

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. The Integrated Marine and Coastal Regionalisation for Australia (IMCRA V 4.0) scheme divides this Bioregion into three meso-scale regions: Abrolhos Islands, Central West Coast and Leeuwin Naturaliste (West Coast Overview Figure 1).

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 Coast and even into the South Coast.

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.

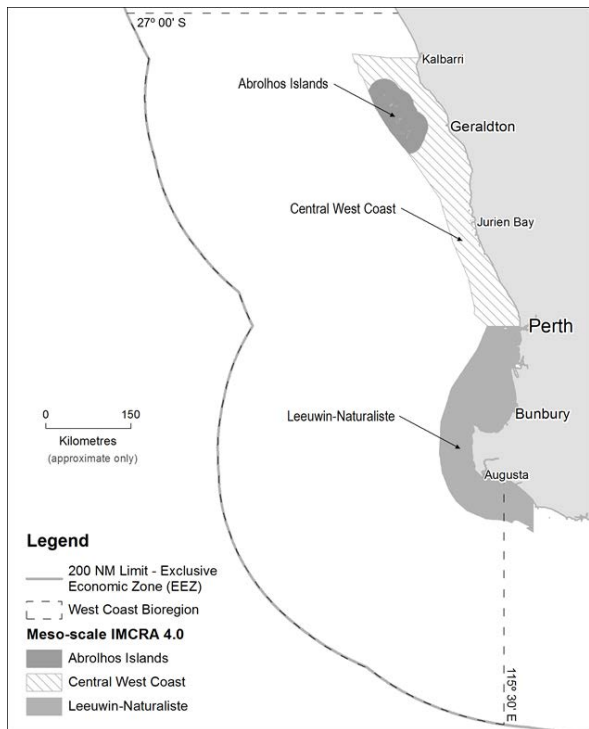
The West Coast is characterised by exposed sandy beaches and a limestone reef system that creates surface reef lines, often about 5 kilometres off the coast. Further offshore, the continental shelf habitats are typically composed of coarse sand

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 Midwest Coast, plus behind Rottnest and Garden Islands in the Perth metropolitan area.

The two significant marine embayments in the West Coast are Cockburn Sound and Geographe Bay. 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.

Southward of Cape Naturaliste, the coastline changes from limestone to predominantly granite and becomes more exposed to the influences of the Southern Ocean.

The ecosystem boundaries as defined by IMCRA (V 4.0) in the bioregion are depicted in West Coast Overview Figure 1. The potential threats and risks to these ecosystems are often similar. For simplicity risk ratings were allocated by grouping the ecosystems into two broad groups, estuarine or marine. However, if a particular ecosystem is unique and/or is exposed to different or significant threats, risk was allocated to these ecosystems separately.

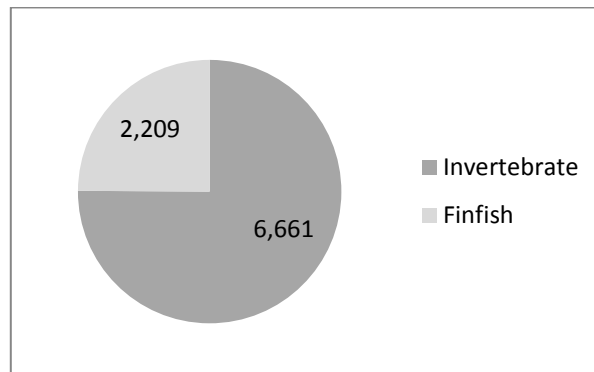


WEST COAST OVERVIEW FIGURE 1
 Map showing the three main IMCRA (v4.0) ecosystems in the West Coast Bioregion: Abrolhos Is.; Central West Coast and the Leeuwin-Naturaliste.

SUMMARY OF ACTIVITIES POTENTIALLY IMPACTING THE BIOREGION

Commercial Fishing

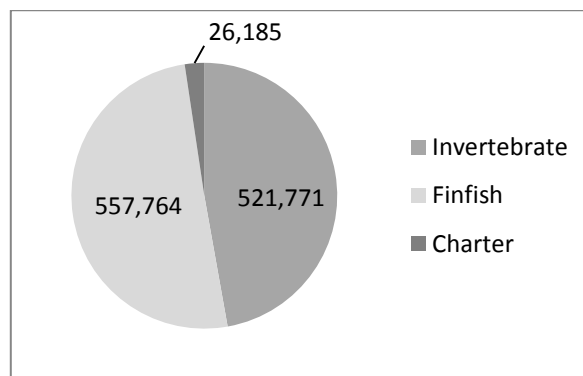
The principal commercial fishery in this region is the western rock lobster fishery, which is Australia’s most valuable single-species wild capture fishery. There are also significant commercial fisheries for other invertebrates including scallops, abalone, blue swimmer crabs and octopus that use trawl, diving and potting methods. Commercial fishers also 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 very restricted number of locations.



WEST COAST OVERVIEW FIGURE 2
 Relative contribution of finfish and invertebrates to the total commercial wild fishery catch originating from the West Coast Bioregion. Numbers represent total catch (in tonnes) based on all major assessed fisheries identified in the Overview section of this report (West Coast Overview Table 1).

Recreational Fishing

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.



WEST COAST OVERVIEW FIGURE 3
 The West Coast Bioregion finfish and invertebrate catch numbers as assessed in the integrated survey of boat-based recreational fishing in WA 2013/14, and the charter boat catch numbers for the same period.

Aquaculture

The principal aquaculture development activities in the West Coast Bioregion are the production of blue mussels (*Mytilus galloprovincialis*), 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. Initiatives to expand the number of aquaculture sectors in this bioregion currently include those for octopus, live rock/coral and finfish, the Department of Fisheries is in the process of securing strategic environmental approvals for Mid-West Aquaculture Development Zone.

Tourism

The State capital, Perth, is the principal gateway to more than two million visitors to Western Australia each year and a major international transit point for travellers arriving in Australia from Europe and Asia. The south-west of the state is also an important tourism destination for international and interstate visitors, as well as for Western Australian residents. Beach-going is among the most popular leisure activities for tourists in the West Coast Bioregion. Surfing, fishing, SCUBA diving and snorkelling, windsurfing, whale watching and other marine wildlife experiences are also popular tourist activities.

Shipping and Maritime Activity

The West Coast Bioregion contains several major port facilities, including the State's busiest general cargo port (Fremantle), as well as the Royal Australian Navy's largest base (HMAS Stirling) on Garden Island. In addition to handling most of Western Australia's container trade, significant quantities of non-containerised cargo passes through Fremantle, including: motor vehicles, steel and machinery imports, livestock exports and bulk commodities, such as petroleum, grain, alumina, iron ore, mineral sands, fertilisers and sulphur. Two other major commercial ports at Bunbury and Geraldton, primarily export iron ore, grain, mineral sands and alumina. In addition to commercial and naval shipping, international cruise ship visitations have increased to record levels in recent years and some cruise liners are now home-based in Fremantle.

Major shipbuilding, repair, maintenance and offshore construction support industries are also located at Henderson in the north-eastern corner of Cockburn Sound. Collectively, these enterprises directly employ over 2000 people, indirectly

support 3000 more jobs and generate around \$700 million annually in trade.

Other Activities

High rates of population growth and boat ownership in Western Australia have strained recreational boating facilities around major population centres, particularly in the Perth metropolitan region. New and upgraded marinas and boat launching facilities have therefore been completed or are planned to accommodate this demand. In addition, major coastal infrastructure developments have been planned for an outer deep-water harbour at Fremantle and for a deep-water iron-ore port at Oakajee, 24 km north of Geraldton. Two large desalination plants at Kwinana and Binningup (22km North of Bunbury), which supply approximately half of Perth's freshwater requirements, also operate in the bioregion.

BIOREGIONAL SPECIFIC ECOSYSTEM MANAGEMENT

Within each Bioregion there are a range of management measures that have been implemented to manage the potential impact of activities (See Chapter 3 for an overview). Management measures specific to the West Coast Bioregion include:

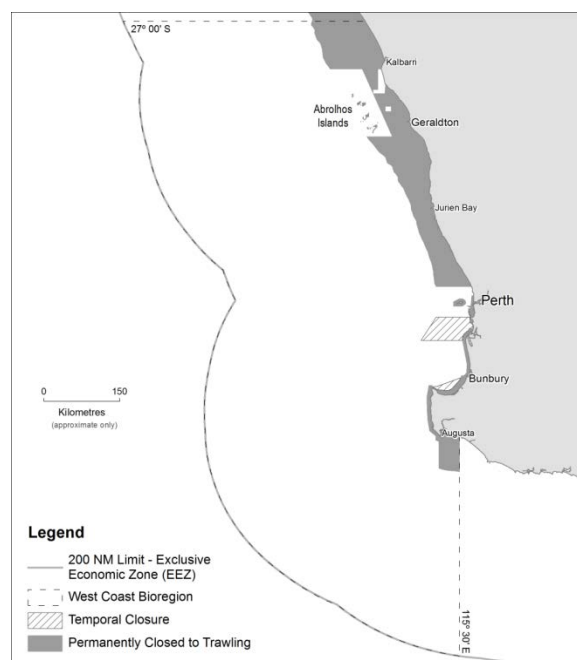
Spatial Closures

The marine benthic habitats and their associated biodiversity along most of the West Coast are largely protected 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 Overview Figure 4). Demersal gillnet and longline fishing was also prohibited from waters inside the 250m isobath between 31° and 33° South in November 2007. The extent of these areas means that most of the West Coast Bioregion inside 200m depth could be classified as one of the marine protected area IUCN categories (Ecosystem Management Table 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 Abrolhos Islands, Lancelin Island Lagoon, Cottesloe Reef, and Kalbarri Blueholes; Reef Observation Areas within the Abrolhos 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). In addition, marine conservation areas proclaimed under the Conservation and Land Management Act 1984 exist at Jurien Bay, Marmion, Swan Estuary, Shoalwater Islands, and Ngari Capes Marine Park between Cape Leeuwin and Cape Naturaliste; and the Rottne Island Marine Reserve. (West Coast Overview Figure 5).

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



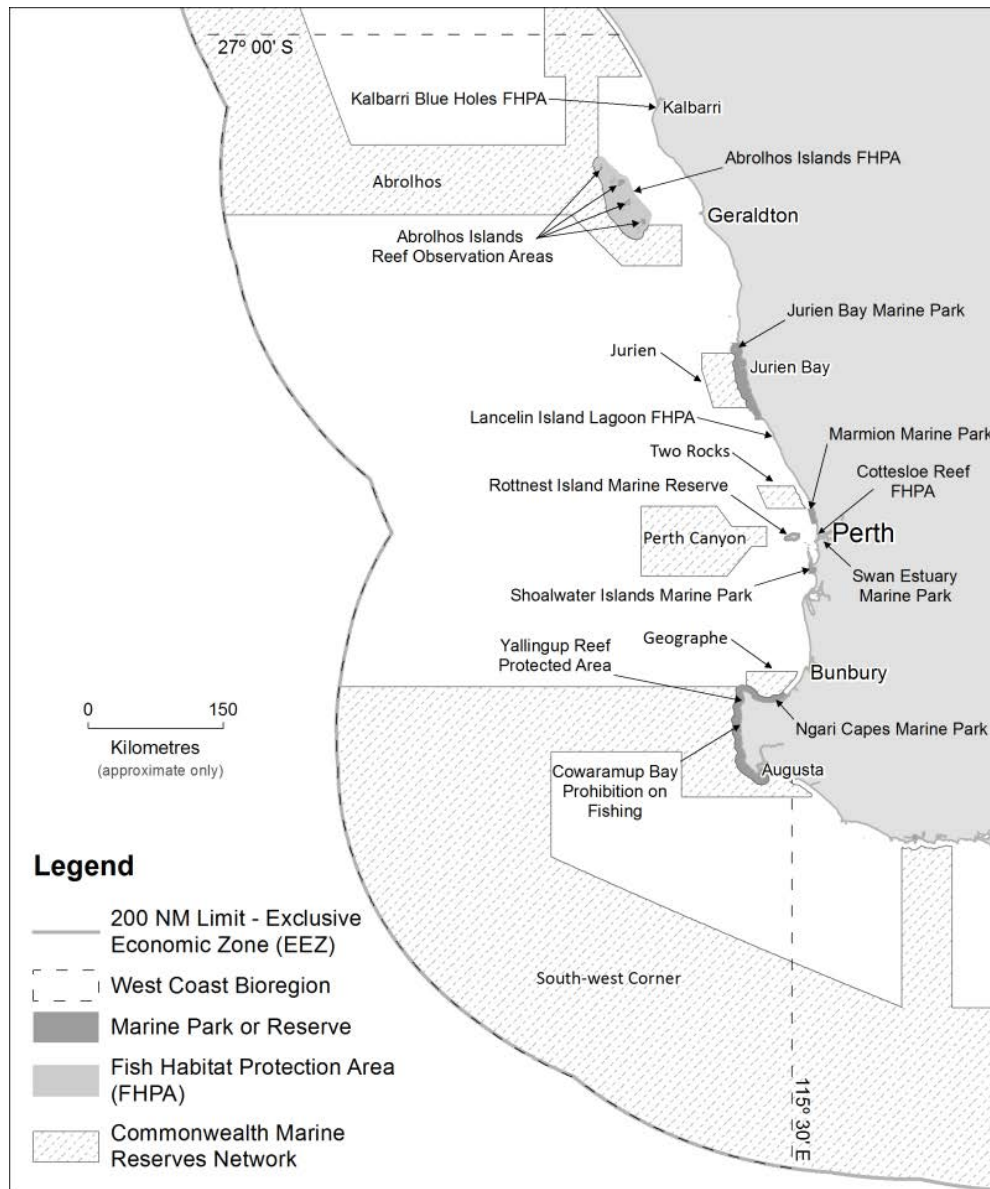
WEST COAST OVERVIEW FIGURE 4

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 TABLE 1

The areas and proportions of the West Coast Bioregion making up State Waters and all continental shelf waters, out to 200 m depth, which meet the IUCN criteria for classification as marine protected areas. This table does not yet include the closures that may be implemented by the Commonwealth as part of their marine planning zones.

IUCN category or equivalent	State Waters only (10,088 km ²)				All Waters (481,488 km ² (including State Waters))			
	Fisheries		Existing MPA		Fisheries		Existing MPA	
	km ²	%	km ²	%	km ²	%	km ²	%
I	0	0	0	0	0	0	0	0
II	1	< 1	171	2	1	< 1	171	< 1
III	0	0	0	0	0	0	0	0
IV	4,500	44	1,900	19	33,600	7	1,900	< 1
V	0	0	0	0	0	0	0	0
VI	3,400	34	116	1	445,700	93	116	< 1



WEST COAST OVERVIEW FIGURE 5

Map showing current and proposed formal marine protected areas in the West Coast Bioregion.

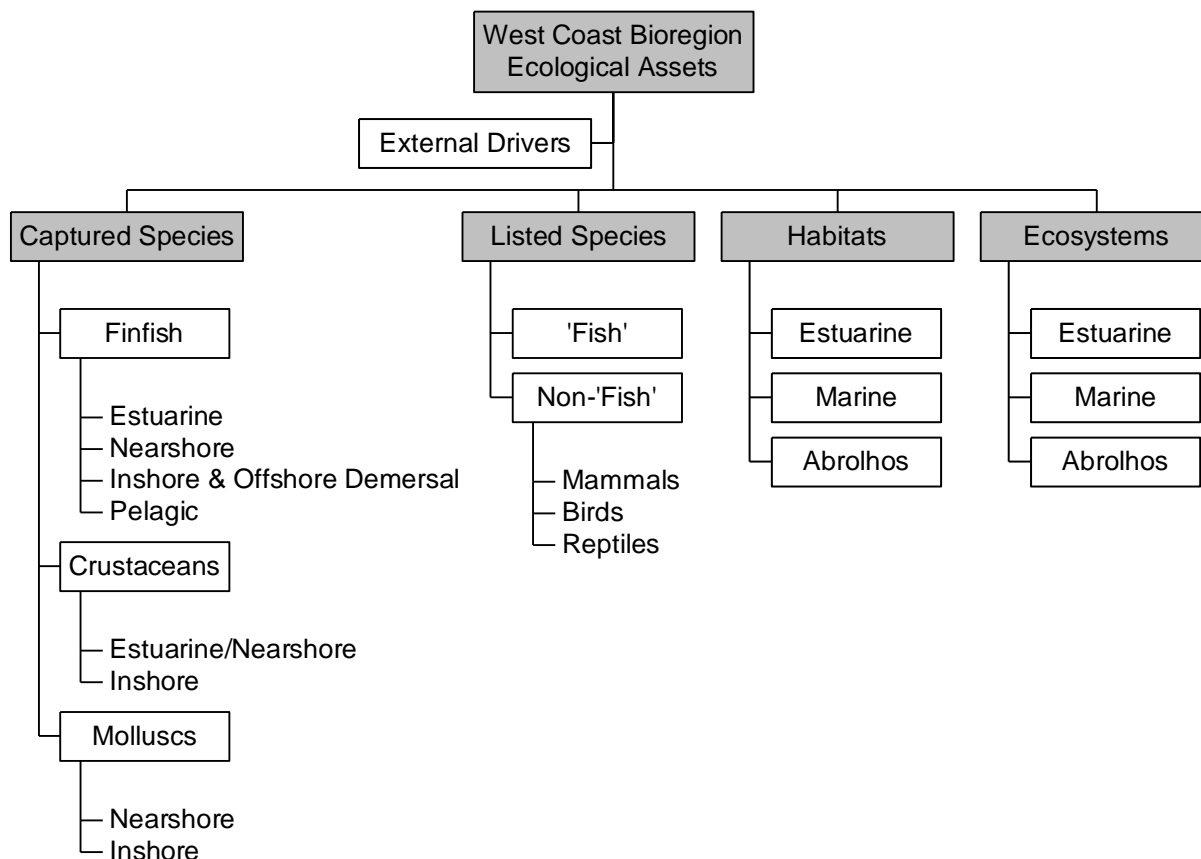
ECOSYSTEM MONITORING AND STATUS

In order to assess the adequacy of management arrangements aimed at ensuring sustainability of the ecological assets within the West Coast Bioregion, the Department must identify and monitor trends in the condition of these resources. This is achieved through application of an Ecosystem Based Fisheries Management (EBFM) framework (Fletcher, *et al.*, 2010 see How to use this Volume for more information) to identify, in a hierarchical manner, the key ecological resources that require ongoing monitoring and assessment. (See How to Use section for more details). These key ecological assets identified for the West Coast Bioregion are identified in West Coast Ecosystem

Management Figure 6 and their current risk status reported on in the following sections.

