



## **North Coast demersal fisheries status report. In: State of the fisheries and aquatic resources report 2010/11. Eds W. J. Fletcher and K. Santoro.**

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# NORTH COAST BIOREGION

## ABOUT THE BIOREGION

The oceanography of the North Coast bioregion includes Pacific Ocean waters that enter through the Indonesian archipelago and from the Indian Ocean current. The Integrated Marine and Coastal Regionalisation for Australia (IMCRA V 4.0) scheme divides this bioregion into 8 meso-scale regions: Pilbara inshore, Pilbara offshore, North West Shelf, Eighty Mile Beach, Canning, King Sound, Oceanic Shoals and Kimberley.

Ocean temperatures range between 22°C and 33°C, with localised higher temperatures in coastal waters due to the arid nature of the hinterland, particularly along the Pilbara coastline. Fish stocks in the North Coast bioregion are entirely tropical, with most having an Indo-Pacific distribution extending eastward through Indonesia to the Indian subcontinent and Arabian Gulf regions.

Coastal waters are generally low-energy in terms of wave action, but are seasonally influenced by infrequent but intense tropical cyclones, storm surges and associated rainfall run-off. These cyclone events generate the bulk of the rainfall, although the Kimberley section of the coastline does receive limited monsoonal thunderstorm rainfall over summer.

Significant river run-off and associated coastal productivity can be associated with cyclone events, with run-off ceasing during winter. The entire north coastal region is subject to very high evaporation rates (3 metres per year), although the Pilbara coastline is more arid than the Kimberley, due to its lower cyclone frequency.

The second significant influence on coastal waters is the extreme tidal regime, related to the wide continental shelf. Spring tides range from up to 11 metres along the Kimberley section of the coast down to around 2 metres in the west Pilbara.

As a result of these factors, the generally tropical low-nutrient offshore waters can, in the few locations with rivers, be significantly influenced by rainfall run-off and tidal mixing to generate varying water quality in different sections of the North Coast Bioregion. Along the Kimberley coastline, waters are turbid and relatively productive, while the Pilbara coast with its lower run-off and lesser tidal influence has the clear waters more typical of the tropics.

The coastal geography of the various sections of the coastline also differs. The Kimberley coast is highly indented, with bays and estuaries backed by a hinterland of high relief. Broad tidal mudflats and soft sediments with fringing mangroves are typical of this area. The eastern Pilbara coast is more exposed than the Kimberley, with few islands and extensive inter-tidal sand flats. Softer sediments and mangroves occur around the river entrances. The western Pilbara coastline is characterised by a series of significant but low-relief islands including the Dampier Archipelago, Barrow Island and the Montebello Islands. Near-shore coastal waters include rocky and coral reef systems, creating significant areas of protected waters. West Pilbara shorelines

also include areas of soft sediment and mangrove communities.

## SUMMARY OF FISHING AND AQUACULTURE ACTIVITIES

One of the principal commercial fisheries in the North Coast bioregion focuses on tropical finfish, particularly the high-value emperors, snappers and cods that are taken by the Pilbara Fish Trawl Fishery and the Pilbara and Northern Demersal trap fisheries. The typical catch is in the order of 3,000 t annually, making these fisheries, at an estimated annual value of around \$12 million, the most valuable finfish sector in the state.

Another significant commercial fishery in this bioregion is based on the collection of pearl oysters (*Pinctada maxima*) for use in the aquaculture production of pearls (see below). These are collected from the fishing grounds primarily off the Eighty Mile Beach, with smaller catches being taken around the Lacepede Islands (north of Broome).

The North Coast Bioregion also has a number of small, limited-entry trawl fisheries for prawns, producing about 700 t annually, valued at around \$10 million.

A number of other finfish fisheries operated in the region including surface trolling for Spanish mackerel, demersal line fishing, near-shore beach seining and gillnetting for barramundi/threadfin salmon and shark.

Recreational fishing is experiencing significant growth in the North Coast Bioregion, with a distinct seasonal peak in winter when the local population is swollen by significant numbers of metropolitan and inter-state tourists travelling through the area and visiting, in particular, the Onslow, Dampier Archipelago and Broome sections of the coastline. This has been added to by the increased recreational fishing by those involved in the construction or operation of major developments in this region. Owing to the high tidal range, much of the angling activity is boat-based, with beach fishing limited to periods of flood tides and high water.

The numerous creek systems, mangroves and rivers, and ocean beaches provide shore and small boat fishing for a variety of species including barramundi, tropical emperors, mangrove jack, trevallies, sooty grunter, threadfin, mud crabs and cods. Offshore islands, coral reef systems and continental shelf waters provide species of major recreational interest including saddletail snapper and red emperor, cods, coral and coronation trout, sharks, trevally, tuskfish, tunas, mackerels and billfish.

Aquaculture development in the north coast bioregion is dominated by the production of pearls from the species *P. maxima*. A large number of pearl oysters for seeding is obtained from wild stocks and supplemented by hatchery-produced oysters, with major hatcheries operating at Broome

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and King Sound. Pearl farm sites are located mainly along the Kimberley coast, particularly in the Buccaneer Archipelago, in Roebuck Bay and at the Montebello Islands.

Developing marine aquaculture initiatives in this region include growing trochus and barramundi. A focus of aquaculture development is provided by the Department of Fisheries' Broome Tropical Aquaculture Park, which houses a commercial pearl oyster hatchery, an indigenous-owned multi-species hatchery and the Kimberley College of TAFE aquaculture training facility.

## ECOSYSTEM MANAGEMENT

Extensive fisheries closures in coastal and most offshore waters have been introduced to manage finfish trawling by Australian vessels (North Coast Ecosystem Management Figure 1). However, trawling is still permitted in a number of locations (see specific commercial trawl fishery reports elsewhere in this volume). This activity is carefully managed to ensure that impacts are acceptable. The trawling is subject to Ecologically Sustainable Development (ESD) requirements in accordance with Australian Government 'Guidelines for the Ecologically Sustainable Management of Fisheries' under the Environment Protection and Biodiversity Conservation Act 1999. The extent of these areas means that 41% of the entire shelf region of the North Coast Bioregion could be classified as a marine protected area with an IUCN category of IV (as per Dudley, 2008<sup>1</sup>; North Coast Ecosystem Management Table 1).

In addition to these habitat related marine protected area closures, the bioregion has a number of other marine protected areas including the Montebello and Barrow Islands Rowley Shoals proclaimed under the Conservation and Land Management Act 1984, and closures to fishing under section 43 of the Fish Resources Management Act 1994 at Point Samson, Peron Peninsula and the wreck of the Kunmunya Samson II (Delambre Reef) (see North Coast Ecosystem Management Figure 2). The proposed Dampier Archipelago marine conservation reserves are still under consideration by Government.

The Department of Fisheries has also participated in the marine conservation reserve planning process in this region. This has resulted in the proposal to establish the Camden Sound Marine Park which is likely to be gazetted in 2011/2012. The Department has recently received funding to

establish baseline and ongoing monitoring and research to underpin ecosystem management of this area. There is considerable interest in developing further marine protected areas within the Kimberley area, and the State Government has announced funding of a further marine protected area at Eighty Mile Beach. The Department continues to work closely with relevant agencies and stakeholders to develop strategies to minimize environmental effects in the marine environment including the Kimberley Science and Conservation Strategy with DEC.

The Australian Government's Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) is also undertaking a Marine Bioregional Planning process for Commonwealth waters between Shark Bay and the Northern Territory border, with the aim of releasing a draft North Marine Bioregional Plan for public consultation in 2011/12

Marine habitats within the North Coast Bioregion of Western Australia are experiencing increasing pressure through a range of activities but most notably as a result of increased resource development activity that is occurring in the area.

The Department continues to engage with the Environmental Protection Authority through the environmental impact assessment process by providing advice on individual development proposals, which if implemented, have the potential to have an adverse impact on the marine environment. These include new (and upgraded) port developments in the Pilbara region, as well as offshore and nearshore oil and gas extraction projects in the Kimberley and Pilbara region. Major developments recently assessed for which the Department has played a key role include the Gorgon Gas Development at Barrow Island, and the proposed Kimberley LNG processing site.

The increase in international shipping movement and dredging activity associated with resource development in the Northern region is considered to present a high risk to the marine environment because of the potential for the introduction of non-indigenous marine organisms (including animals, plants, pathogens and diseases) into WA's coastal environment.

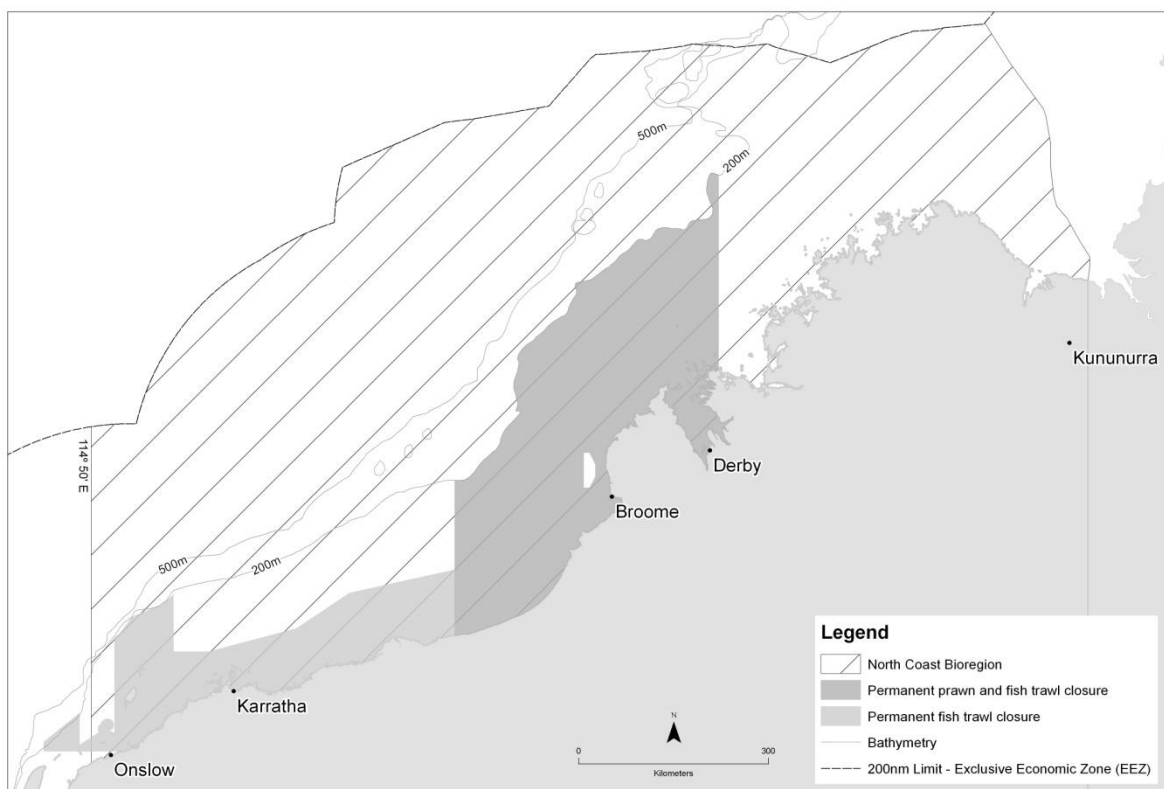
The recent Montara oil spill that occurred in this region highlights the potential risks to this area from oil and gas production. The outcome of this incident on fishery resources and assets may not be known for some time.

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

**NORTH COAST ECOSYSTEM MANAGEMENT TABLE 1**

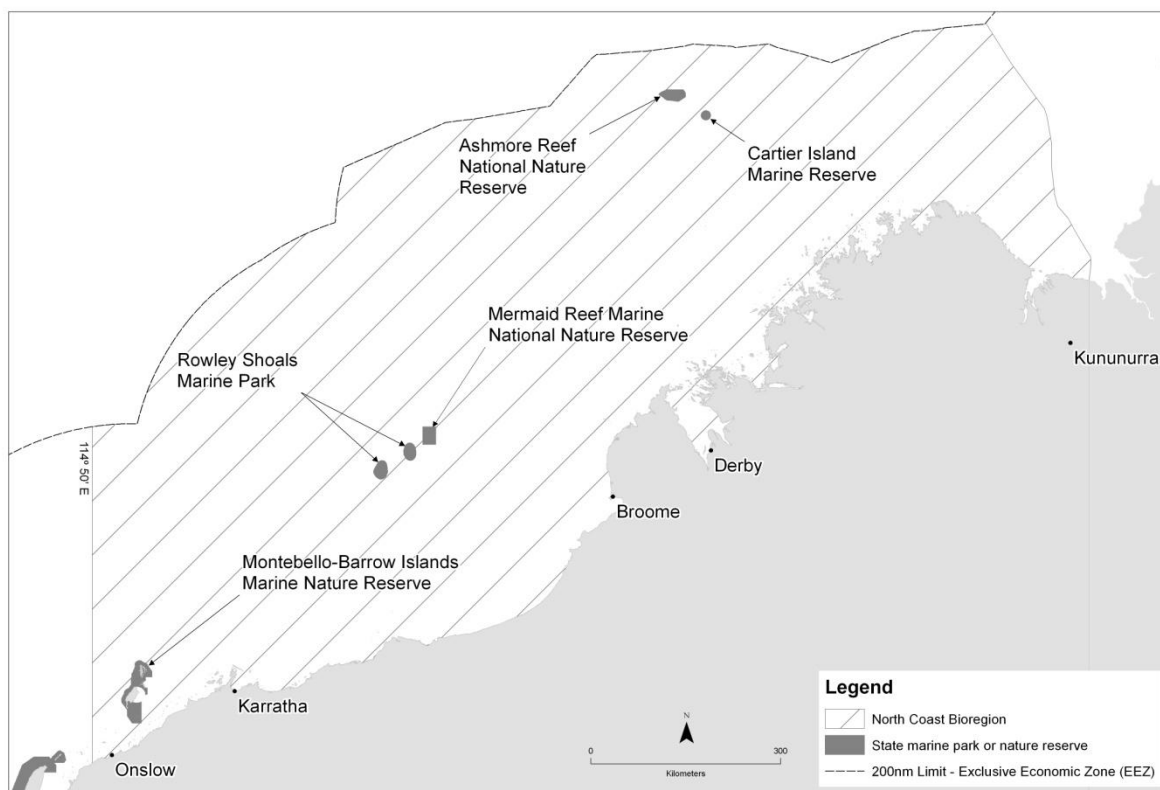
The areas and proportions of the North Coast Bioregion making up State Waters and continental shelf waters where habitats are protected from the physical disturbance of trawl fishing. The areas, 200 m depth which are formally closed to trawling would be equivalent to meet category IV of the IUCN criteria for classification as marine protected areas. The area effectively protected covers those areas of the shelf < 200 m depth where state managed trawling doesn't occur.

Total Area of Shelf	Area of shelf equivalent to IUCN marine protected area category IV (%)	Maximum area of actual trawling activity	Total area of habitat effectively protected (%)
98600 sq nm	40700 sq nm (41%)	10500 sq nm	88100 sq nm (89%)

**NORTH COAST ECOSYSTEM MANAGEMENT FIGURE 1**

Map showing areas permanently closed to trawling by WA state managed fisheries in the North Coast bioregion.

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### NORTH COAST ECOSYSTEM MANAGEMENT FIGURE 2

Map showing current and proposed areas of protected fish habitat in the North Coast bioregion.

## ECOSYSTEM BASED FISHERIES MANAGEMENT

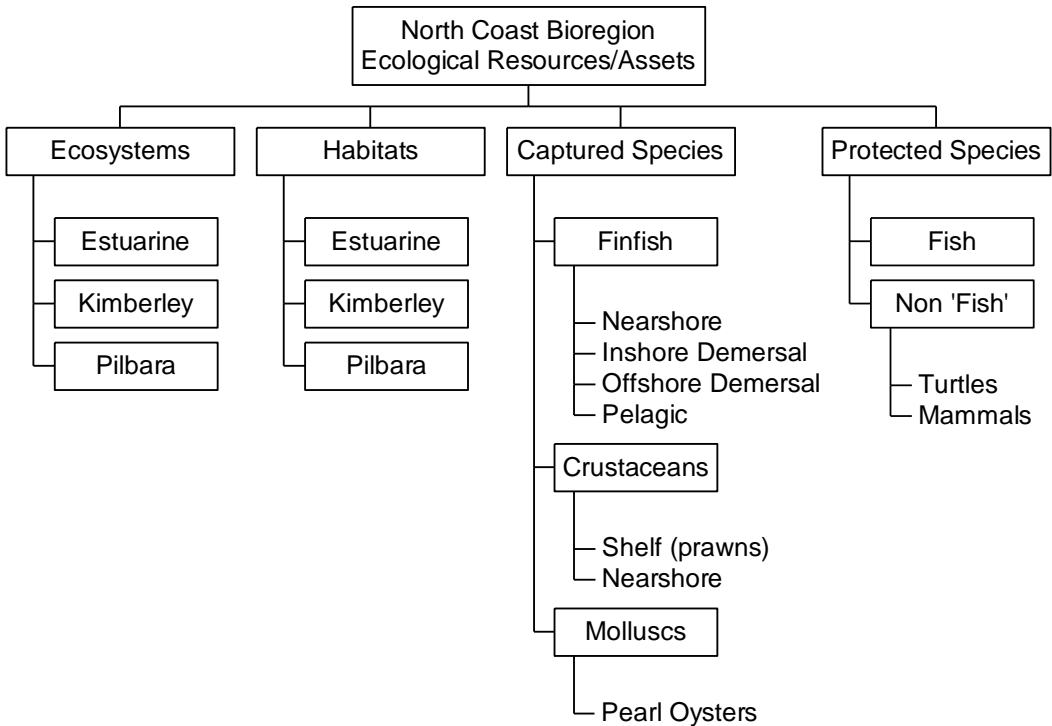
### Identification of Ecological Assets using the EBFM framework

Under the Integrated Marine and Coastal Regionalisation for Australia scheme, the bioregion has been divided into the bioregion has been divided into 8 meso-scale regions: Pilbara inshore, Pilbara offshore, North West Shelf, Eighty Mile Beach, Canning, King Sound, Oceanic Shoals and Kimberley Gulf (IMCRA, V 4.0, 2006). While this sub-regional scale of management has been adopted by the Department through the implementation of an Ecosystem Based Fisheries Management (EBFM) framework (see How to Use section for more details), in the North Coast these meso-scales have been combined into two marine based ecosystems Pilbara (Pilbara and NW Shelf, eighty Mile Beach), Kimberley (Canning, Kimberley) and a Nearshore/estuarine ecosystem.

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

- Ecosystem structure and biodiversity;
- Captured fish species
- Protected species (direct impact – capture or interaction);
- Benthic habitats; and
- External impacts.

For some issues a finer level of division of the IMCRA ecosystems is used by the Department. This relates to recent management initiatives necessary to recognise different suites of exploited fish and invertebrates across the continental shelf. These sub-components are defined by depth contours (Nearshore 0-20m; Inshore 20-250m; Offshore >250m; Pelagic). The full set of ecological assets identified for assessment and in some cases ongoing monitoring are presented in North Coast Ecosystem Management Figure 3.



**NORTH COAST ECOSYSTEM MANAGEMENT FIGURE 3**  
Component tree showing the ecological assets identified and separately assessed for the North Coast Bioregion.

**Risk Assessment of Bioregional Level Ecological Assets**

The EBFM process identifies the ecological assets in a hierarchical manner such that the assets outlined in North Coast Ecosystem Management Figure 3 are often made up of individual components at species or stock level. The risks to each of the individual stock or lower level components are mostly detailed in the individual fishery reports presented in this document.

The following table (North Coast Ecosystem Management Table 2) provides an overview and cumulative assessment of the current risks to the ecological assets of the North Coast Bioregion, at a bioregional level and provides a mechanism for reporting on their status and the fisheries management arrangements that are being applied. These bioregional level risks are now used by the Department as a key input into the Department’s Risk Register which, combined with an assessment of the economic and social values and risks associated with these assets, is integral for use in the annual planning cycle for assigning priorities for activities across all Divisions in this Bioregion.

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### NORTH COAST ECOSYSTEM MANAGEMENT TABLE 2: RISK LEVELS FOR EACH NORTH COAST ASSET.

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

#### Ecosystem Structure and Biodiversity

Ecosystem	Aquatic zone	Risk	Status and Current Activities
Nearshore/ Estuarine	Marine	LOW (non fishing)	With the onshore developments that are proposed in this area, while some specific areas may be locally impacted, these still only pose a low risk to the overall nearshore/estuarine ecosystem of this bioregion.
Pilbara	Marine	LOW	Given the large areas closed to both trawling and to all commercial fishing, there is only a low risk that the level of fishing in this region is changing the community structure at a regional level to an unacceptable level. A recent study by Hall and Wise (2010) found no change in community structure of commercially captured finfish over the past 30 years consistent with a significant trophic impact. A proposal to further examine recovery of this area from the impacts of Taiwanese fishing that occurred in the 1980s is currently under development.
Kimberley	Marine	LOW (non fishing)	While there are a number of specific oil and gas related offshore developments that are proposed in this region, at the overall ecosystem level there is only a negligible risk that the ecosystem will be altered measurably. A recent study by Hall and Wise (2010) found no change in community structure of commercially captured finfish over the past 30 years consistent with a significant trophic impact. A significant level of planning has been undertaken to study this region as part of the Kimberley Science Plan.

#### Captured fish species

Fish species	Aquatic zone	Risk	Status and Current Activities
Finfish	Nearshore/estuarine	MODERATE	The barramundi and threadfin salmon stocks are considered to be at acceptable levels.
	Shelf demersal	MODERATE	The current status of demersal finfish stocks captured by the Pilbara trawl fishery requires a review. A research survey is underway to assist determine if the recent low catch rates are due to changes to trawl gear or to localized depletion.
	Pelagic	MODERATE	The Spanish mackerel stock in this region is at acceptable levels and there are few other pelagic fish that are impacted.
Crustaceans	Nearshore/Estuarine	LOW	There is a small amount of fishing for mud crabs and blue swimmer crabs in some estuarine and inshore areas.
	Shelf	MODERATE	There are a number of separate prawn stocks and fisheries within this bioregion that each have limited entry, seasonal and area closures. Annual recruitment to these stocks is variable, which combined with the higher costs of operating in this region, has resulted in fishing effort being much lower in recent years.

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Fish species	Aquatic zone	Risk	Status and Current Activities
Molluscs	Pearls	LOW	The fishery only targets a very small section of the stock both spatially and the available size range. Recent catches have been well below the quota levels due to low market demand,

### Protected species

Protected fish species	Species	Risk	Status and Current Activities
Protected non 'Fish' species	Non fish	NEGLIGIBLE	Crocodiles are occasionally captured in nets but are released alive.
	Mammals	MODERATE	Dolphins are captured by the Pilbara trawl fishery, but dolphin excluder devices have reduced this incidence to acceptable levels but further refinements in net design are underway.
Protected 'Fish' Species	Fish	LOW	The sawfish (Pristidae), speartooth shark (Glyphis glyphis) or the northern river shark (Glyphis garricki), are captured in small numbers by net fishing in small regions of the Kimberly region.

### Benthic habitat

Benthic Habitat	Category	Risk	Status and Current Activities
Estuaries/ Nearshore		LOW (non Fishing)	The main risks to nearshore habitats come from oil and gas developments.
Pilbara		MODERATE	This bioregion has fish trawling but this activity is tightly constrained. The large area permanently closed to trawling and the relatively small area where trawling actually occurs indicates that the habitat in this region is appropriately managed.
Kimberley		LOW (Non Fishing)	Except for some small areas where prawn trawlers operate for short periods each year, most of this region is closed to trawling. These activities may be examined as part of the proposed Camden Sound marine park. The most likely potential impacts to the habitat in this area are from oil and gas infrastructure and operations.

### External Drivers (NON FISHING)

External Drivers	Risk	Status and Current Activities
Introduced Pests and Diseases	HIGH	The extremely high level of international shipping that operates in this region poses a high risk that an introduced pest may be imported. The department is working towards developing and implementing a suitable monitoring and inspection program.
Climate	LOW	This area is predicted to have relatively minor impacts from climate change, especially in the coming decade compared to more southerly locations. Projects to examine potential impacts are planned.



### Summary of Monitoring and Assessment of Ecosystem Assets

The Department of Fisheries continues to provide advice to the Environmental Protection Authority on development proposals, which, if implemented, have the potential to impact on the aquatic environment. The Department is working closely with the Australian Government and other jurisdictions to develop and implement the National System for the Prevention and Management of Marine Pest Incursions that will minimise the biosecurity risks associated with increased shipping in the Pilbara and Kimberley regions. Within WA, this will be achieved through the Fish Resources Management Act 1994 and the Biosecurity and Agriculture Management Act 2007. Associated regulations and subsidiary legislation are currently being developed. Work has also been undertaken to develop monitoring designs for introduced marine species for the Port of Dampier. The design has been developed in conjunction with the Invasive Marine Pests Program within DAFF (Department of Agriculture Fisheries and Forestry). This work is expected to contribute to introduced aquatic organism incursion and fish kill incident response programs already in place.

The Department of Fisheries' Research Division's Biodiversity and Biosecurity Branch has recently completed a pilot project aimed at establishing resource condition monitoring protocols for the Pilbara and Kimberley. The project focussed on an extensive survey of the research literature relating to the coastal and marine environments in the Pilbara and Kimberley. The review of the literature has highlighted those areas of research that are lacking from the

region. These knowledge gaps ranged in scope from fine scale life history trait studies of particular species; to large-scale oceanographic studies to identify major ocean current dynamics, and oceanic primary production from plankton.

The vast and remote coastline of the region dictates that remote sensing (satellite imagery and aerial photography) will be the primary tool for resource condition monitoring. The project concentrated on developing remote sensing as a monitoring tool, and developing a suite of resource condition indicators that accurately portray the health of the numerous marine and coastal environments, and set bench marks for which to assess environmental change, within the Pilbara and Kimberley.

The Department has been provided with funds for an ongoing monitoring program in the Camden Sound Marine Park. Further initiatives are being developed as part of the broader Kimberly Science and Conservation strategy and in the progression of the recently established WAMSI 2 project.

The Biodiversity and Biosecurity branch have implemented a series of biosecurity related projects during 2010 – 2011. All projects aim to detect the presence of introduced marine pests (IMPs) using a suite of tools including ongoing background monitoring and large-scale Port monitoring. Early detection of IMPs is vital if any attempt at eradication or other management strategies are to be successful. Two large-scale, nationally approved, surveys have been implemented for the Ports of Dampier and Port Hedland that will inform the Department of the status of IMPs in those Ports. Background monitoring programs are also continuing within Dampier and Port Hedland Ports waters with assistance from the Dampier Port Authority and Port Hedland Port Authority.

## FISHERIES

## North Coast Prawn Managed Fisheries Status Report

Main Features			
Status		Current Landings	
Stock level	Acceptable	Onslow:	29 t
		Nickol Bay:	40 t
Fishing level	Acceptable	Broome:	3 t
		Kimberley:	256 t

## Fishery Description

There are four small prawn fisheries that operate in the north coast bioregion which are all undertaken using otter trawls.

The Onslow (OPMF) and Nickol Bay (NBPMF) Prawn Managed Fisheries operate along the western part of the North-West Shelf and OPMF targets western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*Penaeus esculentus*), endeavour prawns (*Metapenaeus* spp.) whereas NBPMF primarily targets banana prawns (*Penaeus merguensis*).

The Broome Prawn Managed Fishery (BPMF) operates in a designated trawl zone off Broome and targets western king prawns (*Penaeus latisulcatus*) and coral prawns (a combined category of small penaeid species).

The Kimberley Prawn Managed Fishery (KPMF) operates off the north of the state between Koolan Island and Cape Londonderry. It predominantly targets banana prawns (*Penaeus merguensis*) but also catches tiger prawns (*Penaeus esculentus*), endeavour prawns (*Metapenaeus endeavouri*) and western king prawns (*Penaeus latisulcatus*).

operate within the season. These are designed to protect smaller prawns and allow access to the various target species, primarily tiger and banana prawns, at appropriate times.

## Boundaries

The boundaries of the OPMF are 'all the Western Australian waters between the Exmouth Prawn Fishery and the Nickol Bay prawn fishery east of 114°39.9' on the landward side of the 200 m depth isobath and is divided into three parts with associated size management fish grounds (SMFGs) and nursery areas for prawns as follows: Area 1, incorporating the Ashburton SMFG; Area 2, incorporating the Mangrove Island and Weld Island SMFGs and Coolgra Point Nursery; and Area 3, incorporating the Fortescue SMFG (Northern Prawn Figure 1).

The boundaries of the NBPMF are 'all the waters of the Indian Ocean and Nickol Bay between 116°45' east longitude and 120° east longitude on the landward side of the 200 m isobath' (Northern Prawn Figure 2).

The boundaries of the BPMF are 'all Western Australian waters of the Indian Ocean lying east of 120° east longitude and west of 123°45' east longitude on the landward side of the 200 m isobath. The actual trawl area is contained within a delineated small area north west of Broome as shown in Northern Prawn Figure 3.

