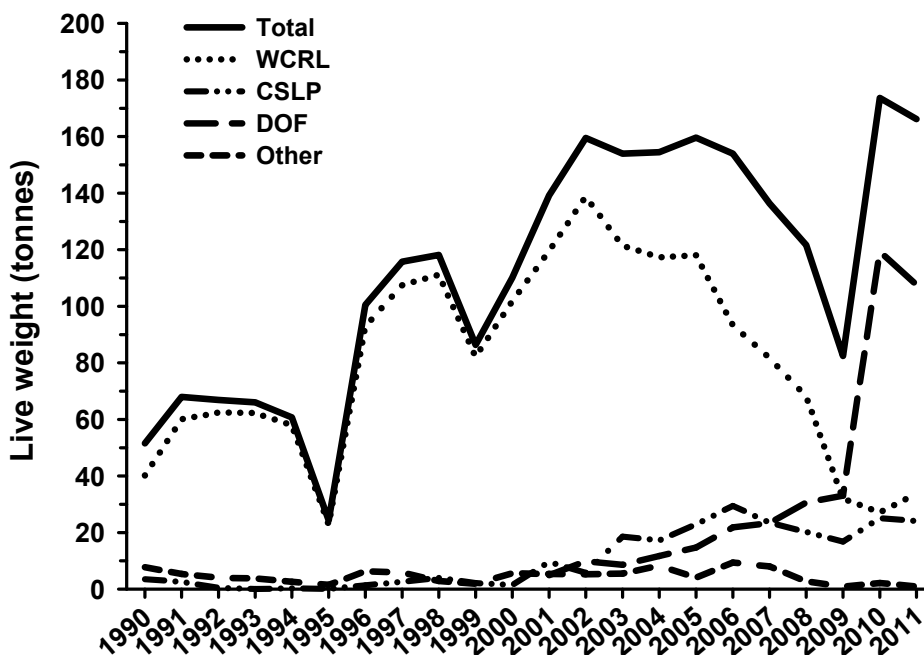
Cephalopods in general, including octopus, are known to be subject to large environmentally-driven fluctuations in abundance. If the fishery expands to reach a catch level approaching maximum possible yields, this year-to-year variability in abundance may prove a significant issue for the fishery. In particular, a "marine heatwave" experienced on the West Coast in the summer of 2010/11, where water temperatures reached 3 degrees C above average, may prove to have a significant effect on the fishery.

The move of the rock lobster fishery from an effort-controlled fishery to a catch quota fishery will change the octopus catch in the fishery. The low puerulus settlement in the lobster fishery has also resulted in the recent reductions of fishing effort of 50-70%.

OCTOPUS TABLE 1

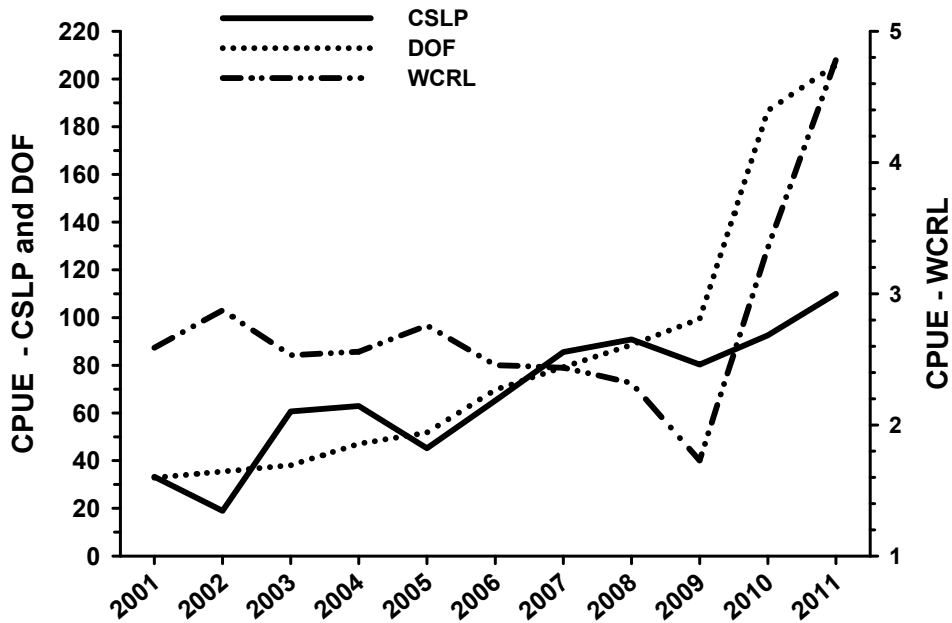
Percentage of octopus catch and total days fished from different sectors of the fishery. – WCRLF (West Coast Rock Lobster Fishery), CSLPF (Cockburn Sound Line and Pot), DOF (Developing Octopus Fishery) and Other, which is by-catch from trawl and miscellaneous pot fisheries.