External Drivers

External factors include factors impacting at the bioregional-level that are likely to affect the ecosystem as whole and may not fall within the direct control of Fishery legislation (e.g. climate change). An understanding of these factors, which are typically environmental (cyclones, ocean currents) is necessary to fully assess the performance of the ecological resource. The main external drivers identified with potential to affect the West Coast Bioregion include climate and introduced pests and diseases.



WEST COAST ECOSYSTEM MANAGEMENT FIGURE 6
 Component tree showing the ecological assets identified and separately assessed for the West Coast Bioregion.

Climate

External Drivers	Current Risk Status
Climate	HIGH (long term)

Some climate change information has been taken into account in the rock lobster stock assessment process but further information is required to examine potential impacts on this bioregion.

Introduced Pests and Diseases

External Drivers	Current Risk Status
Introduced Pests	LOW
Introduced Diseases	LOW

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 introduced species *Didemnum perlucidum* has recently been detected at the Abrolhos Islands.

Captured Species

Finfish

Estuarine

Captured Species	Aquatic zone	Ecological Risk
Finfish	Estuarine	HIGH (non-fishing)

There is concern for some indicator fish stocks within estuaries in the West Coast Bioregion mainly due to external (non-fishing) factors (e.g. poor water quality and other environmental factors).

Nearshore

Captured Species	Aquatic zone	Ecological Risk
Finfish	Nearshore	SIGNIFICANT

With the increasing concerns for Australian herring, tailor and whiting in the nearshore regions, additional activities are being undertaken to assess these stocks and to develop methods to measure shore-based fishing catch and effort.

Inshore (20-250m depth) and Offshore (>250m depth) Demersal

Captured Species	Aquatic zone	Ecological Risk
Finfish	Inshore and Offshore Demersal	MODERATE

Following assessments of the inshore demersal indicator species (dhufish, pink snapper, baldchin groper), management actions were implemented to reduce both the commercial and recreational catch levels by 50% of their 2005/06 levels. Based on level 3 assessments of indicator stocks in 2013, this resource is now considered to be in a recovery phase.

While the deep-water indicator species are vulnerable to overfishing, current catch levels are low and therefore the stocks are not at risk. However, long term management arrangements for fishing in these depths, particularly for the recreational sector are still being finalised.

Pelagic

Captured species	Aquatic zone	Ecological Risk
Finfish	Pelagic	LOW

There is minimal capture of pelagic fish in this bioregion.

Invertebrates

Crustaceans

Captured species	Aquatic zone	Ecological Risk
Crustaceans (Crabs)	Estuarine/Nearshore	HIGH
Crustaceans (Lobsters)	Inshore	LOW
Crustaceans (Prawns)	Inshore	LOW

The stocks of crabs in Cockburn Sound have now recovered and the fishery has re-opened. Assessment of other crab stocks in this region (e.g. Peel/Harvey) has been completed and all are considered to be in an adequate state and fishing levels are acceptable.

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

Captured species	Aquatic zone	Ecological Risk
Molluscs (Abalone)	Nearshore	HIGH
Molluscs (Scallops)	Inshore	HIGH

The stocks of abalone are conservatively managed with strong management controls on both commercial and recreational fishers. However, the marine heat wave in 2010/11 caused the almost total loss of Roes abalone in the Kalbarri region and that region has consequently been closed since 2011/12.

The stock of scallops is considered environmentally limited with the Abrolhos Island fishery closed and no fishing occurring in the Mid-West Trawl Fishery.

Listed species

A variety of endangered, threatened and protected¹ (ETP) species can be found within the West Coast Bioregion, including cetaceans, sealions, elasmobranchs, seahorses and pipefish and sea/shore birds. These species are protected by various international agreements and national and state legislation. Primary pieces of legislation include the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*, the *Western Australian Wildlife Conservation Act 1950*, and the *Fish Resources Management Act 1994*.

Fish

Listed species	Ecological Risk
Fish	MODERATE

Grey nurse shark (*Carcharias taurus*) is protected under State and Commonwealth legislation throughout this and all bioregions. Blue groper (Rottnest Island), cobbler (Swan Canning) and baldchin groper (Abrolhos Islands FHPA between 1 Nov and 31 Jan) cannot be landed by commercial or recreational fishers in the particular areas and periods given parentheses.

¹ It must be noted that merely being on the listed species list does not automatically indicate that a species is either threatened or endangered.

Non-Fish

Listed species	Ecological Risk
Mammals	MODERATE
Birds and Reptiles	LOW

The only identified risk to bird species was to little penguins from boat strikes and non-fishing activities.

The West Coast Bioregion lies to the south of most marine turtles' distributions and, thus, there are minimal risks to turtles from fishing activities within this bioregion. The leatherback turtle, which is relatively more common in temperate latitudes, is rarely encountered in continental shelf waters, where the majority of fishing activities occur. Therefore, fishing is also considered to pose a low risk to this species. In addition, the small trawl fishery that operates around the Abrolhos Islands uses bycatch reduction devices, which are effective at minimising the capture of turtles.

Sea lion exclusion devices have now been implemented for rock lobster pots near Australian sea lion breeding colonies. Demersal gillnet fishing effort, which has historically been responsible for a very small number sea lion captures, has been reduced to less than 10% of its peak level in the late 1980s. Regulated modifications rock lobster fishing gear configuration during humpback and southern right whales' northerly winter migration, have successfully reduced entanglement rates by more than 65% in recent years. Thus, risks to mammals from fishing activities in the West Coast Bioregion have decreased in recent years (but are not yet considered to be low).

Habitats and Ecosystems

Due to the counter-acting Leeuwin and Capes currents, the West Coast Bioregion has the unique characteristic of containing tropical, sub-tropical and temperate ecosystems.

The key habitats occurring in depths of less than 40 m (where the vast majority of relevant fisheries resources are located and fishing activities are undertaken in this bioregion) include:

Algae: Along the WCB, algae attach to intertidal and subtidal rocky substrata and in turn, are habitat to a variety of organisms. Algal assemblages contribute to marine nutrient and carbon cycling are also an important as a food source, nursery grounds and shelter for a variety of organisms. Along the WCB, there is a gradual transition from a subtropical flora

of the Abrolhos Islands and north of Geraldton to a cold-temperate flora found along the southwest corner and south coast of WA. Macroalgae along the southwestern and southern coasts of Australia are very diverse, with a high level of endemism.

Sand: The majority of seabed of the WCB is composed of soft, unconsolidated sediments. These sediments provide an important habitat for microalgae and benthic infauna.

Seagrasses: In temperate WA, seagrasses occupy approx. 20 000 km² of shallow coastal and grow predominantly on sand from 1 – 35 m depth, but also on deep rock to over 50 m deep. Seagrasses provide of habitat for many fish and crustacean species, stabilise of coastal sediments and prevent of coastal erosion. In addition seagrasses are also important for primary production, CO₂ uptake and nutrient cycling. The diversity of seagrasses in temperate south-western Australia is the highest for any temperate region, with 17 species within WCB and SCB combined.

Corals: Due to the cool temperate waters corals are not common in the WCB with the exception of the Abrolhos Islands, which are located offshore and are more exposed to the warm Leeuwin Current. The Abrolhos Islands are well-known for their high species diversity, coral reefs and unique mixture of temperate and tropical species. Currently there are 184 known coral species at the Abrolhos. Elsewhere in the WCB corals occur in patches around offshore islands, usually comprised of only a few species.

Sponges: In southwestern Australia, sponges are found in areas where algae are less dominant, which includes areas deeper than 30 m and caves. As they are sessile filter-feeders, sponges flourish in areas of high current, although large sponges are also found in calmer deeper waters. In areas with an absence of reef-building corals, sponges function as large epibenthos that form the three-dimensional structure of subtidal reefs providing shelter for other organisms, such as worms, crustaceans, echinoderms, molluscs and fish.

Habitats

Habitats	Aquatic zone	Current Risk Status
West Coast Habitat	Estuarine	SIGNIFICANT (non-fishing)
West Coast Habitat	Marine	LOW
Abrolhos Islands	Marine	MODERATE

The West Coast is a microtidal, relatively high-energy area, with clear water and few rivers. The coastline is characterised by long beaches with occasional limestone cliffs and headlands, with offshore limestone islands and reef complexes. There are numerous protected marine areas in the West Coast (West Coast Overview Figure 5). Spatial zoning restricts activities within these areas including preventing trawling.

The Peel Harvey Estuary habitats are under pressure due to poor water quality as a result of farming, canal development and urbanisation in the surrounding catchment. A benthic habitat monitoring program is planned to quantify impacts of recreational crabbing as a part of the MSC assessment process. Cockburn Sound which contains large areas of seagrass has been mined for shell sand since 1972. The permitted areas for mining have been increasingly restricted and regulated since the commencement of mining operations.

The main fisheries in the Central West Coast involve fishing gear which has minimal impacts to the benthic habitats. These include: western rock lobster which uses traps, Roes abalone which are hand collected and several fin fisheries that mainly use lines.

Due to the unique diversity of tropical and temperate habitats, the Abrolhos Islands were gazetted as WA's first Fish Habitat Protection Area (FHFA) and have been placed on the National Estate Register. Due to this, the risks to Abrolhos Islands habitats are assessed separately to the bioregion as a whole.

The main activities at the Abrolhos are commercial rock lobster potting and line fishing and recreational fishing and diving. The Department has a long term coral reef monitoring program at the Abrolhos to detect potential impacts from human use and natural influences. A significant coral bleaching event was observed during the marine heat wave event in 2011 (Abdo *et al.* 2012)¹.

There are 45 public moorings installed at the Abrolhos Islands, distributed around the different island groups, to minimise impacts of anchoring to the benthic habitats. The commercial scallop fishery (which is currently closed) also operates away from coral reef habitats, predominately in areas of sand.

Ecosystems

Ecosystem	Aquatic zone	Current Risk Status
West Coast	Estuarine	SIGNIFICANT (non-fishing)
West Coast	Marine	MODERATE
Abrolhos Islands	Marine	MODERATE

The estuarine ecosystems within this bioregion 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 mass mortality events in Cockburn Sound are of particular concern.

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)². Continued monitoring of a deep water closed area will allow evaluation of potential ecosystem impacts of lobster fishing in deeper water ecosystems.

The Abrolhos Islands is noted for its high species diversity, which is attributed to the relatively equal mix of temperate and tropical species. Due to the uniqueness of the AIE in the West Coast Bioregion, it is assessed separately to the bioregion as a whole.

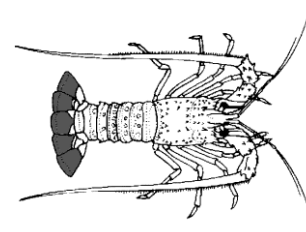
The Abrolhos Islands are protected within a 'Fish Habitat Protection Area', and are not considered to be at unacceptable risk from fisheries related activities. The first significant bleaching of corals was observed during the marine heat wave event along the Western Australian coast in 2011 (Abdo *et al.* 2012)¹, with the impact of this event being monitored as part of an ongoing monitoring program run by the Department. The program also includes monitoring of key invertebrate species, and the community structure of finfish within and outside of non-fishing areas.

¹Abdo DA, Bellchambers LM, Evans SN. 2012. Turning up the Heat: Increasing Temperature and Coral Bleaching at the High Latitude Coral Reefs of the Houtman Abrolhos Islands. PLoS ONE 7(8): e43878.

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

WEST COAST ROCK LOBSTER RESOURCE STATUS REPORT 2016

S. de Lestang and M. Rossbach



OVERVIEW

The West Coast Rock Lobster Managed Fishery (WCRLMF) targets the western rock lobster, (*Panulirus Cygnus*), on the west coast of Western Australia between Shark Bay and Cape Leeuwin by both the commercial and recreational sector for which formal IFM allocations have been determined.

The commercial fishery was one of the first limited entry fisheries in the world and for over 20 years utilised a sophisticated Individual Transferrable Effort system based on the number of allowable baited pots. In 2010/11 the fishery began the transition to an Individually Transferable Quota (ITQ) fishery and now has a harvest strategy that uses maximum economic yield as its management

target (DoF, 2014). This fishery has historically been Australia's most valuable single species wild capture fishery and, in 2000, became the first fishery in the world to achieve Marine Stewardship Council (MSC) Certification. In 2012 it was the first to be certified by MSC for the third time. The commercial fishing season now begins on the 15 January each year and runs 12 months.

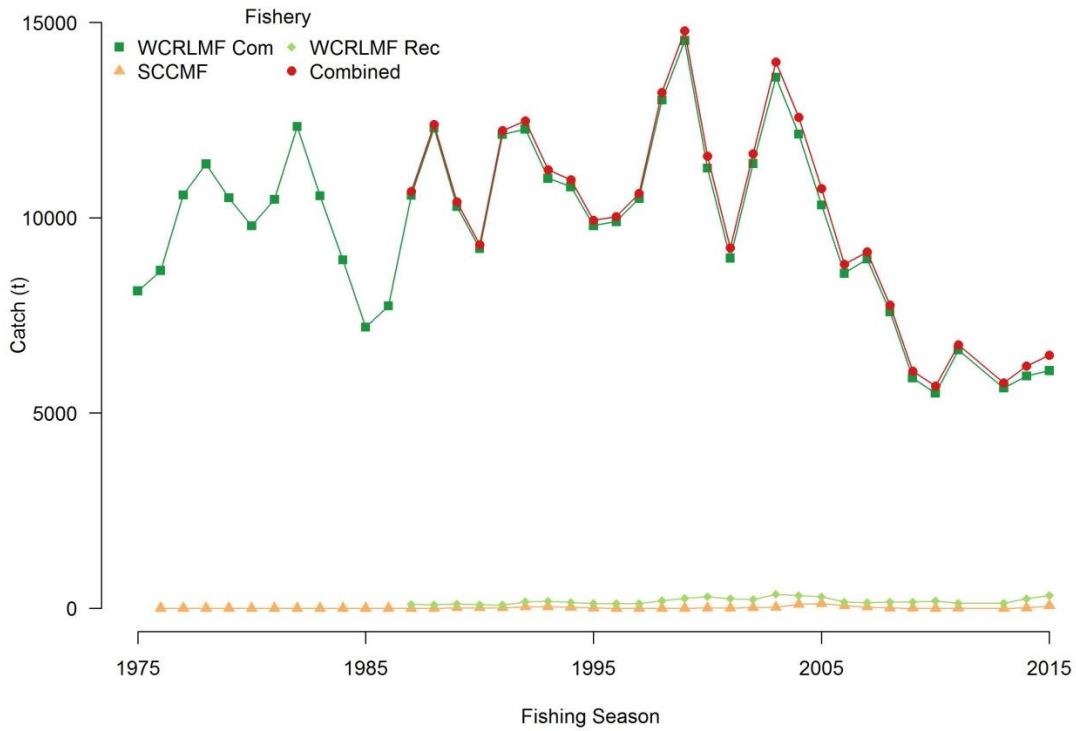
The recreational fishery extends from 15 October each year until the following 30 June. Licenced recreational fishers are allowed to each use two baited pots or hand collection by diving to collect legal sized and reproductive condition lobsters up to the bag or boat based limit.

SUMMARY FEATURES 2016

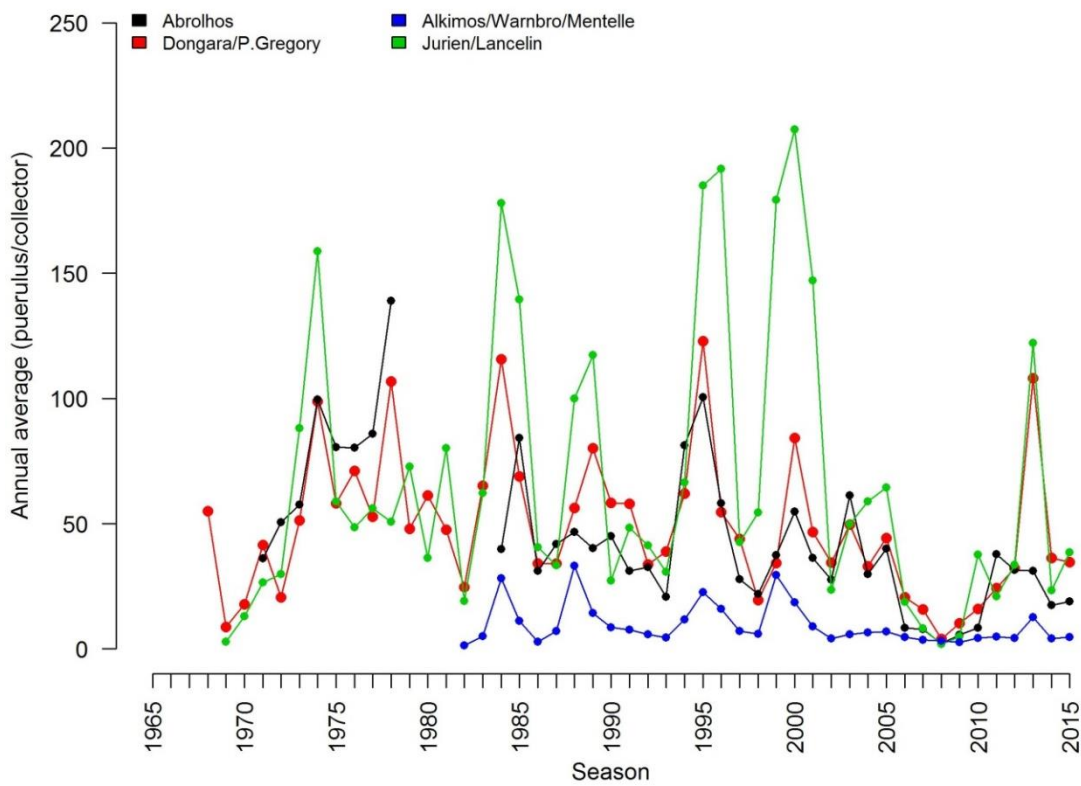
Fishery Performance	Commercial	Recreational	
Total Catch 2015	6086 t	267-394 t	
Fishing Level	Acceptable	Acceptable	
Stock/Resource Performance	Stock Status	Assessment Indicators	
Western Rock Lobster	Sustainable - Adequate	Annual: Integrated Model, Egg Production	
EBFM Performance			
Asset	Level	Asset	Level
Bycatch	Low Risk	Listed Species	Negligible Risk
Habitat	Low Risk	Ecosystem	Low Risk
Social	High Amenity Low Risk	Economic	GVP (\$423 million)- Moderate Risk
Governance	Review of Harvest Strategy	External Drivers	Moderate Risk