The boundaries of the KPMF are 'all Western Australian waters of the Indian Ocean lying east of 123°45' east longitude and west of 126°58' east longitude'. It abuts the western boundary of the Commonwealth Northern Prawn Fishery (NPF) (Northern Prawn Figure 4).

## Governing legislation/fishing authority

Onslow Prawn Fishery Management Plan 1991

Onslow Prawn Managed Fishery Licence

Nickol Bay Prawn Fishery Management Plan 1991

Nickol Bay Prawn Managed Fishery Licence

Broome Prawn Managed Fishery Management Plan 1999

Broome Prawn Managed Fishery Licence

Kimberley Prawn Fishery Management Plan 1993

Kimberley Prawn Managed Fishery Licence

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

## Consultation process

Annual meetings between the Department of Fisheries and licence holders to consider the status of the stocks and recommend changes to the opening and closing dates that

## Management arrangements

Management controls for all the north coast prawn fisheries are based on limited entry, seasonal and area closures, and gear controls including bycatch reduction devices. The Department's vessel monitoring system (VMS) monitors the activities of all boats.

**OPMF:** The management arrangements in the OPMF involve

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using a standardised net headrope allocation whereby each Managed Fishery Licence (MFL) has an equal allocation of net headrope length in each area. However, there are different net sizes permitted between Areas. Area 1 boats are authorised to use two trawl nets each having a maximum headrope length of 6 fathoms (10.98 metres). In Area 2 and 3 a maximum headrope length of 16 fathoms (29.27 metres) is permitted in either twin or quad gear configuration. Trawl net headrope amalgamation between MFLs has been permitted in the OPMF consistent with other trawl fisheries. The fleet is composed of trawlers up to 23 metres in length, operating under an exemption from the net size and boat unit rule specifically for Area 1 and the 375 hull-unit rule for Areas 2 and 3.

The official season arrangements during 2010 for the various areas in the OPMF were as follows:

Area 1	6 May – 22 October
Area 2	6 May – 22 October
Area 3	6 May – 22 October
Fortescue SMFG	5 June – 12 September
Ashburton SMFG	5 June – 25 July
Weld Island SFMG	5 June – 24 August
Mangrove Island SFMG	1 April – 22 October

Moon closures were again implemented this season on a voluntary basis. The moon closure period was three days around each full moon during the fishing season across all areas.

Different licence classes apply to the OPMF, allowing boats to trawl in specific zones. These classes are listed below, with figures in brackets indicating number of licensed boats:

Class A	Areas 1, 2 and 3 (four MFLs)
Class B	Areas 2 and 3 (three MFLs)
Class C	Area 2 (12 Exmouth Gulf prawn MFLs)
Class D	Area 3 (12 Nickol Bay prawn MFLs)

**NBPMF:** The NBPMF management arrangements provide for authorised boats to use standard otter trawl nets not exceeding 16 fathoms (29.27 metres in either twin or quad gear configuration) whereby each boat has an equal allocation and the maximum total headrope length for the entire fleet is 224 fathoms (409.78 metres). The 2010 season opened on 8 March with a closure on 14 November. The major fishing areas opened during these periods:

Nickol Bay	20 May – 1 August (Day fishing only 20 May – 3 June)
Extended Nickol Bay SMFG	20 May – 14 November
Depuch SMFG	20 May – 1 August (Day fishing only 20 May – 3 June)
De Grey SMFG	20 May – 14 November

**BPMF:** The BPMF management arrangements provide for standard otter trawl nets not exceeding 40 fathoms (73.16 metres in either twin or quad gear configuration). Each boat has an equal allocation and the maximum total headrope length for the entire fleet is 200 fathoms (365.8 metres).

The 2010 season arrangements opened the Fishery on 17

May and it officially closed at 0800 hrs 17 August, providing 72 fishing nights. Only one boat entered the BPMF fishery in June and it fished for 13 nights before leaving to fish in the Northern Prawn Fishery (NPF) where the expected catch rates were much higher. Because there were indications that the prawn catch rates might have improved beyond the set season end date, operators requested that the fishing season be extended. Subsequently, the season was extended for one month and closed 17 September.

**KPMF:** The KPMF Management Plan permit the use of two otter trawl nets where the total headrope length does not exceed 32 fathoms (58.5 metres) and mesh of trawl nets does not exceed 50 mm.

Seasonal dates for the KPMF are generally aligned with those of the adjacent NPF. Of the 126 licensees in the KPMF, as at 30 June 2010, 31 also held an NPF licence. Opening and closing dates are aligned to prevent large shifts of fishing effort into the KPMF. Consequently, the 2010 season opened on 1 April and closed mid-season closure on 27 May. The fishery re-opened on 1 August, with a promulgated final season closure on 30 November. The total allowable effort cap system was in place for both periods with a total of 1500 days allocated.

A comprehensive Ecologically Sustainable Development (ESD) assessment of these fisheries has been undertaken to identify any potential sustainability risks requiring direct management action. The only issue identified through this process related to the breeding stock levels of target species (e.g. banana, tiger and king prawns). Boxed text in this status report provides the annual assessment of performance for this issue. The SEWPaC (formerly DEWHA) have recently completed the reassessment of the NBPMF, OPMF, KPFM and BPMF trawl fisheries and export approval has been granted until 20 August 2015 for all fisheries under the one approval. DoF has also agreed to prepare a comprehensive Bycatch Action Plan for the invertebrate trawl fisheries identifying best practice for bycatch reduction and a plan for moving all of these fisheries to best practice. As a first step, in 2010 the Department initiated a review of gear and BRDs used in all the Western Australian prawn and scallop trawl fisheries.

### Research summary

Research programs are focused to underpin the sustainable management of these small fisheries involving stock monitoring and assessment utilising information from daily logbooks and processor unloads. For the NBPMF and KPMF rainfall records are also used to update the rainfall-catch relationship for banana prawns. In the OPMF a field-based consultative process is normally undertaken whereby industry and the Departments' Research Division decide on the extent of an area to be fished within the areas that are officially opened, and not fish small size prawns. For 2010 this did not occur because only one boat fished and the late opening date and market prices mitigated the risk of taking small size prawns. For the BPMF a De Lury depletion analysis is undertaken when sufficient fishing activity occurs (insufficient effort in 2010) which assists in the assessment of the king prawn stocks within the permitted fishing area.

## Retained Species

### Commercial production (season 2010):

<b>Onslow:</b>	<b>29 tonnes</b>
<b>Nickol Bay:</b>	<b>40 tonnes</b>
<b>Broome:</b>	<b>3 tonnes</b>
<b>Kimberley:</b>	<b>256 tonnes</b>

### Landings

**OPMF:** The total landings of major penaeids for the 2010 season were 29 t, comprising 1 t of king prawns, 27 t of tiger prawns, <1 t of endeavour prawns and <1 t of banana prawns. Tiger prawn landings in 2010 were low but within the target catch range and at the expected level given the low effort in this fishery. King and endeavour prawn landings were extremely low and below the target catch range (Northern Prawn Figure 5). Recorded landings of by-product species in the OPMF included 1 t of bugs (*Thenus orientalis*) with the landings of all other species being less than one tonne.

**NBPMF:** The total landings of major penaeids for the 2010 season were 40 t comprised only of banana prawns with no recorded landings of king, tiger or endeavour prawns (Northern Prawn Figure 6). The recorded landings of banana prawns in 2010 were low but within the projected catch range (30 to 60 t) and at the lower end of the target catch range. Recorded byproduct landings for 2010 were extremely low with < 1 tonne of blue swimmer crabs as the only species recorded.

**BPMF:** Recorded landings for target species were very low at 3 t, in the BPMF and no byproduct species was recorded (Northern Prawn Figure 7).

**KPMF:** The total recorded landings in the KPMF were 256 t, comprising 241 t of banana prawns, 11 t of tiger prawns, 4 t of endeavour prawns (Northern Prawn Figure 8). Banana prawn landings were within their target catch range (200–450 t) and the projected catch range (230 to 350 t) calculated using the relationship between summer rainfall and catches. Both tiger and endeavour prawns were slightly below their target catch ranges. Fishing occurred in both fishing periods for 2010 but effort was still low, possibly reducing total catch for these species. Negligible quantities of byproduct were reported as landed.

**Recreational component:** Nil

### Fishing effort/access level

**OPMF:** One boat fished in 2010 with a total of 97 boat days, a decrease compared to 265 boat days (two boats fished) in 2009. It is understood the other two boats did not fish in 2010 because of depressed product prices and high operating costs. This effort is extremely low compared to the days fished between 2000 and 2005 inclusive (mean of 1136 days) and the second lowest effort ever recorded in this fishery. In Area 1, one boat was exempted to fish with larger nets using a total net headrope length of 18 fathoms (four 4.5-fathom nets) instead of the permitted 16 fathoms total net

headrope length because of economic conditions and low abundance of prawns in recent years. This required the amalgamation of net allocations from two boats, licensed to fish all areas, onto one boat, resulting in a reduction of net headrope length from 32 fathoms to 18 fathoms for fuel efficiency. There is also competition for boat crew with the oil and gas resource sector.

**NBPMF:** Three boats fished during the 2010 season for an aggregated total of 69 boat days, a very low level of effort.

**BPMF:** Only thirteen nights of fishing effort was expended by one boat in this fishery in 2010.

**KPMF:** Thirteen boats operated in the fishery during 2010. The total number of days fished was 365 days well under the total days (1500) allocated to fish and the lowest since 1990 when effort estimates were first made.

## Stock Assessment

**Assessment complete:** Yes

**Assessment method:** Level 1 - Catch  
(Rainfall catch relationship for NBPMF and KPMF for banana prawns, DeLury depletion analysis for BPMF - when appropriate)

**Breeding stock levels:** Adequate

**Projected catch next season (2011):**

**NBPMF:** 250 t banana prawns

**KPMF:** 390 t banana prawns

For the northern prawn fishery stocks, their short life cycle, high fecundity and dispersed nature prevent fishing from depleting breeding biomass to unacceptable levels. Historical catch levels from periods where it is known that recruitment was not affected by fishing effort have been used as the basis for calculating target catch ranges. These catch ranges are used as an indicator of breeding stock adequacy.

The low landings of prawns in general cannot be completely explained in these northern fisheries but any stock abundance issues that may have existed, were exacerbated by very low effort caused by the current economic conditions including: high fuel prices and purchasing fishing equipment, increased time to sell prawns into markets (longer term cold storage of product) and low market prices. These variable market conditions mean that operators only fish when they consider it profitable to do so. In addition, increased fuel and labour costs, direct competition from both higher prawn production from other Australian fisheries and the increase in the volume of low priced domestic and imported aquacultured prawns are generally squeezing profit margins. In summary, it is considered the low catches and resultant falling GVP in these fisheries may indicate under exploitation in response to increased competition and declining profit opportunities rather than a lack of abundance.

**OPMF:** The 2010 season tiger prawn landings (27 t) were lower compared to 2009. The effort in this fishery since 2006 has been very low with a maximum number of boats fishing in any one year being three but in most of these years only 1 boat fished. The low overall landings is in part a reflection

## NORTH COAST BIOREGION

of low effort. The abundance of tiger prawns could only maintain fishing over 4 months (May to August inclusive) mainly because of the absence of other species to increase overall catch rates to fish profitably. Although the landings were below the average landings (the mean reference landings range for 1985 to 2009 inclusive is 49 t) these tiger prawn catches were taken at efficient catch rates. The total catch of tiger prawns taken with level of effort indicates adequate breeding stock

King prawn catch (1 t) remains low compared to the mean catch of 33 t for 1985 to 2009. Since the early 2000's, there has been a decline in king prawn abundance in this fishery. Since 2006, the decline in effort may also be contributing to the low catches. There were no recorded landings of banana prawns this season. Generally there is a positive correlation between early seasonal rainfall and the catch of banana prawns. However, this generally requires a few consecutive years of rainfall to provide a stock build-up. With low landings since 2002 and low rainfall there was no expectation of banana prawn abundance.

**NBPMF:** The landings of banana prawns (40 t) in 2010 were lower than in 2009 but within the target catch range and expected catch range for this species. There were no king and tiger prawn landings therefore the target ranges for these species was not met.

The catch projection for banana prawns in Nickol Bay is based on the summer rainfall level between December and March (Northern Prawn Figure 9). The total rainfall between December 2010 and March 2011 (at Roebourne) was 411 mm and the predicted catch for 2011 is around 250 t with a range of 205 –310 t of banana prawns.

**BPMF:** Very low fishing effort (and resultant catch) occurred in this fishery during 2010 so no stock assessment was completed.

**KPMF:** Banana prawns were within the target catch range and tiger and endeavour prawns were below their target ranges. Effort levels were at historic low levels and the tiger and endeavour prawn landings are likely to be effort related as in the 2009 season.

The relationship identified between the early season rainfall and catches of banana prawns (the dominant species taken in this area) provides a degree of forecasting. The projected catch for 2011, based on the rainfall in Kalumburu and Derby in January and February 2011, is 390 tonnes with a range of 310-460 t.

*The main performance measures for the OPMF, NBPMF and KPMF relate to maintenance of breeding stocks for each of the major target prawn species. In 2010 the breeding stock indicators in the OPMF (catches within specified ranges, as set out in the 'Fishery Governance' section) for tiger prawns were met whereas king, banana and endeavour prawns were below the target catch range due to low effort. Environmental conditions i.e. low summer rainfall did not benefit banana prawn production this year, therefore, prawn abundance was expected to be low.*

*The breeding stock indicator for banana prawns in the NBPMF was met and the landings was within the projected catch range (at the low end of the range). There were no recorded king or tiger prawn landings, therefore, they were below the target ranges. This is likely to be a result of the very low effort and very limited targeting of these species this year.*

*An assessment of breeding stock could not be made for the BPMF due to very low fishing effort.*

*The breeding stock indicators in KPMF (catches within specified ranges) for banana prawns were met but tiger and endeavour prawns were below the target ranges. This may be due to low effort.*

## Non-Retained Species

### Bycatch species impact:

**Low**

Bycatch from the northern prawn fisheries is typical of tropical trawl fisheries (i.e. from 2:1 up to about 5:1 relative to the target species), but the effort levels and spatial coverage are too low to impact bycatch species' populations. The introduction of fish escapement devices (FEDs) within all the nets towed by each vessel has reduced this risk even further. The NBPMF and KPMF fishery operates predominantly by specifically targeting schools of banana prawns. This targeting results in relatively low effort and minimal bycatch compared with other trawl fisheries. The impact on bycatch in the BPMF was negligible due to very low effort. All trawl nets have grids to exclude large fish and protected species.

### Protected species interaction:

#### OPMF:

**Low**

#### NBPMF, BPMF, KPMF:

**Negligible**

The northern prawn fisheries have previously caught the occasional turtle and sea snake. These are generally returned to the sea alive, and the overall low effort level and targeted coverage suggest that such interactions would not have been significant. Bycatch reduction devices ('grids') and FEDs are now fully implemented minimising the capture of large animals including turtles. One turtle and sixteen sea snakes were reported as caught but released alive in the OPMF. There were no reported interaction with protected species in the NBPMF, BPMF or the KPMF.

## Ecosystem Effects

### Food chain effects:

**Low**

For all the northern prawn fisheries and in particular the OPMF and BPMF the limited spatial coverage of the fisheries and low levels of effort and catch, it is unlikely to have any significant ecological consequences. In addition for the NBPMF and the KPMF, the highly variable nature of banana prawn recruitment, positively related to cyclonic rainfall, any food chain impacts from fishing are likely to be minimal.

**Habitat effects:****BPMF:** Negligible**OPMF, NBPMF, KPMF:** Low

In 2010 the area fished in all four fisheries was less than 1-3% of the overall fishery. The fisheries are generally restricted to clean sand and mud bottoms, where trawling has minimal long-term physical impact.

**Social Effects**

Estimated employment in these fisheries for 2010 was 70 to 80 including skippers and other crew with additional people involved in local processing.

**Economic Effects****Estimated annual value (to fishers) for year 2010:****OPMF/NBPF/BPMF:** \$0.6 million**KPMF:** \$2.2 million**Fishery Governance****OPMF Target catch range:** 60 – 180 tonnes**Current fishing level:** Acceptable

Under normal effort levels and previous environmental conditions, the target ranges of prawn catches, based on the catches of the 1990s, are as follows:

King prawns 10 – 55 t

Tiger prawns 10 – 120 t

Endeavour prawns 5 – 20 t

Banana prawns 2 – 90 t

**NBPMF Target catch range:** 90 – 300 tonnes**Current fishing level:** Acceptable

Historical catch ranges from periods where it is known that recruitment was not affected by fishing effort have been used as the basis for target catch ranges for these species. These historical catch ranges are used as an indicator of breeding stock adequacy. Under current effort levels and previous environmental conditions, the target ranges of prawn catches, based on the catches of the 1990s, are as follows:

Banana prawns 40 – 220 t

King prawns 20 – 70 t

Tiger prawns 2 – 40 t

**BPMF Target catch range:** 55 – 260 tonnes**Current fishing level:** Acceptable

Under current effort levels and previous environmental conditions, the target ranges of prawn catches are as follows:

King prawns 35 – 170 t

Coral prawns 20 – 90 t

For king prawns the target range is based on the catches of the 1990s, while for coral prawns it is based on the seven-year range (1996 – 2002) since catches were first recorded.

**KPMF Target catch range:** 240 – 500 tonnes**Current fishing level:** Acceptable

Under current effort levels and previous environmental conditions, the target ranges of prawn catches, based on the catches of the 1990s, are as follows:

Banana prawns 200 – 450 t

Tiger prawns 15 – 60 t

Endeavour prawns 7 – 80 t

The overall target range for all species combined is different from the aggregate of the individual species ranges shown above. This is because the environmental circumstances that benefit banana prawns generally result in decreased catches of the other species. Effort is now a considered a factor when reviewing target catch ranges in these northern fisheries.

**New management initiatives (2011):**

The Department will consider an application for an exemption from licensees holding both NPF and KPMF licenses to allow boats to use the quad net gear configuration used in the NPF within the KPMF.

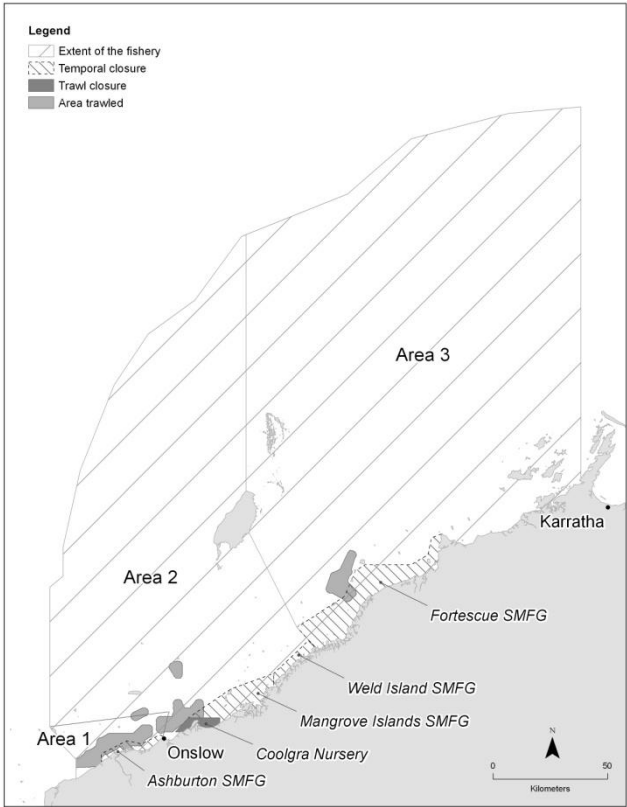
**External Factors**

Banana prawns are rainfall dependent and can be highly variable annually in the KPMF, NBPMF and for the OPMF where banana prawns may be in some years be taken predominantly off the mouth of the Ashburton River. Due to high costs of fishing and low prawn prices, some boats in these fisheries are choosing not to fish in years of relatively low banana prawn catches. In the BPMF one factor influencing catches is the timing of the season which is set by the mid-season closure for the Northern Prawn Fishery, and, since the permitted fishing area is small, in some years the timing of prawn recruitment and the prawn migration patterns may not result in significant abundances in the permitted fishing area. The success of this fishery depends on how the limited fishing season coincides with the king prawn recruitment and catchability, which is strongly influenced by the lunar period. The KPMF fishing season also been set to mirror dates used in the NPF to prevent the KPMF from attracting too much fishing effort from the NPF.

**Contributors**

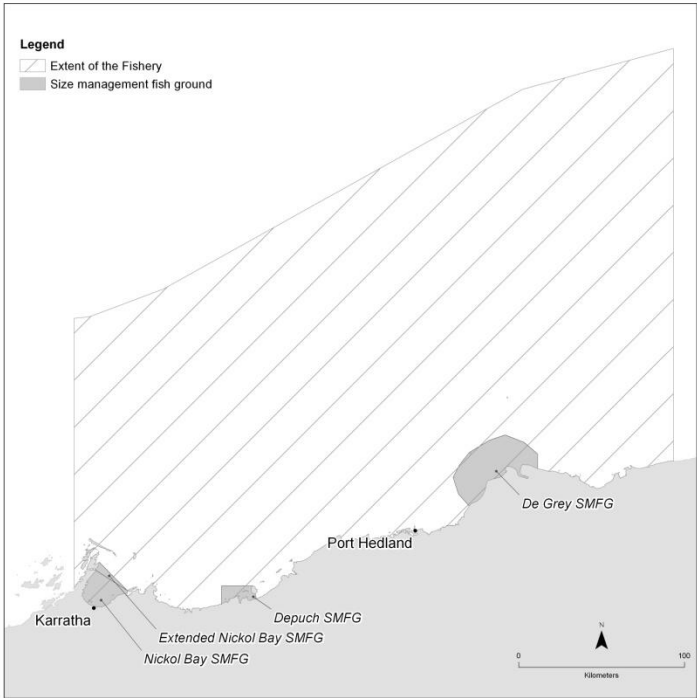
E. Sporer, M. Kangas, S. Brown and R. Gould.

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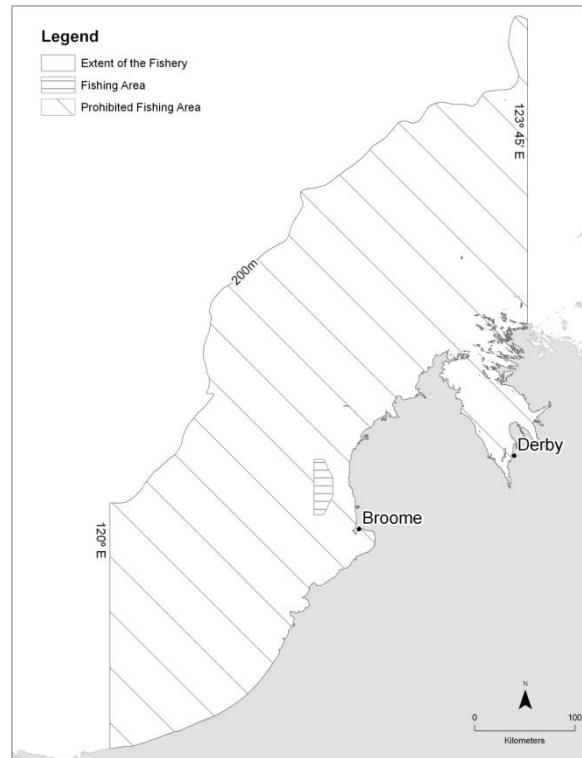
NORTHERN PRAWN FIGURE 1

Boundaries of the Onslow Prawn Managed Fishery indicating trawl closures and size management fish grounds and area trawled in 2010.



NORTHERN PRAWN FIGURE 2

Boundaries of the Nickol Bay Prawn Managed Fishery indicating nursery areas and size management fish grounds and areas trawled in 2010.



**NORTHERN PRAWN FIGURE 3**

Boundaries of the Broome Prawn Managed Fishery. Negligible area was trawled in 2010.

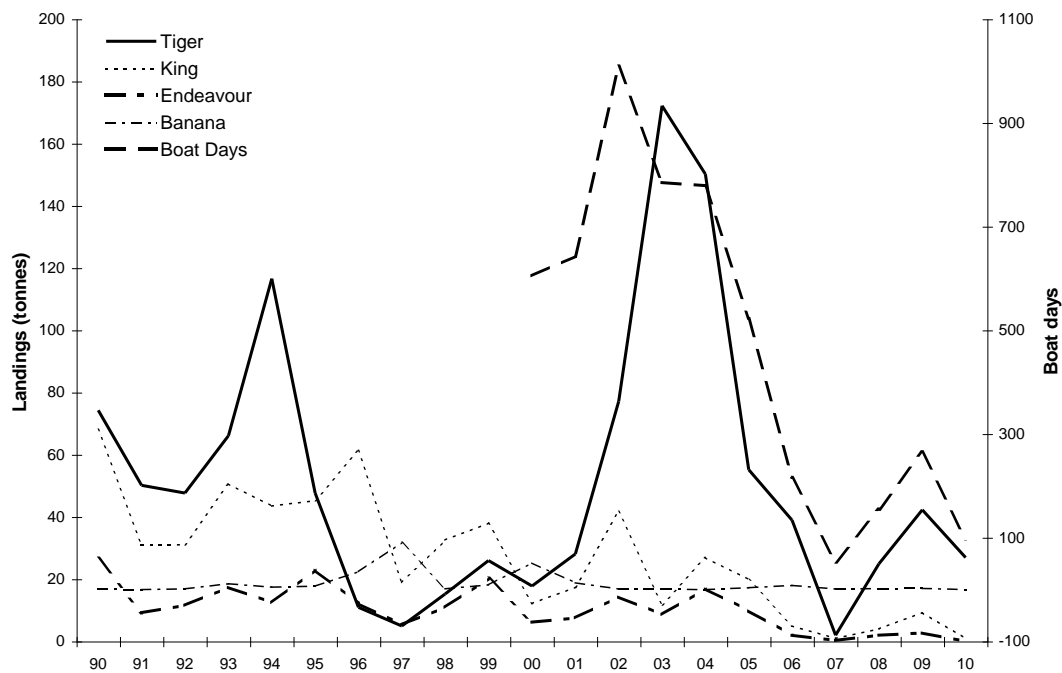


**NORTHERN PRAWN FIGURE 4**

Areas fished in the Kimberley Prawn Managed Fishery in 2010, Size Management Fish Grounds and the inshore trawl closures.

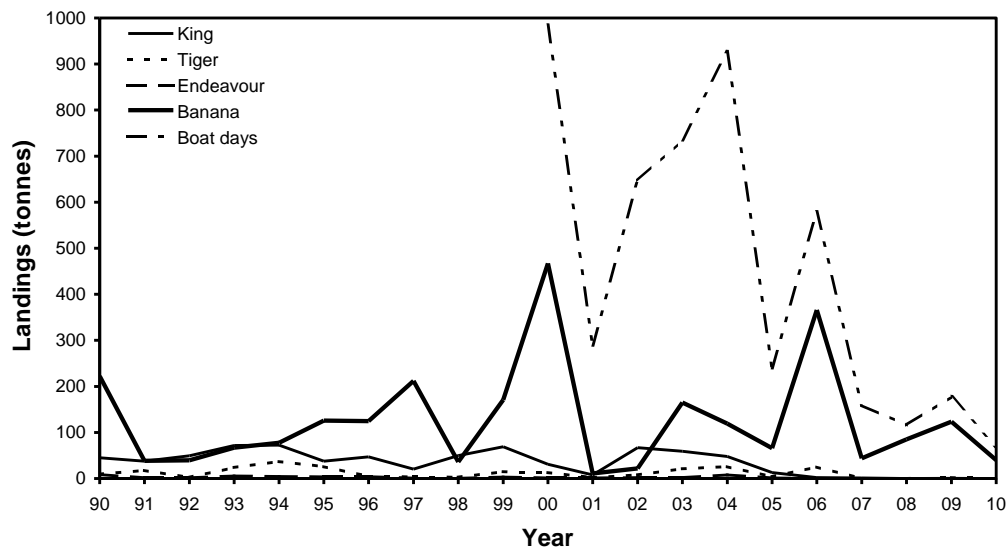


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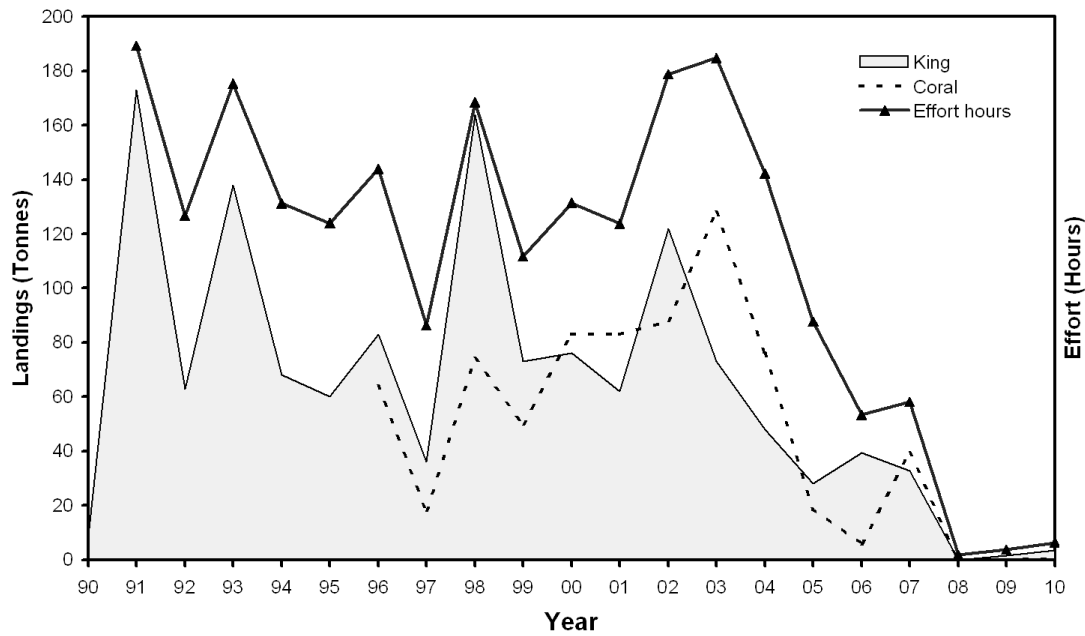
### NORTHERN PRAWN FIGURE 5

Annual landings and number of boat days (from 2000) for the Onslow Prawn Managed Fishery, 1990 – 2010.