| Year | Percentage of total catch | | | | Effort (total days fished) | | |
|------|---------------------------|-------|------|-------|----------------------------|-------|-----|
| | WCRLF | CSLPF | DOF | Other | WCRLF | CSLPF | DOF |
| 2001 | 86 | 6.9 | 3.5 | 3.8 | 46,100 | 287 | 149 |
| 2002 | 87 | 3.6 | 6.2 | 3.2 | 48,300 | 300 | 278 |
| 2003 | 79 | 12.1 | 5.6 | 3.6 | 47,900 | 306 | 225 |
| 2004 | 76 | 11.1 | 7.6 | 5.3 | 45,900 | 273 | 249 |
| 2005 | 74 | 14.3 | 9.2 | 2.5 | 42,800 | 505 | 284 |
| 2006 | 62 | 19.7 | 11.6 | 6.3 | 38,000 | 451 | 250 |
| 2007 | 63 | 18.1 | 12.9 | 6.1 | 33,500 | 274 | 211 |
| 2008 | 61 | 18.0 | 19.0 | 2.4 | 29,400 | 222 | 241 |
| 2009 | 39 | 20.3 | 40.0 | 1.0 | 19,299 | 256 | 248 |
| 2010 | 16 | 14.4 | 68.7 | 1.2 | 8,071 | 271 | 639 |
| 2011 | 20 | 14.5 | 64.7 | 0.5 | 7,063 | 218 | 522 |



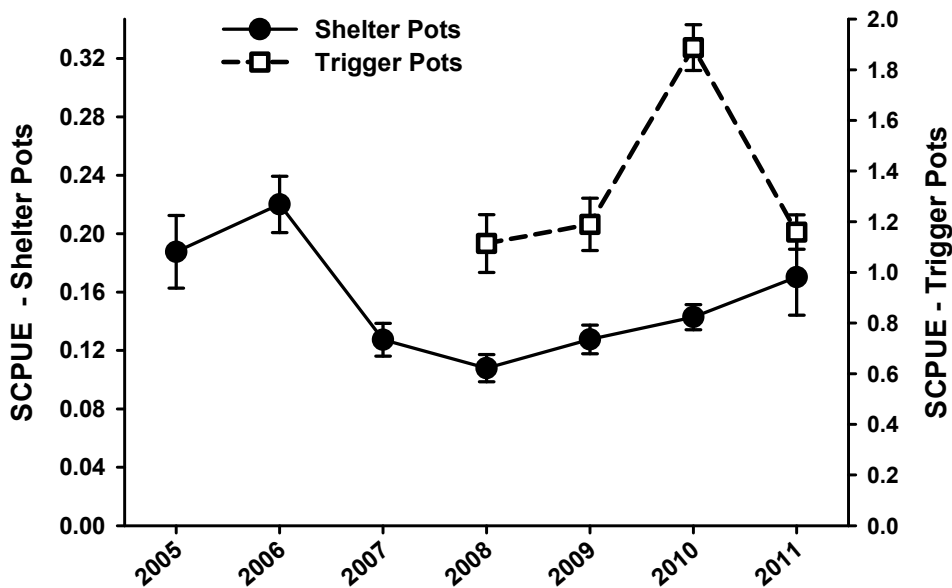
OCTOPUS FIGURE 1

Commercial catch (t) of octopus in Western Australia since 1990. Catch is divided between the main sectors – WCRLF (West Coast Rock Lobster Fishery), CSLPF (Cockburn Sound Line and Pot), DOF (Developing Octopus Fishery) and Other, which is by-catch from trawl and miscellaneous pot fisheries