CATCH AND LANDINGS

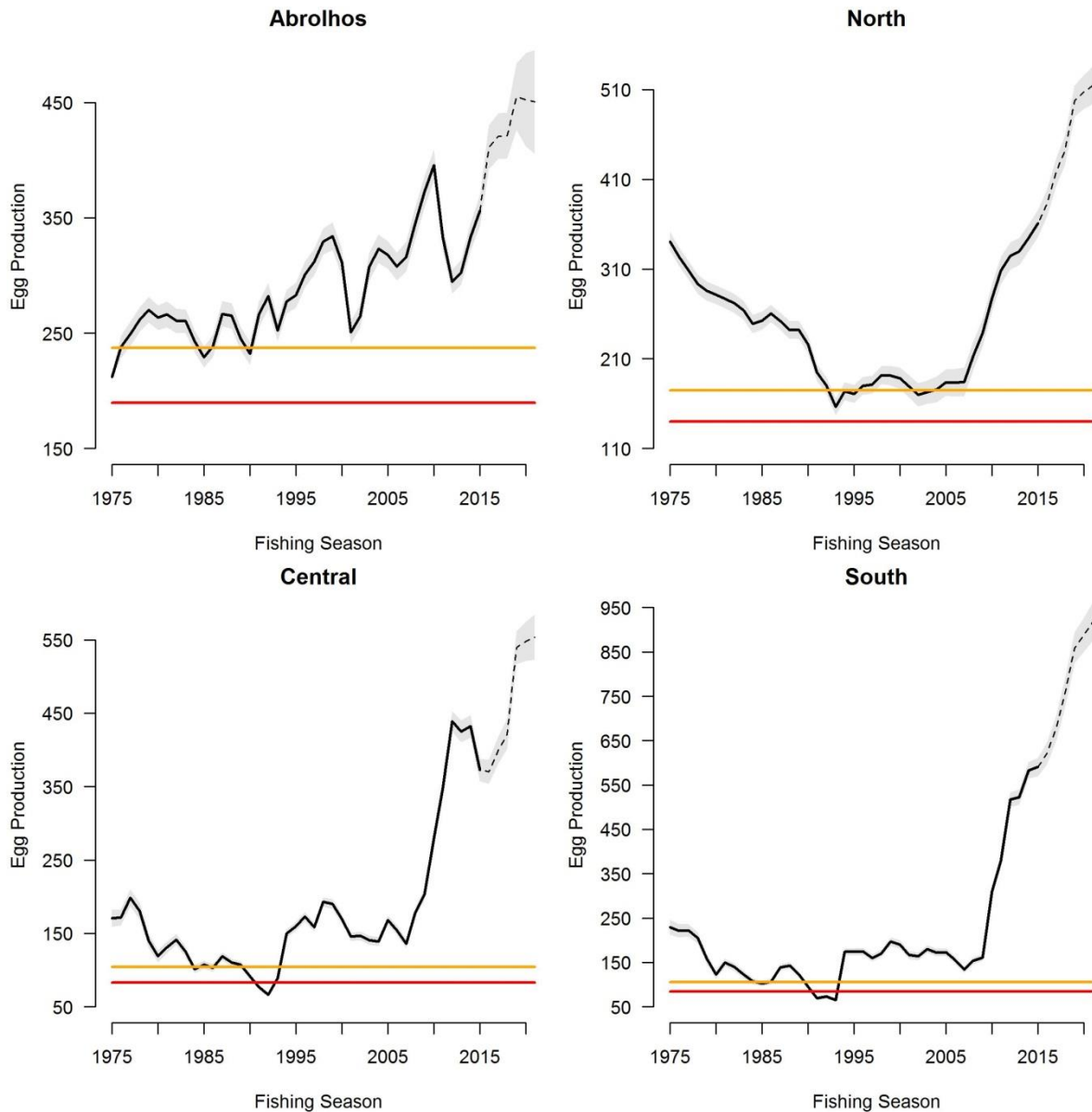
The total landings of western rock lobster in 2015 from the WCRLMF were 6416 t. The commercial catch was 6086 t compared to an allowable catch of 6090 t (TACC of 6000 plus drip loss). The recreational catch was estimated to be between 274-394 t compared to the TARC of 404 t (Western Rock Lobster Figure 1).



WESTERN ROCK LOBSTER FIGURE 1. Total landings by fishery (and combined) for western rock lobster.



WESTERN ROCK LOBSTER FIGURE 2. Levels of puerulus settlement in four regions of the fishery from 1968 until 2015.



WESTERN ROCK LOBSTER FIGURE 3. Modelled estimates (black) and projections (dotted line) of egg production for the four breeding stock management areas based on a TACC of 6300 t. 75% CI is denoted in grey. Horizontal lines represent the threshold (orange) and limit (red) reference points for breeding stock levels in each breeding stock management area.

INDICATOR SPECIES ASSESSMENTS AND STOCK STATUS

Western rock lobster - (Sustainable-Adequate)

Western rock lobster (WRL) is considered a single management unit in the West Coast Bioregion and the same genetic stock extends into the South Coast Bioregion (see de Lestang *et al.*, 2016 - WRL RAR 2016 for further details).

http://www.fish.wa.gov.au/Documents/wamsc_reports/wamsc_report_no_9.pdf

Fishery-independent egg production indices at all sites are well above long-term levels and above

threshold reference levels indicating that the biomass and egg production in all locations of the fishery is at record high levels since the mid-1970s. The breeding stock is therefore considered adequate.

Fishery-independent recruitment (puerulus) monitoring indicates that the current puerulus settlement is continuing its recent pattern of being just below its historic average (Western Rock Lobster Figure 2).

The integrated population model indicates that a continuation of fishing at similar or slightly higher TACCs (e.g. 6300 t) over the coming five year

period will continue to result in increasing biomass and catch rates (see WRL RAR section 9.3.14 and Western Rock Lobster Figure 3).

BYCATCH AND PROTECTED SPECIES INTERACTIONS

The main by-catch species landed in the WCRLMF are octopus, champagne crabs (CC) and baldchin grouper (BG). Octopus contribute most to total by-catch landings with 10.2 t in 2015 and only incidental landings of the other species being recorded (1.1 and 1.5 t for CC and BG, respectively).

The WCMRLF may interact with a number of protected species with substantial improvements having been achieved during the past decade (see WRL EAR section 4).

To mitigate the risk to juvenile Australian sea lions (ASL) all pots fished within designated sea lion areas are now fitted with devices to stop the accidental drowning of ASL. Since their implementation there have been no records of drowned ASL.

During the whale migration season (May – October inclusive) all pots must comply with mitigation measures aimed at reducing the entanglement of migrating whales (see WRL EAR section 4). This has resulted in a significant (80%) reduction in reported whale entanglements. There were two entanglements reported in 2015.

Turtles can also get caught in the float rigs of lobster pots. In 2015 no turtles were reported to have been entangled in lobster fishing gear.

HABITAT AND ECOSYSTEM INTERACTIONS

While WRL may use a range of habitats throughout their life-cycle, including shallow water reefs and adjacent seagrass beds as juveniles, or un-vegetated areas during their migratory phase ('whites'), the algal covered limestone reefs form the habitat for the majority of the population.

WRL are an omnivorous generalist feeder, with a diet that consists on a variety of invertebrate, algae, carrion and bait. Results from monitoring in areas closed and open to WRL fishing, established to examine the potential ecosystem effects of WRL removal, suggest that lobsters do not play a

keystone role in ecosystem functioning (see WRL EAR section 6.2).

SOCIAL AND ECONOMIC OUTCOMES

Social

The commercial rock lobster fishery is important for regional employment with over 230 commercial vessels operating in 2015 with catch handled by four main processing establishments. The rock lobster fishery is also a major recreational activity and provides a significant social benefit to the Western Australian community with over 50,000 recreational fishers obtained rock lobster licences in 2015. At current high stock levels there is **low risk** to the social amenity.

Economic

The estimated average price across all processors and all zones of the fishery received by commercial fishers for the western rock lobster in 2015 was \$69.52/kg. This was an increase on the \$60.40/kg paid in 2014, and may be due to better fishing practices and a stronger export market and relatively lower Australian dollar. The increased beach price with a slightly higher TACC resulted in the overall value of the fishery increasing to \$420 million. As the majority of landed lobsters are exported to a single market (China) this represents a **moderate risk**.

GOVERNANCE SYSTEM

Allowable Catch Tolerance Levels

The landed commercial catch of 6086 was very close to the Total Allowable Commercial Catch (TACC) of 6000 t plus 1.5% for water loss (= 6090 t) and therefore the catch level was acceptable. The upper end of the estimate of recreational catch (274-394 t) was also close to the TARC of 404 t and was therefore also considered acceptable.

Harvest Strategy

A common Harvest Strategy and Decision Rules (DoF, 2014) are used to set catch limits for both commercial and recreational sectors on an annual basis. The HSDR have a primary sustainability objective to maintain egg production at sustainable levels and a secondary economic objective to target maximising the profitability of the fishery i.e. at Maximum Economic Yield (MEY) levels. The upper limit of the MEY assessment is currently used to determine the upper limit of the annual Total Allowable Catch (TAC) as this is the

basis of setting the Total Allowable Recreational Catch (TARC).

Modelled future projections of the fishery and MEY analysis indicates that a small (5 – 10%) increase in TAC will move the commercial fishery towards MEY and maintain healthy levels of egg production. As such the commercial fishery has requested an increase in the TACC from 6000 t in 2016 to 6300 t in 2017.

Compliance

The majority of enforcement effort is applied to ensure that fishers' catches are within their quota entitlement.

Consultation

Consultation occurs between the Department and the commercial sector either through the Western Rock Lobster Council or the Annual Management Meetings convened by the Western Australian Fishing Industry Council. Consultation with Recfishwest and other interested stakeholders is conducted through specific meetings and the Department's website.

Management Initiatives

Consultation with the commercial industry and Recfishwest on the review of the HSDR will begin

in 2017. This process will aim to incorporate some of the outcomes from a recent FRDC project which examined the current TAC setting methodology.

EXTERNAL DRIVERS (*Moderate Risk*)

The variations in western rock lobster recruitment to the fishery are largely a result of variable levels of puerulus settlement 3-4 year previously. Catches are also dependent upon the environmental conditions at the time of fishing. Investigation into the puerulus downturn in 2007-2009 have identified that when the spawning started early (temperature driven) and was coupled with low numbers of winter storms during the larval phase, the puerulus settlement was significantly lower.

At a longer time scale, western rock lobsters have been rated a **high risk** to the effects of climate change as many aspects of its life history are highly sensitive to environmental conditions (Caputi *et al.*, 2010).

The economic performance of the fishery is strongly affected by the value of the Australian dollar (affecting the price of lobsters), fuel and labour costs and status of the Chinese economy as China imports nearly all of the western rock lobsters.

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WEST COAST ROE'S ABALONE RESOURCE STATUS REPORT 2016

L. Strain, J. Brown and S. Walters



OVERVIEW

The Roe's abalone (*Haliotis roei*) fishery is a dive and wade fishery, operating in shallow coastal waters along WA's western and southern coasts. The commercial Roe's abalone fishery is managed primarily through Total Allowable Commercial Catches (TACCs), which are set annually for each of the six management areas and allocated as Individually Transferable Quotas (ITQs).

The recreational fishery is divided into three zones: Zone 1 (Western Zone - including Perth metropolitan area), Zone 2 (Northern Zone) and Zone 3 (Southern Zone), with management arrangements that include a specific abalone recreational fishing licence, size limits, daily bag and possession limits, temporal and spatial closures, and a Total Allowable Recreational Catch (TARC) in the Western Zone. Further details on the fishery can be sourced from Hart *et al.* (2017).

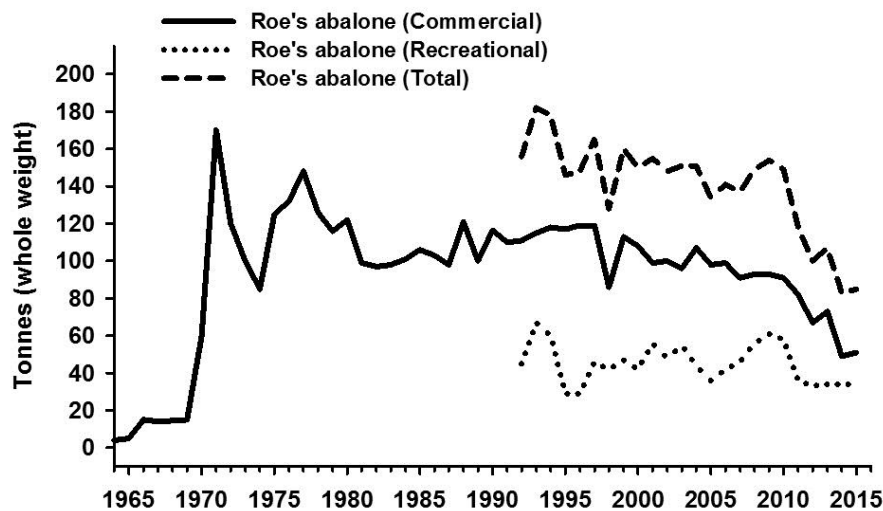
SUMMARY FEATURES 2016

Fishery Performance	Commercial	Recreational	
Total Catch 2015	51 t	15 - 25 t Perth Metro Area; 14 t Other	
Fishing Level	Acceptable	Acceptable	
Stock/Resource Performance	Stock Status	Assessment Indicators	
Roe's abalone	Sustainable - Adequate (some areas)	Annual: Catch, Catch Rates, Surveys	
EBFM Performance			
Asset	Level	Asset	Level
Bycatch	Negligible Risk	Listed Species	Negligible Risk
Habitat	Negligible Risk	Ecosystem	Negligible Risk
Social	High Amenity High Risk	Economic	GVP - \$1.2 million High Risk
Governance	TAC review (Area 7 / Zone 1) MSC full assessment underway	External Drivers	High - Extreme Risk

CATCH AND LANDINGS

In 2015 the total commercial catch was 51 t whole weight, a 4% increase from 2014 (49 t) and only 59% of the 87 t whole weight TACC (Roe's Abalone Figure 1). The commercial catch was less than the TACC in Area 1 (0% caught), Area 2 (61% caught), Area 5 (28% caught) and Area 6 (22% caught), which was primarily driven by economic reasons (low value of catch and few viable markets), high cost of accessing these areas and prevailing weather conditions (Area 6). Area 7 (Perth metropolitan fishery) was the only management area that fishers caught the entire TACC, while Area 8 is still closed.

The total recreational catch of Roe's abalone in 2015 was 34.4 t whole weight, which represents about 40% of the total Roe's abalone catch (Roe's Abalone Figure 1). The recreational catch includes 15 – 25 t (20.4 t) from the Perth metropolitan stocks, and an estimate of 14 t for the rest of the state (Western Zone excluding the Perth metropolitan stocks and Southern Zone) derived from a 2007 phone diary survey. The Perth metropolitan fishery catch level was similar to that taken in the last 4 years.



ROE'S ABALONE FIGURE 1. *Roe's abalone commercial and recreational catch (t, whole weight) by season as recorded against the nearest calendar year.*

INDICATOR SPECIES ASSESSMENTS AND STOCK STATUS

Roe's abalone (Sustainable-Adequate for some areas)

Roe's abalone are found in commercial quantities from the WA/SA border to Shark Bay. Evidence suggests the existence of one single Roe's abalone population across this entire range but with three adaptive populations (Sandoval-Castillo *et al.* 2015). The size at sexual maturity is approximately 40 mm shell length and the legal minimum length for Roe's abalone is 60 mm in most parts of the fishery, which based on growth rates, protects 1 to 2 breeding year classes (see Hart *et al.* 2017).

The stock status is assessed using commercial and recreational catch and effort, and fishery-independent sampling. Trends in stock indicators were used to determine the 2016 TACC for each management area, and the TARC for Zone 1 of the recreational fishery.

Area 1 (near WA/SA border): There was no fishing in 2015. This area is a marginal part of the fishery in a remote location making it uneconomical for fishers given current market conditions.

Area 2 (Esperance): The catch in 2015 was 11 t whole weight of the 18 t TACC. The standardised catch per unit effort (SCPUE) has been gradually declining since 2010 but it is above the threshold reference level.

Area 5 (Albany): The catch in 2015 was 5.6 t whole weight of the 20 t TACC. The SCPUE has reduced slightly in the last three years but it is still above the threshold reference level.

Area 6 (Capes): The catch in 2015 was 2.6 t whole weight of the 12 t TACC. The SCPUE in 2015 was above the threshold reference level and within the historical range, but due to the prevailing weather conditions resulting in low catch there is a degree of uncertainty around the SCPUE estimate.