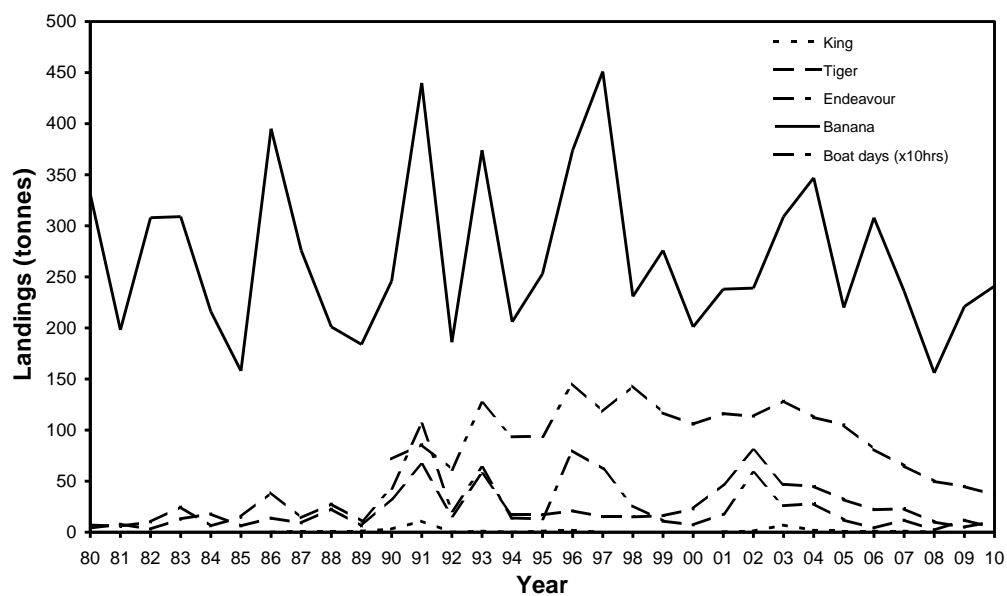
### NORTHERN PRAWN FIGURE 6

Annual landings and boat days (from 2000) for the Nickol Bay Prawn Managed Fishery, 1990 – 2010.



**NORTHERN PRAWN FIGURE 7**

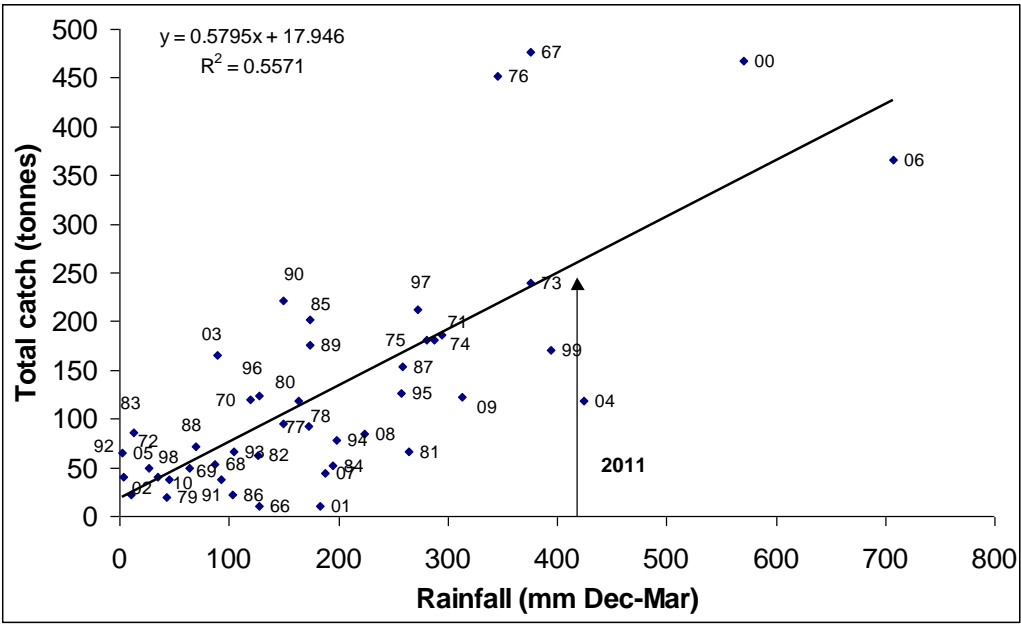
Annual landings and fishing effort for the Broome Prawn Managed Fishery, 1990 – 2010.



**NORTHERN PRAWN FIGURE 8**

Annual landings and number of boat days (from 1990) for the Kimberley Prawn Managed Fishery, 1980 – 2010-.

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**NORTHERN PRAWN FIGURE 9**

Relationship between banana prawn landings in Nickol Bay and rainfall between December and March for 1966 – 2010 with rainfall level for 2011 indicated.

# North Coast Nearshore and Estuarine Fishery Status Report

## Main Features

Status		Current Landings	
Stock levels	Acceptable	Total	150.9 t
		Barramundi	57.1 t
Fishing Levels	Not Acceptable	Threadfin	83.3 t
		Recreational	2-10% of total (last estimate 2000)
		Charter	< 5 t (barramundi and threadfin)

## Fishery Description

### Commercial

The Kimberley Gillnet and Barramundi Managed Fishery (KGBF) operates in the nearshore and estuarine zones of the North Coast Bioregion from the WA/NT border (129°E) to the top of Eighty Mile Beach, south of Broome (19°S). It encompasses the taking of any fish by means of gillnet in inshore waters and the taking of barramundi (*Lates calcarifer*) by any means.

The other species taken by the fishery are predominantly king threadfin (*Polydactylus macrochir*) and blue threadfin (*Eleutheronema tetradactylum*). The main areas of operation for the fishery are the river systems and tidal creek systems of the Cambridge Gulf, the Ria coast of the northern Kimberley, King Sound, Roebuck Bay and the northern end of Eighty Mile Beach to 19°S.

### Recreational

Recreational fishing activities are concentrated around key population centres, with a seasonal peak in activity during the dry season (winter months).

### Governing legislation/fishing authority

#### Commercial

Kimberley Gillnet and Barramundi Managed Fishery Management Plan 1989

Kimberley Gillnet and Barramundi Managed Fishery Licence.

#### Recreational

*Fish Resources Management Act 1994*

*Fish Resources Management Regulations 1995* and subsidiary legislation.

### Consultation processes

#### Commercial

Department–industry meeting.

#### Recreational

Recfishwest

### Boundaries

#### Commercial

The waters of the KGBF are defined as ‘*all Western Australian waters lying north of 19° south latitude and west of 129° east longitude and within three nautical miles seaward of the low water mark of the mainland of Western Australia and the waters of King Sound of 16°21.47’ south latitude and Jacks Creek, Yardogarra Creek and in the Fitzroy River north of 17°27’ south latitude*’. The principal fishing areas from the Broome coast to Cambridge Gulf in the KGBF are illustrated in Kimberley Gillnet Figure 1.

#### Recreational

The North Coast Bioregion, which encompasses the Pilbara and Kimberley regions, extends from the Ashburton River south of Onslow to the WA/NT border (all land and water north of 21°46’S latitude and east of 114°50’E longitude).

### Management arrangements

#### Commercial

The KGBF is managed primarily through input controls in the form of limited entry, seasonal and spatial area closures and gear restrictions. Access to the KGBF is limited to seven licences.

There is a closed season in which fishing is prohibited in the KGBF. In the southern KGBF (west of Cunningham Point, 123°08.23’ E longitude) the closure extends from 1 December to 31 January the following year, while in the northern section of the KGBF (east of Cunningham Point) the closure extends from 1 November to 31 January the following year. There are also limits on the length of net and mesh sizes to be used in the fishery.

There are four principal fishing areas within the KGBF: Cambridge Gulf (including Ord River), Kimberley coast (six small river systems), King Sound (including Fitzroy River) and the Broome coast (Roebuck Bay).

Following the development of the *Accord for Future Management of the Barramundi Resource 2000-2005*, additional management arrangements were introduced for the commercial, charter and recreational sectors to facilitate improved management and conservation of barramundi

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resources in the Kimberley region. These arrangements include commercial fishing area closures around major town sites and recreationally important fishing locations, namely Broome Jetty to Crab Creek, Jacks Creek, Yardogarra Creek, Thangoo Creek, Cape Bossut to False Cape Bossut, Derby Jetty, the Fitzroy River north of 17°27' S and the lower Ord River upstream of Adolphus Island.

In March 2007, representatives from the commercial, recreational and charter fishing sectors negotiated a revised agreement, the *Accord for the Future Management of Barramundi and Threadfin 2007-2012*. The new Accord includes a number of recommendations for improved management, sustainable harvesting and sectoral shares of barramundi and threadfin stocks in the Kimberley region.

### Recreational

As a precautionary measure to ensure that breeding stock levels of barramundi are maintained, special fishing rules are in place for three key fishing areas: Fitzroy River area and King Sound (bag and possession limit of 2 fish, maximum size limit of 800mm); Broome area (bag limit of 1 fish, possession limit of 2 fish); and the Ord River area (bag and possession limit of 1 fish, maximum size limit of 800mm). Fish species in the North Coast Bioregion are assigned to a number of risk categories for the purposes of recreational fisheries management. The bag and size limits are species-specific (e.g. Barramundi) or species group specific (e.g. mullet). Recreational set and haul netting is prohibited in all waters of the North Coast Bioregion with the exception of haul netting in the waters of the Dampier Archipelago (between Cape Preston and Cape Lambert) with the following restrictions: haul nets must not exceed 30 metres in length; mullet are the only species to be retained and all other species must be returned to the water.

### Research summary

Monthly catch and effort data from the commercial fishery are used to assess the status of barramundi and threadfin populations targeted by this fishery. This status report is compiled annually and provided to industry and regional management.

The biological characteristics required for fisheries management for both the threadfin species have been completed (Pember et al. 2005). These data may be used to provide a stock assessment of threadfin in the KGBF and Pilbara in the future. The bycatch of elasmobranchs in the KGBF and the Pilbara Coast fishing area was examined during 2002 and 2003 (McAuley et al. 2005). The stock structure of both threadfin species was defined in FRDC Project 2007/032 (Welch et al. 2010).

## Retained Species

### Commercial landings (season 2010):

All species	150.9 tonnes
Barramundi	57.1 tonnes
Threadfin	83.3 tonnes

The principal species landed are two species of threadfin (the king threadfin and the blue threadfin), and barramundi. Small quantities of elasmobranchs (sharks and rays), black jewfish (*Protonibea diacanthus*) and tripletail (*Lobotes surinamensis*) are also landed. The composition of the elasmobranch catch varies considerably between fishing areas but it mainly consists of whaler shark species (Carcharhinidae), including pigeye sharks (*Carcharhinus amboinensis*), blacktip whalers (mainly *C. tilstoni*) and various species of rays. Sawfish (Pristidae) became totally protected under the *Fish Resources Management Regulations 1995* in December 2005 and may no longer be retained by this fishery, and are released alive wherever possible.

The total reported catch of all species in the KGBF in 2010 was 151 t (Kimberley Gillnet Figure 2). The total landings of barramundi from all four prescribed fishing areas within the KGBF were 57.1 t for 2010 (Kimberley Gillnet Table 1, Kimberley Gillnet Figure 3), a slight decrease on the reported catch of 59.6 t in 2009, which is the highest recorded catch since 1987. The 2010 landings of threadfin from the KGBF were 83.3 t (Kimberley Gillnet Table 1, Kimberley Gillnet Figure 4). Although slightly lower than in 2009, this is still a relatively high level of catch. The composition of the KGBF catch in 2010 is summarised in Kimberley Gillnet Table 2.

### Recreational catch estimate (last estimate 2000):

#### 2-10% of total catch

The most recent non charter boat data available are from a 12-month creel survey of recreational boat-based and shore-based fishing in the Pilbara and West Kimberley region conducted from December 1999 to November 2000 (Williamson et al., 2006<sup>1</sup>). In the entire survey area (Onslow to Broome), the total recreational fishing effort for the year was estimated to be 190,000 fisher days and the total recreational scalefish catch approximately 300 t. Recreational fishers in the survey area reported an estimated total catch of approximately 18 t of threadfin, whereas the estimated total catch of barramundi was less than 1 t. As this survey covered the Broome coast and Pilbara coast areas, the recreational catch can be estimated at around 10% of the combined (commercial and recreational) threadfin catch and around 2% of the combined barramundi catch in these areas in 2000.

The reported charter vessel catches for the north coast bioregion in 2010 was estimated to be approximately 3.3 t of barramundi and less than 1.0 t of threadfin. The total charter vessel catches in 2010 are estimated at less than 5 t of barramundi and threadfin.

### Fishing effort/access level

#### Commercial

Procedures to validate and standardise reported fishing effort in the KGBF were developed by McAuley et al. (2005)<sup>2</sup>.

<sup>1</sup> Williamson et al., 2006). In the entire survey area (Onslow to Broome), the total recreational fishing effort for the year was estimated to be 190

<sup>2</sup> McAuley, R., Lenanton, R. Chidlow, J., Allison, R. and Heist, E. 2005. Biology and Stock Assessment of the Thickskin

These procedures are used to assess the fishery. The fishery's 'effective effort' is calculated from the validated data as the total length of net set per gillnet hour (km gn.hr-1). During 2010, the total effective effort across the four prescribed fishing areas 2059.5 km gn.hr-1, which is a significant increase on the 2009 effort figure of 1542.6 km gn.hr-1 (Kimberley Gillnet Figure 2), and the highest level of effort reported since 1992. There may be considerable latent effort in the KGBF.

#### Recreational

Not assessed this season.

## Stock Assessment

### Assessment complete:

**Barramundi** Yes

**Threadfin** Yes

### Assessment method and level:

#### Level 2 - Catch Rate

### Breeding stock levels:

**Barramundi** Acceptable

**Threadfin** Acceptable

The overall increased levels of catch of both barramundi and threadfin in the KGBF during the last 3 years is predominantly due to a marked increase in fishing effort in the Cambridge Gulf and Kimberley Coast (62% increase from 2009 to 2010) regions, and to a lesser extent King Sound. Fishing effort in the Broome Coast region (Roebuck Bay) has remained stable during the past three years by comparison. The increased level of effort in the other regions appears to be the result of new operators in the fishery.

The catch rates for both barramundi and threadfin in the KGBF decreased in 2010. The catch rate for barramundi in 2010 fell to 27.7 kg/km gn.hr-1 (35.5 kg km/gn.hr-1 in 2008, 38.8 kg km/gn.hr-1 in 2009) (Kimberley Gillnet Figure 3), while the catch rate for threadfin fell to 40.4 kg/km gn.hr-1 (65.5 kg km/gn.hr-1 in 2008, 58.6 kg km/gn.hr-1 in 2009) (Kimberley Gillnet Figure 4).

Continuing high levels of catch and effort will need to be monitored closely for both these species across all regions, particularly given the decreased catch rates for barramundi and threadfin in 2010. The 2010 catch and effort data highlight the need to update the stock assessments for both barramundi and threadfin to assess any impact the increased catches may be having on stocks in each of the sectors across the commercial fishery. The re-evaluation of targeted effort, and factors such as species – specific targeting by fishers on catch rates need to be investigated and incorporated into any

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(Sandbar) Shark, *Carcharhinus plumbeus*, in Western Australia and Further Refinement of the Dusky Shark, *Carcharhinus obscurus*, Stock Assessment. Final Report to the Fisheries Research & Development Corporation for FRDC project no. 2000/134. Fisheries Research Report no. 151. Department of Fisheries, Government of Western Australia. Perth.

such assessment. There is the potential for localised depletion risks to threadfin populations given their fine scale spatial stock structure.

## Non-Retained Species

### Bycatch species impact:

**Low**

The fishery operates at a relatively low intensity over a wide area of the Kimberley region, specifically targeting barramundi and threadfin. The fishing gear uses large mesh sizes, and hence does not generate a significant bycatch of species important to other sectors, but does take some sharks and rays. Where practicable, sharks and rays are released alive. However, there is some mortality of sharks and rays associated with gillnet capture. Because of the low spatial density of fishing effort relative to the widespread distribution of these species and the size-selectivity of the permitted mesh sizes, these impacts are unlikely to be significant to the stocks involved.

### Protected species interaction:

**Low**

The fishing gear used for this fishery (gillnets) is known to result in the bycatch of protected crocodiles (*Crocodylus porosus*) and sawfish (Family Pristidae). These species are generally released alive or avoided as far as is practicable. Because of the low effort levels and the low spatial intensity of fishing effort, these impacts are unlikely to pose a significant threat to the sustainability of the stocks of these species.

Catches of the speartooth shark (*Glyphis glyphis*) or the northern river shark (*Glyphis garricki*), which are listed under the *Environment Protection and Biodiversity Conservation Act 1999* as critically endangered and endangered, respectively, are rare in the KGBF. However, as these species look similar to other whaler shark species, they may be captured but misidentified. Given the fishery's overall low effort levels, particularly inside the freshwater drainages in which these species are most likely to occur, the fishing operations of the KGBF are unlikely to pose a significant threat to the sustainability of the stocks of these species. Any increase in effort levels inside freshwater drainages will need to be monitored.

## Ecosystem Effects

### Food chain effects:

**Low**

This fishery is unlikely to be having anything but a minimal effect on the nearshore and estuarine ecosystem of the Kimberley region.

### Habitat effects:

**Low**

The fishing gear has minimal impact on the habitat. The area and habitat fished is subject to extreme tidal currents and associated effects.

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### Social Effects

#### Commercial

During 2010, seven vessels fished in the KGBF with an average crew level of approximately 2.3 people, with an estimate of at least 16 people directly employed in the fishery. There was additional employment through local processors and distribution networks. The fishery provides fresh fish for the local communities and the tourism industry throughout the Kimberley region.

#### Recreational

A significant number of recreational and charter anglers also fished across the region.

### Economic Effects

#### Estimated annual commercial value (to fishers)

**for year 2010: \$1.1 Million**

The KGBF landed a total of 151 t of fish in 2010, for a catch value of approximately \$1.1 million. This estimate is based on the landed weight of each species recorded in the CAES system and the most recent data available on average prices per kilogram of whole weight of each species as supplied by fish processors.

### Fishery Governance

#### Target commercial catch range:

**Barramundi 25-40 tonnes**

**Current Fishing (or Effort) Level Not Acceptable**

The target catch range for barramundi (25–40 t) was derived from a double exponential smoothed forecasting model of the annual barramundi catches of the KGBF up to 1999. For the five years from 1999 to 2003, the level of barramundi catch was at the top end of the target catch range. The catch in 2004 exceeded the target range, although this was achieved at a CPUE suggesting higher abundance levels than during the 1980s and 1990s. The barramundi catch in 2010 was above the target range for the third successive year. The catch rate for this species is now declining and the overall catch rates for the fishery are also declining. Therefore a review of the fishery is recommended. This review should include the status of the barramundi stock, the current fishing and effort levels, the target catch range for barramundi along with the development of a target catch range for threadfin.

### New management initiatives (2011/12)

In March 2007, representatives from the commercial, recreational and charter fishing sectors agreed to a revised agreement, the *Accord for the Future Management of Barramundi and Threadfin 2007-2012*. The new Accord includes a number of recommendations for improved management and conservation of barramundi and threadfin stocks in the Kimberley region.

The Department plans to review the KGBF management plan in order to modernise the fishery management arrangements and address concerns in relation to transferability of licences and the potential for shifting of effort and localised depletion of stocks.

### External Factors

The barramundi stocks utilising the large Kimberley river systems as nursery areas are expected to be reasonably resilient to fishing pressure. However, the impact of increasing exploitation from the charter and tourism sectors, as well as population growth associated with the gas and mining development sectors on barramundi stocks needs to be investigated.

Furthermore, the smaller, isolated stocks along the arid Pilbara coastline are likely to experience highly variable recruitment due to environmental fluctuations (e.g. the amount of rainfall). These stocks will be subject to increased exploitation pressure from recreational fishers (driven in the main by population growth resulting from gas and mining developments), and are likely to need specific management arrangements in the future.

In addition, the introduction of marine parks across the Kimberley region has the potential to concentrate fishing effort from multiple sectors into those areas that are easily accessible, further increasing sustainability risks to barramundi and threadfin stocks.

### Contributors

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**KIMBERLEY GILLNET TABLE 1**

Annual catches of the major target species by the KGBF from 1999-2010.

Species	Kimberley Gillnet Annual Catch (tonnes)											
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Barramundi	41.2	42.9	38.8	39.5	45.0	53.5	35.6	36.3	27.2	54.8	59.6	57.1
Threadfin	109.8	66.7	50.9	76.4	94.1	75.8	70.6	67.7	78.5	101.2	89.9	83.3
Total	160.4	120.7	100.5	124.4	148.0	136.1	117.8	109.9	111.4	165.6	167.3	150.9

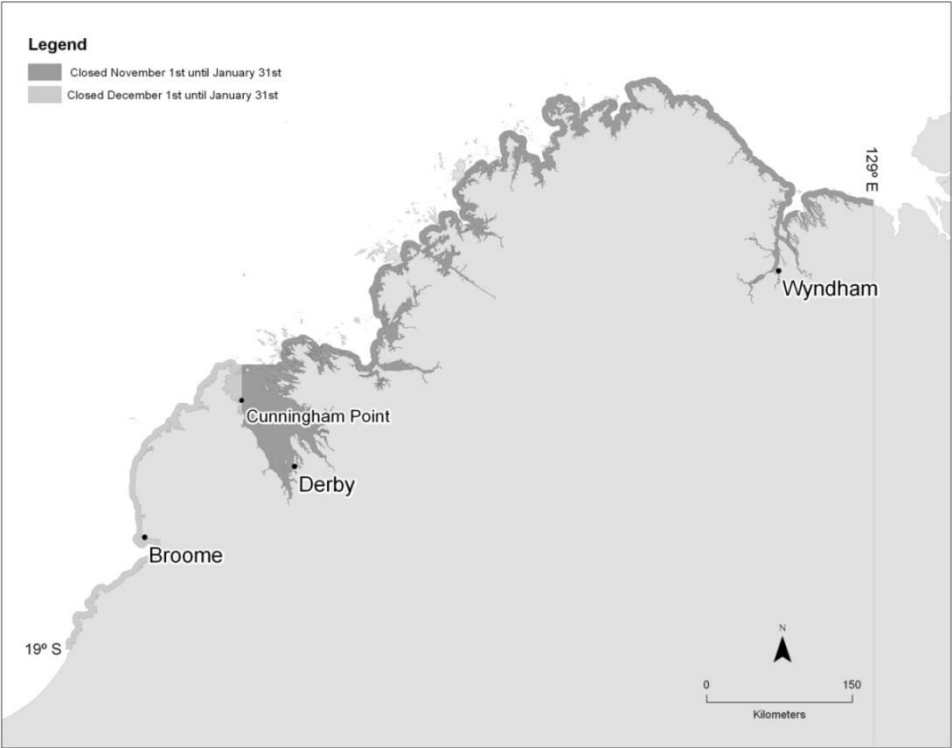
**KIMBERLEY GILLNET TABLE 2**

Summary of the reported catch (t) in the KGBF in 2010 and the percentage composition of each of the major species retained.

Species	Catch (tonnes)	Composition %
Threadfin	83.3	55.2
Barramundi	57.1	37.8
Tripletail	3.4	2.2
Black jewfish	4.3	2.9
Sharks and rays	1.3	.9
Other fish	1.5	1.0
Total	150.9	100

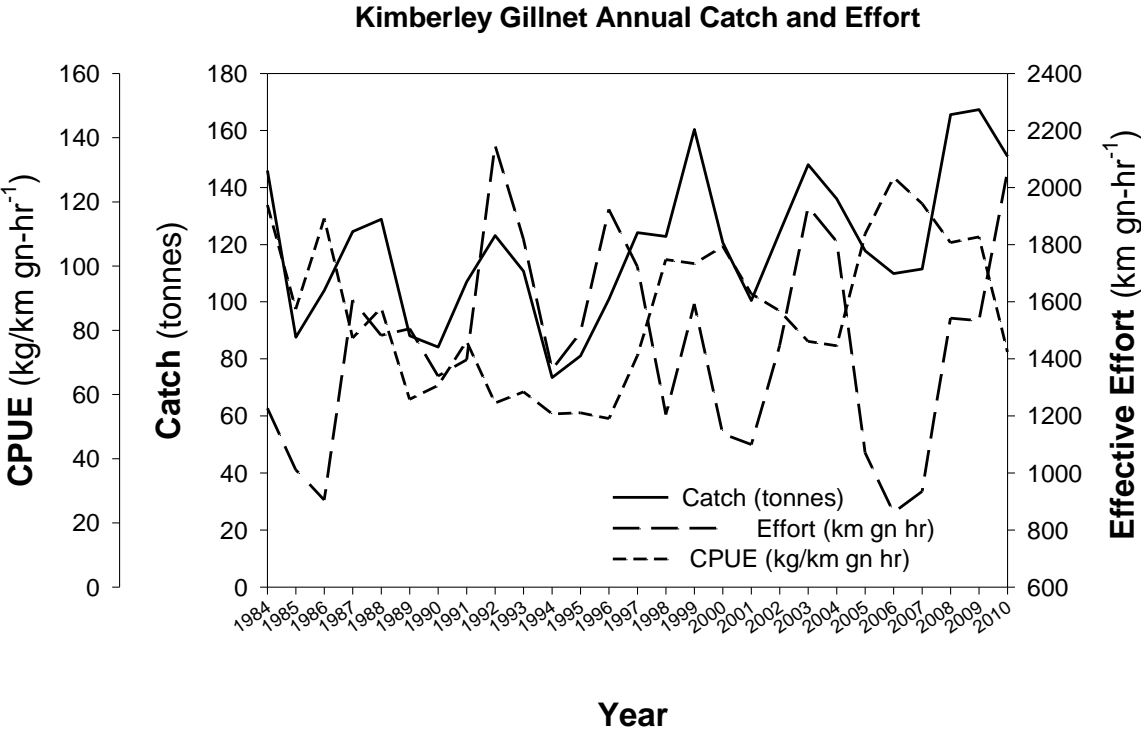


NORTH COAST BIOREGION



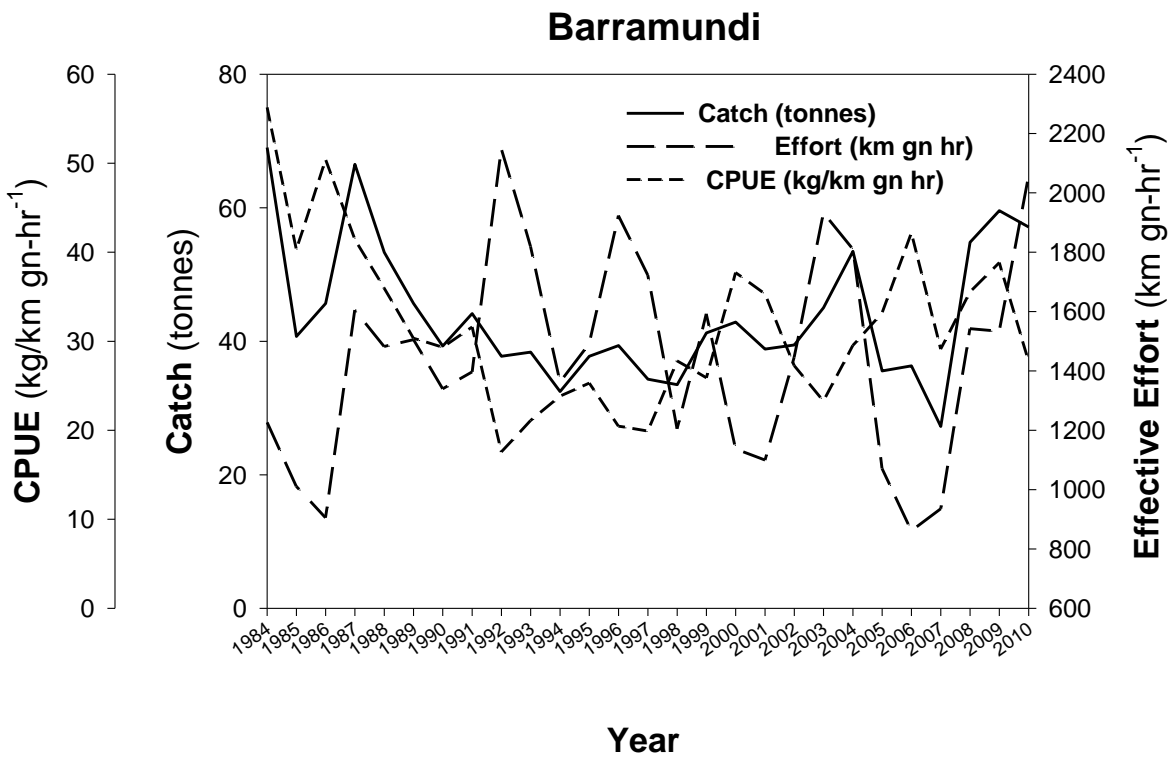
**KIMBERLEY GILLNET FIGURE 1**

Location and extent of the KGBF within the Kimberley region of Western Australia. Note: this map is indicative only

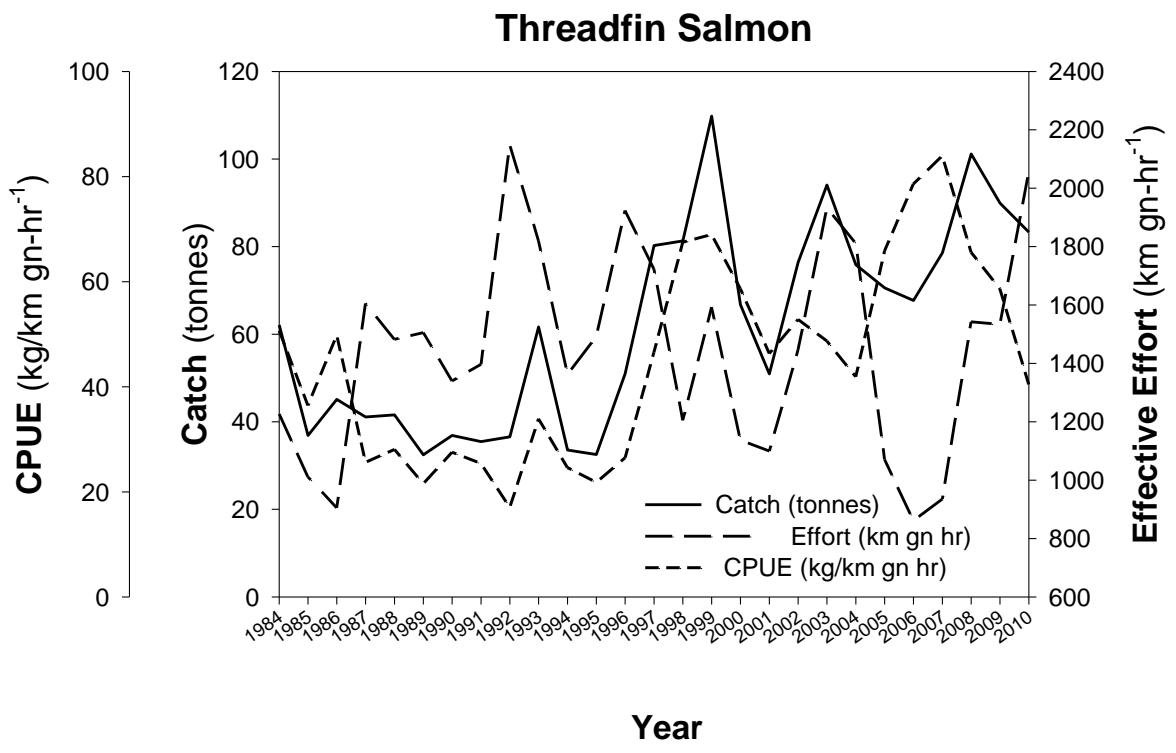


**KIMBERLEY GILLNET FIGURE 2**

The annual total catch, effective effort (km gillnet hours) and catch per unit effort (CPUE, km gn.hr<sup>-1</sup>) from the KGBF over the period 1984 to 2010.