OCTOPUS FIGURE 2

Catch per unit effort (CPUE) in kg/day of Octopus in the three main sectors – WCRLF (West Coast Rock Lobster Fishery), CSLPF (Cockburn Sound Line and Pot), DOF (Developing Octopus Fishery).



OCTOPUS FIGURE 3

Standardised catch per unit effort (SCPUE) ($\pm 95\%$ CL) in kg / pot (kg in live weight) of Octopus in all sectors. Trends are for two pot types – passive shelter pots, and active trigger pots.

AQUACULTURE

Regional Research and Development Overview

Aquaculture production statistics are compiled at the Western Australian Fisheries and Marine Research Laboratories (WAFMRL) at Hillarys.

The *Fish Resources Management Act 1994* now includes several new and amended provisions for aquaculture, mainly in relation to the environmental management of the industry and the establishment of offshore zones for aquaculture development.

The Department of Fisheries is now responsible for the environmental management of aquaculture in WA waters under the terms of a Memorandum of Understanding it has executed with the Department of Environment and Conservation. Environmental management will be effected principally through a requirement for licensees (with some exceptions) to develop and operate according to a Management and Environmental Monitoring Plan (MEMP). The Department is writing a set of Guidance Statements to assist licensees in the preparation of MEMPs.

A focus of the Department of Fisheries in the Abrolhos Islands area is the regulation of the pearling industry, based on species such as the blacklip oyster *Pinctada margaritifera*. The production of pearls from several other species such as *Pinctada albina* and *Pteria penguin* is also increasing in importance. More recently, attention has focused on the naturally-occurring Akoya oyster (*Pinctada imbricata*). A recent project, initiated by industry partners, demonstrated Akoya pearls can be produced successfully and provided the industry sector with the information it needs to continue to improve production strategies, reduce production costs, improve pearl quality and enhance the market value of the cultured Akoya pearls.

There is significant interest in coral and live rock aquaculture in the Abrolhos Islands. Several aquaculture licences have been issued authorising the production of naturally-occurring coral and live rock at sites at the Abrolhos Islands and others are being assessed.

Given the increasing interest in aquaculture in the vicinity of the Abrolhos Islands, the Department of Fisheries has started the development of a dedicated aquaculture policy for that area. The policy development process will involve substantial communication and consultation with stakeholders.

Through its Fish Health Unit, the Department of Fisheries worked closely with the Marine Fishfarmers Association and the Mid West Development Corporation on a successful project to test the feasibility of farming yellowtail kingfish in sea cages at Geraldton. The project demonstrated and validated the technical and commercial feasibility of offshore marine finfish aquaculture in WA coastal waters. Information generated by the project will underpin the future growth of the industry in the Mid-West region.

An FRDC project, developed in collaboration with a commercial octopus fishing and processing company, is continuing with research on ranching wild-caught juvenile octopus and seeking to close the life cycle through larvae rearing. This project has made a number of advances in rearing mechanisms for this species.

To assist in addressing the regulatory and approvals issues concerning aquaculture development in WA coastal waters, the Department of Fisheries has received Government funding of \$1.85 million over 2½ years to establish two aquaculture zones in the Kimberley and Mid West regions. Through this project, the Department of Fisheries will secure strategic environmental approvals for the zones from the Environmental Protection Authority, thereby streamlining the approvals processes for commercial projects within zoned areas and providing an “investment ready” platform for prospective investors.

The Department’s review of aquaculture licence conditions is scheduled to start in the 2012/13 fiscal year. The outcome of the review will deliver higher levels of consistency, transparency and certainty in licensing and compliance arrangements across all aquaculture industry sectors.