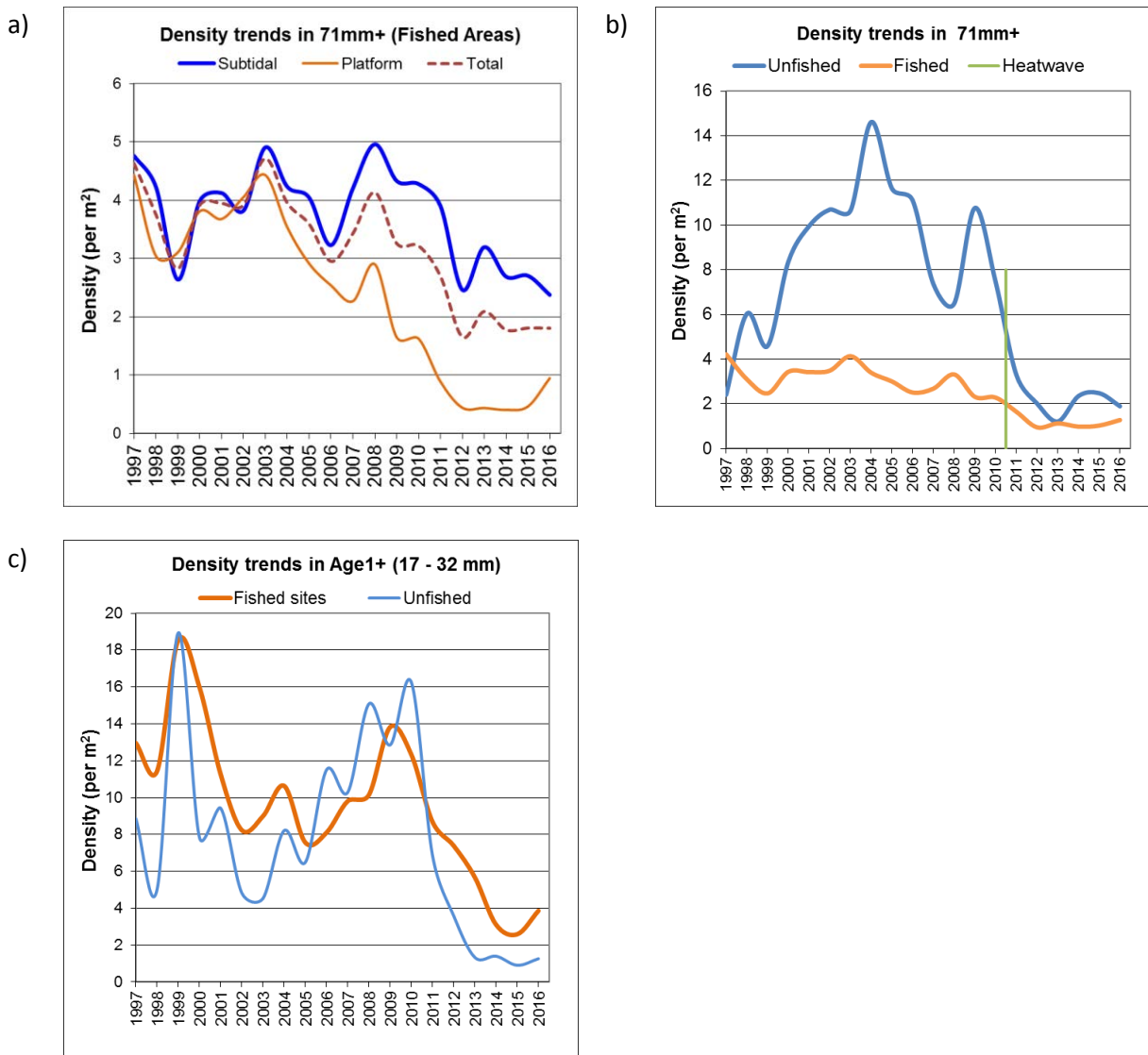
Area 8 (Kalbarri): Closed since the 2011/12 season due to catastrophic mortality following the 2011 marine heat wave. With no evidence of natural recovery, a restocking project has been initiated.

Perth Metropolitan Roe's Abalone Fishery (Area 7/Zone 1): The commercial catch in 2015 was 31.7 t of the 32 t TACC, which was 4 t less than the average historical catch/TACC (1999-2013). The SCPUE in Area 7 has declined since 2005 but it is still above the threshold reference level and the TACC was set using the stock prediction model (DoF 2017). The recreational catch estimate was 15 – 25 t (20.4 t) whole weight and has been managed to the 20 t (± 2 t) TARC for the last 5 years. Despite the reduced recreational catch through this period, the catch rates and mean Roe's abalone whole weight caught are still within historical ranges.

Fishery-independent surveys indicate that the density of harvest-sized (commercial) Roe's

abalone has declined in both subtidal and platform habitats, and across both fished and unfished areas over the last decade (Roe's Abalone Figure 2a and b). The density of harvest-sized animals on the reef platform declined by more than 80% from 2003 to 2012 but has since remained stable, whereas in the reef subtidal habitat the density is currently at the lowest recorded level (Roe's Abalone Figure 2a). Significantly, the levels of

decline have been even greater in areas where no fishing occurs suggesting these declines are not being generated by fishing (Roe's Abalone Figure 2b). The trend in declining density is also present in Age 1+ (17 – 32 mm) animals post marine heat wave, when the recruitment density declined by 80% between 2010 and 2013, with 2012 – 2016 being the five lowest years on record (Roe's Abalone Figure 2c).



ROE'S ABALONE FIGURE 2. Density of Roe's abalone in the Perth metropolitan fishery (Area 7/Zone 1) from fishery-independent surveys. a) Density of Roe's abalone (71 mm+) in the subtidal and platform fished areas, b) Density of Roe's abalone (71 mm+) in the fished and unfished areas, c) Density of Roe's 1+ abalone (17 – 32 mm) in the fished and unfished areas.

BYCATCH AND PROTECTED SPECIES INTERACTIONS (Negligible Risk)

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. The only potential listed species interaction is with the white shark (*Carcharodon carcharias*), with some divers adopting the 'shark shield' technology.

HABITAT AND ECOSYSTEM INTERACTIONS (*Negligible Risk*)

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 fished areas, and hence it is considered unlikely that the fishery has any significant effect on the food chain in the region.

SOCIAL AND ECONOMIC OUTCOMES *Social (High Risk)*

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 Perth 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 16,965 licenses were issued that would have allowed fishers to participate in the recreational abalone fishery.

Economic (High Risk)

Estimated annual value (to fishers) for 2015 was \$1.2 million, based on the estimated average price for Roe's abalone of \$23.69/kg whole weight. 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 and wild caught Roe's abalone being in direct market competition with abalone produced by aquaculture.

GOVERNANCE SYSTEM

Annual Catch Tolerance Levels (Commercial – Acceptable)

Commercial: 87 t (TACC) (530 - 640 fishing days)

(Recreational – Acceptable)

Recreational: 20 t (TARC) Perth metropolitan fishery only (Zone 1)

Commercial catch was less than the quota in Area 1 (0% caught), Area 2 (61% caught), Area 5 (28% caught) and Area 6 (22% caught), due to economic reasons (low value of catch) and high cost of accessing these areas. Area 8 is still closed due to the catastrophic mortality following a marine heat wave. Area 7 (Perth metropolitan fishery) survey abundance of recruitment and spawning stock at

low levels, which require additional management actions implemented including the TARC being reduced to 20 t.

Harvest Strategy (Formal)

The harvest strategy (DoF 2017) uses SCPUE as a proxy for biomass as the key performance indicator, which are assessed against specified biological reference levels for each management area. The Perth metropolitan fishery (Area 7 / Zone 1) is managed using a stock prediction model along with a temperature factor (DoF 2017). The predicted recruitment is used to set the TAC, with the habitat biomass and sectorial patterns of usage separating the TAC into TACC and TARC.

Compliance

The Department conducts regular inspections of commercial catch at both the point of landing and processing facilities to ensure the commercial industry is adhering to governing legislation. The recreational fishery, particularly the Perth metropolitan fishery, has a high level of enforcement given its high participation rate combined with restrictive season length and bag limit.

Consultation

The Department undertakes consultation directly with the Abalone Industry Association of Western Australia (AIAWA), the West Coast Abalone Divers Association and licensees on operational issues. Industry Annual Management Meetings are convened by the West Australian Fishing Industry Council (WAFIC), who are also responsible for statutory management plan consultation under a Service Level Agreement with the Department. Recreational consultation processes are facilitated by Recfishwest under a Service Level Agreement, although the Department undertakes direct consultation with the community on specific issues.

Management Initiatives (MSC Assessment)

The fifth year of the trial of a summer season for the Western Zone of the recreational fishery was undertaken for the 2015/16 summer. The season began on the first Sunday of November 2015 and extended till the first Sunday of March 2016, with fishing taking place between 7 and 8 am on the first Sunday of each month. Evidence from the first four seasons indicates a considerable drop in

effort due primarily to poor weather conditions, despite a relatively constant number of licenses. For the 2015/16 season, the same number of fishing days and the reduced daily bag limit of 15 (from 20) abalone per person was maintained from the previous season. The objective of continuing the reduced bag limit is to maintain low catches so as to promote an increase in density on the platform habitats, which have experienced significant declines in the last decade (Roe's Abalone Figure 2a). The commercial Roe's abalone fishery is currently undergoing full MSC assessment (<https://www.msc.org/track-a-fishery/fisheries-in-the-program/in-assessment/Indian-ocean/Western-Australia-abalone-fishery/Western-Australia-abalone-fishery>).

EXTERNAL DRIVERS (*High-Extreme Risk*)

During the summer of 2010/11, the West Coast experienced a marine heat wave such that in the area north of Kalbarri mortalities on Roe's abalone were estimated at 99.9%, and a complete closure of the commercial and recreational fisheries was implemented. The heat wave also affected the Perth metropolitan stock but to a lesser extent. Annual weather conditions have a significant effect on catch rates and total catch of recreational fishers. The small size of Roe's abalone mean it is in direct competition with hatchery-produced abalone and therefore, there has been a decline in beach price and overall economic value during the last decade.

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WEST COAST BLUE SWIMMER CRAB RESOURCE STATUS REPORT 2016

D. Johnston, R. Marks and J. O'Malley



OVERVIEW

Blue swimmer crabs (*Portunus armatus*) are found along the entire Western Australian coast (<50 m). The commercial crab fisheries within the West Coast Bioregion are the Cockburn Sound Crab Managed Fishery, the Warnbro Sound Crab Managed Fishery, Area 1 (Swan-Canning Estuary) and Area 2 (Peel-Harvey Estuary) of the West Coast Estuarine Managed Fishery and Area 1 (Comet Bay) and Area 2 (Mandurah to Bunbury) of the Mandurah to Bunbury Developing Crab Fishery. Commercial crab fishers currently use purpose-designed crab traps. For more detailed descriptions of the crab fisheries see Johnston *et al.*, 2015a.

Blue swimmer crabs represent the most important recreationally fished inshore species in the southwest of WA in terms of participation rate centred largely on the estuaries and coastal embayments from Geographe Bay to the Swan River and Cockburn Sound using either drop nets, scoop nets or diving. Management arrangements for the commercial and recreational fisheries include minimum size, protection of breeding females, seasonal closures with effort controls for the commercial fishery.

Both the commercial and recreational Peel-Harvey crab fisheries attained MSC Certification in 2016 (see Johnston *et al.*, 2015b for full details).

SUMMARY FEATURES 2016

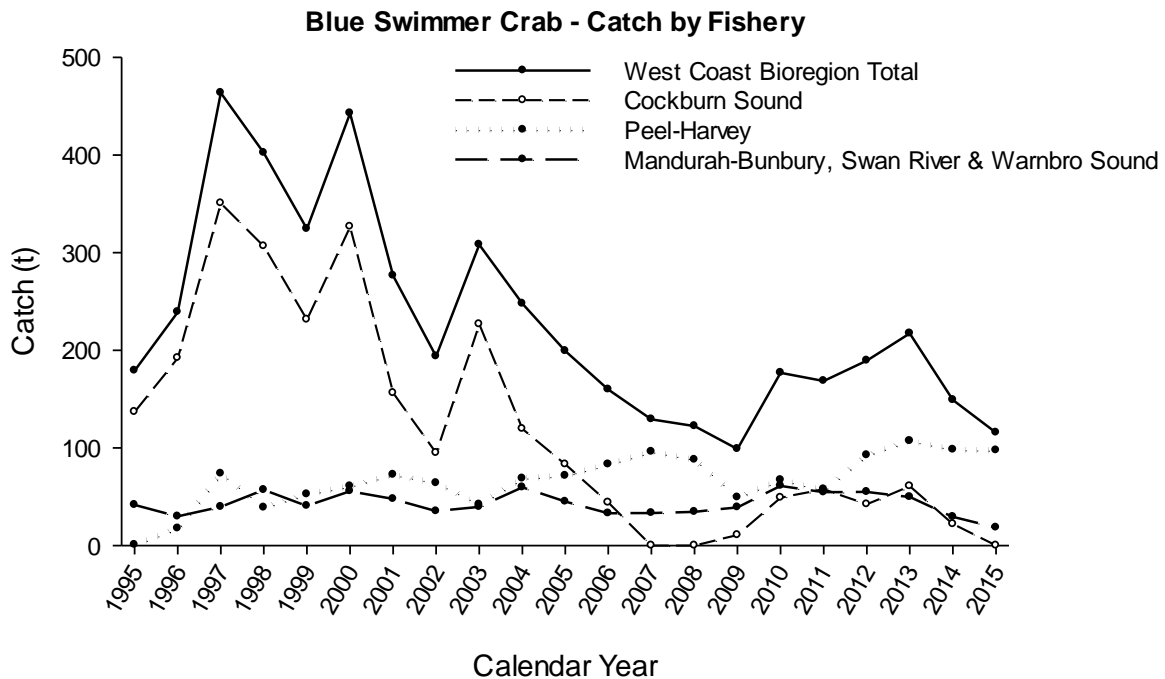
Fishery Performance	Commercial	Recreational	
Total Catch 2015	116 t	64 t (Boat survey May 13-Apr 14)	
Fishing Level	Cockburn Sound: Closed Peel-Harvey: Acceptable Other fisheries: Acceptable	Cockburn Sound: Closed Peel-Harvey: Acceptable Other fisheries: Acceptable	
Stock/Resource Performance	Stock Status	Assessment Indicators	
Cockburn Sound	Environmentally Limited	Level 4 Direct Survey	
Peel-Harvey	Sustainable – Adequate	Level 2 Catch Rates	
Other SW	Sustainable - Adequate	Level 2 Catch Rates	
EBFM Performance			
Asset	Level	Asset	Level
Bycatch	Negligible Risk	Listed Species	Negligible Risk
Habitat	Low Risk	Ecosystem	Low Risk
Social	High Amenity Moderate-High Risk	Economic	GVP Level 2 (\$1-5 million) Moderate-High Risk
Governance	Management Review Underway	External Drivers	Moderate- High Risk

CATCH AND LANDINGS

Commercial Sector

The total commercial catch from the West Coast Bioregion in 2015 was 116 t. This represents a 22% decrease on the 149 t taken in 2014, primarily

due to the closures of Cockburn Sound and Warnbro Sound and cessation of fishing in Area 2 of the Mandurah to Bunbury Developing Crab Fishery (Blue Swimmer Crab Figure 1).



BLUE SWIMMER CRAB FIGURE 1. West Coast bioregion commercial catch history for the blue swimmer crab in Western Australia since 2000.

Recreational Sector

Most (88%) of the recreational blue swimmer crab fishing in Western Australia occurs in the West Coast Bioregion (Ryan *et al.* 2015). The survey provided a statewide estimate of the boat-based recreational retained catch of 72 t (S.E.±4.8 t), of which 64 t (S.E.±4.7 t) was from the West Coast bioregion.

A previous (2008), more comprehensive survey of recreational fishing in Peel-Harvey covering fishing from boats, shore, canals, and houseboats estimated the recreational catch to be between 107-193 t. This was lower compared to the recreational catch estimate of 251-377 t in 1998/99 (Johnston *et al.*, 2014). Additional recreational surveys have been conducted in Cockburn Sound, Warnbro Sound, Swan-Canning Estuary, Leschenault Inlet and Geographe Bay (see Johnston *et al.*, 2015a,b).

INDICATOR SPECIES ASSESSMENTS AND STOCK STATUS

Crab assemblages in the southwest are genetically separate to more northern stocks in Shark Bay and Exmouth Gulf, but there is genetic overlap between some stocks in the south-west that are spatially adjacent to each other. South-west stocks are however managed separately at the present time but with recognition that recruitment

and breeding stock may be fluid between some areas.

Spawning in the south-west peaks between September and January. Juvenile growth is rapid with crabs maturing (at approx. 90mm carapace width) within 12 months and attaining commercial size (130 mm CW) within 15 months.

Cockburn Sound (Environmentally Limited)

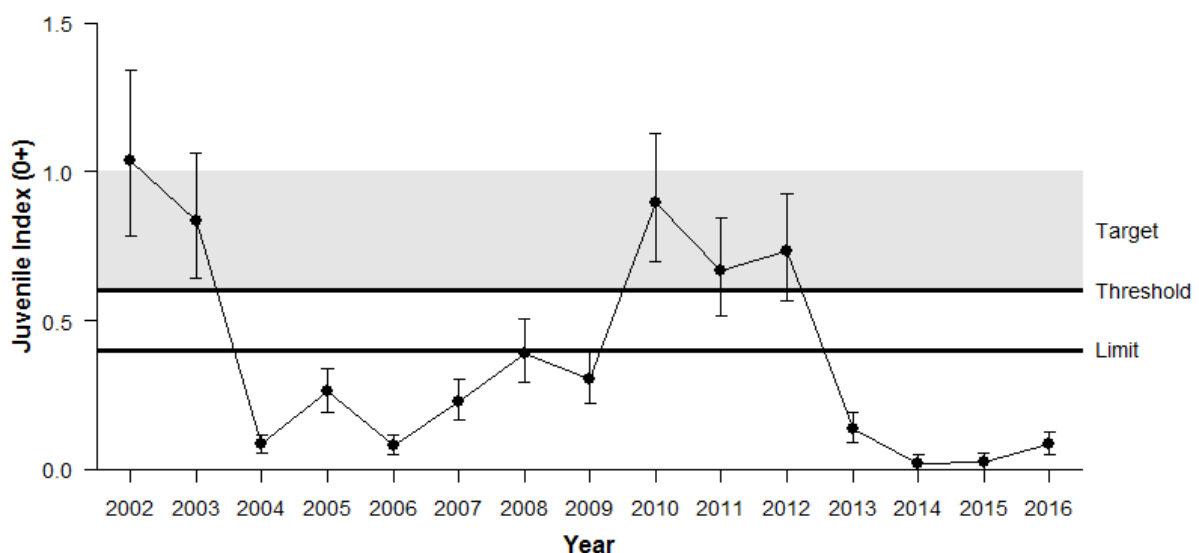
Since the fishery was closed in 2014, a preliminary harvest strategy has been determined for the Cockburn Sound Crab Fishery where the primary performance indicators are the juvenile index and egg production index (Johnston *et al.*, 2015a,b). A weight of evidence approach is used for the stock assessment where the indices, in addition to commercial catch rates and the proportion of females in the commercial catch, are taken into account to assess stock status.