**KIMBERLEY GILLNET FIGURE 3**  
The annual catch, effective effort (km gillnet hours) and catch per unit effort (CPUE, km gn.hr<sup>-1</sup>) for barramundi from the KGBF over the period 1984 to 2010.



**KIMBERLEY GILLNET FIGURE 4**  
The annual catch, effective effort (km gillnet hours) and catch per unit effort (CPUE, km gn.hr<sup>-1</sup>) for threadfin from the KGBF over the period 1984 to 2010.

## North Coast Demersal Fisheries Status Report

## Main Features

## Status

**Pilbara:**

Stock level	Acceptable
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Fishing Level

Trawl Fishery	Not Acceptable
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Trap Fishery	Acceptable
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Line Fishery	Acceptable
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**Kimberley:**

Stock level	Acceptable
-------------	------------

Fishing Level	Acceptable
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## Current Landings

Total North Coast Demersal landings	2,981 t
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**Pilbara:**

Total	1,865 t
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Red emperor	167 t
-------------	-------

Rankin cod	68 t
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Bluespotted emperor	254 t
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Pilbara Fish Trawl Fishery	1,259 t
----------------------------	---------

Pilbara Fish Trap	489 t
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Pilbara Line	117 t
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Charter (Recreational)	< 25 t (2.5% of total)
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**Kimberley (NDSF):**

Total	1,116 t
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Red emperor	142 t
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Goldband snapper	523 t
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Charter (Recreational)	< 5 t (1.5% of total)
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## Fishery Description

There are a number of commercial and recreational fisheries that operate in this region which target, to varying degrees, the following tropical, demersal fish species (in order of gross tonnage); goldband snapper (*Pristipomoides multidens*), red emperor (*Lutjanus sebae*), bluespotted emperor (*Lethrinus punctulatus*), saddletail snapper (*Lutjanus malabaricus*), crimson snapper (*Lutjanus erythropterus*), rosy threadfin bream (*Nemipterus furcosus*), Rankin cod (*Epinephelus multinotatus*), brownstripe snapper (*Lutjanus vitta*), spangled emperor (*Lethrinus nebulosus*) and frypan snapper (*Argyrops spinifer*). Each of these fisheries is outlined below.

**Commercial****Pilbara**

The Pilbara Demersal Scalefish Fisheries include the Pilbara Fish Trawl (Interim) Managed Fishery, the Pilbara Trap Managed Fishery and the Pilbara Line Fishery, which collectively use a combination of vessels, time, gear limits plus spatial zones (including extensive trawl closures) as management measures. The Trawl Fishery lands the largest component of the catch of demersal finfish in the Pilbara (and North Coast Bioregion) targeting all the main demersal species, with smaller subsets of species taken by the Trap and fewer still by the Line Fishery.

**Kimberley**

The Northern Demersal Scalefish Managed Fishery (NDSF) operates off the northwest coast of Western Australia in the waters east of 120° E longitude. The permitted means of

operation within the fishery include handline, dropline and fish traps, but since 2002 it has essentially been a trap based fishery which uses gear time access and spatial zones as the main management measures. The main species landed by this fishery are red emperor and goldband snapper.

**Recreational**

Recreational fishing activities on these species are mostly line based fishing from boats which are concentrated in inshore areas around key population centres, with a peak in activity during the dry season (winter months, April/May to September/October).

**Governing legislation/fishing authority****Commercial****Pilbara**

Pilbara Trap Managed Fishery Management Plan 1992

Prohibition on Commercial Fishing for Demersal Scalefish (Pilbara Area) Order 1997

Pilbara Fish Trawl Fishery (Interim) Management Plan 1997

Prohibition on Fishing by Line from Fishing Boats (Pilbara Waters) Order 2006

Australian Government Environment Protection and Biodiversity Conservation Act 1999 (Wildlife Trade Order)

## Kimberley

Northern Demersal Scalefish Managed Fishery Management Plan 2000

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

## Recreational

*Fish Resources Management Act 1994*

*Fish Resources Management Regulations 1995* and other subsidiary legislation.

## Consultation processes

### Commercial

#### Pilbara

Department - engagement with:

Western Australian Fishing Industry Council (WAFIC); and

Licensee meetings for the Fish Trawl, Trap and Line Fisheries

#### Kimberley

WAFIC

Department – industry meeting for the NDSF and the annual Broome Consultative Forum.

### Recreational

Department - in liaison with:

Annual Broome Consultative forum; and

Recfishwest and stakeholder meetings

## Boundaries

### Commercial

#### Pilbara

The Pilbara Fish Trawl Fishery is situated in the Pilbara region in the north west of Australia. It occupies the waters north of latitude 21°35'S and between longitudes 114°9'36"E and 120°E. The Fishery is seaward of the 50 m isobath and landward of the 200 m isobath (North Coast Figure 1).

The Fishery consists of two zones; Zone 1 in the south west of the Fishery (which is closed to trawling) and Zone 2 in the North, which consists of six management areas. Areas 1 to 6 each cover 1,300; 1,800; 880; 1,500; 2,300 and 7,200 square nautical miles respectively. The total area available for trawling in Zone 2 is 14,980 square nautical miles, however, only 6,900 square nautical miles are currently open (~46% of Zone 2 is currently open to trawling). This represents less than 5% of the total area available in the North Coast Bioregion. The exact latitudes and longitudes delineating the areas are listed in the *Pilbara Fish Trawl Fishery (Interim) Management Plan 1997*.

The Pilbara Trap Managed Fishery (North Coast Figure 1) lies north of latitude 21°44'S and between longitudes 114°9.6'E and 120°00'E on the landward side of a boundary approximating the 200 m isobath and seaward of a line generally following the 30 m isobath. The exact latitudes and longitudes delineating the fishery are listed in the *Pilbara Trap Management Plan 1992*.

The Pilbara Line fishing boat licensees are permitted to

operate anywhere within "Pilbara waters". This means all waters bounded by a line commencing at the intersection of 21°56'S latitude and the high water mark on the western side of the North West Cape on the mainland of Western Australia; thence west along the parallel to the intersection of 21°56'S latitude and the boundary of the Australian Fishing Zone and north to longitude 120°E. The exact latitudes and longitudes delineating the Fishery are listed in the *Prohibition on Fishing by Line from Fishing Boats (Pilbara Waters) Order 2006*

## Kimberley

The waters of the Northern Demersal Scalefish Fishery are defined as all Western Australian waters off the north coast of Western Australia east of longitude 120°E. These waters extend out to the edge of the Australian Fishing Zone (200 nautical mile) under the Offshore Constitutional Settlement arrangements (North Coast Figure 2). The fishery is further divided into two fishing areas; an inshore sector (Area 1) and an offshore sector (Area 2) (see North Coast Figure 2). Under a voluntary industry agreement (now formalised under an Exemption), the offshore sector (Area 2) has been further divided into 3 zones; A, B and C. Zone B comprises the area of most historical fishing activity. Zone A is an inshore developmental area and Zone C is an offshore deep slope developmental area representing waters deeper than 200 m. The inshore waters in the vicinity of Broome are closed to commercial fishing. This closure was put in place to reduce the potential for conflict between commercial fishers and recreational, charter and customary fishers. This closure is represented in North Coast Figure 2 as the area that is closed to fishing.

### Recreational

The North Coast Bioregion, which encompasses the Pilbara and Kimberley regions, extends from the Ashburton River south of Onslow to the WA/NT border (all land and water north of 21°46'S latitude and east of 114°50'E longitude), with the exception of some areas within Marine Parks.

## Management arrangements

### Commercial

#### Pilbara

The Pilbara Fish Trawl Interim Managed Fishery is managed through a combination of area closures, gear restrictions, and by the use of output controls in the form of individual transferable effort allocations monitored by a satellite-based vessel monitoring system (VMS). This Interim Management Plan was implemented for the Fish Trawl Fishery in the Pilbara in 1998, with effort levels determined to achieve the best yield from the Fishery while keeping exploitation rates of the indicator species at sustainable levels.

A large amount of the area of the Trawl Fishery is closed to trawling, and has been since the implementation of the (Interim) Management Plan (1998). Zone 1 of the Fishery and Area 3 of Zone 2 of the Trawl Fishery have been closed since 1998. In addition, Area 6 of Zone 2 has been closed since the commencement of the Interim Plan except for two periods of research trawling in 1998 and 1999. The area inshore of the 50 m depth isobath is also closed to trawling. Areas 1, 2, 4 and 5 are open to fishing all year, with separate effort allocations (in hours) in each Area, as outlined in the

## NORTH COAST BIOREGION

Interim Plan. The open areas of the Trawl Fishery are trawled with varying intensity due to differing effort allocation, substrate composition and economic considerations (e.g. distance from ports).

There are 11 permits for the Fishery, with the combined effort allocations being consolidated over time onto 3 full time vessels.

The Trap Fishery is also managed primarily by the use of input controls in the form of individual transferable effort allocations monitored with a satellite-based VMS. There has also been a closure to trapping in Area 3 since 1998. A review of the Trap Fishery was undertaken in 1996 and based on performance criteria, the number of licences was halved.

The authority to fish in the Trap Fishery is limited by reference to a specified number of trap days expressed in terms of units of entitlement. The capacity is currently limited to 5,456 trap days. However, the Management Plan allows the Chief Executive Officer to alter the value of these units. There are 6 licences in the Fishery, with the allocation consolidated onto 3 vessels.

The Line Fishery is managed under the Prohibition on Fishing by Line from Fishing Boats (Pilbara Waters) Order, 2006. 9 Fishing Boat Licences are exempted from this prohibition for any nominated 5-month block period within the year.

Comprehensive ESD assessments were submitted to the Australian Govt. agency now called SEWPaC in 2004 for both the Pilbara Trap and Trawl Fisheries. These ESD assessments determined that performance should be assessed annually for breeding stock levels, protected species interactions and habitat effects. As a result, the Pilbara Trap Fishery was declared an approved Wildlife Trade Operation in November 2004 for a period of three years. This lapsed in December 2007. The Pilbara Fish Trawl Interim Managed Fishery is an approved Wildlife Trade Operation until June 2013.

### Kimberley

The Northern Demersal Scalefish Fishery is managed primarily through input controls in the form of an annual fishing effort capacity, with supplementary gear controls and area closures. The annual fishing effort capacity limits the amount of effort available in the fishery to achieve the notional target total allowable catch (TAC). The annual effort capacity is based on the available research advice in consultation with licensees. The effort capacity is set by the Chief Executive Officer and is then allocated among license holders through units of entitlement on Managed Fishery Licences, for use in Area 2 of the Fishery. An Exemption provides for additional effort in Zone A (56 standard fishing days per 160 unit licence) and Zone C (50 standard fishing days per 160 unit licence), in order to encourage fishers to explore the lesser-fished waters of the NDSF.

The notional target TAC for Zone B is a recommended level of catch for the entire demersal species suite and is derived from the estimated sustainable catch of the key target species (determined through stock assessments) and their historical proportions in the catch. In 2010, Zone B effort allocation was 1,038.4 standard fishing days.

The areas that encompass Zone A and Zone C are likely to

have a lower sustainable catch compared with Zone B, and thus exploratory TACs are set for Zone A and Zone C. These will need to be revised as effort and catches in these zones increase. In 2010, the Zone A effort allocation was 616 standard fishing days.

Access to the offshore sector (Area 2) of the NDSF is limited to 11 licences under an individually transferable effort (ITE) system. This allows the effort quota to be operated by a lesser number of vessels. For example, during 2010, 7 vessels (trap fishing only) collectively held and operated the effort individually assigned to the 11 licences. Each trap must have an internal volume equal to or less than 2.25 m<sup>3</sup>. There is no restriction on the number of traps that can be fished per vessel. However, as each licensee is allocated an annual effort quota in 'standard fishing days' based on the use of 20 traps (or 5 lines) per day, if the number of traps (or lines) being fished increases, the number of allowable fishing days declines. The number of days fished, as recorded by the vessel monitoring system, is converted to standard fishing days. A comprehensive ESD assessment of this fishery has determined that performance should be reported against measures relating to breeding stocks of the two indicator species, red emperor and goldband snapper, and the cod/grouper complex (a suite of more than 10 species), as reflected by their catch levels.

### Recreational

The recreational fishery for demersal fish in the North Coast Bioregion is managed in a similar manner to other Bioregions across the State through the use of input controls (e.g. size limits) and output controls (e.g. limits on the numbers of fish that can be taken by individuals and boats – these are assigned based on a number of risk categories).

From 2 March 2010 all persons fishing from a powered boat anywhere in the state have been required to hold a Recreational Fishing from Boat Licence or fish in the company of a licence holder. The Recreational Fishing from Boat Licence will provide a state-wide database of recreational boat fishers for survey purposes in 2012.

Demersal fish, particularly the icon species such as coral trout and red emperor, are considered prime recreational target species. As such, resource-sharing issues will be a consideration in future management arrangements across this Bioregion.

### Research summary

#### Pilbara

Monitoring and assessment of the Pilbara Trawl, Trap and Line Fisheries includes the collection of spatial data on effort and catch of 11 major target species from logbooks, VMS data, and weighed catches from unload data. Assessment of the status of the suite of retained demersal scalefish is based on the performance of indicator species (red emperor, Rankin cod, bluespotted emperor, brownstripe snapper and goldband snapper) using various assessment methods constituting a weight-of-evidence approach. These methods include trend analysis of trawl catch rates using two measures of effort (time spent trawling reported in logbooks and time spent in each management area derived from VMS) for five indicator species and the total catch in each of the trawl-managed

areas. In addition, ages are determined from otolith sections for the indicator species in each of the trawl-managed areas and the Trap Fishery, and for ruby snapper from the Line Fishery.

Estimates of fishing mortality are derived from age structures and compared to internationally recognised benchmarks or reference points (see Stock Assessment section).

Approximately every 4-5 years the spawning biomass of two indicator species, red emperor and Rankin cod, are assessed using the age-composition and catch rate data in an integrated age-structured model. In 2010, a fishery independent research survey was conducted which was aimed at describing the demersal fish assemblages associated with trawl, trap and closed management areas.

### Kimberley

Assessment of the status of the demersal fish stocks in Zone B of the NDSF is determined annually using catch and catch rates of the major species or species groups, and every 4-5 years using an age-based stock assessment model to assess the status of the two indicator species, red emperor and goldband snapper, based on age-composition data collected in previous years. Ongoing monitoring of this fishery is being undertaken using both catch and effort logbook and VMS data.

The catch from the NDSF also includes components from Zone A of the fishery. This zone has a somewhat similar catch composition to Zone B of the fishery. The level of catch from Zone A will be monitored as this area of the fishery is developed.

The catch from the NDSF also includes at times some species from the waters of Zone C in depths greater than 200 m. The resources of this zone are unlikely to be substantial, and given the lower productivity of these longer-lived, deeper-slope reef fish, the sustainable catch from this zone is likely to be lower than for Zone B.

## Retained Species

### Commercial landings (season 2010):

<b>Pilbara Fish Trawl</b>	<b>1,259 tonnes</b>
<b>Pilbara Fish Trap</b>	<b>489 tonnes</b>
<b>Pilbara Line</b>	<b>117 tonnes</b>
<b>Kimberley (NDSF)</b>	<b>1,116 tonnes</b>

The commercial catches of key species and species groups from across the North Coast Bioregion and their relative contribution to catches within the Pilbara and Kimberley sectors in 2010 are summarised in North Coast Table 9. The relative contribution of the Kimberley sector has been increasing as the catch from the Pilbara sector has been declining.

### Pilbara

The fish trawl catch increased slightly in 2010 but remained below the target catch range (North Coast Tables 1 and 2). The increase in catch is thought to be a result of improving catch rates following substantial reductions in effort since 2007, which have allowed stocks to rebuild. The major target species landed by the trawl fishery in 2010 (2009 catch in brackets) were rosy threadfin bream 187 t (165 t), bluespotted emperor 164 t (108 t), crimson snapper 93 t (92 t), goldband

snapper 63 t (69 t), red emperor 76 t (66 t), brownstripe snapper 76 t (62 t), saddletail snapper 50 t (51 t), Rankin cod 14 t (13 t) and spangled emperor 15 t (10 t). The total retained by-product was 32 t (37 t) including bugs, cuttlefish, and squid (North Coast Table 2).

The Trap Fishery catch increased from 455 t in 2009 to 489 t in 2010, but remained within the 400-500 t target catch range (North Coast Tables 1 and 2). Major species taken by the trap fishery in 2010 (2009 figures in brackets) were red emperor 89 t (92 t), crimson snapper 48 t (71 t), bluespotted emperor 90 t (65 t), Rankin cod 52 t (60 t), goldband snapper 37 t (31 t) and spangled emperor 20 t (15 t).

Demersal scalefish catches taken by line fishing in 2010 were slightly less than that reported in 2009 (North Coast Tables 1 and 2). Catches of goldband snapper in 2010 were similar to 2009, 17 t and 15 t, respectively (North Coast Table 1). The catch of ruby snapper by the Pilbara Line Fishery continue to increase, rising from 12 t in 2008, 37 t in 2009 to 56 t in 2010. This fishery and the Commonwealth's North West Slope Trawl Fishery are likely to be targeting the same stock (management unit) of ruby snapper, so catches from both commercial fisheries will need to be considered in any future assessment or harvest strategy.

### Kimberley

After the initial development period from 1990 to 1992, the catch of the NDSF reached the first peak in catch (> 900t) in 1996 before declining to levels of about 500 t in 2003 (North Coast Figure 4). The total catch began to increase again in 2003 and the 2010 catch of 1,116 t is the highest recorded, mainly to increased levels of catch from Zone A of the fishery (North Coast Tables 6 and 7).

The NDSF principally targets red emperor and goldband snapper, with a number of species of snappers (Lutjanidae), cods (Epinephelidae) and emperors (Lethrinidae) comprising the majority of the remainder of the catch (North Coast Table 6). The species composition of the landed catch in 2010 is similar to that reported in 2009. In 2010 the total catch of red emperor was 141 t, down from the reported catch of 156 t and 173 t in 2009 and 2008 respectively. There was an increase in the landed catch of goldband snapper up from 485 t in 2009 to 523 t in 2010 (457 t in 2008), as well as a slight increase in the cods/groupers catch, up from 142 t in 2009 to 153 t in 2010 (148 t in 2008). Rankin cod dominates the composition of the cod/grouper catch complex. The catch of Rankin cod increased from 45 t in 2009 to 49 t in 2010 (North Coast Table 7).

The catch rates of red emperor in Zone B from 2005 to 2010 have been relatively stable, however, there has been a slight declining trend in catch rates from 2007 to 2010 (North Coast Figure 5). In contrast, the catch rates for goldband snapper in Zone B have increased steadily from 2006 to 2009 (North Coast Figure 6) and have been stable from 2009 to 2010. Similarly, the catch rates of the cod/grouper complex in Zone B have been increasing since 2002 (North Coast Figure 7).

The 2010 catch of red emperor and cods/groupers were within acceptable levels as defined in the Export exemption for this fishery (see 'Fishery Governance' section), while the catch of goldband snapper exceeded the trigger point (20% increase in average catch of the previous 4 years).

## NORTH COAST BIOREGION

### Recreational catch estimate (season 2010):

**Pilbara** **2.5%**

**Kimberley** **<1.5%**

#### Pilbara

While there is a major recreational fishery in the Pilbara and the charter sector is an increasing user of the resource, the inshore closures to the commercial sector provide a high degree of spatial separation between the user groups. The recreational and charter sectors do not catch significant quantities of most species targeted by the commercial Pilbara demersal scalefish fisheries. The reported charter vessel catch of demersal scalefish in the offshore waters of the Pilbara (depth > 30 m) in 2010 is estimated to be ~1.6% (~29 t) of the commercial catch. Due to the increasing population in the Pilbara from mining developments, catches are likely to increase in the future.

#### Kimberley

Historically, there has been little recreational or charter boat fishing effort directed towards the demersal fishes in Area 2 of the NDSF, the species that are targeted by commercial fishers. However, this is now changing with charter vessels moving into the inshore demersal waters of the NDSF. The reported charter vessel catch of demersal scalefish in the inshore demersal waters of the NDSF (depth > 30 m) in 2010 is estimated to be less than 1% (~8.2 t) of the commercial catch. Most of the recreational fishing effort targeting demersal finfish in the Kimberley region is thought to be concentrated in the Broome sector of Area 1, which is closed to commercial fishing. The magnitude of recreational fishing catch is small relative to the total commercial catch. However, the increasing number of people associated with oil and gas developments in the Kimberley region has the capacity to significantly increase the level of recreational catch taken from nearshore and inshore demersal waters of the NDSF.

### Fishing effort/access level

#### Pilbara

The fishing effort in the trap and line sectors of the commercial fishery is based on the monthly catch and effort returns (North Coast Table 3). The Trawl Fishery effort is recorded as the net bottom time (hours) taken from skippers' logbook data, along with the time spent in each management area derived from VMS data.

The trawl fleet had the equivalent of three full-time vessels. The percentage of allocated hours used by the trawl fleet during the 2009/10 season were 79.0% in Area 1, 94.2% in Area 2, 100.6% in Area 4 and 85.2% in Area 5. Note, that trawling has not been permitted in either Area 3 or Area 6 since 1998 and trapping has not been permitted in Area 3 since 1998 (North Coast Figure 1).

In 2010, trap fishers were allocated 5,457 trap days (capacity is set in trap days with a value per unit of 1 unit = 1 trap day), with 93% of the units used as calculated from the VMS.

In 2010, line fishers reported operating for 366 days, compared with 282 days in 2009.

#### Kimberley

The seven fish trap vessels that fished in the NDSF in 2010 reported using between 19 and 35 fish traps per day. Line fishing has not been reported since 2002 and no line fishing was undertaken in Zone B of the NDSF in 2010. Effort increased in 2010 to 1,178 days, the highest since 2007 (North Coast Table 8).

The total effort allocated in Zone B in 2010 was 1,038.4 standard fishing days (i.e. using 20 traps) (North Coast Table 8). The number of standard fishing days (SFDs) recorded in Zone B using VMS data was 936 SFD's (90%). That is, 10% of effort allocated to Zone B in 2010 was not used. A total of 616 standard fishing days was allocated to Zone A in 2010. The number of SFDs recorded using VMS data was 237 SFD's (38%), indicating that 62% remained unutilised in Zone A at the end of the season. Thus, some latent effort exists in this fishery.

## Stock Assessment

### Assessment complete:

**Pilbara** **Yes**

**Kimberley** **Yes**

### Assessment method and level:

#### Pilbara

**Level 1 - Catch and effort statistics (Annual)**

**Level 2 - Catch rates (Annual)**

**Level 3 - Fishing mortality (Periodic - 2007)**

**Level 5 - Age Structured model (Periodic - 2007)**

#### Kimberley

**Level 1 - Catch and effort statistics (Annual)**

**Level 2 - Catch rates (Annual)**

**Level 5 - Age Structured Model (Periodic -2007)**

### Breeding stock levels:

#### Pilbara

**Trawl Fishery** **Acceptable**

**Trap Fishery** **Acceptable**

**Line Fishery** **Acceptable**

**Kimberley** **Acceptable**

#### Pilbara

There are four tiers of assessment used in the Pilbara, that when combined constitute a weight-of-evidence approach to determine overall stock status based on the performance of indicator species that represent the entire demersal suite of species. Four different tiers of assessment (see How to Use This Volume for more details) are applied to the indicator species of this suite. Catch rate analyses are used to assess five indicator species and the total combined retained catch on an annual basis. Fishing mortality estimates (F) derived from age structure data are used to assess red emperor, Rankin cod, goldband snapper and bluespotted emperor relative to internationally recognised exploitation reference

points (ERP) based on ratios with natural mortality<sup>1</sup> on a periodic basis with the last analysis completed using 2008 data. An age-structured model incorporating catch rates, catch history and age structure data is used to assess spawning biomass levels for red emperor and Rankin cod also on a periodic basis (5 year) with the last assessment completed in 2007.

**Catch Rates:** Catch rates are derived from logbook catch data and adjusted according to the unload data, so that catches match reported unloads with the area component obtained from logbooks. There are two measures of effort used to derive catch rates including the duration of the trawl shots as reported in logbooks and the time spent in each management area on each trip derived from VMS data. VMS data have only been available since 2000. Catch rates were calculated using the adjusted catch divided by effort (separately for both methods) by area for each trip. A moderate efficiency increase (0-4% per year) is applied to nominal catch rates based on trawl-time as this level of efficiency increase is typical for many trawl fisheries internationally.

Mean trawl catch rates of the indicator species and the total catches decreased annually from 2004 to 2008 (North Coast Figures 3). Over the last one to two years (2009 and 2010) the catch rates of the indicator species (with the exception of goldband snapper) and total catch have increased to some degree but are still below the catch rate values observed prior to 2004. The increases were most evident for the two relatively shorter-lived indicator species (bluespotted emperor and brownstripe snapper) and red emperor in Area 1 and 2 (North Coast Figures 3). The catch rates of Rankin cod have had only slight increases in some Areas 1, 4 and 5 while those for goldband snapper have remained relatively constant in all management areas.

**Fishing Mortality:** The high rate of fishing mortality of red emperor (> ERP Limit level) in the western areas (Areas 1 and 2) of the trawl fishery (North Coast Table 4), and the declining catch rates of several species including the indicator species of red emperor and Rankin cod led to a reduction in effort of 16% in Areas 1 and 2 and 4% in Area 4 in 2009. This followed an industry agreed effort reduction in Area 1 in 2007 and 2008.