COMPLIANCE AND COMMUNITY EDUCATION

Compliance and community education in commercial and recreational fisheries in the West Coast Bioregion is undertaken by Fisheries and Marine Officers (FMOs) based at the Busselton, Bunbury, Mandurah, Rockingham, Fremantle, Hillarys, Lancelin, Jurien, Dongara and Geraldton offices, as well as aboard the large ocean-going patrol vessels *P.V's Mc Laughlin, Hamelin and Walcott*. The Department's MarineDiscoveryWest education team delivers targeted education programs throughout the West Coast region. These programs are delivered by Community Education Officers based in Busselton and Fremantle, with the assistance (where available) of Fisheries Volunteers based in some regional centres within the bioregion. Staff from the MarineDiscoveryWest team and the Naturaliste Marine Discovery Centre also provide education services and activities at Hillary's and in the Regions.

Services provided by land-based officers include processing inspections, landing and gear inspections, licensing checks, wholesale/retail checks and inshore sea-based patrols utilizing vessels ranging in size from 5 m to 12 m. They also provide support to seagoing personnel and provide a wide variety of educational and extension services through formal and informal media to commercial fishers, fishing related operations (wholesale/retail/processors), other resource management agencies and community members.

The Department also delivers at-sea marine safety compliance services on behalf of the Department of Transport in the Metropolitan region extending from Mandurah to Lancelin (excluding the Swan/Canning Rivers). Outside of this area, marine safety is unfunded and inspections are carried out in combination with fisheries compliance inspections.

Activities during 2010/11

During 2010/11, Fisheries and Marine Officers delivered a total of 24 334 hours of compliance and community education services in the field (West Coast Bioregion Compliance Table 1). This represents a 26% increase in field compliance over the previous year. A major component of this time was focused on the West Coast Rock Lobster Managed Fishery and recreational fishing. A continuing emphasis was placed on employing risk- and intelligence-based approaches to compliance planning and prioritization.

The Quota Management System commenced for the West Coast Rock Lobster Fishery on 15 November 2010. This presented a number of new requirements for fishers. The Department introduced a comprehensive education program during the course of the year, to assist fishers in their understanding of how to operate under the new Management Plan. The education program included both a number of preseason education sessions, and a high level of field education over the first few months. Attempts were made to contact all fishers at least twice during the season.

Other compliance activity for the West Coast Rock Lobster Managed Fishery focused on the outcomes of the Compliance Risk Assessment process. Routine compliance operations targeted catch disposal records, quota weight declarations, container security, over potting, Sea Lion exclusion devices

and other pot design issues, and black market operations.

Within the West Coast Rock Lobster Managed Fishery, 300 vessels had their catch inspected by FMOs on at least one occasion, with an average of 7 checks per vessel throughout the fishery (West Coast Compliance Table 2). On average 6.6 baskets were inspected per vessel, a decrease on the number of 11.4 baskets per vessel in 2009/10. The percentage of total catch inspected was 0.16 - 0.2% of the catch inspected (compared to 1.1 - 1.4% in 2009/10). These declines are reflective of the change of focus of compliance under a quota management system. The observed per-animal non-compliance rate for the catch was higher than the previous season with an estimated range of 0.0015 - 0.0023. This range has been used to estimate that between 8.0 and 12.4 tonnes of illegal rock lobster were consigned during 2010/11.

In addition to the rock lobster fishery, FMO's focused activity on ensuring high levels of compliance in other commercial fisheries such as the abalone, demersal scalefish (Wetline), crab, shark, scallop, pilchard and estuarine fisheries. A dedicated effort was applied to the Abalone 'black market' trade with a substantial prosecution resulting in four people being prosecuted and convicted.

Overall, compliance in the west coast bioregion by commercial fishers was similar to previous years, with the number of prosecutions marginally higher at 41 compared to 34 in 2009/10. The number of infringements decreased from the previous year, with a total of 16 infringement notices being issued. Infringement warnings decreased from 134 to 36.

A new initiative in 2010/11 was the introduction of the recreational mobile patrol teams. Five dedicated recreational fishing mobile patrols commenced operating within the bioregion based at Geraldton, Hillarys, Fremantle, Mandurah and Busselton will deliver fisheries compliance and education services to the recreational fishing community. They were supported by one of the state-wide recreational mobiles during the period of peak activity.