Juvenile index: The juvenile index for 2015 of 0.02 juveniles/100m² trawled was still below the limit. The juvenile index for 2016 was a slight improvement but continues to be below the limit at 0.08 juveniles/100m² trawled (Blue Swimmer Crab Figure 2).

Egg Production index: The revised egg production index in 2014 (4.0) and 2015 (2.8) remains well

below the proposed threshold level of 12, (based on the stock-recruitment relationship) outlined within the draft harvest strategy and the fishery remains closed.

Reasons for the stock decline being investigated include combined effects of reduced levels of primary productivity within Cockburn Sound, changes in water temperature, increased predation and the negative effects of density dependent growth which appears to have had an effect on the proportion of berried females. The declines in abundance are therefore substantially attributable to environmental changes, rather than fishing, consequently the stock is classified as **Environmentally Limited**.



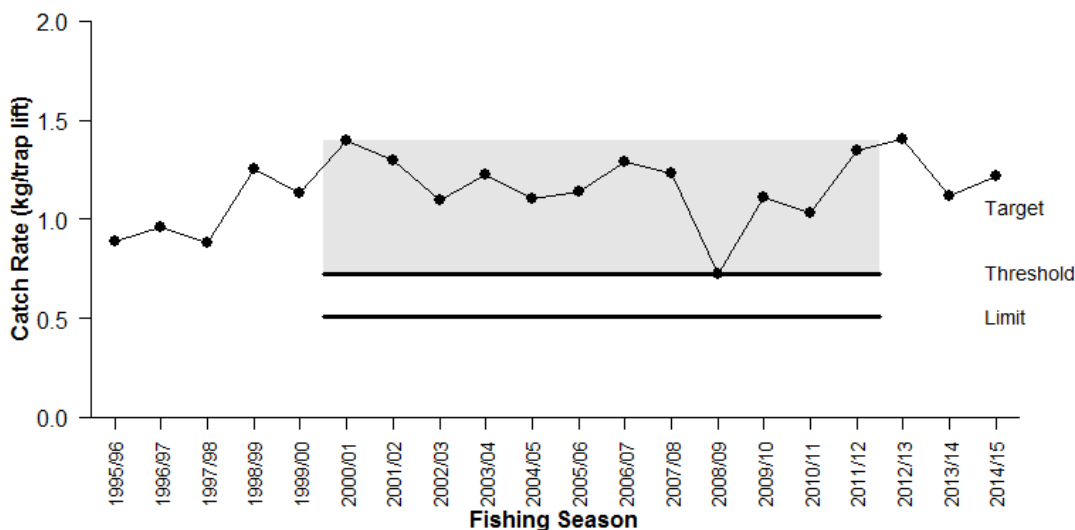
BLUE SWIMMER CRAB FIGURE 2. Annual standardised index of juvenile (0+) blue swimmer crabs in Cockburn Sound calculated using data from juvenile research trawl conducted in April, May and June of each year. The index units are numbers of juveniles/100m² trawled. The associated reference points (target, threshold and limit) for the preliminary harvest strategy and the 95% confidence intervals are shown.

Peel-Harvey Estuary (Sustainable Adequate)

The commercial catch and effort from the Peel-Harvey Estuary for the 2014/15 fishing season was 97 t from 69,888 trap lifts which are both very similar to 2013/14 (Blue Swimmer Crab Figure 3).

Since the complete gear conversion from nets to traps in 2000/01, annual commercial catch rates have fluctuated between 0.8 and 1.7 kg/trap lift, but have generally remained above 1 kg/trap lift.

The nominal annual catch rate for 2014/15 in the Peel-Harvey Estuary was 1.4 kg/trap lift (West Coast Blue Swimmer Crab Figure 3). The standardised catch rate of 1.3 kg/traplift for the 2014/15 fishing season was well above the harvest strategy threshold of 0.7 kg/traplift, indicating the stock is currently being fished at sustainable levels. On the basis of this evidence, the crab stock in the Peel Harvey is classified as **Sustainable**.

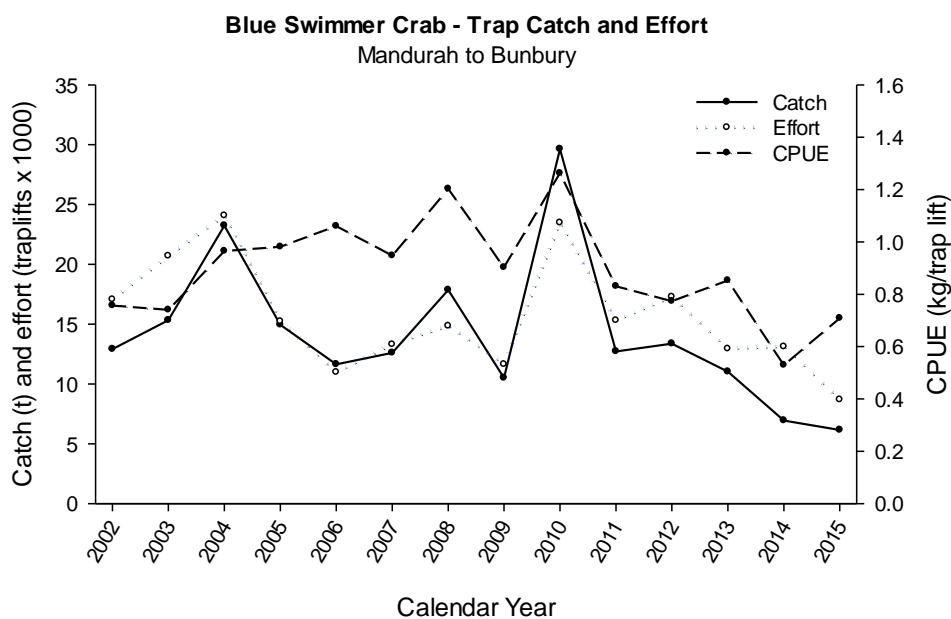


BLUE SWIMMER CRAB FIGURE 3. Annual standardised commercial catch rate (kg/traplift) of blue swimmer crabs in the Peel-Harvey crab fishery relative to the associated reference points (target, threshold and limit) for the harvest strategy. The reference period is from 2000/01 to 2011/12; defined as the period where the fishery was operating with traps only and during which time the threshold (lowest historical catch rate), limit (20% below the lowest catch rate) and target (range between the threshold and highest historical catch rate) were set. Fishing season is defined as 1 November to 31 August.

Mandurah to Bunbury Developing Crab Fishery (Sustainable – Adequate)

The Mandurah to Bunbury Developing Crab Fishery (Area 1 and Area 2) reported a total annual catch and effort for 2015 of 6 t from 8,684 trap lifts, representing 11% and 34% decreases compared to 2014 (Blue Swimmer Crab Figure 4).

The mean catch rate for 2015 of 0.7 kg/trap lift was a 34% increase on the 2014 catch rate of 0.5 kg/trap lift (Blue Swimmer Crab Figure 4). On the basis of this evidence, the crab stock in this region is classified as **Sustainable**.



BLUE SWIMMER CRAB FIGURE 4. Blue swimmer crab trap catch per unit effort (kg/traplift) in Area 1 and Area 2 of the Mandurah to Bunbury Developing Crab Fishery since 2002.

BYCATCH

Crab pots are purpose-designed to minimise the capture of non-target species and are therefore an inefficient way to capture fish. The low number of fish caught and returned poses a **negligible risk** to these stocks.

PROTECTED SPECIES INTERACTIONS

The crab trap longline system 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 and are therefore considered a **low risk**.

HABITAT

Retrieval of traps may result in minor dragging across the mostly sandy substrate. The small amount of living seagrass removed, results in minimal habitat damage and hence trapping poses a **low risk** to benthic habitats. The potential impacts of wading on near shore habitats by the recreational fishers who scoop net in the Peel-Harvey Estuary is currently being assessed.

ECOSYSTEM INTERACTIONS

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 and are a **low risk** to the ecosystem.

SOCIAL AND ECONOMIC OUTCOMES

Social

West Coast blue swimmer crab fisheries provide a high social amenity to recreational fishing and diving and to consumers via commercial crab supply to markets and restaurants. During 2015, approximately 20 people were employed as skippers and crew on vessels targeting blue swimmer crabs in the West Coast Bioregion. Blue swimmer crabs 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. They are the highest captured recreational species.

Economic

The commercial blue swimmer crab catch in the West Coast Bioregion for 2015 had an estimated gross value of product (GVP) of approximately \$0.62 million, an increase on the \$0.78 million in 2014 (level 2 \$1-5 million). Most of the catch from the West Coast Bioregion was sold through local markets. Price data was generated by collecting monthly returns recording prices paid to fishers by fish processors, a weighted average price is then calculated for the financial year from the monthly data collected and for 2015 were set at \$5.36 per kg.

GOVERNANCE SYSTEM

Allowable Catch Tolerance Levels

Cockburn Sound: Under review

Peel Harvey: 45 - 107 tonnes

Other West Coast fisheries: Under review

A catch range for Cockburn Sound crabs will need to be developed when the management arrangements and stock levels have 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.

Harvest Strategy

Cockburn Sound: Closed

A preliminary harvest strategy has been determined for the Cockburn Sound Crab Fishery where the primary performance indicators are the juvenile index and egg production index.

As these indicators are below the limit levels, the fishery will remain closed.

Peel Harvey:

A harvest strategy has been determined for the Peel-Harvey Crab Fishery (Johnston *et al.*, 2015 b) where the primary performance indicator is standardised annual catch rate with the reference period between 2000/01 and 2011/12.

As the indicator was above the threshold, no changes to the management will occur for the 2017 season.

Other West Coast Fisheries:

A preliminary harvest strategy has been determined for Area 1 and Area 2 of the Mandurah to Bunbury Developing Crab Fishery where the primary performance indicator is nominal annual catch rate using the reference period for Area 1 Comet Bay is between 2005/06 and 2011/12, and for Area 2 Mandurah-Bunbury between 2004/05 and 2011/12.

As the indicator was above the threshold, no changes to the management will occur for the 2017 season.

Compliance

Current risks to enforcement are low for West Coast crab fisheries. However, the Peel-Harvey Estuary has a high level of enforcement risk as it has the highest level of non-compliance in the State, particularly for undersize crabs being taken and during night-time periods.

Consultation**Commercial**

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

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.

Management Initiatives

A southwest crab fishery management review is being undertaken during 2016/17 with the aim of increasing protection to female breeding stock. Potential options include extending or introducing season closures and increasing minimum size to provide a greater buffer to female breeding stock.

EXTERNAL DRIVERS

Levels of recruitment to many of the crab fisheries fluctuate considerably, mainly due to environmental influences (e.g. water temperature), both on spawning success and larval survival through to recruitment. The climate change implications associated with these environmental variables are also under consideration. The effect of the heat wave in the summer of 2010/11 and above average water temperatures on the following two summers on the spawning and juvenile phase of the crabs is being investigated for Cockburn Sound (and adjacent coastal areas), as well as the cause of the low proportion of berried females in the 2012/13. These temperature changes have also resulted in the increased abundance of crabs in the South Coast estuaries. Blue swimmer crabs were rated a high risk to climate change due to their sensitivity to water temperature changes. Temperature appears to be an important factor contributing to the decline of the Cockburn Sound Crab Fishery.

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WEST COAST OCTOPUS RESOURCE STATUS REPORT 2016

A. Hart, D. Murphy, L. Pickles and S. Walters



OVERVIEW

The octopus fishery in Western Australia targets the gloomy octopus (*Octopus tetricus*). Commercial octopus catch is harvested from three different fisheries with the majority of commercial catch coming from the Octopus Interim Managed Fishery (OIMF). The primary harvest method in the OIMF is a 'trigger trap'. Unbaited or passive

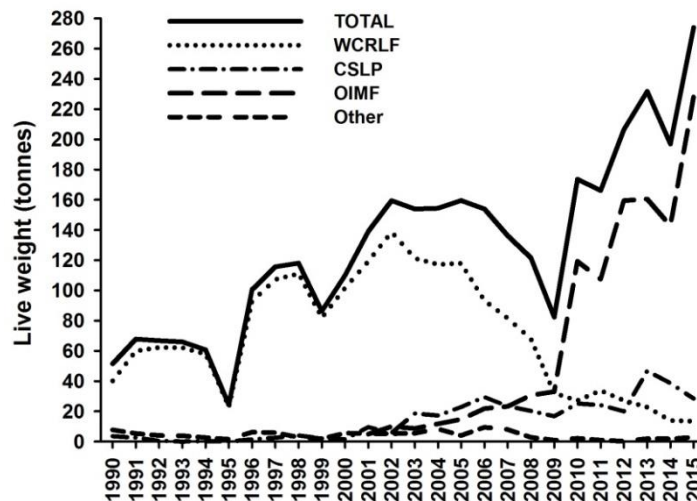
(shelter) pots are also used and octopus are also caught as by-product by rock lobster pots. Commercial management arrangements include input controls on the total allowable number of pots/traps permitted in each spatial management zone.

SUMMARY FEATURES 2016

Fishery Performance	Commercial	Recreational	
Total Catch 2015	274 t	2 t	
Fishing Level	Acceptable	Acceptable	
Stock/Resource Performance	Stock Status	Assessment Indicators	
Gloomy Octopus	Sustainable - Adequate	Annual: Catch, CPUE	
EBFM Performance			
Asset	Level	Asset	Level
Bycatch	Low Risk	Listed Species	Low Risk
Habitat	Low Risk	Ecosystem	Low Risk
Social	Low Amenity	Economic	GVP – (\$2.2 million)
	Low Risk		Low Risk
Governance	New Management Plan	External Drivers	Low Risk

CATCH AND LANDINGS

In 2015 the total commercial octopus catch was 274 t live weight, which was a record-high catch and a 34% increase over last year's catch of 204 t (Octopus Figure 1). The recreational catch by boat-based fishers at both the state-wide and bioregional levels estimated the total number of octopus captured during 2013/14 for all bioregions was 2,800 (92% in the West Coast Bioregion), which equates to a total weight of 2.0 tonnes (Ryan *et al.* 2015).



OCTOPUS FIGURE 1. Commercial catch (t) of *Octopus tetricus* in Western Australia since 1990. WCRLF (West Coast Rock Lobster Fishery), CSLPF (Cockburn Sound Line and Pot), OIMF (Octopus Interim Managed Fishery) and Other, which is bycatch from trawl and miscellaneous pot fisheries.

INDICATOR SPECIES ASSESSMENTS AND STOCK STATUS

Gloomy octopus (Sustainable-Adequate)

Octopus tetricus was subject to a recent comprehensive stock assessment which looked at biology, fishing efficiency and stock abundance and distribution (Hart *et al.* 2016). The overall conclusion was that the stock is highly productive, with an average maximum age of 1.5 years, as well as abundant and widely distributed along the West and South Coast of Western Australia. The estimated area of fished habitat (507 km²) was found to be only a minor percentage (~2%) of the total estimated habitat area of >30,000 km² (Hart *et al.* 2016). The current catch of 274 t is considerably lower than the estimate of sustainable harvest derived by Hart *et al.* (2016), which was in the range of 800 – 2200 tonnes. Consequently the breeding stock is considered to be **adequate**.

BYCATCH AND PROTECTED SPECIES INTERACTIONS (Low Risk)

The selective method of fishing used results in a minimal level of bycatch of other species. In 2015 there were no reported entanglements with whales. This compares favourably with 2014 when there were two reported whale entanglements in octopus fishing gear. Fishers have adopted gear changes to mitigate entanglements, which includes setting pots on longlines, and using

weighted ropes that hang vertically in the water column.

HABITAT AND ECOSYSTEM INTERACTIONS

Habitat effects (Low Risk)

In the CSLPF and OIMF, 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 10 days in the OIMF and 15-20 days in the CSLP. 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 (see WCRLF report for full details).

Food chain effects (Low Risk)

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**.

SOCIAL AND ECONOMIC OUTCOMES

Social (Low Risk)

Each dedicated octopus fishing vessel employs between 2 and 4 people. In 2015, ~ 200 vessels caught octopus, although the vast majority of

these landings were small (< 100 kg), as they were bycatch in the WCRLF. Within the octopus specific fisheries, 4 vessels fished in the CSLP, and 14 vessels in the OIMF. There is also a substantial processing and value-added component to the octopus catch with factories in Fremantle and Geraldton.

Economic (Low Risk)

The estimated annual value for 2015 was \$2.2 million based on the total catch of 274 t and an average product price of \$8.13 /kg live weight.

GOVERNANCE SYSTEM

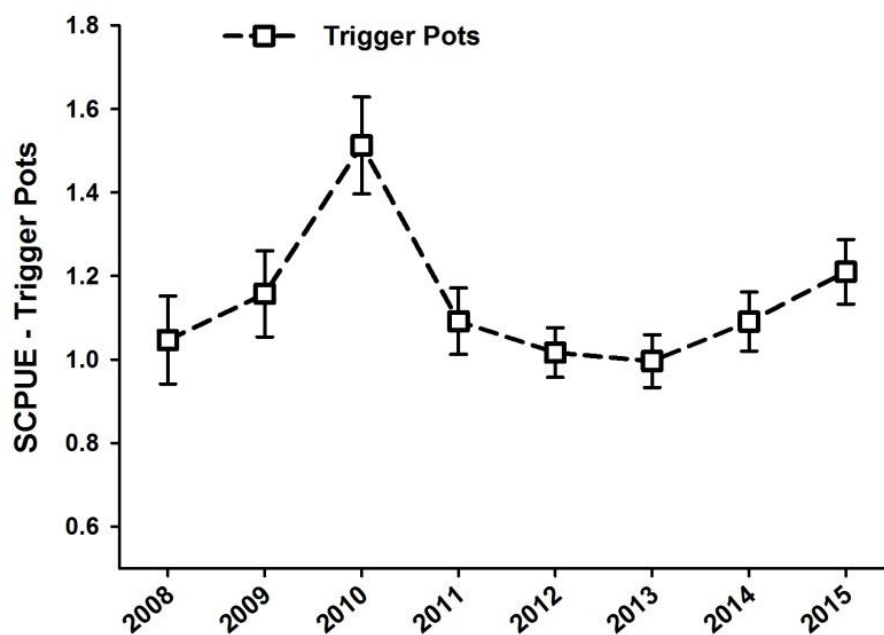
Annual Catch Tolerance Range (Acceptable)

Under previous commercial fishing effort levels, the target catch range for octopus was 50-250 t, this level has been exceeded in 2016 due to

expansion of the fishery and additional pot allocations in late 2015. The Fishery is currently in a new development phase and the allowable catch range will be reviewed in 2016 and 2017.