**Age Structured Model:** The integrated age-structured model outputs for 2007 indicated the following: red emperor spawning biomass was greater than 40% of virgin biomass overall with a stable trend forecast for future years, with a declining trend in some management areas; and Rankin cod spawning biomass was greater than 40% of virgin biomass overall with a declining trend forecast for future years, with a declining trend across most management areas. This assessment indicated that the spawning biomass for these indicator species of the Pilbara Demersal Fishery as a whole were above their target levels indicating satisfactory breeding

stock levels.

**Current Assessment:** The catch rates of all indicator species (except goldband snapper) and those of the total catch in 2010 are displaying signs of improvement since 2008/09, and for some indicator species this constitutes two consecutive years of increasing catch rates. This recent turn around in catch rate trends is likely to be a response from the reduced fishing effort in Areas 1, 2 and 4 since 2007. These recent increases in annual catch rates may also provide an early indication of recovery of the red emperor stocks in the western areas (Areas 1 and 2). Otoliths of the indicator species, red emperor, rankin cod, bluespotted emperor and brownstripe snapper are being collected in 2010/11 from the trawl and trap fisheries, and for ruby snapper from the line fishery. The age structures derived from these otolith collections will be used to evaluate changes in fishing mortality since the levels estimated in 2007/08 and therefore the sustainability of current exploitation levels.

*Pilbara: The major performance measures for the fish stocks in the Pilbara demersal fisheries relate to breeding stock levels of the long-lived indicator species. The target level of spawning biomass is 40% of the initial level when the catch was first recorded. The limit level is 30% of the initial spawning biomass. The spawning biomass levels of the target species were assessed as adequate (spawning biomass was greater than 40% of virgin biomass) in 2007 by synthesising the available data in an age-structured model.*

### Kimberley

Assessment of the indicator species in the NDSF is also undertaken using a multitier approach. Catch and catch rates are assessed annually and an age structured stock assessment model is applied using relevant data on a periodic (5 year) basis with the last assessment completed in 2007.

**Catch Rates:** The determination of catch per unit of effort (CPUE) prior to 2009 was based on mean catch rates calculated from monthly returns. During 2009 a transition from monthly returns to trip returns was undertaken to establish an improved level of spatial and temporal catch reporting. As a consequence there were two sources of catch returns for vessels operating in the NDSF during 2009; daily returns and monthly returns. In 2010, all NDSF vessels reported catch and effort using daily logbook returns. Catch per unit of effort was determined by calculating the mean CPUE from the analysis of catch and effort for every fishing trip undertaken in 2010. During 2010, Zone B catch rates for the indicator species were 132 kg/std day for red emperor, 577 kg/std day for goldband snapper and 167 kg/std day for cods/groupers. Catch rates for goldband snapper and red emperor were slightly lower than those reported in 2009 (141 kg/std day for red emperor, 582 kg/std day for goldband snapper), while catch rates for cods/groupers increased from 145 kg/std day in 2009 to 164 kg/std day in 2010.

The 2010 catch of goldband snapper continued the trend of increased catches for this species in recent years, and exceeded the ESD trigger point of a 20% increase in catch above the average of the past four years. While the increased cods/grouper catch in 2010 was above the average of the past

<sup>1</sup> The ERPs for long-lived (> 20 years) species include (1) the Target level, where  $F \leq 2/3$  the ratio of natural mortality (M), for which fishing mortality is sustainable; (2) Threshold level, where  $F = M$ , which indicates fishing has exceeded sustainable levels; and (3) Limit level, where  $F = 1.5M$ , which indicates that fishing has greatly exceeded sustainable levels.



## NORTH COAST BIOREGION

4 years, it remained below the trigger point. The catch of red emperor was well below the average of the previous 4 years.

Increases in catch levels are, by themselves, not very sensitive indicators of stock status but combined with the previous estimates of fishing mortality of goldband snapper being close to the upper acceptable limit, further material increase in their catch would represent an unacceptable risk given the information currently available. While several scenarios may explain the increased catches of goldband snapper in recent years, their validity should be resolved following the next collection and analysis of the representative age samples.

**Age Structured Model:** The spawning biomass of the key target species in the NDSF was last estimated by an age-structured stock assessment model in 2007, which indicated the spawning biomass was above the international reference point of 40% of virgin biomass but with a slight declining trend for both red emperor and goldband snapper. These model outputs were reviewed by Prescott and Bentley in 2009, they concluded that the model was appropriate for use but would benefit from modifications including the better determination of levels of model uncertainty. Improvements have been made to the model in 2009 and 2010.

**Current Assessment:** The most recent model based assessment estimates indicated that there was a high probability that the spawning stocks of the indicator species were both above their respective threshold levels at that time. The overall catch levels and the species based catches were all within the acceptable ranges for the fishery, noting significant increases in goldband catches since 2007. The catch rates for the indicator species were all stable or increasing and the F based assessments indicated that the fishing level on the indicator species were either lower than the target level or between target and threshold levels. Consequently the stocks for the suite of species targeted by this fishery are effectively fished and currently considered to be at acceptable levels. If catches in Zone B are maintained at current levels, there is a low likelihood that the spawning stocks of any species within this suite declining to unacceptable levels. The current risk to sustainability for this suite is therefore moderate. Zone A of the fishery continues to receive low levels of effort and catch. Therefore, there is currently a low risk to the sustainability of the fishery resources in this zone. Zone C of the fishery received very low levels of effort in 2009. Therefore, there is currently a very low risk to the sustainability of the fishery resources in this zone.

*NDSF: The performance measures for this fishery relate to the maintenance of adequate breeding stocks for the key indicator species as indicated by the catch levels. In 2010, the catches of goldband increased from 2009, and exceeded the performance indicator of a 20% increase in catch above the average catch of the preceding four years. The 2010 level of catch of cods/groupers was above that taken in 2009, and although also above the average of the previous four years, did not exceed the trigger point.*

*The 2010 red emperor catch was below the average of the preceding four years. The spawning biomass was greater than 40% of virgin biomass in 2007 with a slight declining trend for both red emperor and goldband snapper. All three species/groups are thus considered to currently have adequate breeding stock levels.*

### Non-Retained Species

#### Bycatch species impact:

**Pilbara**

**Moderate**

**Kimberley**

**Low**

#### Pilbara

An independent observer program designed to monitor bycatch and interactions with protected species was completed in September 2009. The outcomes of the observer program are reported in the FRDC report for Project No. 2008/048. This project identified the need to trial a top-opening in the trawl nets to potentially further reduce the incidental capture of dolphins and turtles. A top-opening net configuration has recently been developed by industry and is scheduled for scientific trials in 2011/12. The fish trap and line fisheries have minimal bycatch (see Kimberley below).

#### Kimberley

As a result of the catching capacity of the gear and the marketability of most species caught, there is a limited quantity of non-retained bycatch in this fishery. The most common bycatch species is the starry triggerfish, *Abalistes stellaris*, but the numbers taken are not considered to be significant.

#### Protected species interaction:

**Pilbara**

**Moderate**

**Kimberley**

**Negligible**

#### Pilbara

The fish trawl fishery has an incidental capture of bottle nosed dolphins, turtles, sea snakes, pipefish and seahorses (North Coast Table 5). Turtles and sea snakes are generally returned to the water alive but dolphins, pipefish and seahorses are generally dead when landed. The catch of these species is recorded in skippers' logbooks and reported annually to SEWPaC. The bycatch of dolphins and turtles has remained well below levels prior to the introduction of exclusion grids in trawl nets in 2005. Given the area of distribution and expected population size of these protected species, the impact of the fish trawl fishery on the stocks of these protected species is likely to be minimal. There is a small catch of green sawfish, a species that is protected in WA waters. The trap fishery has a negligible impact on protected species (see Kimberley below).

*Pilbara: The performance measures for the impact of the trawl fishery on protected species: skippers are required to record incidents of capture and to minimise mortality. In 2010, the dolphin mortality rate was 4.9 per 1,000 shots.*

*The present catch rate is less than that in 2005 when grids were used and one-tenth that in 2005 when grids were not being used. The turtle catch rate was 2.3 per 1,000 shots (North Coast Table 6).*

## Kimberley

Using trap gear in continental shelf regions is very unlikely to interact with protected species. Recent video observations indicate that the potato cod (*Epinephelus tukula*), a totally protected species, is present in high numbers at discrete locations within the fishery. The potato cod rarely enters traps due to its large size and girth that limits its capacity to pass through the entrance funnel into the traps.

## Ecosystem Effects

### Food chain effects:

<b>Pilbara</b>	<b>Low</b>
<b>Kimberley</b>	<b>Negligible</b>

### Pilbara

The current Fish Trawl Fishery operates with standard stern trawling gear (single net with extension sweeps) within an area previously trawled by a Taiwanese fleet. Historical research by CSIRO has suggested that the extensive Taiwanese pair Trawl Fishery caused a significant decrease in the biomass of finfish on the North West Shelf, and a change in species composition towards smaller (shorter lived) species. The current WA Fish Trawl Fishery, which developed when the fish stocks had begun to recover, uses a much larger mesh size and much lighter ground gear, and operates at lower exploitation rates. At the present levels of fish trawl, fish trap, and line catch, the broader effect of the Fishery on the food chain of the North West Shelf is considered to be at an acceptable level. In addition, Hall and Wise (2011) demonstrated that there has been no reduction in either mean trophic level or mean maximum length in the finfish catches recorded within the Pilbara (i.e. no fishing down of the food web).

### Kimberley

The need to maintain relatively high levels of biomass for the species caught in this fishery to meet stock recruitment requirements results in a negligible risk to the overall ecosystem from the fishery. Furthermore, Hall and Wise (2011) demonstrated that there has been no reduction in either mean trophic level or mean maximum length in the finfish catches recorded within the Kimberley (i.e. no fishing down of the food web).

### Habitat effects:

<b>Pilbara</b>	<b>Moderate</b>
<b>Kimberley</b>	<b>Low</b>

### Pilbara

Impacts to the habitat are limited to those of the Fish Trawl Fishery, which is restricted to around 7% of the North West Shelf (North Coast Figure 1). Area 3 and the waters inside

50 m are permanently closed to fish trawling, Zone 1 is closed to fish trawling, and Area 6 has had no fish trawl effort allocation since 1998.

Within the areas actually trawled, past research has indicated that approximately 10% of the sessile benthic fauna (e.g. sponges) is detached per year. It is not known whether the detachment rate exceeds the rate of re-growth.

## Kimberley

As a result of the gear design, the fishery has little impact on the habitat overall, although there may be some rare interactions with coral habitats which are not common in areas where the fishery operates.

*Pilbara: The performance measure for the fish trawl impact on the North West Shelf habitat was set as a maximum area of operation by the trawlers. With the current closures within the licensed area of the fishery (50 m to 200 m depth), 46% of the area is accessible to the trawl vessels. Plots of trawl activity from VMS data indicate the actual area trawled being less than this as some of this area is too rough to be trawled.*

## Social Effects

### Pilbara

It is estimated that 14 fishers on 3 vessels were directly employed during 2010 in the Pilbara Fish Trawl Fishery, and 8 fishers on 3 vessels in the Trap Fishery, and at least 21 fishers on 7 vessels in the line fishery. At least 41 people were directly employed in the Pilbara Demersal Scalefish Fisheries.

This fishery supplies significant amounts of fish to Perth with catches from the Pilbara fisheries dominating the Perth metropolitan markets and supporting the local fish-processing sector. The exports from this fishery have been minimal in the last few years due to the increased value of the Australian dollar.

### Kimberley

Seven vessels fished in the 2010 fishing season, with generally three crew per vessel, indicating that at least 21 people were directly employed in the NDSF. Approximately half the fish from this fishery are supplied to Perth metropolitan markets, while the other half are supplied to east coast metropolitan markets.

## Economic Effects

### Estimated annual commercial value (to fishers)

<b>for year 2010:</b>	<b>\$20.1 Million</b>
<b>Pilbara</b>	<b>\$10.9 Million</b>
<b>Kimberley</b>	<b>\$9.2 Million</b>

These current estimated commercial values for the north coast Fisheries are based on the most recent inputted price values for each species and are calculated for the 2010 calendar year, not necessarily the individual fishery entitlement year.

## NORTH COAST BIOREGION

### Pilbara

This estimate is based on the landed weight of each species recorded in catch returns the average price per kilogram of whole weight of each species as supplied by fish processors. There has been little overall increase in fish prices in the last few years. The fish trawl demersal finfish catch is dominated by lower-valued species such as bluespotted emperor and threadfin bream, and its value in 2010 was estimated to be \$6.5 million. The fish trap and line catches are dominated by the valuable species such as red emperor and goldband snapper, and the demersal scalefish catch from these sectors was valued at approximately \$3.6 million (fish trap) and \$0.78 million (line).

### Kimberley

The NDSF principally targets the higher-value species such as the goldband snapper and red emperor. The fishery landed a total of 1,116 t of demersal scalefish in 2010, for a catch value of approximately \$9.2 million. This estimate is based on the landed weight of each species recorded in catch returns and the average price per kilogram of whole weight of each species as supplied by fish processors.

## Fishery Governance

### Target commercial catch range:

<b>Pilbara Fish Trawl</b>	<b>2,000–2,800 tonnes</b>
<b>Pilbara Fish Trap</b>	<b>400–500 tonnes</b>
<b>Pilbara Line</b>	<b>50–115 tonnes</b>
<b>Kimberley (NDSF)</b>	<b>600–1000 tonnes (All Zones)</b>

### Current Fishing (or Effort) Level

#### Pilbara

<b>Trawl Fishery</b>	<b>Not Acceptable (review required)</b>
<b>Trap Fishery</b>	<b>Acceptable</b>
<b>Line Fishery</b>	<b>Acceptable</b>
<b>Kimberley</b>	<b>Acceptable</b>

#### Pilbara

In the Fish Trawl Fishery, the total catch was still well below the target catch range continuing a trend of the last three seasons which is classed as not acceptable. Given that it is unclear if this reduction is due to changed net designs or from reduced abundances in the trawled areas a formal examination is required. This may involve a revision to the target catch range for the trawl fishery in association with a review of the status of the indicator species.

In the fish trap fishery, the total catch was within the target catch range in 2010. The line catch was at the upper limit of the acceptable catch range in 2010.

#### Kimberley

For the 2010 calendar year, the total allowable effort was set at 1,038.4 standard fishing days in Zone B, and 616 standard fishing days in Zone A, of the fishery respectively. The Zone A allocation aims to facilitate the exploration and development of this area of the fishery, while there is also

further scope for fishers to develop Zone C (the deep slope area). At these levels of total effort and at recent catch rates, the total catch of the fishery is expected to be in the range of 600–1,000 t. The 2010 catches were above the reported range, given the fishing activities in Zone A and C of the fishery there is a need to review the target catch range for this fishery.

In addition to the overall catch target, ESD performance measures state that the annual catch of each of the key target species/groups (red emperor, goldband snapper and the cod/grouper complex) by the fishery should not increase by more than 20% above the average for the previous four years. Of the key target species/groups, the goldband snapper catch exceeded ESD performance measures in 2010, the cods/groupers catch was above the average of the previous four years but did not exceed the ESD performance measure, while the red emperor catch remained significantly below the trigger level. Several different scenarios could explain the increased catches of goldband snapper in recent years and the validity of each of these scenarios should be resolved with the collection of the next representative age sample.

## New management initiatives (2011/12)

### Pilbara

The Pilbara Fish Trawl Interim Managed Fishery Management Plan cessation date was recently extended to 30 June 2013. The extension was provided to allow for the implementation of the Fisheries Research and Development Corporation (FRDC) Project 2008/048 *Reducing dolphin bycatch in the Pilbara finfish trawl fishery* recommendations, being, 1) the need for further net modifications, i.e. the installation of top opening escape hatches, to potentially further reduce dolphin capture rates; and 2) observer coverage combined with deployment of net-mounted video cameras in underwater housings for the trials, to be assessed. Following this, assessment regarding the long-term future of the Pilbara Fish Trawl Interim Managed Fishery, including consideration of moving the Fishery to “managed” Fishery status will be carried out.

### Kimberley

There is a need to incorporate the industry agreed zoning and effort allocation arrangements of Area 2 of the NDSF into the management plan. The Department continues to consider projects related to the outcomes of the Prescott Review in consultation with licensees.

## External Factors

The Commonwealth’s North-west Marine Bioregional Plan incorporates the aim of introducing marine reserves, which are likely to contain areas closed to fishing. This has the potential to restrict access to fishing in parts of the North Coast Bioregion to all sectors, i.e. commercial, recreational and charter.

Under the Offshore Constitutional Settlement, commercial trawl vessels licensed by the Commonwealth may operate in waters outside of a line that is meant to represent the 200 m isobath as part of the North West Slope Trawl Fishery (NWSTF). However, as this line encompasses waters in Zone

B of the NDSF, any future catches by Commonwealth trawl vessels in these waters that are shallower than 200 m will impact on the demersal fish resources of the NDSF.

Climate change and climate variability has the potential to impact fish stocks in a range of ways including influencing their geographic distribution (e.g. latitudinal shifts in distribution). However, it is unclear how climate change may affect the sustainability risk to North Coast demersal fisheries.

#### Pilbara

The available fishing area has decreased slightly over recent years as a result of exclusion zones for gas pipelines and associated facilities. Seismic surveys also restrict the operation of fishers. However, neither of these operations is expected to significantly affect fish catches as these closures and operations occur over a limited area.

#### Kimberley

The impacts of environmental variation on the fishery are not considered to be large as the target species are long-lived. Some commercial fishers within the fishery have raised concerns about the increasing numbers of charter vessels operating in the offshore waters of the NDSF, which could generate resource-sharing issues in the future. In addition, offshore developments in the energy/gas industry may involve exclusion zones thus potentially limiting fisher access to some areas of the fishery. Increasing development of the Kimberley region is also likely to see a marked increase in the recreational effort and this may impact on stock sustainability.

#### Contributors

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#### NORTH COAST TABLE 1

Commercial catches (tonnes) and the percentages of each major species taken by trawl, trap and line in the Pilbara in 2010 (estimates rounded to the nearest tonne).

Species		Trawl catch		Trap catch		Line catch		Total catch
		tonnes	%	tonnes	%	tonnes	%	tonnes
Bluespotted emperor	<i>Lethrinus punctulatus</i>	164	65%	90	35%	–	–	254
Crimson snapper	<i>Lutjanus erythropterus</i>	93	64%	48	33%	5	3%	146
Rosy threadfin bream	<i>Nemipterus furcosus</i>	187	99%	2	1%	–	–	189
Brownstripe emperor	<i>Lutjanus vitta</i>	76	84%	14	16%	–	–	90
Goldband snapper	<i>Pristipomoides multidens</i>	63	54%	37	32%	17	15%	117
Red emperor	<i>Lutjanus sebae</i>	76	46%	89	53%	2	1%	167
Saddletail snapper	<i>Lutjanus malabaricus</i>	50	69%	16	22%	6	8%	72
Spangled emperor	<i>Lethrinus nebulosus</i>	15	41%	20	54%	2	5%	37
Frypan snapper	<i>Argyrops spinifer</i>	37	95%	2	5%	–	–	39
Rankin cod	<i>Epinephelus multinotatus</i>	14	21%	52	76%	2	3%	68
Ruby snapper	<i>Etelis carbunculus</i>	–	–	–	–	56	100%	56
Other demersal scalefish		484	77%	119	19%	27	4%	630
<b>All demersal scalefish</b>		<b>1,259</b>	<b>68%</b>	<b>489</b>	<b>26%</b>	<b>117</b>	<b>6%</b>	<b>1,865</b>

## NORTH COAST BIOREGION

**NORTH COAST TABLE 2**

Summary of reported commercial catches (tonnes) of demersal scalefish by line, trap and trawl in the Pilbara fishery, as well as by-product from the fish trawl fishery.

Year	Demersal Scalefish			Total	By-product*
	Line	Trap	Trawl		Trawl
1985	180	168		348	
1986	65	113		178	
1987	67	192	3	262	
1988	136	243	3	382	
1989	104	457	124	685	
1990	157	407	421	985	4
1991	107	119	754	980	14
1992	63	148	1,413	1,624	21
1993	67	178	1,724	1,969	42
1994	79	207	2,506	2,792	102
1995	95	222	2,821	3,138	77
1996	136	302	3,201	3,639	102
1997	109	234	2,630	2,973	133
1998	78	250	2,512	2,840	119
1999	50	371	2,136	2,419	69
2000	59	257	1,995	2,314	80
2001	99	266	2,221	2,592	150
2002	90	306	2,310	2,706	180
2003	81	363	2,860	3,304	154
2004	240	395	2,837	3,449	113
2005	260	408	2,371	3,005	80
2006	105	473	2,222	2,800	46
2007	102	460	1,704	2,266	36
2008	86	508	1,210	1,804	37
2009	123	455	1,044	1,622	37
<b>2010</b>	<b>117</b>	<b>489</b>	<b>1,259</b>	<b>1,865</b>	<b>32</b>

\* By-product in 2010 consists of cuttlefish, squid, bugs, and tropical lobster.

**NORTH COAST TABLE 3**

Summary of the fishing effort in the Pilbara Demersal Scalefish Fisheries, 1985 to 2010. The trap, line and trawl effort (days) are derived from monthly catch and effort returns. The trawl effort (hours) is nominal effort from operators' logbook data.

Year	Line (days)	Trap (days)	Trawl (days)	Trawl (hours)
1985	809	709	-	-
1986	655	548	19	-
1987	614	507	17	-
1988	985	804	32	-
1989	863	1,198	310	-
1990	1,332	1,321	698	-
1991	740	472	1,132	8,660
1992	514	681	983	10,030
1993	876	696	832	10,725
1994	732	545	1,484	22,087
1995	852	608	1,571	21,529
1996	814	513	1,550	25,246
1997	809	483	1,389	19,810
1998	692	503	1,291	20,555
1999	453	842	1,139	15,963
2000	500	518	957	14,084
2001	401	446	1,162	15,330
2002	660	418	1,035	14,830
2003	715	412	1,014	14,663
2004	816	418	953	15,372
2005	993	425	886	14,721
2006	418	467	914	15,792
2007	344	429	841	14,197
2008	278	428	831	11,966
2009	282	483	713	10,605
<b>2010</b>	<b>366</b>	<b>472</b>	<b>659</b>	<b>9,723</b>

# NORTH COAST BIOREGION

## NORTH COAST TABLE 4

Estimates of fishing mortality (F) relative to Exploitation Reference Points (ERPs) calculated for each of the indicator species collected in different management areas of the commercial trawl and trap fisheries in the Pilbara region from 2006 to 2008. ns = not sampled.

Indicator species	Year	Trawl area (Zone 2)				Trap
		1	2	4	5	
Red emperor	2007	$F > F_{\text{limit}}$	$F > F_{\text{limit}}$	$F_{\text{threshold}} > F > F_{\text{target}}$	$F_{\text{threshold}} > F > F_{\text{target}}$	$F_{\text{limit}} > F > F_{\text{threshold}}$
Rankin cod	2006	$F = F_{\text{target}}$	$F < F_{\text{target}}$	$F_{\text{threshold}} > F > F_{\text{target}}$	$F = F_{\text{threshold}}$	$F < F_{\text{target}}$
Goldband snapper	2008	$F_{\text{threshold}} > F > F_{\text{target}}$	$F < F_{\text{target}}$	$F < F_{\text{target}}$	$F_{\text{threshold}} > F > F_{\text{target}}$	ns
Bluespotted emperor	2008	$F_{\text{threshold}} > F > F_{\text{target}}$	ns	ns	ns	ns

## NORTH COAST TABLE 5

Reported by-catch of protected species by skippers in the Pilbara trawl fishery in 2010.

	Number Alive	Number Dead*	Total Reported
bottlenosed dolphins	4	13	17
pipefish	29	88	117
sawfish, green	17	2	19
sawfish, narrow	10	3	13
seahorses	3	0	3
sea-snakes	97	7	104
Turtles	8	0	8

\*Where the condition was not reported, the animal was considered deceased.

## NORTH COAST TABLE 6

Recent total annual catches of major target and by-product species or species groups across all zones in the NDSF.

Species	NDSF annual catch (tonnes)					
	2005	2006	2007	2008	2009	2010
Goldband snapper ( <i>Pristipomoides spp.</i> )	429	336	393	457	485	523
Red emperor ( <i>Lutjanus sebae</i> )	192	166	176	173	156	141
Saddletail snapper ( <i>Lutjanus malabaricus</i> )	92	79	96	104	108	125
Spangled emperor ( <i>Lethrinus nebulosus</i> )	21	28	14	18	23	30
Cod/grouper (Epinephelidae)	110	129	121	148	142	153
Other species	78	63	108	110	132	144
<b>Total demersal scalefish catch</b>	<b>922</b>	<b>801</b>	<b>908</b>	<b>1010</b>	<b>1046</b>	<b>1116</b>

**NORTH COAST TABLE 7**

Catches of major target and by-product species or species groups by zone in the NDSF in 2009 and 2010.

Species	NDSF annual catch (tonnes)			
	2009		2010	
	Zone A & C	Zone B	Zone A & C	Zone B
Goldband snapper ( <i>Pristipomoides</i> spp.)	22.2	462.3	29.5	493.1
Red emperor ( <i>Lutjanus sebae</i> )	34.0	121.9	41.1	100.4
Saddletail snapper ( <i>Lutjanus malabaricus</i> )	14.4	93.7	21.0	104.6
Spangled emperor ( <i>Lethrinus nebulosus</i> )	2.8	20.5	3.5	26.4
Rankin cod ( <i>Epinephelus multinotatus</i> )	10.0	34.9	16.0	33.0
Other Cods/groupers (Epinephelidae)	14.9	82.6	23.2	80.7
Other species	38.7	93.0	65.0	78.7
<b>Total demersal scalefish catch</b>	<b>137</b>	<b>909</b>	<b>199</b>	<b>917</b>

**NORTH COAST TABLE 8**

Total catches (t) of demersal finfish and effort (days) by line and trap vessels in the NDSF since the introduction of full management arrangements in 1998.