The mobile patrols enhanced the Department's visibility with the recreational fishing sector, and significantly supported the educational activities of field staff. This resulted in a significant increase in field contacts with recreational fishers, with FMOs achieving 71 257 field contacts, a 39% increase from 2009/10. The majority of the field contact and compliance effort focused on marine finfish (particularly the high risk demersal finfish), rock lobster, abalone, and crabs.

The Department continues to work collaboratively with the Department of Environment and Conservation (DEC) in delivering compliance services to marine parks throughout the bioregion. This collaborative approach has worked very effectively, particularly during the metropolitan abalone season (which occurs predominately within the Marmion Marine Park), and in the Jurien Marine Park, where DEC officers undertake joint patrols with FMOs thereby increasing the effectiveness of compliance service delivery. The level of non-compliance encountered in these parks is low.

Throughout the year FMOs undertook joint patrols with other agencies including the Department of Transport, Australian

WEST COAST BIOREGION

Customs Service and WA Police Service. The Department also continued to provide at sea resources to assist the Department of Environment and Conservation in the disentanglement of whales in the West Coast Bio Region. This assistance led to the successful disentanglement of a number of humpback whales entangled with primarily rock lobster fishing gear.

In the bioregion, the Department has had a growing role in shark response as part of the whole of government approach to the shark hazard program. During the year, FMO's provided support to incident responses and other program activities.

Initiatives in 2011/12

The second year of the implementation of the Quota Management System in the West Coast Rock Lobster fishery will see an ongoing high level of industry liaison and education to ensure a high level of voluntary compliance with the additional management changes from 20010/11. An ongoing priority is to ensure integrity with quota figures, and compliance focus will maintain on consignment weights and weight declarations. This will entail attention on catch recording regime and on landing and processor inspections to ensure that the relevant catch entitlement details are being recorded. There will also be a significant effort in the gathering of intelligence and dealing with black market operations as the catch limits reduce the number of lobster available in the domestic market. Compliance focus will be

on ensuring the catch limits, both individually and collectively, are not exceeded.

For the Abrolhos Islands, new regulations will be introduced for Sea Lion Exclusion devices and a prohibition on bait bands. There will be attention to fisher education and liaison on these requirements with field compliance checks.

Ensuring that only licensed wetline fishers are taking fish for a commercial purpose in the West Coast Demersal Scalefish Interim Managed Fishery will remain a compliance priority throughout the bioregion.

The increased focus on recreational fishing compliance will continue, particularly with the ongoing operation of the recreational mobile patrols operating within the Bio Region. Compliance and management personnel will continue to refine compliance planning to deliver greater efficiencies and outcomes through the use of risk assessments and intelligence processes.

In the Metropolitan area, MarineDiscoveryWest staff will continue their focus on school-based incursions working on sustainability and education themes developed as part of the state-wide education strategic plan. They will continue to deliver information and education activities at major events such as the Mandurah Boat Show and Crab Fest. The Naturaliste Marine Discovery Centre continues to play its role as the hub for education programs in the Metropolitan area, catering to students from kindergarten through to tertiary levels, school and environmental educators and the broader community.

WEST COAST COMPLIANCE TABLE 1

Summary of compliance and educative contacts and detected offences within the west coast bioregion during the 2010/11 financial year.

| | |
|--|----------------------|
| PATROL HOURS DELIVERED TO THE BIOREGION | 24,334 Officer Hours |
| CONTACT WITH THE COMMERCIAL FISHING COMMUNITY¹ | |
| Field Contacts by Fisheries & Marine Officers | 247 |
| Infringement warnings | 36 |
| Infringement notices | 16 |
| Prosecutions | 41 |
| CONTACT WITH THE RECREATIONAL FISHING COMMUNITY | |
| Field Contacts by Fisheries & Marine Officers | 71,257 |
| Infringement warnings | 1,405 |
| Infringement notices | 903 |
| Prosecutions | 267 |
| OTHER FISHING-RELATED CONTACTS WITH THE COMMUNITY² | |
| Field Contacts by Fisheries & Marine Officers | 6,281 |
| Fishwatch reports ³ | 574 |
| VMS (Vessel Days) ⁴ | 19,732 |

1 Commercial West Coast Rock Lobster contacts are excluded from these totals and detailed in West Coast Compliance Table 2.