Harvest Strategy

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 OIMF sector. Current catch rate is around 250 kg/day, however both these measures are being reviewed in light of the developing nature of the fishery. The main performance indicator for the proposed new harvest strategy will be a standardised catch per unit effort (SCPUE) in kg/pot lift, which accounts for environmental and efficiency changes in the fishery, and has been increasing since 2013 (Octopus Figure 2).



OCTOPUS FIGURE 2. Standardised catch per unit effort (SCPUE) ($\pm 95\%$ CL) in kg / pot (kg in live weight) of *octopus tetricus*.

Compliance

There are no significant issues but it is important to highlight the importance of timely logbook data from fishers to reflect current status of the fishery.

Consultation

The Department undertakes consultation directly with licensees on operational issues. Industry

Annual Management Meetings are convened by the Western Australian Fishing Industry Council (WAFIC), who are also responsible for statutory management plan consultation under a Service Level Agreement with the Department.

Consultation processes are now facilitated by Recfishwest under a Service Level Agreement with

the Department, although the Department undertakes direct consultation with the community on specific issues.

Management Initiatives (New Management Plan)

The Department has developed formal management arrangements for the OIMF. Following the conclusion of an independent panel process on access and allocation, an Interim Management Plan for the OIMF was gazetted in 2015.

The Cockburn Sound (Line and Pot) Limited Entry Fishery Notice 1995 was reviewed following the Minister for Fisheries' decision on octopus pot entitlement allocation in the CSLPF. Amendments

to the Cockburn Sound (Line and Pot) Limited Entry Fishery Notice 1995 were made on 1 May 2015 to introduce an octopus pot scheme of entitlement.

EXTERNAL DRIVERS (Low Risk)

Cephalopods in general, including octopus, are known to be subject to large environmentally-driven fluctuations in abundance. Octopus was rated as a **medium-low risk** to climate change.

The move of the rock lobster fishery from an effort-controlled fishery to a catch quota fishery, coupled with significant effort reductions, will ensure the octopus catch in the WCRL fishery remains a low % of the overall catch.

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WEST COAST NEARSHORE AND ESTUARINE FINFISH RESOURCE STATUS REPORT 2016

K. Smith and M. Holtz



OVERVIEW

In the West Coast Bioregion (WCB) nearshore and estuarine finfish are targeted by beach-based fishers and boat-based fishers operating in shallow water. The main recreational method is line fishing. The main commercial methods are haul, beach seine and gill netting. Fishery landings of nearshore species include whitebait (*Hyperlophus vittatus*), western Australian salmon (*Arripis truttaceus*), Australian herring (*Arripis georgianus*), southern school whiting (*Sillago bassensis*), yellowfin whiting (*Sillago schomburgkii*), yelloweye mullet (*Aldrichetta forsteri*), tailor (*Pomatomus saltatrix*), southern garfish (*Hyporhamphus melanochir*), silver trevally (*Pseudocaranx*

georgianus) and King George whiting (*Sillaginodes punctata*). Landings of estuarine finfish are mainly sea mullet (*Mugil cephalus*), estuary cobbler (*Cnidoglanis macrocephalus*) and black bream (*Acanthopagrus butcheri*).

Five commercial fisheries target nearshore and/or estuarine finfish in the WCB. Four estuaries are open to commercial fishing. The Peel-Harvey Estuary commercial fishery (Area 2 of the West Coast Estuarine Managed Fishery) received Marine Stewardship Council (MSC) certification in June 2016 (see Department of Fisheries 2015, Johnston *et al.* 2015 for full details).

SUMMARY FEATURES 2016

Fishery Performance	Commercial	Recreational	
Total Catch 2015	371 t	78 t (boat-based only)	
Fishing Level	Acceptable	Acceptable	
Stock/Resource Performance	Stock Status	Assessment Indicators	
Nearshore	Inadequate	Annual: Catch, Catch Rate; Periodic: Fishing mortality, SPR	
Estuarine	Sustainable - Adequate	Annual: Catch, Catch Rate	
EBFM Performance			
Asset	Level	Asset	Level
Bycatch	Low Risk	Listed Species	Negligible Risk
Habitat	Negligible Risk	Ecosystem	Low Risk (from fishing)
Social	High Amenity Moderate Risk	Economic	GVP Level 2 (\$1-5 million) Moderate Risk
Governance	Harvest strategy for herring under development	External Drivers	High Risk (habitat degradation, climate change)

CATCH AND LANDINGS

In 2015, the total commercial catch of nearshore and estuarine finfish in the WCB was 371 t, comprising 217 t from ocean waters and 154 t from estuaries (Nearshore and Estuarine Finfish Table 1). The commercial catch was taken by five fisheries: West Coast Estuarine Managed Fishery, West Coast Beach Bait Managed Fishery, Cockburn Sound (Fish Net) Managed Fishery, South West Coast Salmon Managed Fishery and the South West Beach Seine Fishery.

The total recreational catch was not estimated in 2015 due to lack of information about the shore-based recreational sector, which takes a significant proportion of the catch of these species. The boat-based recreational catch of nearshore and estuarine finfish in the WCB was estimated to be 78 t in the most recent survey in 2013/14 (Ryan *et al.* 2015).

NEARSHORE AND ESTUARINE FINFISH TABLE 1. Total catches of finfish in commercial fisheries in nearshore and estuarine waters in West Coast Bioregion in previous five years.

Species	Scientific name	2011	2012	2013	2014	2015
Sea mullet	<i>Mugil cephalus</i>	77.7	103.7	100.1	123.4	143.4
Whitebait	<i>Hyperlophus vittatus</i>	34.8	65.7	18.6	63.5	61.2
Western Australian salmon	<i>Arripis truttaceus</i>	6.3	47.1	92.7	60.1	37.9
Australian herring	<i>Arripis georgianus</i>	37.2	28.5	47.1	46.6	49.0
Yellowfin whiting	<i>Sillago schomburgkii</i>	17.9	18.4	24.1	36.6	46.5
Yelloweye mullet	<i>Aldrichetta forsteri</i>	16.2	22.6	18.6	19.8	6.3
Tailor	<i>Pomatomus saltatrix</i>	7.2	9.0	14.2	10.5	9.8
Southern garfish	<i>Hyporhamphus melanochir</i>	19.2	5.8	4.3	4.8	2.4
Estuary cobbler	<i>Cnidoglanis macrocephalus</i>	7.4	5.2	1.8	0.2	1.3
King George whiting	<i>Sillaginodes punctata</i>	5.1	3.7	2.0	0.9	0.8
Trevallies	<i>Pseudocaranx</i> spp.	2.3	2.3	2.8	2.2	1.7
Other finfish		15.1	14.0	24.7	11.7	10.5
Total		246.5	325.4	346.4	378.4	370.8

INDICATOR SPECIES ASSESSMENTS AND STOCK STATUS

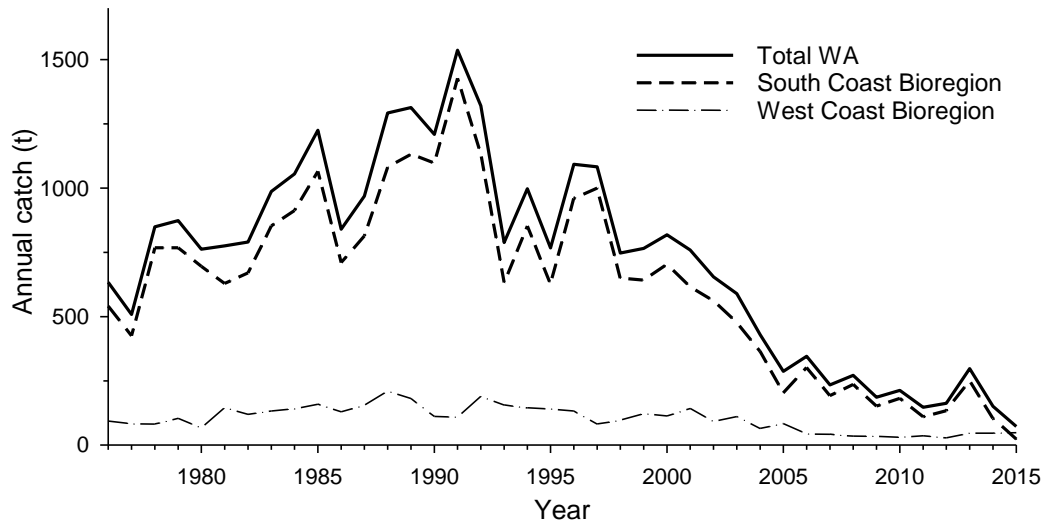
The status of each stock is assessed using a weight-of-evidence approach that considers all available information about the stock. For level 3 assessments, performance indicators now include both spawning potential ratio (SPR) and fishing mortality (F).

Australian herring (Sustainable-Recovering)

Australian herring comprise a single breeding stock across southern Australia, which spawns in Western Australia (WA) (Smith and Brown 2014). The species is caught by commercial and recreational fisheries in WA and South Australia, with negligible quantities also taken in Victoria (Smith *et al.* 2013a).

In 2015, the total WA commercial catch was 72 t, the lowest since the 1940s (Nearshore and Estuarine Finfish Figure 1). The South Coast Estuarine Managed Fishery, Cockburn Sound (Fish Net) Managed Fishery and South West Beach Seine Fishery reported most of the commercial catch in 2015. Estimated boat-based recreational catches of herring declined from 29 t (± 3 t) in 2011/12 to 16 t (± 2 t) 2013/14 (Ryan *et al.* 2015). The current shore-based recreational catch is unknown.

SPR is now the key indicator of stock status; with *F* used as one of the lines of evidence in Level 3 assessments. SPR has been below the limit reference level of 20% since 2009/10 (Department of Fisheries in prep). A recovery plan has been implemented for this stock. On this basis, the Australian herring stock is classified as **recovering**.



NEARSHORE AND ESTUARINE FINFISH FIGURE 1. Total commercial catches of Australian herring, 1976 to 2015.

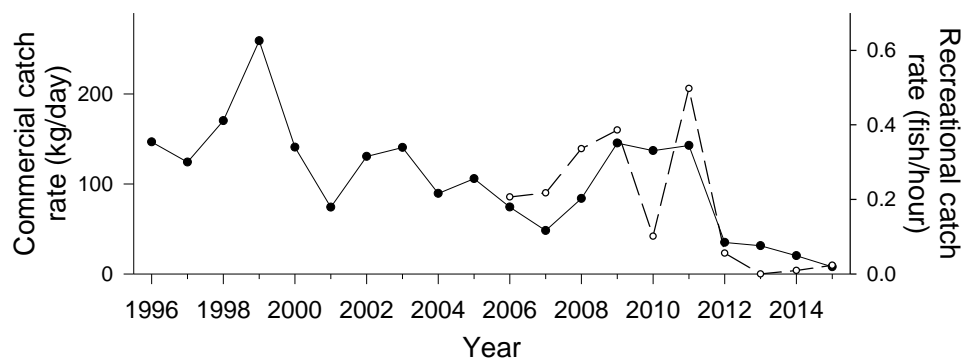
Southern garfish (Perth metropolitan zone) (Inadequate)

Southern garfish ranges across southern Australia from WA (Lancelin) to New South Wales (Eden). Population structure is complex. Semi-discrete populations can arise over small distances (<60 km) due to the low rates of movement/dispersal by individual fish (Smith *et al.* 2016). In the WCB, the main fishing area is the Perth metropolitan zone, particularly Cockburn Sound. Garfish in this area are likely to have limited connectivity with populations further south (e.g. in Geographe Bay).

Total commercial landings in the WCB peaked at 44 t in 1999 and then steadily declined, reaching an historical low of 2 t in 2015. Partial estimates of shore-based recreational catch are available for the Perth area, April-June only. The April-June catch was estimated to be >5 t in 2010, but <0.5 t

in subsequent years (Smallwood *et al.* 2012). In the WCB, the total boat-based recreational catch was estimated to be 2-5 t per year in 2005/06, 2008/09, 2009/10, and 2011/12, but declined to <1 t in the most recent survey in 2013/14 (Ryan *et al.* 2015, Smith *et al.* 2016).

The SPR had declined from 40% in 1998 to be approximately equal to the limit reference level of 20% in 2010/11 (Smith *et al.* 2016). Commercial catch rates have been declining since 1996 (Figure 2), including a sharp decline after the 2011 'heatwave' event, and further declines during 2012-2015. The trends suggest a substantial decline in stock level since the late 1990s. The current spawning biomass is likely to be <20% of the unfished level and therefore the southern garfish stock in this region is classified as **inadequate**.



NEARSHORE AND ESTUARINE FINFISH FIGURE 2. Standardised commercial and recreational catch rates of southern garfish in Cockburn Sound.

Sea mullet (Sustainable-Adequate)

Sea mullet occurs in all WA Bioregions. It was formerly regarded as a single species with a global distribution but sea mullet along the west and east coasts of Australia are now regarded as at least two distinct species (Krück *et al.* 2013). Sea mullet within each WA Bioregion are currently regarded as discrete breeding stocks.

In the WCB, the majority (60-70% p.a.) of commercial landings are taken in Peel-Harvey Estuary. Recent commercial landings are low compared to historical levels due to effort reductions. Since 2000, landings have been relatively stable and ranged from 77 t (in 2011) to 143 t (in 2015) (Table 1). The boat-based recreational catch is estimated to be <1 t (Ryan *et al.* 2015) and, whilst the current recreational shore-based catch is not known, it is believed to be low.

The Peel-Harvey standardised commercial catch rate has been stable since the 1970s, suggesting a relatively stable WCB stock level over a long period. On the basis of this evidence, the sea mullet stock in this region is classified as **adequate**.

Yellowfin whiting (Sustainable-Adequate)

Yellowfin whiting occurs in WA from Exmouth to Albany and based on known life history and behaviour traits, the 'southern' (WCB and South Coast Bioregion) and 'northern' (Gascoyne Coast Bioregion) populations of this species are currently regarded as separate stocks.

The majority (>95%) of commercial landings of the southern stock occur in the WCB. The West Coast Estuarine Managed Fishery (WCEMF) takes ≥50% of these landings each year, with the South West Beach Seine Fishery contributing significant amounts in some years. The commercial catch in the Peel-Harvey Estuary (i.e. Area 2 of the WCEMF) has rapidly increased in the past 3 years, from 10 t in 2012 to 30 t in 2015. In 2015, the total commercial catch was 49 t.

The total recreational catch is unknown due to lack of information about the shore-based sector which is believed to take almost all recreational landings of this species (Brown *et al.* 2013). Anecdotal reports suggest a recent increase in the recreational catch also occurred in the Peel Harvey

region. The boat-based recreational catch is estimated to be very low (<1 t) (Ryan *et al.* 2015).

Preliminary findings from a level 3 assessment indicate that the higher catches in recent years are due to strong recruitment. Catches in both sectors are expected to decline and return to more typical levels in the next few years as the influence of the recruitment event wanes. On the basis of this evidence, the yellowfin whiting stock in this region is classified as **adequate**.

King George whiting (Sustainable-Adequate)

King George whiting ranges across southern Australia from WA (Jurien Bay) to New South Wales (Jervis Bay). It is believed that that a separate breeding stock occurs in WA (Jenkins *et al.* 2016).

In WA, the majority of landings are taken recreationally. The current shore-based recreational catch is unknown, but likely to be smaller than the boat-based recreational catch (Brown *et al.* 2013). Estimated boat-based recreational catches were 27 t (±4 t) in 2011/12 and 22 t (±4 t) in 2013/14 (Ryan *et al.* 2015). In those years, the total commercial catch was 15 t and 14 t, respectively. In 2015, the total commercial catch was 23 t. The catch level can fluctuate markedly in response to recruitment variations.

A level 3 assessment in 2010-2012 indicated that F was moderate in inshore waters where juveniles occur, but low in offshore waters where adults occur (Fisher *et al.* 2014). SPR was estimated to be around the target level of 40%. The total catch (commercial plus recreational) in 2015 is likely to be higher than in 2010-2012, due to recruitment variations, but still within the historical range. Thus, overfishing is unlikely to be occurring and the current spawning biomass is likely to be at a similar level to that estimated in 2010-2012. On the basis of this evidence, the King George whiting breeding stock is classified as **adequate**.

Whitebait (Sustainable-Adequate)

In WA, whitebait has been reported from Kalbarri southwards, but most commonly between Perth and Cape Naturaliste. The range appears to have contracted over the past 1-2 decades in response to environmental changes, and the stock is now

mainly found in the Bunbury area. Whitebait usually inhabits coastal waters within 10 km of the shore and has traditionally been targeted by commercial beach-based haul netting (Gaughan *et al.* 1996). Recreational landings are negligible.

Since 2003/04, virtually all commercial landings have been reported in the Bunbury area by the SWBSF. Landings followed a relatively stable trend (i.e. non-directional) from the late 1980s until 2009/10. Since then, relatively low catches have been reported that are likely due to low stock abundance. Whitebait has a lifespan of only 3-4 years, and so catches are strongly driven by recruitment variability. The 2011 heatwave event along the west coast appears to have resulted in spawning failure in winter 2011, and led to exceptionally low catches and catch rates in 2012/13 and 2013/14 (Nearshore and Estuarine Finfish Table 1). The increase in total catch to 97 t in 2014/15 suggests that the breeding stock is **adequate**.

Tailor (Adequate)

In WA, tailor occurs from Onslow to Esperance and is believed to constitute a single stock over this range (Smith *et al.* 2013b). In 2015, the total commercial catch of tailor was 20 t (Nearshore and Estuarine Finfish Table 1). Approximately half of this catch was taken in the WCB, with most of the remainder in the Gascoyne Coast Bioregion (see Inner Shark Bay Scalefish Status Report) and a small amount in the South Coast Bioregion. In the WCB, the total commercial catch has typically been less than 20 t per year since records commenced in 1912. The catch was 10 t in 2015, with the majority taken in the Peel-Harvey Estuary.