Year	Total allowable effort (days)	Line catch (t)	Line effort (days)	Trap catch (t)	Trap effort (days)	Total catch (t)
1998	1,684	45	78	497	916	542
1999	1,716	91	228	486	992	577
2000	1,562	67	155	409	890	476
2001	1,672	47	136	462	928	509
2002	1,760	0	0	434	900	434
2003	1,760	0	0	552	1,060	552
2004	1,760	0	0	690	1,300	690
2005	1,760	0	0	922	1,318	922
2006	1,144	0	0	801	1,193	801
2007	1,144	0	0	908	1,235	908
2008	1,144	7	0	1,003	1,150	1,010
2009	1,144	0	0	1,046	1,090	1,046
<b>2010</b>	<b>1038.4</b>	<b>0</b>	<b>0</b>	<b>1,116</b>	<b>1,178</b>	<b>1,116</b>

(2010 Estimated Catch: Zone A = 199 t, Zone B = 917 t; 2010 Estimated Effort: Zone A = 237 SFDs, Zone B = 936 SFDs)

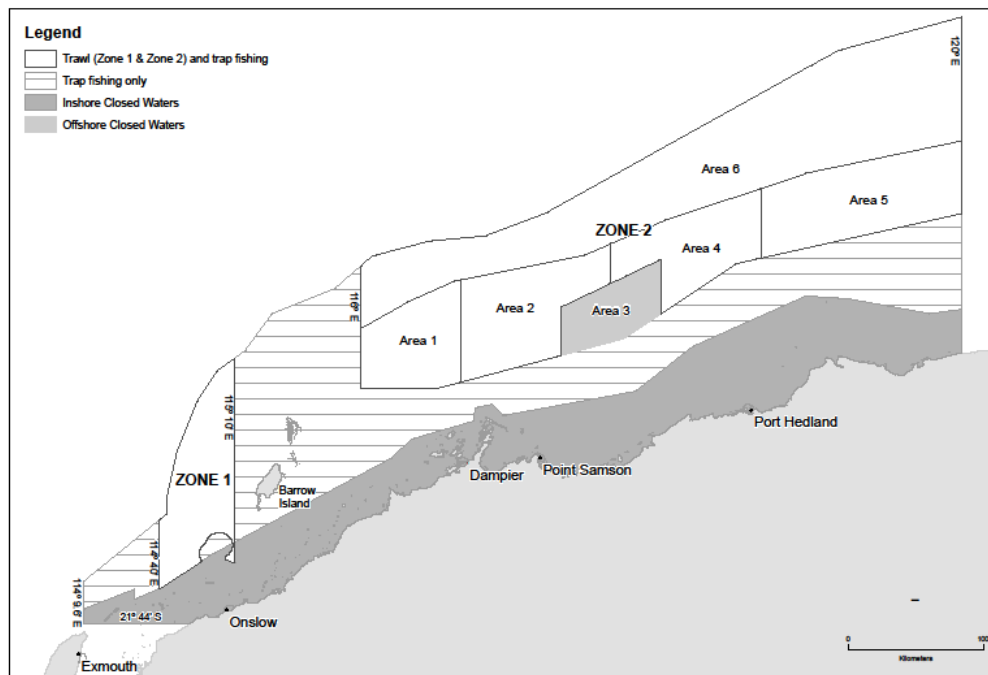


## NORTH COAST BIOREGION

### NORTH COAST TABLE 9

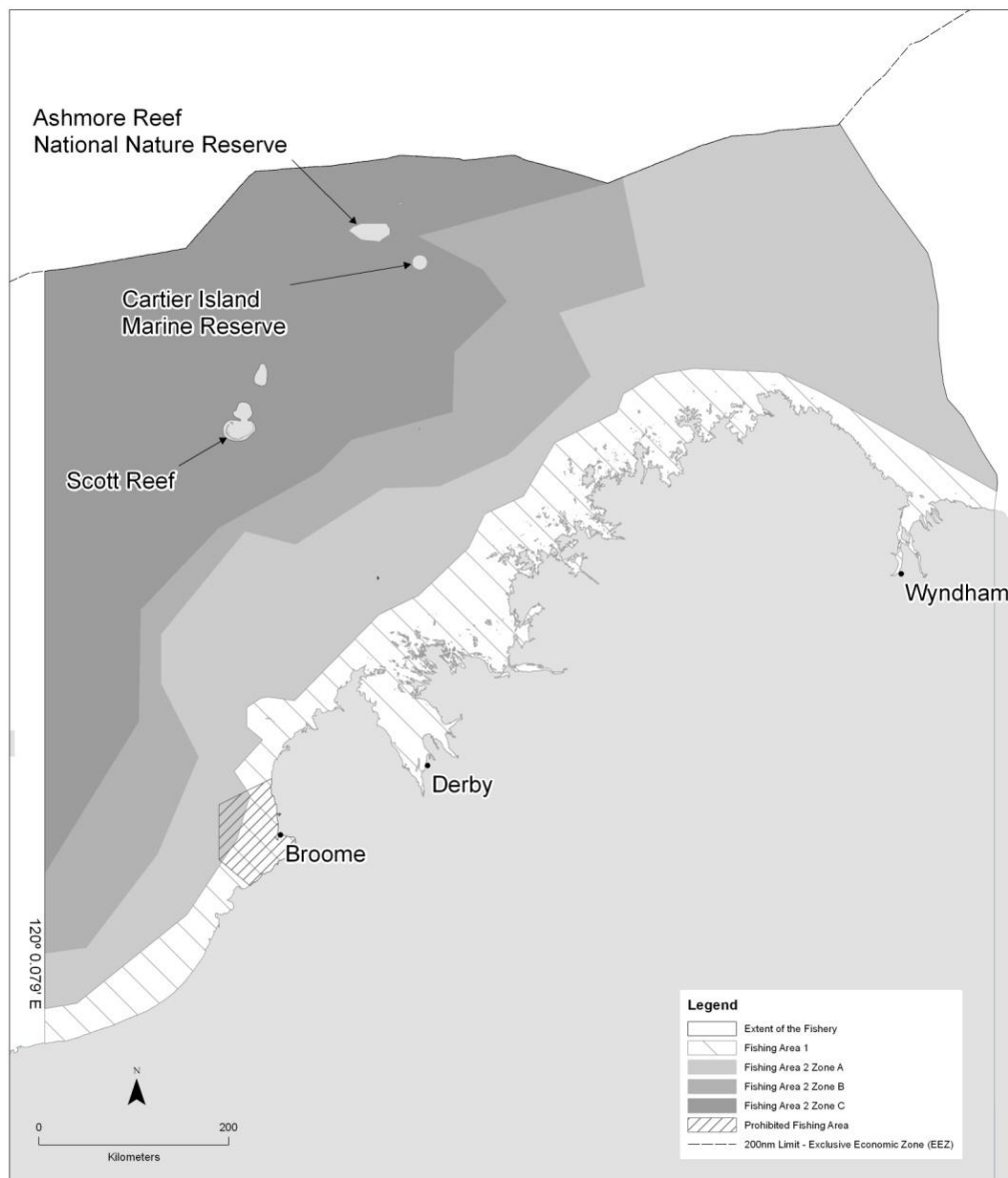
Summary of the commercial catches and the relative contribution (% composition) of each of the major species taken within the Pilbara and Kimberley sectors of the North Coast bioregion in 2010.

Species	Pilbara catch		Kimberley (NDSF) catch		Total catch tonnes
	tonnes	%	tonnes	%	
Red emperor	167	54%	141	46%	308
Saddletail snapper	72	37%	125	63%	197
Crimson snapper	146	77%	43	23%	189
Brownstripe snapper	90	93%	7	7%	97
Goldband snapper	117	18%	523	82%	640
Spangled emperor	37	55%	30	45%	67
Bluespotted emperor	254	90%	27	10%	281
Rankin cod	68	58%	49	42%	117
Frypan snapper	39	100%	<1	0%	39
Rosy threadfin bream	189	100%	<1	0%	189
Other demersal scalefish	686	80%	171	20%	857
<b>Total all demersal scalefish</b>	<b>1,865</b>	<b>63%</b>	<b>1,116</b>	<b>37%</b>	<b>2981</b>



### NORTH COAST FIGURE 1

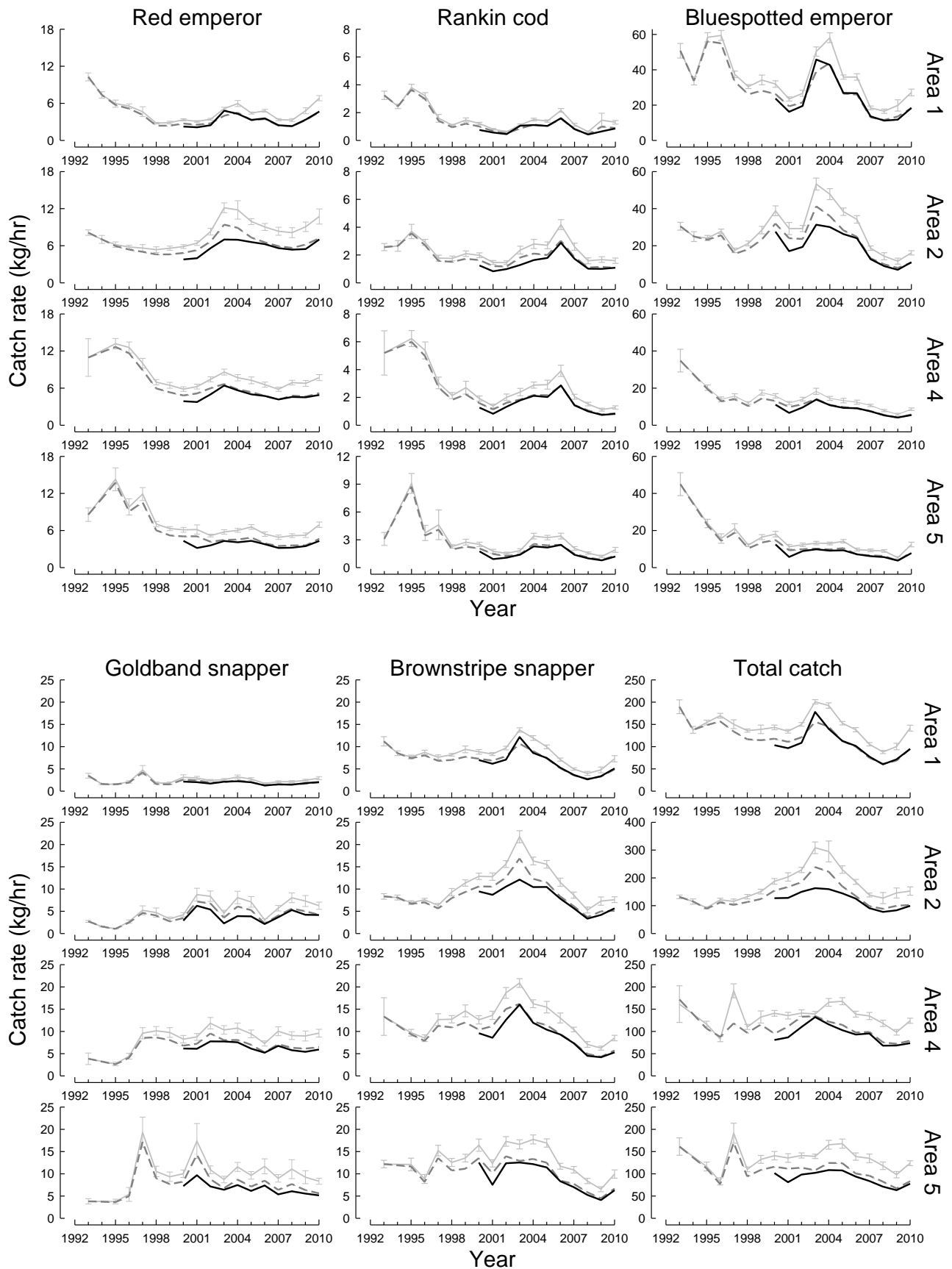
Demersal scalefish fisheries of the Pilbara region of Western Australia. Areas 1 to 6 refer to the management regions in Zone 2 of the trawl fishery. Zone 1 has been closed to trawling since 1998.



### NORTH COAST FIGURE 2

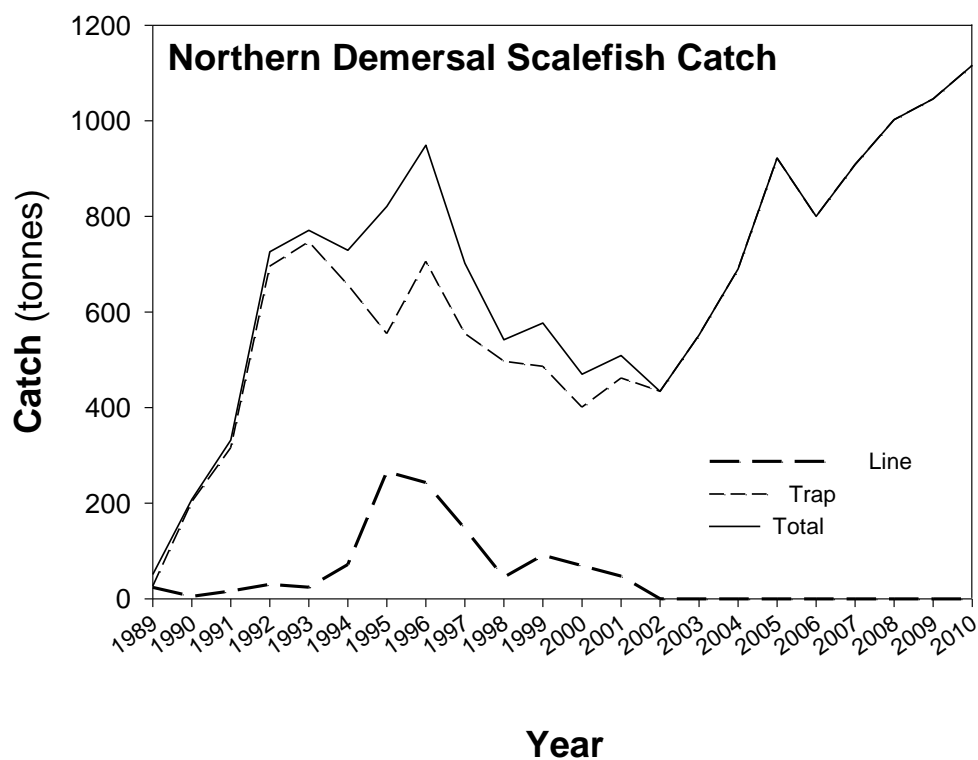
Location of the Northern Demersal Scalefish Managed Fishery in the Kimberley region of Western Australia. Access areas and boundaries within the fishery are shown.

## NORTH COAST BIOREGION



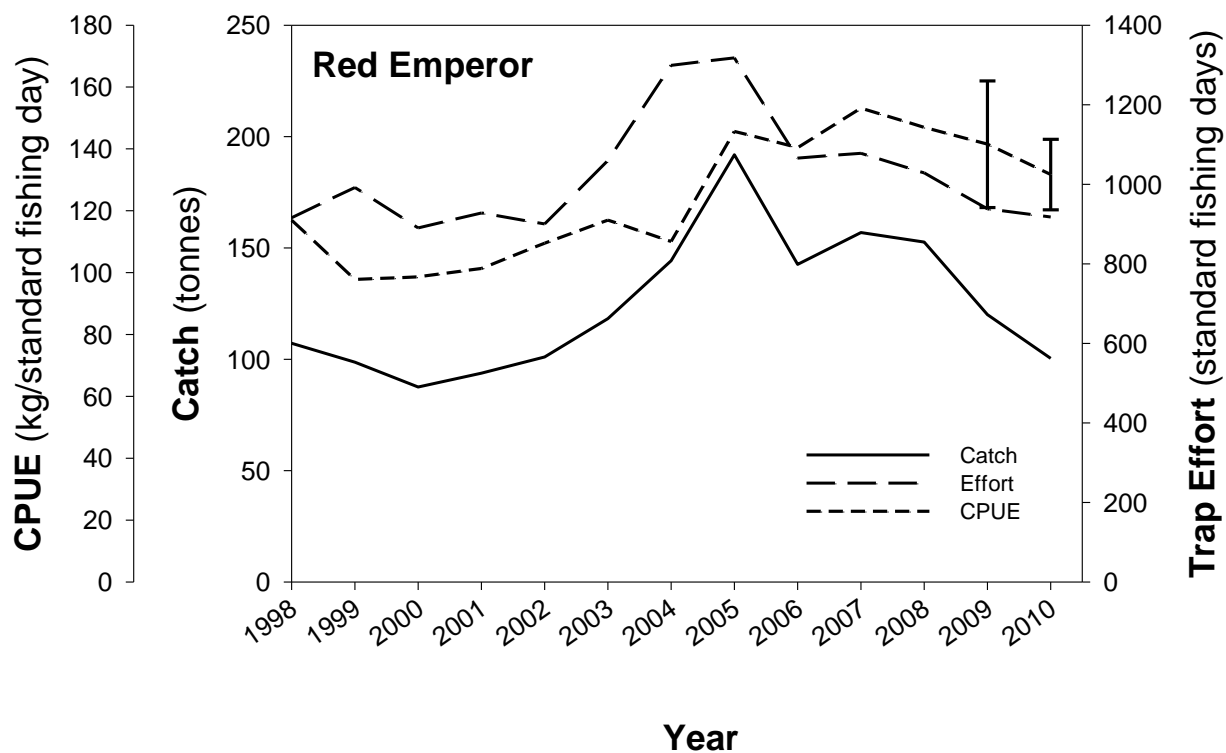
**NORTH COAST FIGURE 3**

Annual mean Catch Per Unit Effort (CPUE, kg/hour) for five indicator species and the total catch in Areas 1, 2, 4 and 5 of the Pilbara Trawl Fishery from 1993–2010. The solid grey line is catch rate ( $\pm 1$  se) with trawl time as the effort measure, the dashed grey line is catch rate incorporating efficiency increase (trawl time as the effort measure) and the solid black line is catch rate using the time spent in each area as the effort measure (derived from VMS, data available since 2000).



**NORTH COAST FIGURE 4**

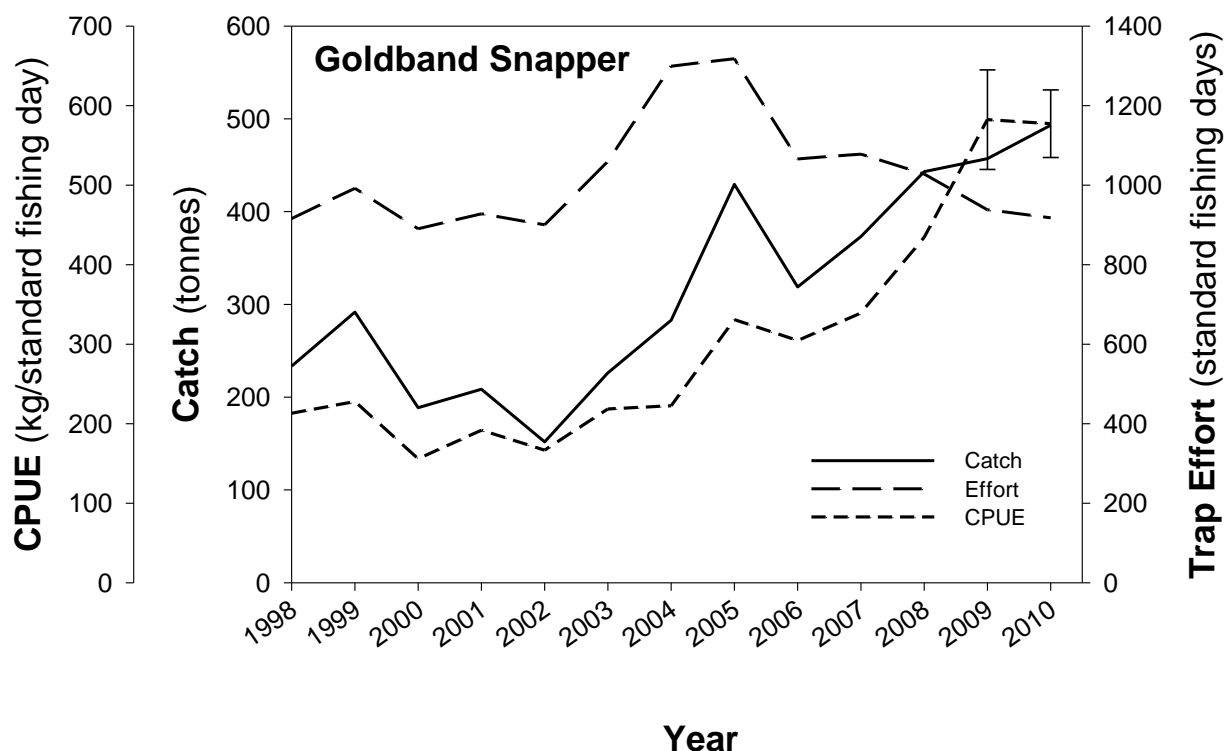
Catch levels of demersal finfish in the NDSF by line and trap, 1989–2010 (All Zones).



**NORTH COAST FIGURE 5**

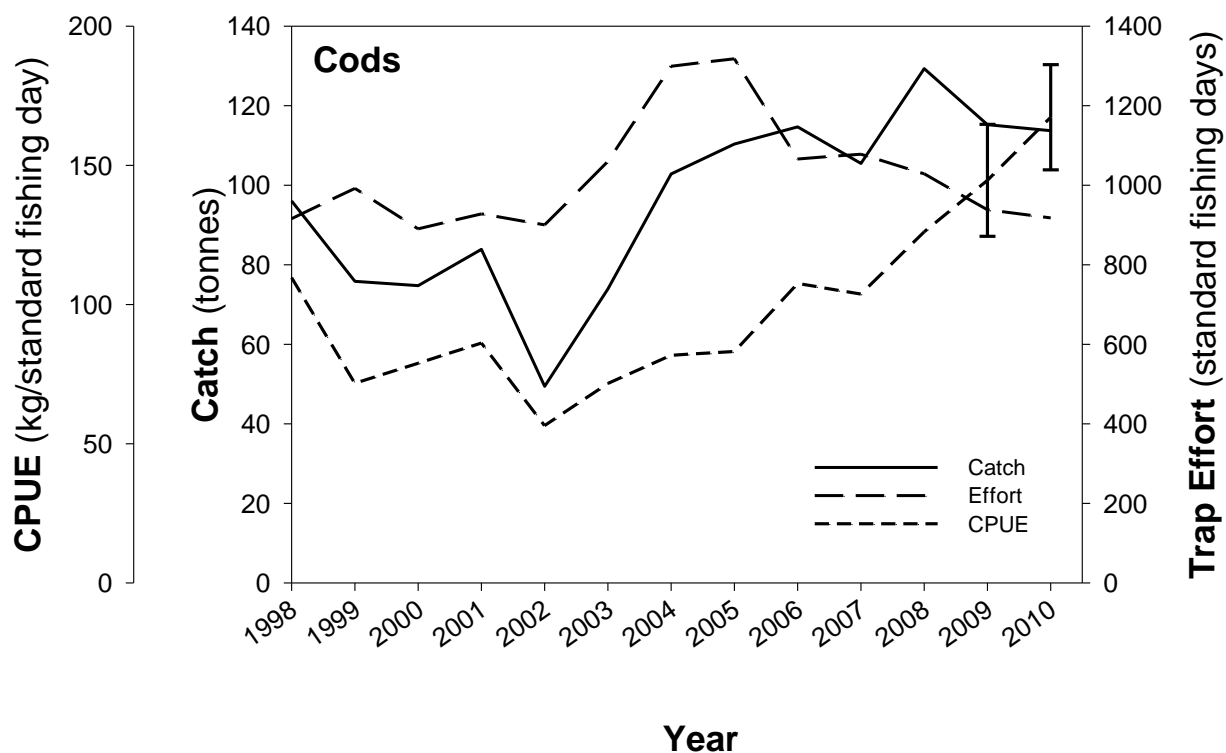
Catch, effort and catch per unit of effort of red emperor in the NDSF by trap, 1998–2010 (2006–2010 for Zone B only). Standard error bars illustrate variability in CPUE from two sources of catch returns (daily and monthly).

## NORTH COAST BIOREGION



**NORTH COAST FIGURE 6**

Catch, effort and catch per unit of effort of goldband snapper in the NDSF by trap, 1998–2010 (2006–2010 for Zone B only). Standard error bars illustrate variability in CPUE from two sources of catch returns (daily and monthly).



**NORTH COAST FIGURE 7**

Catch, effort and catch per unit of effort of cods in the NDSF by trap, 1998–2010 (2006–2010 for Zone B only). Standard error bars illustrate variability in CPUE from two sources of catch returns (daily and monthly).

# Mackerel Managed Fishery Report: Statistics Only

## Fishery Description

### Commercial

The Mackerel Fishery uses near-surface trolling gear from small vessels in coastal areas around reefs, shoals and headlands to target Spanish mackerel (*Scomberomorus commerson*). Jig fishing is also used to capture grey mackerel (*S. semifasciatus*), with other species from the genera *Scomberomorus*, *Grammatocynus* and *Acanthocybium* also contributing to commercial catches.

### Recreational

Recreational fishers target similar species using a range of gears including trolls, shore-based drift fishing with balloons and spear guns.

### Boundaries

#### Commercial

The Fishery extends from the West Coast Bioregion to the WA/NT border, with most effort and catches recorded north of Geraldton, especially from the Kimberley and Pilbara coasts of the Northern Bioregion. Catches are reported separately for three Areas: Area 1 - Kimberley (121° E to WA/NT border); Area 2 - Pilbara (114° E to 121° E); Area 3 - Gascoyne (27° S to 114° E) and West Coast (Cape Leeuwin to 27° S) (Spanish Mackerel Figure 1).

#### Recreational

The fishery operates between the West Coast Bioregion and the WA/NT border, with most activity occurring between Perth and Dampier.

## Management arrangements

### Commercial

An Interim Management Plan was implemented for the Mackerel Fishery in August 2004, with fishing commencing under the plan in 2005. On 1 January 2006, an Individual Transferable Quota (ITQ) system was introduced including setting Total Allowable Commercial Catches (TACCs) for each Area of the Fishery, allocation of the entitlement to take quota in the form of units, and establishment of minimum unit holding requirements to operate in the Fishery.

The maximum quantity of mackerel that may be taken from each Area of the Fishery during any permit period is limited to the quantity of mackerel determined by the Chief Executive Officer. The TACC for each Area of the Fishery is currently:

	Spanish and other mackerel	Grey mackerel
Area 1:	205 t	60 t
Area 2:	126 t	60 t
Area 3:	79 t	60 t

The Plan includes limitations on the number of permits to fish in the Fishery and the type of gear that can be used. Boats operating in the Fishery are monitored by VMS and the

master of an authorised boat is required to submit logbook returns and catch and disposal records. Seasonal closures were removed in May 2008, as they were no longer a necessary tool to maintain sustainable and efficient management of the Fishery after quotas were put in place in 2006.

Permit holders may only fish for mackerel by trolling or handline. There are currently 65 permits in the Fishery with 23, 21 and 21 in Areas 1, 2 and 3 (respectively), with the combined quota allocations being consolidated onto 3, 4 and 7 boats operating within Areas 1, 2 and 3 (respectively).

A comprehensive ESD assessment of this Fishery determined that levels of Spanish mackerel breeding stock should be used as an annual performance measure for the Fishery. The annual assessment of performance is provided within the boxed text. In November 2009, the Fishery was exempt from the export controls of the *Environment Protection and Biodiversity Conservation Act 1999* for a period of five years.

## Landings and Effort (Season 2010)

<b>Spanish mackerel</b>	<b>283.6 tonnes</b>
<b>Grey mackerel</b>	<b>9.6 tonnes</b>
<b>Other mackerel</b>	<b>0.9 tonnes</b>

### Commercial

The majority of the catch is taken in the Kimberly Area, reflecting the tropical distribution of mackerel species (Spanish Mackerel Figure 2). Estimates of catches are monitored through mandatory logbook systems with the total catch of Spanish mackerel in the 2010 season estimated at 283.6 t, similar to the total Spanish mackerel catch taken in 2009 (284.2 t) but lower than the peak catches in the early 2000s. Reductions in total catches since the early 2000s reflects reductions in fishing effort across all Areas (approximately 10 – 15% reduction compared to 2010 levels) with the highest effort reductions occurring in the Gascoyne Coast Bioregion.

A total of 10.5 tonnes of other mackerel were landed in the 2010 season, including 9.6 t of grey mackerel. The catch of grey mackerel has remained at similar levels since 2001 which is well below the TAC and historical high catches of 'other mackerel' recorded in the late 1980s and 1990s.

All estimates reported do not include fish caught and released or lost to sharks.

### Recreational

Catch estimates and resource sharing by this sector are currently only available through creel surveys which have occurred periodically (Spanish Mackerel Table 1). Reported annual catches of Spanish mackerel by recreational charter boats are relatively minor. New estimates of recreational catches will be available in 2012.

## NORTH COAST BIOREGION

### Fishery Governance

#### Target commercial catch range: 246 – 410 tonnes

The total catch in 2010 of 283.6 t was within the acceptable catch range. The reported catch from the Kimberley Area of 154.0 t was within the Area's acceptable catch range (110 – 205 t), albeit lower than in previous years. Catches in the Pilbara Area have been relatively stable since 2006 and the 2010 catch of 80.3 t is within the acceptable range (80 – 126t). Catches from the Gascoyne/West Coast Area in 2010 were 49.3 t, below the acceptable range of 56 – 79 t but similar to the range of catches from this Area since 2004 suggesting a change in this range is required.

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

Fishing effort throughout the Fishery has broadly stabilised since 2006 following reductions due to management changes. This is reflected by stable (Kimberley, Area 1) or increasing (Pilbara Area 2 and Gascoyne/West Coast Area 3) catch rates in the Fishery (Spanish Mackerel Figure 2). The decline in catch rates in Area 1 (Kimberley) in 2009 and 2010 have been due to equipment issues on some vessels, as discussed by licence holders in the Annual Management Meetings.

The performance measure set for the Fishery is the status of the Spanish mackerel spawning stock. As the minimum legal

size of 900 mm total length is similar to the size at maturity for this species, the spawning stock is essentially the same as the exploited stock. In this context, catch rates across the major areas of the Fishery are a general indicator of breeding stock levels.

Additionally, the total catches of Spanish mackerel remain within the target range. The total catch for this Fishery has remained within the acceptable catch range since 1991.

#### New management initiatives (2011/12)

In December 2009, the Mackerel Fishery (Interim) Management Plan cessation date was extended to expire on 31 December 2011. The Minister for Fisheries has approved moving this Fishery to a managed Fishery and a Draft Mackerel Management Plan has recently been developed and is currently out for statutory public consultation (until end of August 2011) as required under the Fish Resources Management Act 1994. It is anticipated that the new Mackerel Management Plan will be gazetted by 31 October 2011 and will come into effect on 1 January 2012.