2 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 Parks), 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. This table includes contacts made by PV's Hamelin and PV Houtman. Contacts made by PV Walcott are included in North Coast Compliance Table 1.

3 This represents the total number of Fishwatch reports, both commercial and recreational, since the service provider reporting mechanism cannot differentiate between sectors.

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

WEST COAST COMPLIANCE TABLE 2

Summary statistics for Commercial West Coast Rock Lobster compliance in all bioregions in the 2010/11 fishing season.

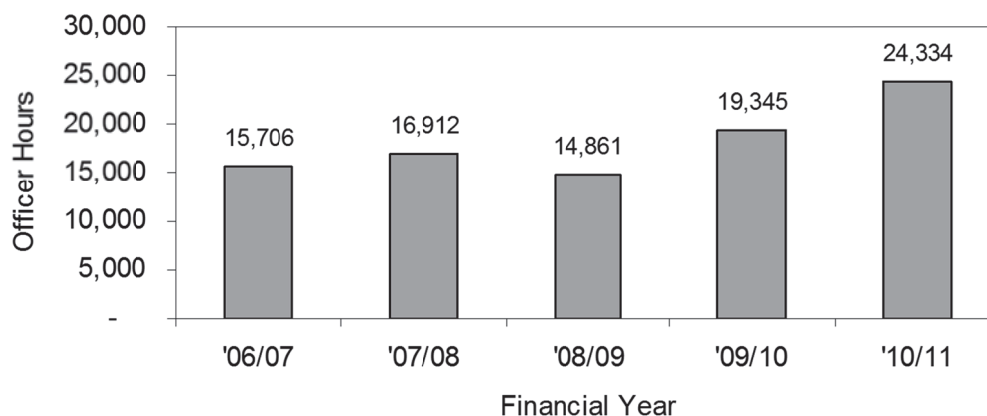
| | |
|---|----------------------|
| TOTAL COMPLIANCE HOURS ¹ | 16,630 Officer Hours |
| Field Contacts by Fisheries & Marine Officers | 934 |
| INSPECTIONS OF CONSIGNMENTS (Factory checks for Totally Protected Fish (TPF)) | |
| Number of unique vessels checked | 300 (61) |
| Average number of inspections per vessel | 7 (0.2) |
| Average number of baskets checked per vessel ² | 6.6 (5.1) |
| Proportion of total commercial catch inspected for TPF | 0.16-0.20% |
| TPF Non-compliance rate (per-animal basis) ³ | 0.0015 – 0.0023 |
| Total consigned commercial catch ('000 kg) | 5,502 |
| Estimated total illegal catch (TPF) consigned ('000 kg) | 8.0-12.4 |

1 Includes all time spent on compliance related tasks e.g. investigations, prosecutions etc.

2 Calculated as the total baskets checked per vessel divided by total inspections per vessel.

3 A rate of 0.001 indicates 1 illegal animal detected in every 1,000 animals checked.

West Coast Bioregion Compliance Patrol Hours



WEST COAST COMPLIANCE FIGURE 1¹

“On Patrol” Officer Hours showing the level of compliance patrol activity delivered to the west coast bioregion over the previous 5 years. The 10/11 total gives the patrol hours in the bioregion that resulted in the contacts detailed in Table 1 and Table 2. (The totals exclude time spent on other compliance related tasks e.g. travel time between patrol areas, preparation and planning time etc.)

1 These figures do not include 3,728 “on-patrol” hours delivered in 2010/11 by PV Hamelin and PV Houtman.

The total on-patrol hours for each of the Department’s 3 large patrol vessels is reported in the compliance summary of the most relevant bioregion: PV Walcott in North Coast, PV Houtman and PV Hamelin in West Coast.