The current recreational catch is unknown due to lack of information about the shore-based sector, which is believed to take a larger catch share of tailor than the boat-based sector (Smith *et al.* 2013b). Estimated boat-based recreational catches were 14 t (± 4 t) in 2011/12 and 6 t (± 1 t) in 2013/14 (Ryan *et al.* 2015). Most of the recreational catch of tailor is taken in the WCB.

The catch rate of tailor fluctuates markedly in response to recruitment variations, which are linked to environmental factors. Catch rates and juvenile recruitment are monitored annually in the Perth area. A level 2 assessment in 2012 indicated that stock status was acceptable (Smith *et al.*

2013b). Current catch, catch rate and recruitment levels are within the recent historical range, indicating that overfishing is unlikely to be occurring and the current stock status remains **adequate**.

Estuarine cobbler (Peel-Harvey-Adequate)

In WA, cobbler occurs in ocean and estuarine waters but is mainly caught by commercial fishers in estuaries. Landings by recreational fishers are believed to be negligible. 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 1996, annual landings of cobbler in the WCB have ranged from <1 t to 10 t. Almost all WCB commercial landings occurred in the Peel-Harvey Estuary. In 2015, approximately 1 t of cobbler was reported from this estuary. Commercial landings of cobbler in the Peel-Harvey Estuary are now managed under a Harvest Strategy, which uses catch and catch rate as indicators of fishery performance (DoF 2015). Both catch and catch rate were within the target range in 2015, indicating a low fishing impact on this stock. On the basis of this evidence, the cobbler breeding stock in this estuary is classified as **adequate**.

Black bream (Swan Canning-Adequate)

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.

In the WCB, this species is mainly taken recreationally. Estimated boat-based recreational catches of black bream were 3.1 t (± 0.9 t) in 2011/12 and 1.1 t (± 0.3 t) in 2013/14 (Ryan *et al.* 2015). The current shore-based recreational catch is unknown, but is believed to be larger than the boat-based recreational catch.

In the Swan-Canning Estuary, recreational and commercial 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 stable availability from

2004 to 2015. On the basis of this evidence, the cobbler stock in the Swan-Canning Estuary is classified as **adequate**.

Perth herring (Environmentally Limited)

Perth herring is endemic to the WCB, where a single breeding stock is believed to occur. Stock level was assessed via commercial catch rate trends in the Swan-Canning Estuary until cessation of fishing for this species in 2007 (Smith 2006). Swan-Canning catch rates suggested a major decline in the stock after 1980, which is attributed to historical overfishing and environmental degradation in estuaries (Smith 2006). Limited fishery-independent evidence suggests regional abundance remains low compared to historical levels. The Peel-Harvey Estuary is now the only area where this species is caught commercially, albeit in low quantities. Landings by recreational fishers are negligible.

Perth herring is anadromous (i.e. spawns in rivers then migrates back to ocean waters after spawning). Low spawning success due to environmental degradation in the upper reaches of WCB estuaries and low rainfall is believed to be the main cause of ongoing low stock abundance. Commercial landings within the Peel-Harvey Estuary are managed under a Harvest Strategy, which specifies a limited annual catch (<2.7 t) for this vulnerable species (Department of Fisheries 2015). The catch was below this target level in 2015, indicating a low fishing impact on the stock. On the basis of this evidence, the Perth herring stock is classified as **environmentally limited**.

BYCATCH AND PROTECTED SPECIES INTERACTIONS

Bycatch: The small-scale commercial finfish 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 and so bycatch species are at **low risk**.

Protected Species: Interactions with listed species by the fishing gear used in these commercial fisheries are negligible. Estuarine birds have been known to interact with fishing nets, but none have been reported in recent years and the risk to their populations is negligible. Commercial fishers are required to report all interactions with listed species. Recreational fishers using line-fishing methods are unlikely to capture listed species and interactions are expected to be a **negligible risk**.

HABITAT AND ECOSYSTEM INTERACTIONS

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

Ecosystem: Whitebait in Warnbro Sound is a key prey item for little penguins (*Eudyptula minor*) and whitebait availability may affect their breeding success (Cannell *et al.* 2012). Major fluctuations in whitebait abundance are believed to be primarily due to environmental factors. Current levels of commercial effort are historically low, and so whitebait removals by fishing pose a **low risk** to local penguins.

SOCIAL AND ECONOMIC OUTCOMES

Social

The nearshore and estuarine recreational fisheries of the WCB provide a **high social amenity** for the WA community. This Bioregion hosts the main population centres and these resources are very accessible to shore-based and small vessel recreational fishers. There is currently a **moderate risk** to these values.

In the WCB, there were 31 commercial fishers employed (either part or full time) in nearshore and estuarine fisheries in 2015, largely supplying fresh fish to meet demand for locally-caught product.

Economic

Estimated annual value (to fishers) for 2015: Level 2 (\$1 to 5 million).

GOVERNANCE SYSTEM

Allowable Catch Tolerance Levels

West Coast Estuarine Managed Fishery (Peel-Harvey Estuary only):

Finfish caught commercially in the Peel-Harvey Estuary are managed according to a Harvest Strategy which uses catches and catch rates as indicators of fishery performance (Department of Fisheries 2015). In 2015, the catches of sea mullet and yellowfin whiting exceeded their threshold reference levels (70 t and 14t, respectively). The Department reviewed the risks posed by these catch levels and determined that they were **acceptable**.

Cockburn Sound (Fish Net) Managed Fishery:

The catch in 2015 was below the tolerance range of 30 – 112 tonnes (finfish only). The catch has been below this range for 8 of the past 10 years. This range was based on annual landings by a higher number of vessels than are currently operating. A single vessel now operates in this fishery and catch data cannot be reported for confidentiality reasons.

Australian herring fisheries:

The commercial catch tolerance range is 50-179 tonnes. This range represents the minimum and maximum total annual catches by 'minor' herring fisheries (i.e. excluding G-trap net fishery) over the period 2000-2014. The 2015 catch was 72 t, which was **acceptable**. The current catch tolerance range used to assess annual recreational fishery performance is based on boat-based catches remaining below the estimated 2013/14 state-wide catch of herring, i.e. <16 t. The next catch estimate (2015/16) for this sector will be available in 2017.

Whitebait:

The catch tolerance range is 60-275 tonnes. The catch in 2014/15 was 97 t and was therefore **acceptable**.

Harvest Strategy

This resource is harvested using a constant exploitation approach, where the annual catch taken varies in proportion to variations in the stock abundance. Indicator species are used to

determine the status of the resource. All indicator species are assessed annually based on catch and/or catch rate trends, where data is available (noting that recreational fishery data is limited for these stocks). Additionally, higher level assessments are periodically undertaken for some stocks. A formal harvest strategy exists for finfish captured commercially within the Peel-Harvey Estuary. A draft Harvest Strategy for Australian herring was released for public comment in 2016. A formal harvest strategy is not currently in place for the remainder of this resource.

Compliance

The Department undertakes regular compliance inspections to ensure fishing is being undertaken in accordance with the governing legislation and runs education programs with various stakeholder groups to increase the levels of voluntary compliance.

Consultation

The Department undertakes consultation directly with licensees on operational issues. Industry Management Meetings are convened by the West Australian Fishing Industry Council (WAFIC), who are also responsible for statutory management plan consultation under a Service Level Agreement with the Department. Consultation with the recreational sector is undertaken via the peak representative body, Recfishwest, and/or the Department's website when documents are released for public comment.

Management Initiatives

In response to Australian herring stock sustainability concerns, the commercial herring 'G-trap' fishery was closed, and the herring recreational bag limit was reduced from 30 to 12, effective from 1 March 2015. A draft Harvest Strategy for Australian herring was released for public comment in 2016.

Consultation with peak sector bodies is currently being undertaken to determine the management response to address concerns about the sustainability of southern garfish in the Metropolitan zone.

EXTERNAL DRIVERS (*High Risk*)

Annual variations in coastal currents (particularly the Leeuwin and Capes Currents) appear to

influence the spawning and recruitment patterns of species such as whitebait, tailor, Australian herring and western Australian salmon (Lenanton *et al.* 2009).

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. These impacts are expected to create both difficulties and opportunities for fisheries.

In 2011, a 'heatwave' event in coastal waters of south-western WA altered the distribution (e.g. tropical species occurring in temperate waters) and behaviour (e.g. spawning activity, migration) of many nearshore finfish species, which appears to have affected the abundance of these species in 2011 and in subsequent years (Caputi *et al.* 2014).

WCB estuaries are highly modified, and often degraded environments and the impacts of environmental factors on estuarine fish are likely to be at least as important as fishing pressure. Impacts in 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).

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

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WEST COAST SMALL PELAGIC SCALEFISH RESOURCE STATUS REPORT 2016

J. Norriss and G. Baudains



OVERVIEW

The five species comprising the west coast small pelagic scalefish resource are tropical sardine (scaly mackerel, *Sardinella lemuru*), pilchard (*Sardinops sagax*), Australian anchovy (*Engraulis australis*), yellowtail scad (*Trachurus novaezelandiae*) and maray (*Etrumeus teres*). They are taken predominantly by the quota based West Coast Purse Seine Fishery (WCPSF) using purse seine gear in waters between Ningaloo and Cape

Leeuwin which includes three separate zones - Northern Development (22° 00'S to 31° 00'S), Perth Metropolitan (31° 00'S to 33° 00'S) and Southern Development Zone (33° 00'S to Cape Leeuwin). The WCPSF is also entitled to take Perth herring (*Nematalosa vlaminghi*), which forms part of the West Coast Nearshore and Estuarine Finfish Resource, but has not done so since 1997.

SUMMARY FEATURES 2016

Fishery Performance		Commercial	Recreational
Total Catch 2015		1,253 t	<1 t (2013/14)
Fishing Level		Acceptable	Acceptable
Stock/Resource Performance		Stock Status	Assessment Indicators
West Coast Small pelagic		Sustainable - Adequate	Biology and total catch
EBFM Performance			
Asset	Level	Asset	Level
Bycatch	Negligible Risk	Listed Species	Low Risk
Habitat	Negligible Risk	Ecosystem	Low Risk
Social	Low Amenity	Economic	GVP (\$1-5 million)
	Low Risk		Low Risk
Governance	Stable	External Drivers	Low Risk

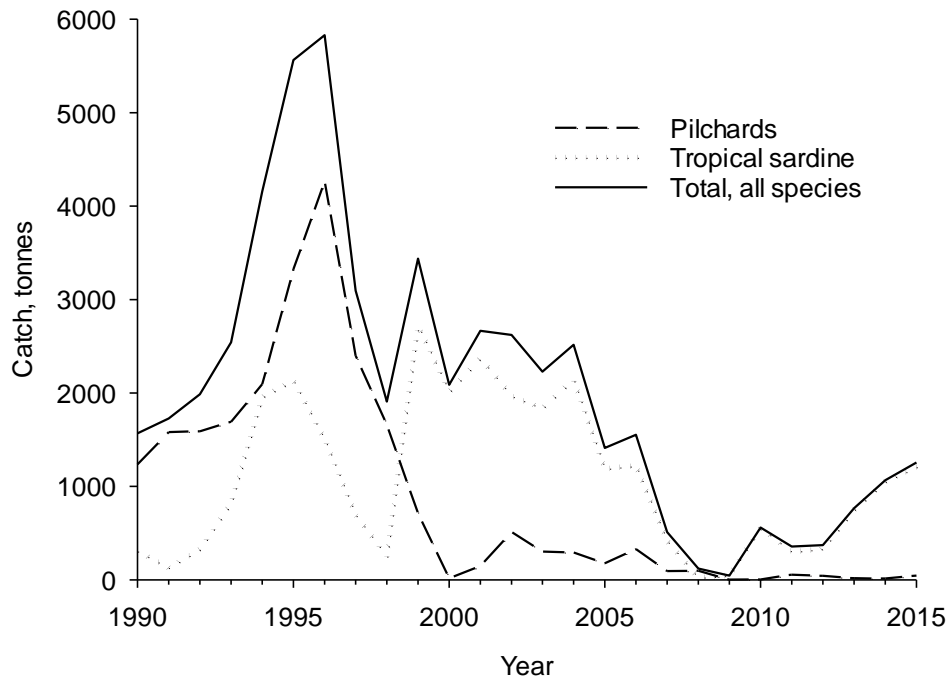
CATCH AND LANDINGS

The total combined catch of the six species that can be taken by the WCPSF in 2015 was 1,253 t, of which 96% was tropical sardine, the remainder being pilchards and yellowtail scad (West Coast Small Pelagic Scalefish Figure 1). Tropical sardines have dominated the catch since pilchards suffered mass mortality events in 1995 and 1998/99 caused by a herpesvirus.

INDICATOR SPECIES ASSESSMENTS AND STOCK STATUS

Tropical sardine (Sustainable-Adequate)

Tropical sardines are a small pelagic species that feed by filtering plankton, living for up to seven years and reaching a maximum size of about 21 cm FL on the WA west coast (Gaughan and Mitchell 2000). The WCPSF operates at the southern limit of the species distribution in WA. Analysis of otolith chemistry showed no evidence for the existence of separate stocks between Carnarvon and Fremantle, where they appear to be highly mobile resulting in a patchy but widespread distribution.



WEST COAST SMALL PELAGIC SCALEFISH FIGURE 1. Time series of total annual catch of tropical sardines, pilchards and the total for all six species combined in the WCPSF since 1990.

The WCPS catch of tropical sardines in 2015 was 1,209 t, a 15% increase from 2014 and a continuation of an upward trend in recent years, though well below historical high levels (West Coast Small Pelagic Scalefish Figure 1). The limited spatial distribution of fishing effort for what appears to be a highly mobile species suggests that only a small proportion of a widespread stock is being targeted. Catches are therefore considered sustainable and the biological stock **adequate**.

Pilchard (Sustainable-Adequate)

The pilchard is a small, low trophic level pelagic species that feeds by filtering plankton. Longevity is up to 9 years and the maximum size is 200-250 mm SL.

The high pilchard catch in the 1990s, primarily from the Perth Metropolitan Zone, declined precipitously during the mid to late 1990s following two mass mortality events (West Coast Small Pelagic Scalefish Figure 1). While the stock had recovered by the mid-2000s (see below), catches have remained low since then as the WCPSF has transitioned to take mostly tropical sardine.

Population modelling, based on spawning biomass estimates (from egg surveys), catch-at-age and catch data, suggested that by the mid-2000s the stock had recovered from the 1998/99 mass mortality event. The mid-2000s exploitation rate for the WA west coast stock was less than 5 per cent (around 400 t) of the estimated spawning biomass of approximately 25,000 t. Since 2007 the total annual catch has never exceeded 100 t. The current exploitation rate is therefore unlikely to cause the stock to become recruitment overfished. The biological stock is therefore considered **adequate**.

BYCATCH AND PROTECTED SPECIES INTERACTIONS

The species available for capture in the WCPSF is restricted by the West Coast Purse Seine Limited Entry Fishery Notice 1989. Small quantities of bycatch species are sometimes captured incidentally, but this occurs infrequently and the majority are released from the net unharmed. Interactions with endangered, threatened and protected species must be reported to the Department of Fisheries on Catch and Effort Statistics returns that must be lodged monthly. There is no evidence to indicate any significant interactions with these species.

HABITAT AND ECOSYSTEM INTERACTIONS

Purse seine nets are pelagic in nature, with no impact on benthic habitats during normal operations. On rare occasions nets may be deployed in shallow waters and come into contact with sensitive habitats such as seagrass beds. The light structure of the net is expected to cause minimal damage to benthic habits when this occurs, and would be kept to a small, localised area. The WCPSF is therefore considered to be a negligible risk to these habitats.

SOCIAL AND ECONOMIC OUTCOMES

Social

Local employment was provided by 7 active vessels as well as local processing factories. The only small pelagic species detected by recent surveys of boat-based recreational fishing was a small total catch of yellowtail scad.

Economic

A small proportion of the catch is sold for human consumption but the large majority for bait, aquaculture feed or pet food. The estimated gross value of product (GVP) for the WCPSF in 2015 was level 2 (\$1-5 million). There is currently a **low level of risk** to this level of return.

GOVERNANCE SYSTEM

Allowable Catch Tolerance Levels

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 2014/15 licensing period (1 April

2014 – 31 March 2015) the notional TAC was 2,328 t for pilchards and a separate TAC of 672 t for other small pelagic species (including *Sardinella*) was in place. Reaching or exceeding the notional TACs will trigger a management response.

Harvest Strategy

No formal harvest strategy has been developed for the WCPSF.

Compliance

Compliance is monitored via aerial patrols and both at-sea and on-land inspections.

Consultation

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

Management Initiatives/Outlook Status

A stable management outlook is envisaged for the WCPSF. Stocks will continue to be monitored principally through Level 1 (catch based) assessments.

EXTERNAL DRIVERS

Climate change is likely to be facilitating a southward shift in the natural distribution of both pilchards and tropical sardine.

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WEST COAST DEMERSAL SCALEFISH RESOURCE STATUS REPORT 2016

D. Fairclough and M. Holtz



OVERVIEW

The West Coast Demersal Scalefish Resource (WCDSR) comprises over 100 species in inshore (20-250 m deep) and offshore (>250 m) demersal habitats of the West Coast Bioregion (WCB), which are exploited by both commercial and recreational (including charter) boat-based line fishers. The indicator species for inshore waters include West Australian dhufish (*Glaucosoma hebraicum*), snapper (*Chrysophrys auratus*), redthroat emperor (*Lethrinus miniatus*), bight redfish (*Centroberyx gerrardi*) and baldchin groper (*Choerodon rubescens*), while the proposed indicators for offshore waters include hapuku (*Polyprion oxygenios*), blue-eye trevalla (*Hyperoglyphe antarctica*) and eightbar grouper (*Hyporthodus octofasciatus*) (see DoF 2011).

Following identification of overfishing of the inshore demersal resource, the current

management arrangements designed to recover stocks were progressively introduced between late 2007 and early 2010. These include maintaining the retained catches of all sectors below 50% of their 2005/06 catch benchmarks in order to reduce fishing mortality rates (*F*) of indicator species to below the threshold reference point and to meet a formal IFM sectoral allocation decision.

To achieve these management goals each of the commercial fisheries authorised to land demersal scalefish in the WCB have individual management plans with access, gear, area and entitlement limitations. Similarly, boat-based recreational and charter fishers are licensed and managed by input/output controls including a closed season. For further details see the West Coast Demersal Scalefish Resource Assessment Report (in prep) and SAFS (2016).