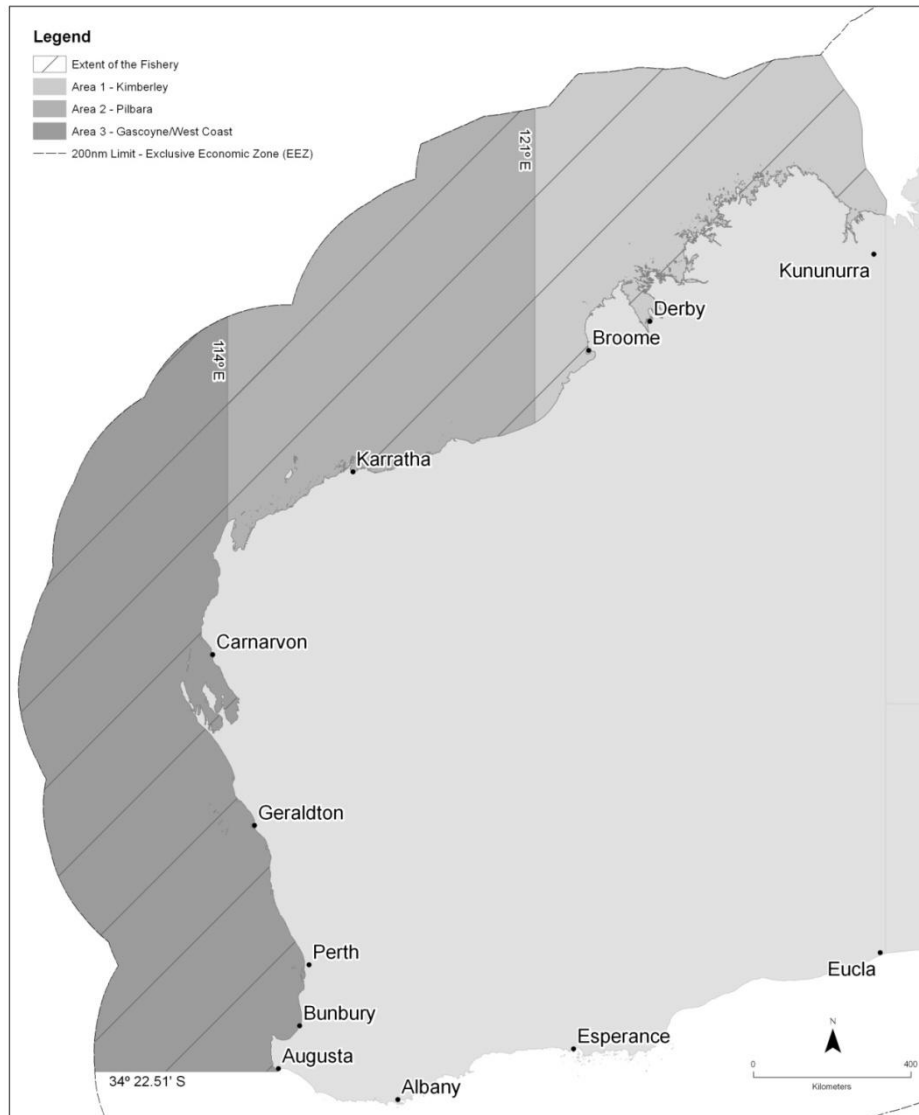
#### Contributors

B. Molony, E. Lai and S. Blazeski.

### SPANISH MACKEREL TABLE 1

Recreational catch estimates of Spanish mackerel in Western Australia

Bioregion	Year	Retained catch	Share	Source
Pilbara (including Broome)	1999/2000	Spanish: 28 t Other: 11 t	21 % 15 %	Williamson et al. (2006)
Gascoyne	1998/1999	Spanish: 48 t Other: 8 t	42 % 10 %	Sumner et al. (2002)
West Coast	2005/2006	Spanish: 7 t Other: <1 t	45 % < 3 %	Sumner et al. (2008)

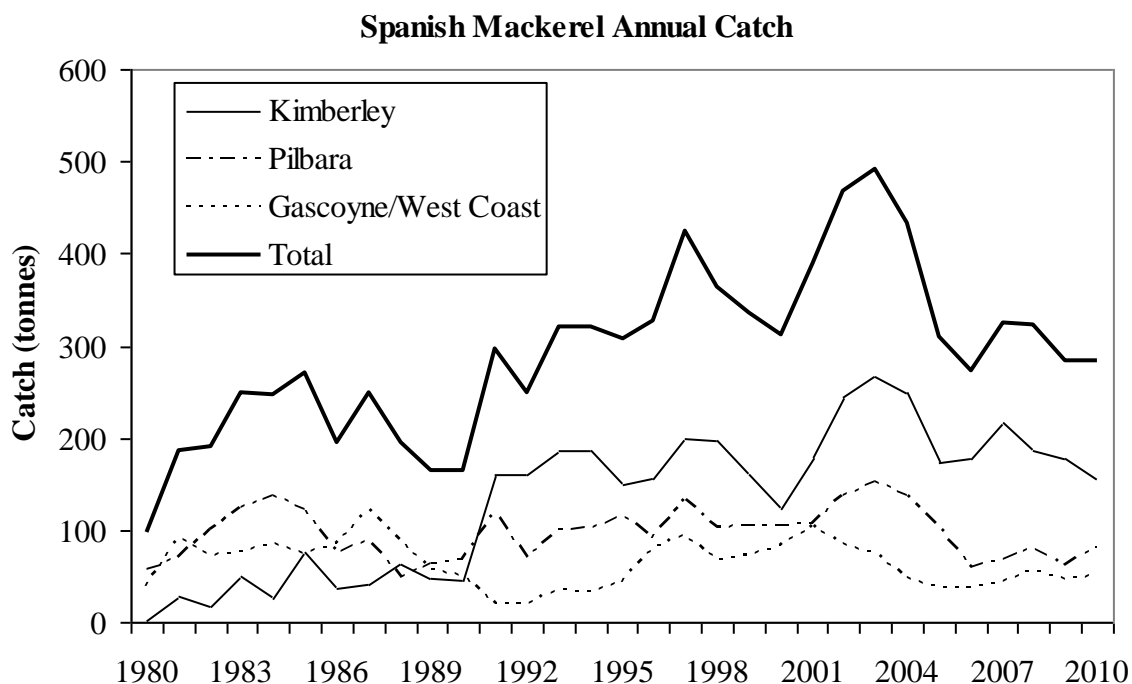


## MACKEREL MANAGED FISHERY FIGURE 1

Map of the extent of the Mackerel Managed Fishery.

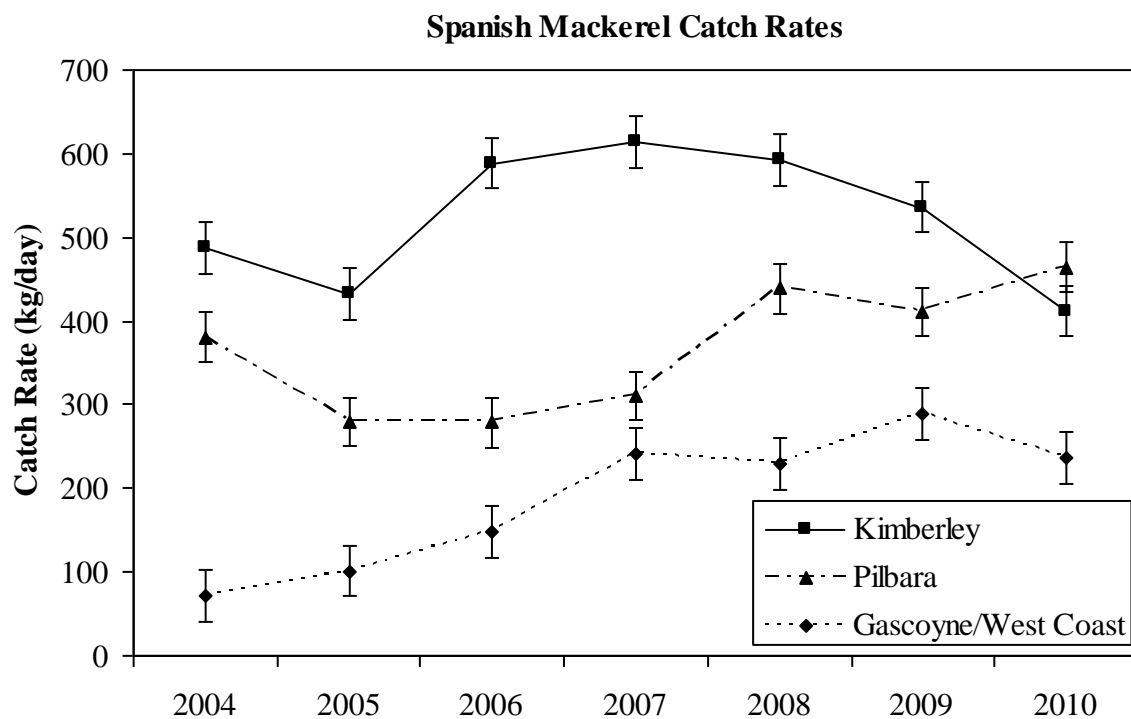


## NORTH COAST BIOREGION



**SPANISH MACKEREL FIGURE 2**

Annual catches of Spanish mackerel in Western Australia, 1979–2010. Note: new management arrangements began in 2005 and quotas were introduced in 2006.



**SPANISH MACKEREL FIGURE 3**

Annualised catch rates of Spanish mackerel in Western Australia derived from daily logbooks, 2004–2010.

# Northern Shark Fisheries Status Report

## Main Features

Status		Current Landings	
Stock level		Total sharks (2009/10)	0 t
Sandbar shark	Unacceptable	Total scalefish (2009/10)	0 t
Blacktip sharks	Uncertain	Shark catches by other commercial Fisheries (2009/10)	4t
Fishing Level (2009/10)	Acceptable	Recreational	Not assessed
		Charter	Not assessed

## Fishery Description

The 'northern shark fisheries' comprise the state-managed WA North Coast Shark Fishery (WANCSF) in the Pilbara and western Kimberley, and the Joint Authority Northern Shark Fishery (JANSF) in the eastern Kimberley. The primary fishing method employed in these fisheries was historically demersal longline with a relatively small amount of pelagic gillnetting in the JANSF. The northern shark fisheries have targeted a variety of species through their history, including sandbar (*Carcharhinus plumbeus*), blacktip (various *Carcharhinus* spp.), tiger (*Galeocerdo cuvier*), hammerhead (Sphyrnidae) and lemon sharks (*Negaprion acutidens*). Due to the small number of vessels authorised to fish in the northern shark fisheries and the commonality of gear-types and target species, data from the two fisheries are combined and they are considered as a single fishery for reporting purposes. As there was no reported fishing activity in the northern shark fisheries during 2009/10, much of the following report is based on assessment of fishing returns submitted between 2006/07 and 2008/09. However, as only a few vessels reported fishing during those three years, annual catch and effort statistics cannot be reported separately and have been combined to ensure individuals' fishing activities cannot be identified.

### Governing legislation/fishing authority

Fisheries Notice no. 476 (Section 43 Order)  
 Fisheries Notice no. 602 (Section 43 Order)  
 Fisheries Notice no. 601 (Section 43 Order)  
 Offshore Constitutional Settlement 1995  
 Condition 127 and 129 on a Fishing Boat Licence  
 Other written authorities  
 Ministerial Exemption (WANCSF)

### Consultation processes

Department–Northern Shark Industry Association meetings  
 WA Fishing Industry Council and Recfishwest

### Boundaries

The WANCSF extends from longitude 114°06' E (North West Cape) to 123°45' E (Koolan Island), and the JANSF from longitude 123°45' E to the WA/NT border (Northern Shark Figure 1).

### Management arrangements

The commercial take of shark in Western Australian waters east of 123°45' E longitude is jointly managed by the Commonwealth Government and the State of Western Australia under an arrangement agreed through the Offshore Constitutional Settlement in February 1995. Under this arrangement, the State was given management responsibility for the JANSF on behalf of the WA Fisheries Joint Authority, whose members include the State and Commonwealth Ministers for Fisheries. Permitted fishing methods are demersal longlines and gillnets.

The solely Western Australian-managed sector of the northern shark fishery was closed by a Section 43 order under the *Fish Resources Management Act 1994* in 2005. Those subsequently permitted to fish in the WANCSF were restricted to approximately 40% of the fishery's previous area under a Ministerial Exemption. This exemption entitles the use of longlines with metal snoods and pelagic gillnets. Longlines are restricted to a maximum of 1,000 hooks and gillnets are limited to 2 kilometres maximum length, 160 – 185 mm stretched mesh size, and a maximum drop of 100 meshes. Additionally, gillnets must be attached to vessels at all times and may not come into contact with the seabed.

The WANCSF is now effectively zoned into three areas with separate levels of access. The area between North West Cape and a line of longitude at 120° E and all waters south of latitude 18° S has been closed indefinitely, primarily to protect the breeding stock of sandbar sharks. Operators are only allowed to fish in the area between 16° 23' S and 18° S latitude between 1 October and 31 January. Operators are allowed to fish in the remaining area (north of 16° 23' S latitude and between 120° and 123° 45' E longitude) throughout the year. A total of 200 gillnet fishing days and

## NORTH COAST BIOREGION

100 longline fishing days are permitted in the WANCSF, with no more than 100 of those days allowed in the southern area (i.e. between 16° 23' and 18° S latitude). All vessels operating in the WANCSF are required to report fishing activities via the Vessel Monitoring System (VMS) and daily logbooks.

Formal management arrangements have not been implemented in the JANSF and management arrangements for this fishery (and the associated WANCSF) have been a matter of ongoing dialogue between the State and Commonwealth. In April 2008 the JANSF's export approval under the EPBC Act was revoked due to the lack of formal management arrangements and concerns about the fishery's ecological sustainability. In February 2009 the Wildlife Trade Operation approval that allowed the export of products from the WANCSF expired and therefore, no product from either fishery can currently be legally exported.

Given that the majority of income from these fisheries has historically been generated by the export of shark fins, the ongoing economic viability of the northern shark fisheries is uncertain. The Department of Fisheries is currently reviewing future options for managing the WANCSF and is working with the Commonwealth Government to finalise a review of the JANSF.

### Research summary

Research to assess the status of northern shark stocks was initiated as an extension of research into the Demersal Gillnet and Demersal Longline fisheries operating in the South and West Coast Bioregions due to their targeting of the same stocks of dusky and sandbar sharks. A three-year FRDC-funded project that concluded in 2005 provided an age-structured demographic assessment of the status of the northern shark fisheries' then principal target species, the sandbar shark (*Carcharhinus plumbeus*) and an improved understanding of the fisheries and of northern shark stocks more generally. That research also confirmed that sandbar sharks taken in the Northern Shark Fisheries were the same unit stock as was being targeted in the West Coast Bioregion of the Temperate Demersal Gillnet and Demersal Longline Fisheries (TDGDLF). Additional information on these fisheries and others that take sharks as bycatch in the North Coast Bioregion was collected during a series of SEWPaC and FRDC-funded research projects to assess sustainability risks to Australia's tropical sharks and rays. Results from those projects have provided risk assessments for 75 elasmobranch species caught by 29 fisheries operating across the northern half of Australia and concluded that numerous species were at high risk of unsustainable exploitation by the WA northern shark fisheries.

Demonstrating the ecological sustainability of the northern shark fisheries is dependent on establishing robust estimates of sustainable harvest levels for target, byproduct and bycatch species. In particular, issues associated with blacktip sharks, sandbar shark and mackerel sustainability, as well as Threatened, Endangered and Protected (TEP) species interactions with pelagic gillnets require evaluation. Further research to estimate key biological parameters and fishing mortality rates for these and other species is required before any robust assessment of the fisheries' ecological

sustainability can be undertaken.

To support the fishery management arrangements introduced in 2005, improve assessments of key stocks and facilitate the more detailed reporting requirements of the fisheries' export accreditation under the EPBC Act, a new daily/trip catch and effort reporting system was introduced in 2006/07.

## Retained Species

### Commercial landings (season 2009/10)

**Northern Shark Fisheries: 0 tonnes**

**Other Commercial Fisheries: 0 tonnes**

### Average Commercial landings (season 2006/07-2008/09 combined):

#### Northern Shark Fisheries:

**Total sharks 78 tonnes**

**Sandbar shark 63 tonnes**

**Blacktip sharks 67 tonnes**

**Scalefish 3 tonnes**

The total shark catch by the northern shark fisheries decreased substantially from its peak of 1,294 t in 2004/05 as a result of the management arrangements introduced in 2005. Between 2006/07 and 2008/09, the mean annual shark catch was 278 tonnes, slightly lower than its long-term (1994/95-2005/06) mean level of 339 t. However, the northern shark fisheries' mean annual sandbar shark catch of 63 t over those 3 years was more than 3 times the level determined to be sustainable (see Stock Assessment section of Demersal Gillnet and Longline Fisheries Status Report). The mean annual blacktip shark catch of 67 t was similar to previous year's catches.

Sharks are also incidentally caught by other commercial fisheries operating in the Northern Bioregion. However, since sharks and rays were commercially protected in 2006, only two non-target shark fisheries are now authorised to retain shark catches in the North Coast Bioregion (Northern Demersal Scalefish<sup>1</sup> and Marine Aquarium Fish). In 2009/10, vessels licensed in those fisheries reported total landings of 4 t of sharks and rays from the area between North West Cape and the WA/NT border. It is expected that those fisheries' landings will remain at low levels in the future due to the limited marketability of sharks from those fisheries.

The northern shark fisheries have a small scalefish catch that is generally retained for sale. Most of the reported scalefish landings between 2006/07 and 2008/09 was caught by gillnets and included 6.2 t of grey mackerel, 1.3 t of estuary cod, 0.6 t of Spanish mackerel and 0.3 t of other mackerel. While such small catches are considered an insignificant risk to stock sustainability, the potential for a thirty-fold increase in pelagic gillnet effort and targeting of mackerel schools represent major sustainability risks. Additional measures to manage this byproduct will need to be developed if fishing resumes and pelagic gillnet effort escalates.

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<sup>1</sup> Within a 2 shark per trip limit.

**Recreational catch estimate:** Not assessed

### Commercial Fishing effort/access level

There was no reported fishing effort in the northern shark fisheries in 2009/10. Two or three vessels reported sporadic activity in the fisheries between 2006/07 and 2008/09, which amounted to approximately 47% of the fisheries' permitted longline effort and 3% of their permitted gillnet effort.

## Stock Assessment

**Assessment complete:** Yes

**Assessment method and level:**

**Sandbar shark:** Level 3 - Catch  
(relative to previous direct survey)

**Blacktip sharks:** Level 1 - Catch

**Breeding stock levels:**

**Sandbar shark:** Unacceptable

**Blacktip sharks:** Uncertain

For details of sandbar shark assessment, see Demersal Gillnet and Longline Fisheries Status Report.

The status of the multi-species northern Australian blacktip shark stock complex was previously assessed using an age-structured model and time-series of CPUE data from various Australian and Taiwanese-operated fisheries that have targeted them since the 1970s. However, that assessment did not provide specific advice on the status of Western Australian stock components and the reliability of the catch, effort and biological data upon which the model relies is questionable. Assessing the status of these stocks is further complicated by the cryptic impacts of illegal foreign fishing, unreported catches in domestic fisheries and uncertainty in the species composition of catches. Given these issues, previous estimates of a 2,000 tonne per year maximum sustainable yield are considered unreliable for assessment of the Western Australian blacktip stock.

Assessing the status of other North Coast Bioregion shark stocks is also complicated by poor species identification in catch returns prior to 2000 and a general lack of biological information. Thus, monitoring the status of other northern shark stocks will rely on analyses of reported catches and catch rates from the target commercial fisheries and, increasingly from a ten-year time series of fishery-independent survey data. Although between 2006/07 and 2008/09 the nominal commercial fisheries CPUE of tiger and hammerhead sharks were at their highest levels since the late 1990s, these rates were derived from relatively small catches and limited effort. Thus, previous declines of 78% and 84% in their respective CPUE between the late 1990s and mid 2000s, remain of concern.

## Non-Retained Species

**Bycatch species impact:** Low

There has previously been some observed discarded bycatch of unsaleable sharks, rays and scalefish in these fisheries

although the magnitude of this bycatch cannot be reliably assessed. Although risks to other scalefish species were previously rated as low to negligible during the ESD risk assessment process, these assessments would require reevaluation if levels of pelagic gillnet fishing effort escalate above historical levels.

## Protected species interactions

**(Longline only)**

**Low**

The northern shark fisheries were rated as having a generally low risk of interacting with TEP species through the ESD risk assessment process. However, as this assessment was based on the majority of fishing effort being applied by longlines, these interactions will need to be reassessed if levels of pelagic gillnet fishing effort escalate above historical levels. Previous ESD risk assessments for individual TEP species groups in the northern shark fisheries are discussed with reference to contemporary data below.

**Sharks and rays:** Because the northern shark fisheries generally operate some distance offshore, they pose a negligible risk to spartooth sharks (*Glyphis garricki* and *G. glyphis*) and sawfish (Pristidae), which have primarily inshore, estuarine and riverine distributions. The closure of the south western portion of the WANCSF is expected to reduce the risk of interactions with white sharks (*Carcharodon carcharias*) and grey nurse sharks (*Carcharias taurus*) as these species have primarily temperate and sub-tropical distributions. Whale sharks (*Rhincodon typus*) are extremely unlikely to be caught by demersal longlines.

**Turtles:** No turtle captures have either been observed or reported in the northern shark fisheries.

**Billfish:** The small observed bycatch of billfish by demersal longlines in the northern shark fisheries was assessed as being insufficient to impact breeding stocks. This level of bycatch is unlikely to increase given the restrictions on longline fishing effort.

**Cetaceans:** As almost all northern shark fishery effort prior to 2005/06 was applied by demersal longlines, the risk of interaction with cetaceans was previously assessed as negligible.

## Ecosystem Effects

**Food chain effects:**

**Negligible**

Given the small shark catches intended under current effort restrictions, the associated risk of any detrimental food chain effects is likely to be negligible. However, given the long recovery times expected for overexploited stocks of long-lived sharks, such as sandbar sharks (and possibly other species, eg. tiger and hammerhead sharks), unassessed residual trophic effects may persist for decades. It may also be necessary to reassess this risk if higher levels of fishing effort resume.

**Habitat effects:**

**Negligible**

The principal types of fishing gear that may be used to target sharks in the region are set so that they either do not or only unintentionally come into contact with the seabed, and their physical impact on the seabed is therefore considered to be

## NORTH COAST BIOREGION

minimal. Fishing is now constrained to a smaller area than in 2005 and the concurrent reduction in overall effort capacity is likely to have reduced the risk of habitat effects further.

### Social Effects

**Direct:** Northern shark fishing vessels reported crews of between 3 and 5 in 2008/09. However, as only two or three fishing vessels have operated for a few months each year, these fisheries represent a part time source of employment.

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

### Economic Effects

#### Estimated annual value (to fishers)

<b>For 2006/07 - 2008/09</b>	<b>\$2.2 million</b>
<b>Shark and scalefish</b>	<b>\$1.1 million</b>
<b>Shark fin*</b>	<b>\$1.1 million</b>
<b>For year 2009/10</b>	<b>\$0</b>

\*As fishers do not separately identify the weight of shark fins in catch returns, fin weight was calculated at an average of 3% of sharks' whole weight and value was estimated using an average price of \$45/kg. Categories of shark which do not have saleable fins were excluded from fin valuation.

### Fishery Governance

#### Target effort range:

- < 600 gillnet days (1,200 km gillnet days)
- < 300 longline days (300,000 hook days)

#### Target catch range:

**Sandbar sharks:** < 20 tonnes

#### Current fishing (or effort) level:

**Effort:** Acceptable (2009/10)

**Sandbar shark catch:** Acceptable (2009/10)

There was no reported fishing effort in the northern shark fisheries in 2009/10 and total fishing effort was significantly lower and more sporadic between 2006/07 and 2008/09 than

prior to 2005/06 (Northern Shark Figure 2). The few vessels that have been active since 2005/06 reported using 516 (57%) of the 900 permitted longline fishing days and 59 (3%) of the permitted 1800 gillnet fishing days between 2006/07 and 2008/09. As operators generally reported using less than the maximum permitted amount of fishing gear (i.e. 1,000 longline hooks or 2,000 m of gillnet), 47% of the 900,000 permitted hook days and 3% of the 3,600 permitted km gillnet days were used during these three years.

Although total shark catches have declined significantly from their 2004/05 peak of 1,294 tonnes, the mean annual sandbar shark catch of 63 tonnes between 2006/07 and 2008/09 far exceeded the upper target limit of 20 tonnes (Northern Shark Figure 2 and 3). As breeding biomass of the sandbar stock is likely to be at the minimal acceptable limit reference point (at least 40% of unfished biomass) and possibly continuing to decline (see Demersal Gillnet and Longline Fisheries Status Report), recent excessive catches of this species in the northern shark fisheries were unacceptable.

#### New management initiatives (2010/11)

Future management arrangements for the JANSF and the WANCSF are the subject of continuing discussion between the State and Commonwealth.

### External Factors

The primary external factor affecting the northern shark fisheries is the withdrawal and expiry of their export approvals under the Commonwealth Government's EPBC Act. Development of demonstrably ecologically sustainable management arrangements required for the fisheries' re-approval is hampered by a lack of contemporary pelagic gillnet data in the North Coast Bioregion and other factors beyond the WA fisheries' control including: Illegal, Unregulated and Unreported (IUU) shark catches; cross-jurisdictional catches of target and byproduct stocks and long-term impacts on the breeding stock of sandbar sharks, the latter being critical to the sustainability of West Coast Demersal Gillnet and Demersal Longline Fishery catches (see Demersal Gillnet and Longline Fisheries Status Report).

#### Contributors

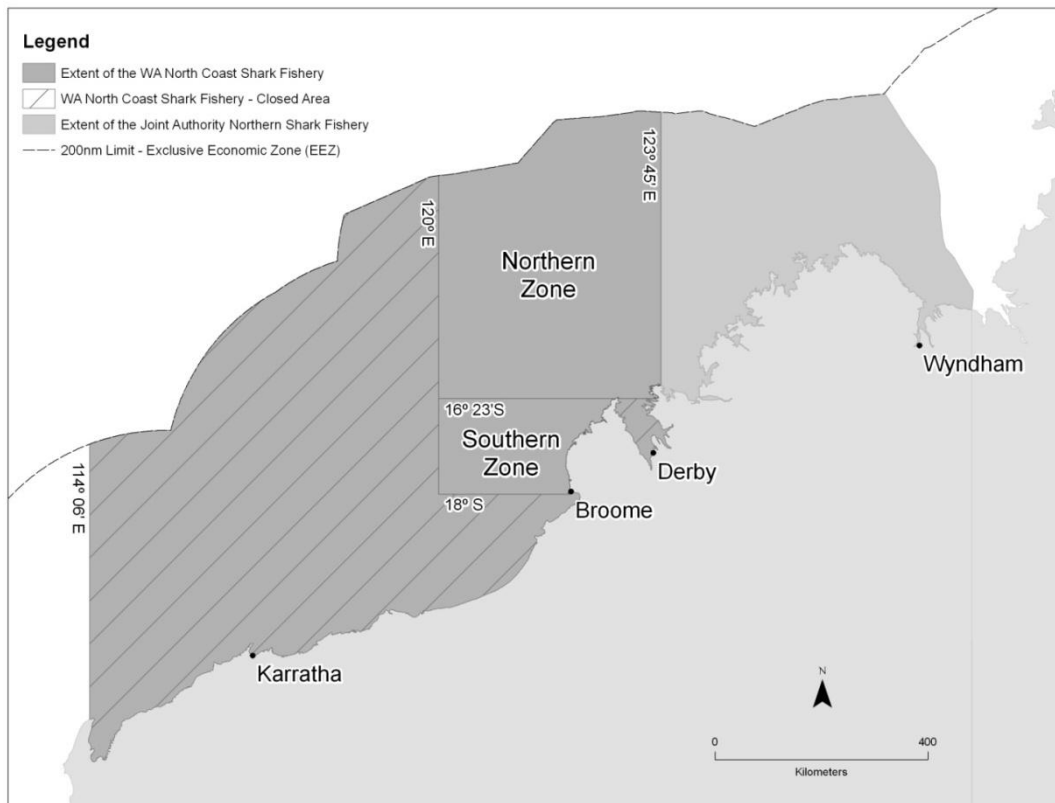
R. McAuley and N. Sarginson.

**NORTHERN SHARK TABLE 1**

Northern shark fisheries' (WANCSF and JANSF) elasmobranch catch from 2006/07 to 2008/09. Data are amalgamated across these three years due to the confidentiality of records from the small number of vessels that were active in the fisheries in those years.