SUMMARY FEATURES 2016

Fishery Performance	Commercial	Recreational	
Total Catch 2015	283 t	184-211 t	
Fishing Level	Acceptable (\leq 450 t)	Acceptable (\leq 250 t)	
Stock/Resource Performance	Stock Status	Assessment Indicators	
Inshore Demersal	Sustainable - Recovering	Annual: Catch Periodic: Fishing mortality, SPR	
Offshore Demersal	Sustainable - Adequate	Annual: Catch	
EBFM Performance Asset	Level	Asset	Level
Bycatch	Low Risk	Listed Species	Negligible Risk
Habitat	Negligible Risk	Ecosystem	Low Risk
Social	High Amenity Moderate Risk	Economic	GVP Level 2 (\$1-5 million) Moderate Risk
Governance	Stable	External Drivers	Moderate Risk

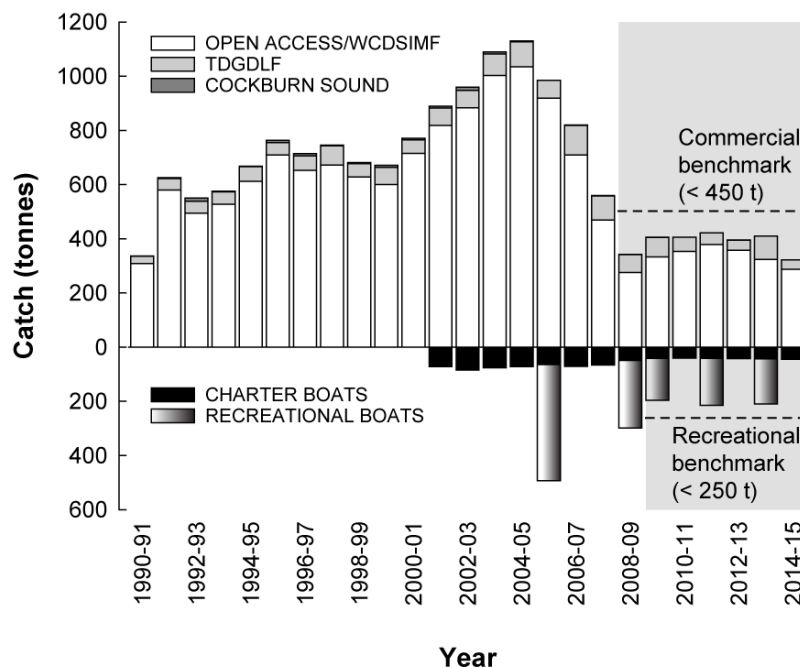
CATCH AND LANDINGS

The total catch of all species in 2015 by the main commercial fishery, the West Coast Demersal Scalefish Interim Managed Fishery (WCDSIMF), was 271 t, of which, 246 t comprised demersal species. Other commercial fisheries in the WCB (during 2015 or 2014/15; Temperate Demersal

Gillnet and Demersal Longline fisheries; Cockburn Sound Line and Pot Managed Fishery, South-west Trawl Managed Fishery, West Coast Rock Lobster Managed Fishery) landed a total of 36 t of demersal species, taken mostly by the temperate demersal gillnet/longline fisheries.

Catches of demersal species by the WCDSIMF and by all commercial fisheries in the WCB were below stock recovery benchmarks (50% of 2005/06 catch) of 410 t and 450 t, respectively, and much lower than prior to management changes (West Coast Demersal Scalefish Figure 1). Catches by the WCDSIMF in 2015 were lower than in recent years (2009-2014). This follows reductions in effort entitlements (and effort expended) in the Kalbarri and Mid-west Areas in 2015 to limit catches of snapper, an indicator species, which had exceeded its stock recovery retained catch benchmark for over three years.

Total annual recreational sector boat based catches of the top 15 demersal species have remained below the recovery benchmark of 250 t (West Coast Demersal Scalefish Figure 1). Charter fishers landed 45 t of the top 15 demersal species in 2014/15, similar to 2013/14, despite a decrease in effort from 22,700 to 19,680 fisher days. Boat-based recreational fishers landed 139-166 t ($\approx 95\%$ CI) of demersal species in 2013/14, which is similar to 2011/12 (West Coast Demersal Scalefish Figure 1). However, effort in the WCB decreased from 293,000 to 250,000 boat days (Ryan *et al.*, 2015).



WEST COAST DEMERSAL SCALEFISH FIGURE 1. Estimated retained catches of demersal species in the West Coast Bioregion since 1990-91 and stock recovery catch benchmarks introduced between 2008 and 2010 (grey shading). Estimated recreational sector retained catches combine data for financial year for charter (since logbooks introduced in 2001/02) and survey year for recreational boats. Recreational catches are point estimates of the mean and do not show 95% CIs (see Ryan *et al.*, 2015). 2011/12 and 2013/14 estimates were derived from integrated phone diary surveys, while prior estimates were derived from boat ramp creel surveys.

INDICATOR SPECIES ASSESSMENTS AND STOCK STATUS

Inshore (Sustainable-Recovering)

Each of the indicator species for the inshore demersal suite (West Australian dhufish, snapper, baldchin groper) comprises a single genetic stock across the entire WCB (SAFS, 2016). These species reach large sizes and are long-lived, with relatively slow growth and complex reproductive biology, making them inherently vulnerable to the effects of fishing (further detail in West Coast Demersal

Scalefish Resource Assessment Report). Annual monitoring is undertaken using catch levels. Periodic Level 3 assessments of stock status for each of the indicator species also evaluate additional key performance indicators including fishing mortality (F) and spawning potential ratio (SPR) using a weight-of-evidence approach that considers all available information (Wise *et al.*, 2007; Fairclough *et al.*, 2014). The next Level 3 assessment will be completed in 2017.

West Australian dhufish (Sustainable-Recovering)

Retained catches of West Australian dhufish in the WCB by all commercial fisheries, the WCDSIMF and the recreational sector (boat-based fishers plus charter fishers) have been at acceptable levels (below stock recovery benchmarks) since inception of the current management regime, i.e. < 82, 72 and 126 t, respectively (West Coast Demersal Scalefish Figure 2a). WCDSIMF catches in the Mid-west and South-west areas have also remained at or below recovery benchmarks of 44 t and 19 t. Discard/release rates of dhufish by boat-based recreational fishers were high in 2013/14 at 66%, mainly as a result of the capture of undersized fish.

The most recent assessment (Fairclough *et al.*, 2014) of F at the biological stock level, using age composition data collected between 2008/09 and 2010/11 (during management changes) decreased from the previous period 2005/06-2007/08 (West Coast Demersal Scalefish Figure 2a; Fairclough *et al.*, 2014). However, F was still above the limit reference point of $1.5M$. Spawning potential ratio lay between the limit (0.2) and threshold (0.3) reference point.

The above evidence indicates that the current level of fishing pressure, if maintained, should allow the stock to recover from overfishing. The biological stock is classified as **recovering**.

Snapper (Sustainable-Recovering)

Retained catches of snapper in the WCB by all commercial fisheries and the WCDSIMF were above recovery benchmarks of 126 and 120 t, respectively between 2010 and 2014. Reductions in effort entitlements to WCDSIMF fishers in the Kalbarri and Mid-west areas in 2015 contributed to reducing the total catch below the benchmarks. This was also the case for both the Kalbarri and Mid-west areas (i.e. \leq 65 and 43 t). Estimated total retained catches of the recreational sector (recreational boat-based fishers plus charter fishers) during years of the integrated surveys of 2011/12 and 2013/14 were above the recovery benchmark of 37 t, but within proposed 10-20% tolerance limits (Fletcher *et al.* 2016). Seventy three per cent of snapper landed in 2013/14 by boat-based recreational fishers were discarded/released, due mostly to being undersize (Ryan *et al.* 2015).

Estimates of F at the biological stock level derived from age composition data collected between 2008/09 and 2010/11 decreased from the previous period 2005/06-2007/08 (West Coast Demersal Scalefish Figure 2b; Fairclough *et al.*, 2014). However, F was still above the limit reference point of $1.5M$ and $SPR \leq$ the limit (0.2).

The above evidence indicates that the current level of exploitation should allow the stock to recover from overfishing. The biological stock is classified as **recovering**.

Baldchin groper (Sustainable-Recovering)

Retained catches of Baldchin groper in the WCB by all commercial fisheries, the WCDSIMF and the recreational sector (boat-based fishers plus charter fishers) have been at or below stock recovery benchmarks since commencement of the current management regime, i.e. < 22, 17 and 33 t, respectively (West Coast Demersal Scalefish Figure 2c). About 35% of baldchin groper landed in 2013/14 by boat-based recreational fishers were discarded/released, with the vast majority being undersize.

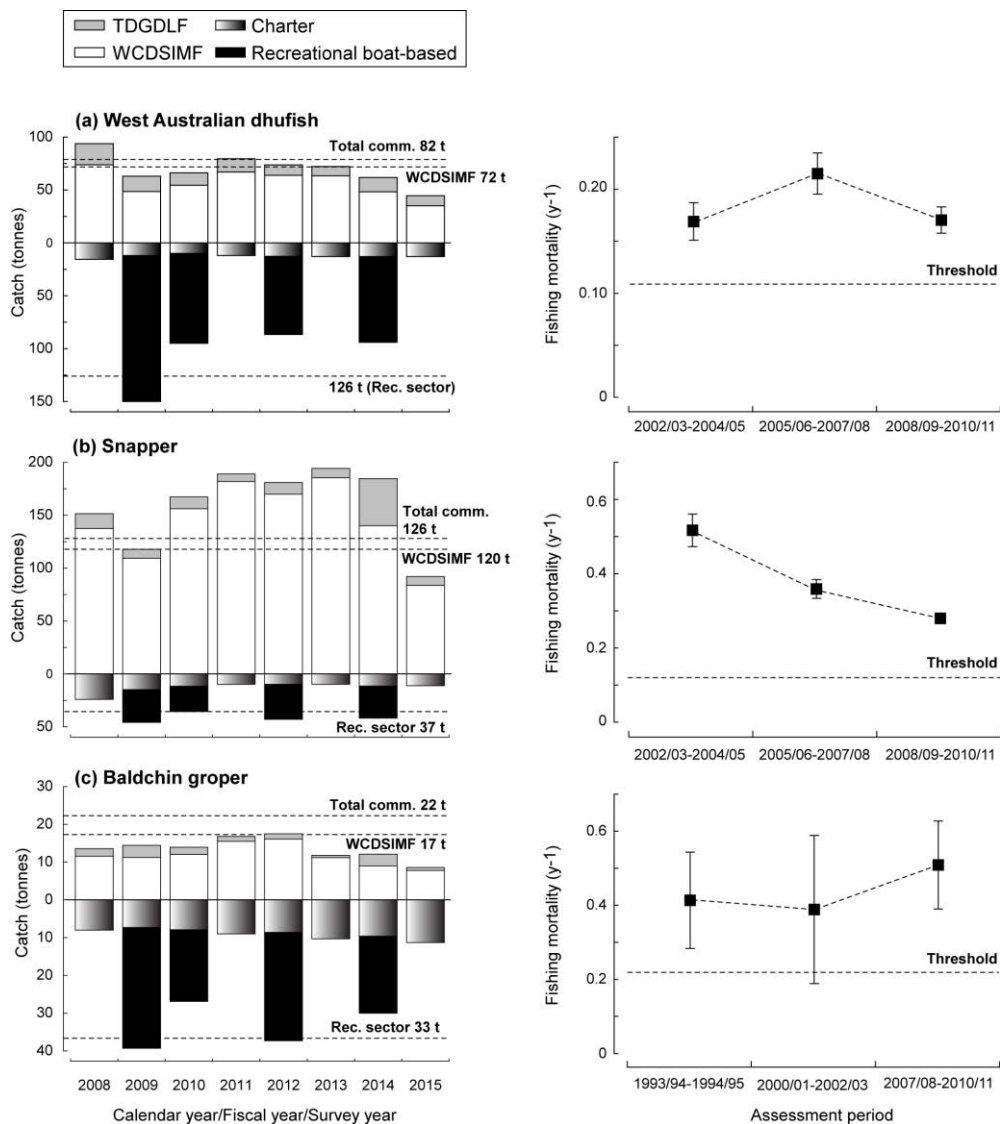
Rates of F at the biological stock level, using age composition data collected from 2008/09 to 2010/11 (i.e. during management changes) indicated no change since the previous assessment and were above the limit reference point of $1.5M$ (West Coast Demersal Scalefish Figure 2c; Fairclough *et al.*, 2014). Similarly, little change was identified in SPR , with point estimates falling between 0.2 and 0.3.

The current level of fishing pressure should allow the stock to recover from overfishing. The biological stock is classified as **recovering**.

Offshore Demersal (Sustainable-Adequate)

Estimated retained catches of offshore demersal species (6-14 t) by the WCDSIMF have remained below the nominal sustainable catch range for this suite (20-40 t) since this fishery commenced in 2008. Offshore demersal species are rarely caught by other state commercial fisheries, but are sometimes caught by the Western Deepwater Trawl Fishery (Cwth). However, recent effort and estimated catches have remained relatively low (e.g. since 2002: ruby snapper < 25 t, hapuku/bass groper < 1 t, blue-eye trevalla = 0 t). The current

level of fishing pressure is such that the biological stocks of offshore demersal species are considered **adequate**.



WEST COAST DEMERSAL SCALEFISH FIGURE 2. Estimated commercial and recreational retained catches vs 50% of 2005/06 catch benchmarks (dashed lines) for stock recovery (left column) and fishing mortality estimates vs threshold reference points (right column; Fairclough et al., 2014) for (a) West Australian dhufish, (b) snapper and (c) baldchin groper. Note recreational catches are point estimates and do not show 95% CIs (Ryan et al., 2015). 2011/12 and 203/14 estimates were derived from integrated phone diary surveys, while prior estimates were derived from boat ramp creel surveys.

BYCATCH AND PROTECTED SPECIES INTERACTIONS

Bycatch: Line fishing for demersal species using baited hooks is highly selective for demersal fishes. While other 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) may

not all survive, this still represents a minor impact to their stocks and therefore a **low risk**.

Protected Species: Interactions with listed species by commercial, charter and recreational fishers in the WCDSF are minimal. Commercial WCDSF and charter fishers are required to record listed species interactions in their statutory returns. During 2015, two grey nurse sharks were caught by the WCDSIMF and both released alive.

In 2014/15, charter fishers caught and released alive three grey nurse sharks, five goldspotted rockcod and one potato rockcod. Risks to protected species are therefore considered **negligible**.

HABITAT AND ECOSYSTEM INTERACTIONS

Habitat: Line fishing is the main fishing method used in the commercial and recreational fishery for demersal species which has little physical impact on the benthic environment and hence **negligible risk** to benthic habitats.

Ecosystem: Hall and Wise (2011) found that while the species composition in catches of commercial wetline, gillnet and longline fisheries in the WCB had changed over a 30 year timeline this 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 and the fishery therefore represents a **low risk** to the ecosystem.

SOCIAL AND ECONOMIC OUTCOMES

Social

The WCDSR provides high social amenity to recreational fishing and diving and to consumers via commercial fish supply to markets and restaurants. There is currently a **moderate level of risk** to these values.

The demersal resource in the WCB is highly accessible to boat fishers with approximately 131,000 Recreational Fishing from Boat Licences held in WA from May 2013 to April 2014. The commercial WCDSIMF vessels operating in 2015 employed zero to four crew, excluding the skipper, with the majority employing two crew per vessel. Fifty three licenced charter operators fished in the WCB in 2014/15, a decrease from 62 in 2013/14. The number of people employed in the charter industry has not been estimated.

Economic

The estimated gross value of product (GVP) for the WCDSIMF in 2015 was level 2 (\$1-5 million). There is currently a moderate level of risk to this level of return.

GOVERNANCE SYSTEM

Allowable Catch Tolerance Levels (Acceptable)

The retained catch levels of both the commercial and recreational sectors indicate that the fishery performance for both sectors is considered **acceptable**. Total retained catches of demersal species by the commercial and recreational sectors were maintained below recovery catch benchmarks of 450 and 250 t, respectively. After retained commercial catches of snapper in the WCB, total WCDSIMF, Kalbarri WCDSIMF and Mid-west WCDSIMF were above their respective recovery catch benchmarks of 126, 120, 65 and 43 t for more than three years, management changes reduced entitlements to the WCDSIMF Kalbarri and Mid-west Areas at the beginning of 2015. Retained catches were reduced to acceptable levels (below recovery benchmarks) in 2015 in each case.

Harvest Strategy (Under Development)

The WCDSR is currently managed using a constant catch strategy. Although a formal harvest strategy is not currently in place for this resource, a stock rebuilding program is underway, whereby retained catches are to remain < 50% of 2005/06 catches until fishing mortality rates fall below the threshold reference point. Proposals to define maximum tolerance levels around the acceptable catches and rates of decrease in *F* during the recovery phase have been identified (Fletcher *et al.*, 2016).

Compliance

The Department undertakes regular compliance inspections to ensure fishing is being undertaken in accordance with the governing legislation and runs education programs with various stakeholder groups to increase the levels of voluntary compliance.

Consultation

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

Recfishwest, and/or the Department's website when documents are released for public comment.

Management Initiatives (Stable)

The trial of filleting on-board commercial vessels presented no compliance issues and will therefore be formalised in the management plan for the fishery. No other reviews of management are anticipated for 2017.

EXTERNAL DRIVERS (Moderate Risk)

Recruitment success of demersal species, such as West Australian dhufish and snapper, vary annually and are influenced in part by environmental factors. Climate change may lead to a range of factors (e.g. increased water temperatures, changes in current strength) which may influence the biology of demersal species.

Declines in demersal catch and catch rates in the South-west Area followed an extreme event, a marine heatwave in 2011 (Caputi *et al.*, 2014), which may be associated. Ongoing industrial development in Cockburn Sound may affect the spawning aggregation behaviour and survival of juvenile snapper in that area.

There is some overlap of species captured in the WCB by state fisheries and by the Commonwealth Western Deepwater Trawl Fishery and Great Australian Bight Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery (>200 m). These catches are currently very small. The Commonwealth's proposed South-West Marine Bioregional Plan incorporates areas that will restrict access to fishing in parts of the WCB to the commercial and recreational sectors.

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