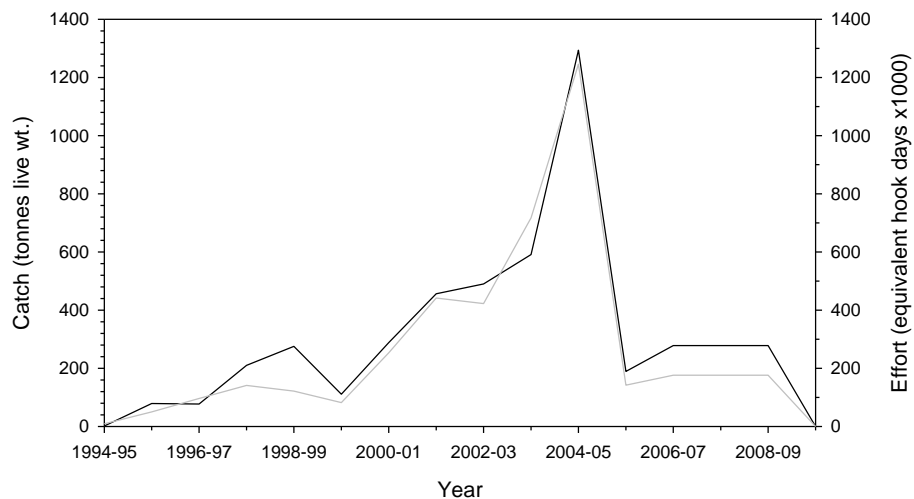
Name	Species or taxon	2006/07 - 2008/09 catch (tonnes)	
		Total	Mean annual
Blacktip shark	<i>Carcharhinus</i> spp.	202.0	67.3
Sandbar shark	<i>Carcharhinus plumbeus</i>	188.5	62.8
Pigeye shark	<i>Carcharhinus amboinensis</i>	138.4	46.1
Tiger shark	<i>Galeocerdo cuvier</i>	103.1	34.4
Hammerhead sharks	Sphyrnidae	82.9	27.6
Lemon shark	<i>Negaprion acutidens</i>	45.4	15.1
Spot-tail shark	<i>Carcharhinus sorrah</i>	36.2	12.1
Dusky shark	<i>Carcharhinus obscurus</i>	10.4	3.5
Shovelnose rays	Rhinobatidae, Rhynchobatidae	8.5	2.8
Other elasmobranchs		18.9	6.3
<b>Total elasmobranchs</b>		<b>834.4</b>	<b>278.1</b>
Grey mackerel	Scomberomorus	6.2	2.1
Cod	Serranidae	1.3	0.4
Spanish mackerel	<i>Scomberomorus commerson</i>	0.6	0.2
Mackerel, other	Scombridae	0.3	0.1
Other scalefish	Teleostii	0.7	0.2
<b>Total scalefish</b>		<b>9.1</b>	<b>3.0</b>

## NORTH COAST BIOREGION



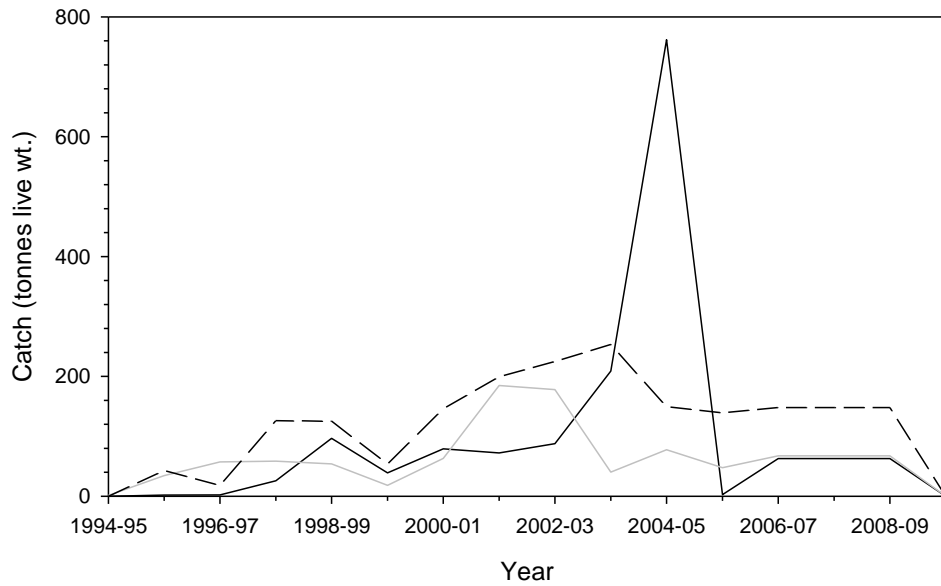
### NORTHERN SHARK FIGURE 1

Management boundaries of the WA northern shark fisheries



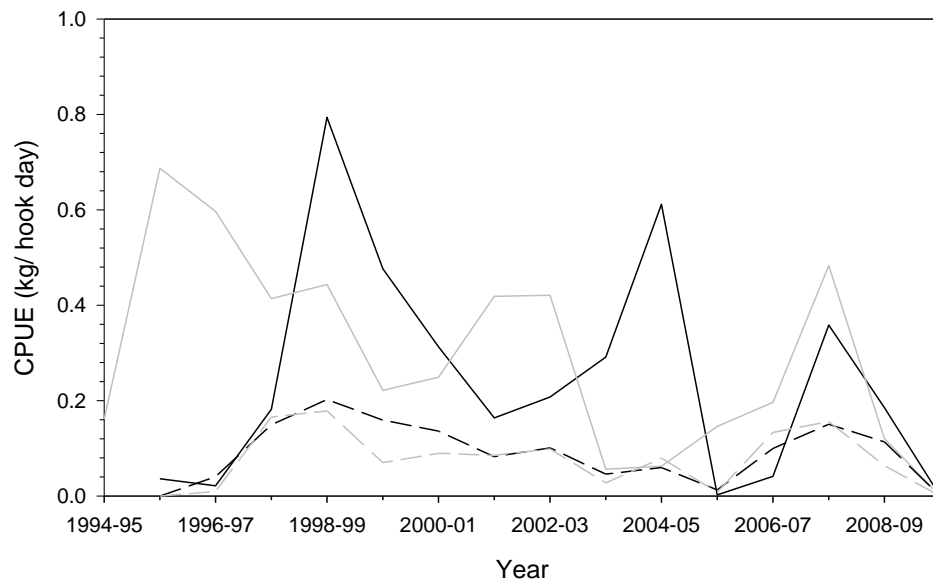
### NORTHERN SHARK FIGURE 2

Total annual elasmobranch landings and standardised fishing effort (WANCSF and JANSF), 1994/95 – 2009/10. Black line is catch (tonnes estimated live weight) and grey line is standardised total fishing effort (thousand hooks). Data from 2006/07 – 2008/09 have been averaged due to the confidentiality of records from the small number of vessels that were active in the fisheries in those years.



### NORTHERN SHARK FIGURE 3

Annual catches (tonnes estimated live weight) of indicator and other shark species by the northern shark fisheries (WANCSF and JANSF), 1994/95 – 2009/10. Solid black line is for sandbar shark, grey line is blacktip sharks and dashed black line is other sharks. Data from 2006/07 – 2008/09 have been averaged due to the confidentiality of records from the small number of vessels that were active in the fisheries in those years.



### NORTHERN SHARK FIGURE 4

Nominal Catch Per Unit Effort (CPUE) of indicator and secondary target shark species in the northern shark fisheries, 1994/95 – 2009/10. Solid black line is sandbar shark, solid grey line is blacktip sharks, dashed black line is tiger shark and dashed grey line is hammerhead sharks.



# Pearl Oyster Managed Fishery Status Report

## Main Features

### Status

Stock level	Acceptable
Fishing level	Acceptable

### Current Landings

Commercial Pearl Oyster Catch	
Shell numbers (All Zones) -	394,947 culture shells

## Fishery Description

The Western Australian pearl oyster fishery is the only remaining significant wild-stock fishery for pearl oysters in the world. It is a quota-based, dive fishery, operating in shallow coastal waters along the North-West Shelf.

The harvest method is drift diving, in which six to eight divers are attached to large outrigger booms on a vessel and towed slowly over the pearl oyster beds, harvesting legal-sized oysters by hand as they are seen. The species targeted is the Indo-Pacific, silver-lipped pearl oyster (*Pinctada maxima*) which are collected mainly for use in the culture of pearls.

### Governing legislation/fishing authority

Pearling Act 1990

Pearling (General) Regulations 1991

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

### Consultation process

Meetings between the Department of Fisheries and industry

### Boundaries

The fishery is separated into 4 zones (Pearl Figure 1), as follows:

**Pearl Oyster Zone 1:** NW Cape (including Exmouth Gulf) to longitude 119°30' E. There are 5 licensees in this zone.

**Pearl Oyster Zone 2:** East of Cape Thoun (118°20' E) and south of latitude 18°14' S. The 9 licensees in this zone also have full access to Zone 3.

**Pearl Oyster Zone 3:** West of longitude 125°20' E and north of latitude 18°14' S. The 2 licensees in this zone also have partial access to Zone 2.

**Pearl Oyster Zone 4:** East of longitude 125°20' E to the Western Australia/Northern Territory border. Although all licensees have access to this zone, exploratory fishing has shown that stocks in this area are not economically viable. However, pearl farming does occur.

There is also a 'buffer zone', which may be accessed by licensees from Zones 1 and 2; in practice, it is generally only utilised by Zone 1 licensees.

### Management arrangements

The Western Australian pearling industry comprises three main components: the collection of pearl oysters from the wild; production of hatchery-reared pearl oysters; and grow-out of pearls on pearl farm leases. Quota limits are set for the take of pearl oysters from the wild to ensure the long-term sustainability of the resource.

In 1996 the WA Government granted hatchery options to licensees as part of an incentive program to encourage them to adopt new technology that enabled the production of pearls from oysters reared in hatcheries, thus reducing the reliance on the wild stocks of pearl oysters. Hatchery bred oysters are now a major component of pearl production in Western Australia.

The pearl oyster fishery is managed primarily through output controls in the form of a total allowable catch (TAC) divided up into individual transferable quotas (ITQs). There are 572 wild-stock ITQ units allocated across three management zones (Zone 1 – 115; Zone 2 – 425; Zone 3 – 32) and 350 hatchery ITQ units allocated amongst 14 pearling licensees.

The value of a hatchery quota unit is 1,000 shell. The value of wild-stock quota units varies, depending on status of wild stocks, but historically has been about 1,000 shell per unit when pearl stocks are at normal levels. However, wild stock quota units for Zone 2/3 for the 2010 season were set at 3,200 shell (TAC: 1,500,000), as result of high stock levels (Pearl Table 1).

Wild stocks are reviewed each year by the Department of Fisheries to enable the TAC to be set for each zone of the fishery. There is a minimum legal size of 120 mm shell length, and maximum legal sizes and area-specific TACs have been set where appropriate, for example in Exmouth Gulf in Zone 1.

A comprehensive ESD assessment of this fishery has been undertaken to identify any potential sustainability risks requiring direct management. The only issue identified through this process related to the breeding stock levels of pearl oysters. Boxed text in this status report provides the annual assessment of performance for this issue.

### Research summary

Current stock assessment research is focused on:

- Stock assessment using catch and effort statistics (taking

into account discard rates) and settlement and length-frequency sampling to estimate the total allowable catch.

- Monitoring an index of settlement for predicting future years catch levels 4 – 6 years ahead using the relative number of piggy back spat.
- Research on decision rules for determining the TAC
- Understanding environmental drivers of pearl oyster abundance

The Department of Fisheries' Research Division's Fish Health Unit also provides a comprehensive disease-testing program to the industry.

There are several other significant research projects being carried out by the pearling industry focusing on environmental management, pearl oyster health, and improved health and safety for pearl divers. The main aims of this research are to:

- Investigate aspects of oyster oedema disease (OOD) in *Pinctada maxima*, to assist in mitigating the impacts and understand pathways to disease and disease response in pearl oysters;

## Retained Species

### Commercial landings (season 2010):

**397,947 oysters**

In 2010, the number of wild-caught pearl oysters was 397,947 (Pearl Tables 1 and 2). The TAC for the pearl oyster fishery was 1,500,000, thus only 26% of the TAC was caught, as this was the quantity required under current market conditions. This represents an increase on the 260,002 oysters caught in 2009 and reflects the improved economic conditions and return of buyers in the market after the Global Financial Crisis (GFC).

As for 2009, Zone 2 was the only area fished, for a total of 397,947 oysters (Pearl Table 1). From this total, Mother of Pearl (MOP) was fished for the first time since 1986 with a total of 12,677 shells. MOP were generally fished offshore in deeper waters at an average depth of 30m, thus increasing the overall average depth fished (Pearl Table 1). There has been no fishing in Zone 1 or Zone 3 since 2008 (Pearl Table 2).

### Fishing effort/access level

Total effort was 4,447 dive hours (Pearl Tables 1 and 2), an increase of 26% from the 2009 effort of 3,285 hours. Of this, 117 hours was applied to MOP diving.

## Stock Assessment

**Assessment complete:** Yes

**Breeding stock levels:** Acceptable

A stock assessment of the *Pinctada maxima* fishery was undertaken for the 2010 fishing season based on catch and effort statistics, settlement analysis (28,871 shell sampled for 'piggyback' spat to obtain estimates of age 0+ and 1+ relative abundance), length-frequency sampling (8,602 shells

measured), shell discard rates by size and location, population surveys, and an evaluation of the predictive capacity of 0+ and 1+ spat settlement data.

These were used to generate trends in stock indicators, from which the determination of the TAC for 2010 was undertaken. Results for each zone, and issues relevant to stock sustainability, were as follows:

**Zone 2/3:** The catch rate achieved by the fishery is an indicator of the abundance of the 3/4 to 6/7-year-old oysters specifically targeted for pearl production. Year-to-year variations reflect changes in recruit abundance, while the long-term trend in catch per unit effort (CPUE) involves an element of effort efficiency change. In 2010, CPUE was 89 shells per dive hour which was the highest since this times series began in 1979 and a 11% increase from the 2009 catch rate (79 shells/hour – Pearl Table 1). While the reduced effort would contribute to the high CPUE, it indicates that stock levels are at an all time high.

**Catch Prediction:** Recruitment to the fishery is predicted by the piggyback spat abundance index at 4 to 6 years prior to the current fishing year. A very high 0+ recruitment detected in the Zone 2 fishery in 2005 was confirmed in the 1+ year class in 2006, and again in the 2+ age class from population surveys in 2007. This cohort entered the commercially fished population between 2009 and 2011 resulting in the highest CPUE for over 30 years.

The 2011 stock abundance in Zone 2 was predicted to be lower than 2010, but with an additional large residual stock left over from uncaught TAC in 2009 and 2010. To account for this, the 2011 TAC in Zone 2/3 was increased slightly to 1,600,000 (3,500 shell per unit). This is 250 % above the baseline level of 1,000 shell per unit (Pearl Table 1).

**Zone 1:** The Zone 1 fishery has not been fished for three years.

**Breeding stock:** Under average growth and mortality, recruitment into the pearl oyster breeding stock exceeds natural mortality, and hence breeding stocks are likely to be increasing in most years. This results from the 'gauntlet' fishing strategy employed by the industry, in which the young, fast-growing shell (principally males) of 120 – 165 mm shell length are targeted for their fast pearl-producing qualities.

Animals that survive this 'gauntlet' are effectively protected from 6 to 7 years of age onward, and may live for another 15 to 20 years. With very low natural mortalities, this results in a large residual broodstock being built-up over time. In Zone 1, breeding stock should also be increasing due to the low effort since 2002, including no fishing in 2004, 2009 and 2010 (Pearl Table 2).

*The performance measures for this fishery, which relate to breeding stock biomass, include the area of fishing compared to the distribution of the stock and the catch rates of young oysters within each of the fishing zones.*

*All performance measures were met for 2010. The area of fishing remains substantially less than 60% of the distribution of oysters within this region. The catch rates in Zones 2 and 3 were both still above their respective performance levels, with a combined catch rate of 89 oysters/hour.*

## NORTH COAST BIOREGION

### Non-Retained Species

**Bycatch species impact:** Negligible

Divers have the ability to target pearl oysters of choice (species, sizes and quality of *P. maxima*). Pearl oysters brought to the vessel after hand collection are young and have relatively little epiphytic growth (fouling organisms). A small number of over-sized or under-sized oysters are returned to the substrate.

**Protected species interaction:** Negligible

There is no interaction between the pearl oyster fishing operation and protected species.

### Ecosystem Effects

**Food chain effects:** Negligible

The fishery removes only a small proportion of the biomass of pearl oysters on the fishing grounds and is considered to have negligible impact on the food chain in the fishing area.

**Habitat effects:** Negligible

Pearl divers have minimal contact with the habitat during fishing operations. The main habitat contact is by pearl oysters held in mesh panels on holding sites following capture. However, these sites cover a very small proportion of the habitat and the activity concerned is unlikely to cause any lasting effect.

Similarly, the pearl farming operation, which uses longline systems in areas of high tidal flow to culture pearls, has limited impact on the environment. Physical effects are limited to static anchoring systems in typically sand/mud habitats. Environmental management research (see 'Research summary') has found categorically that pearl farming has negligible impacts on habitat and environment.

### Social Effects

**Direct:** Pearl oyster fishing vessels operate from the Lacepede Islands north of Broome to Exmouth Gulf in the south. The number of vessels in the fishing fleet has been slowly reducing from 16 in 1997 (overall), mostly due to increased fleet efficiency and increased reliance on hatchery-produced shells. In 2009, with the negative impact of the GFC on the industry, only two vessels fished. Number of vessels fishing increased to 4 in 2010, with the GFC abating.

Most vessels presently operate 10 – 14 crew for the fishing of pearl oysters between March and June each year. These vessels also support a number of other pearl farm functions throughout the year.

**Indirect:** Prior to the GFC, the pearling industry provided employment for approximately 500 people in the northern coastal regions, including in the operation of the pearl farms. However the impact of the GFC resulted in a substantial reduction in personnel employed in the pearling industry.

### Economic Effects

**Estimated annual value (to fishers)**

**2010 (Total Industry value):** \$99 million

A precise estimate of the total industry value is difficult to achieve, owing to the variable time lags that occur between harvesting and sale to offshore buyers, and the costs incurred in marketing before sales take place. Based on information provided by the industry, the value of cultured pearls and by-products in 2010 was considered to be approximately \$99 million, which is \$14 million more than 2009.

### Fishery Governance

**Target effort range:** 14,071 - 20,551 hours

The target effort range relates to the time required to achieve the TAC in the pearl oyster fishery of 1,555,000 oysters in 2010 (1,500,00 oysters in Zone 2/3, and 55,000 oysters in Zone 1).

Acceptable effort ranges for individual management zones are 11,456 – 15,819 dive hours for Zone 2/3 and 2,615 – 4,732 dive hours for Zone 1. These ranges are based on the 5-year period (1994 – 1998) following the introduction of global positioning systems (GPS) into the fishery, and reflect the typical variation in abundance of the stock under natural environmental conditions.

Zone 2/3 of the pearl oyster fishery achieved its catch with 4,447 dive hours of effort (Pearl Table 1), which was well below the target range. The low effort was the result of only 26% of the TAC being caught, which was a consequence of cost-restraint within the industry deriving from GFC.

Zone 1 of the pearl oyster fishery was not fished in 2010 (Pearl Table 2).

**Current effort level:** Acceptable

Overall fishery effort level is acceptable, but current levels reflect market issues and not stock abundance.

#### New management initiatives (2011)

The Department is working with industry to rationalise the legislation that is currently used to regulate the pearl oyster wildstock fishery and incorporate it into the broader managed fishery legislation framework.

### External Factors

The pearl oyster stocks underpinning the fishery in Zone 2/3 continue to provide a sufficient level of production to support this major Western Australian industry, however preliminary research points to environmental factors being an external driver of the current high abundance. The industry will continue to experience difficulty from the Global Financial Crisis, which had a major impact on the market for luxury goods, including pearls. The low catch and effort between 2009 and 2011 are a direct result of companies opting not to fish because of this. Future signs for 2012 suggest a recovery and overall catches are expected to be higher. Finally, the on-going issue of the OOD (oyster oedema disease) continues to hamper hatchery-production capacity in some sectors of the Industry, however to date there is no evidence the disease has affected wild stocks.

#### Contributors

A. Hart and D. Murphy.

**PEARL TABLE 1**

Pearl shell catch and effort – Broome area (Zone 2/3).

Year	Wild stock quota	No. of culture shells	No. of MOP <sup>1</sup> shells	Total shells	Dive hours	Culture shells/hr	Average depth	Total shells/hr
1979		371,806	355,599	727,405	16,068	23.1		45.3
1980		364,502	260,714	625,216	18,568	19.6		33.7
1981		481,193	210,649	691,842	23,320	20.6		29.7
1982	460,000	439,092	132,931	572,023	15,710	27.9		36.4
1983	520,000	365,381	87,049	452,430	19,019	19.2		23.8
1984	375,000	242,828	47,230	290,058	11,615	20.9		25
1985	342,000	272,869	53,831	326,700	12,423	21.0		26.3
1986	360,000	337,566	10,929	348,495	16,478	20.5		21.2
1987	380,000	365,397	0	365,397	17,476	20.9		20.9
1988	445,000	379,657	0	379,657	14,600	26.0		26.0
1989	445,000	445,364	0	445,364	18,625	23.9		23.9
1990	457,000	453,705	0	453,705	23,263	19.5	15.3	19.5
1991	457,000	460,608	0	460,608	21,657	21.3	16.1	21.3
1992	457,000	461,599	0	461,599	19,455	23.7	13.9	23.7
1993	457,000	457,186	0	457,186	14,733	31.0	15.7	31.0
1994	457,000	456,832	0	456,832	12,384	36.9	11.4	36.9
1995	512,000	511,633	0	511,633	12,217	41.9	12.4	41.9
1996	512,000	511,756	0	511,756	12,774	40.1	16.8	40.1
1997	512,000	512,314	0	512,314	16,893	30.3	12.9	30.3
1998	457,000	457,266	0	457,266	14,499	31.5	12.6	31.5
1999	457,000	457,842	0	457,842	10,300	44.4	11.6	44.4
2000	502,500	501,419	0	501,419	9,258	54.2	11.2	54.2
2001	502,500	502,484	0	502,484	12,054	41.7	12.1	41.7
2002	479,750	479,562	0	479,562	15,661	30.6	13.4	30.6
2003	457,000	456,988	0	456,988	14,242	32.1	13.6	32.1
2004	457,000	404,984	0	404,984	11,994	33.8	12.3	33.8
2005	502,500	488,303	0	488,303	14,807	32.9	12.1	32.9
2006	502,500	467,436	0	467,436	11,992	39.0	13.7	39.0
2007	548,400	550,972	0	550,972	12,514	44.0	12.9	44.0
2008	822,600	810,115	0	810,115	15,387	52.6	14.7	52.6
2009	1,005,400	260,002	0	260,002	3,285	79.2	11.4	79.2
2010	1,500,000	397,947	12,677	385,270	4,447	89.0	14.9	89.4
<b>2011</b>	<b>1,600,000</b>							

Notes: Total catches exceeding quota are a result of fisher shell tally error and the collection of broodstock shell being included as part of culture shell tallies. <sup>1</sup> 'MOP' is an abbreviation for mother-of-pearl; <sup>2</sup> wild stock quota in 2008 initially set at 639,800 (see SOF 2007 report), however a mid-season review increased it to 822,600 because of enhanced stock abundance

## NORTH COAST BIOREGION

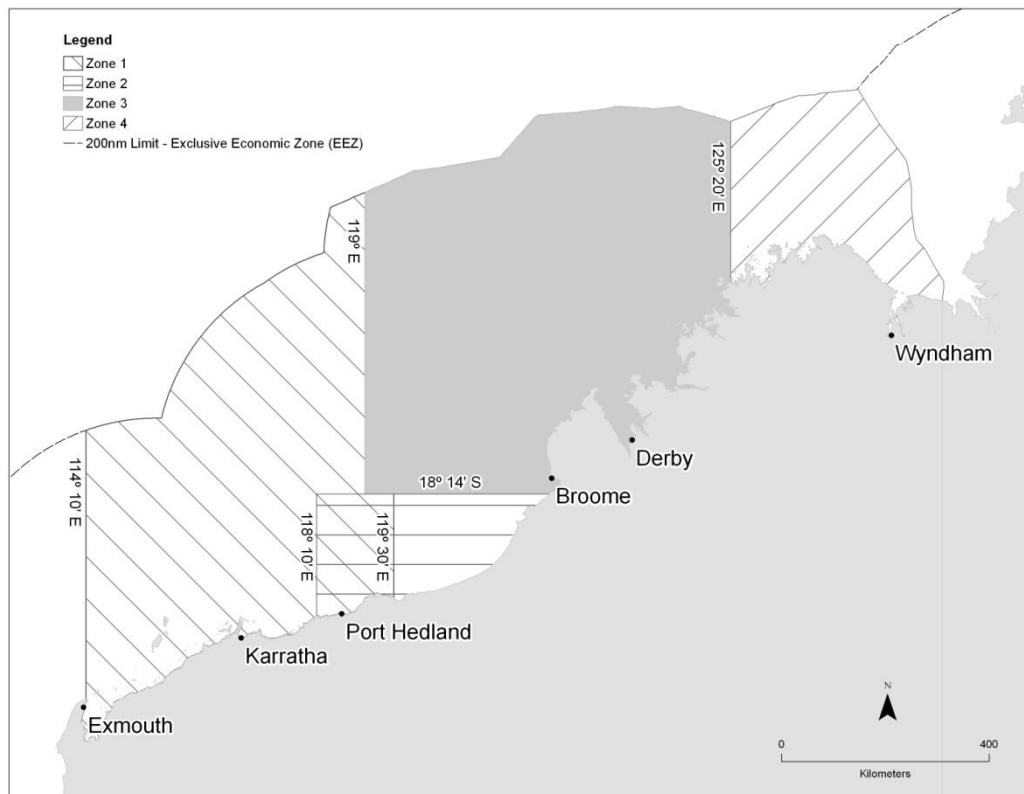
### PEARL TABLE 2

Pearl shell catch and effort in Zone 1 since 1983.

Year	Wild stock quota	No. of culture shells	Dive hours	Culture shells/hr
1983		27,895	542	51.5
1984		45,690	827	55.3
1985	55,000	46,009	897	51.3
1986	55,000	39,663	1,104	35.9
1987	55,000	46,269	1,194	38.7
1988	55,000	43,046	1,243	34.6
1989	55,000	52,937	1,010	52.4
1990	55,000	43,711	1,146	38.1
1991	55,000	63,774	1,681	37.9
1992	55,000	53,386	1,266	42.2
1993	115,000	79,465	2,395	33.2
1994	115,000 <sup>1</sup>	132,316 <sup>2</sup>	6,291	21.0
1995	115,000 <sup>1</sup>	121,312 <sup>2</sup>	6,247	19.4
1996	115,000 <sup>1</sup>	80,163	5,013	16.0
1997	115,000 <sup>1</sup>	110,348	9,494	11.6
1998	115,000	108,056	6,094	17.7
1999	115,000	90,414 <sup>3</sup>	4,789	18.9
2000	115,000	66,772	5,893	11.3
2001	115,000	68,931	9,480	7.3
2002	55,000	29,126	2,729	10.7
2003	45,000 <sup>4</sup>	22,131	1,647	13.4
2004	45,000 <sup>4</sup>	0 <sup>5</sup>	0 <sup>5</sup>	
2005	55,000 <sup>6</sup>	25,572	1,084	23.6
2006a	55,000 <sup>7</sup>	36,546	1,343	27.2
2006b	35,000 <sup>7</sup>	34,900	349	100
2007	55,000	49,686	2,138	23.0
2008	55,000	10,092	398	25.3
2009	55,000	0	0	
2010	55,000	0	0	
2011	55,000			

Notes next page:

1. A developmental period was introduced into the fishery from 1993 to 1997 to encourage hatchery production technology. The main undertakings were the introduction of 3 new Zone 1 pearl industry licences, and an increase in TAC of pearl shell in Zone 1 (from 55,000 to 115,000 shell).
2. Management arrangements in 1994 and 1995 allowed fishing of quota a year ahead.
3. Hatchery stock used since 1999 has reduced the need for wild-stock shell between 1999 and 2005.
4. In 2003 and 2004, the 115,000 Zone 1 quota was still maintained, however only 45,000 could be caught from wild stock due to hatchery shell substitution.
5. In 2004, no wild-stock quota was taken as only hatchery oysters were used.
6. Post 2005, the wild-stock quota for management and compliance purposes was returned to its long-term sustainable level of 55,000.
7. A higher TAC in 2006 was the result of an additional 35,000 experimental quota (2006b) allocated for a lightly-exploited stock within a pearl farm lease, and 34,900 of this quota was caught in 349 dive hours at a CPUE of 100 shells per hour. The remainder was caught at 27.2 shells per hour.



## PEARL FIGURE 1

Distribution of pearl oyster stocks and fishing zones in Western Australia.

# Beche-de-mer Fishery Status Report

## Main Features

Status		Current Landings	
Stock level	Acceptable	Total Catch	121 t
Fishing level	Acceptable	<i>Actinopyga echinites</i> – Redfish	86 t
		<i>Holothuria scabra</i> – Sandfish	35 t

## Fishery Description

Beche-de-mer, also known as ‘sea cucumbers’ or trepang, are in the Phylum Echinodermata, Class Holothuroidea. They are soft-bodied, elongated animals that usually live on the seafloor or buried in sand or mud bottoms.

The Western Australian beche-de-mer fishery is based in the northern half of the State, from Exmouth Gulf to the Northern Territory border. It is a hand-harvest fishery, with animals caught principally by diving, and a smaller amount by wading. There are six commercial target species in Western Australia; prior to 2007 it was essentially a single species fishery, with 99% of the catch being sandfish (*Holothuria scabra*). Since then, an additional species (deepwater redfish - *Actinopyga echinites*) has been targeted and the fishery is now a two species fishery.

### Governing legislation/fishing authority

Fisheries Notice no. 366 – Prohibition for commercial fishers unless otherwise endorsed for shellfish, coral, starfish, urchins and beche-de-mer

Instrument of Exemption (Section 7(3)(c) of the *Fish Resources Management Act 1994*)

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

### Consultation process

Department-industry meetings and an annual Broome Consultative Forum.

### Boundaries

The beche-de-mer fishery is permitted to operate throughout Western Australian waters with the exception of a number of specific closures around the Dampier Archipelago, Cape Keraudren, Cape Preston and Cape Lambert, the Rowley Shoals and the Abrolhos Islands.

### Management arrangements

The developing fishery for beche-de-mer is managed through input controls including limited entry, maximum number of divers, species-dependent minimum size limits, and gear

restrictions. Access to the fishery is limited to the 6 Fishing Boat Licence holders listed in the Instrument of Exemption enabling the take of beche-de-mer.

Beche-de-mer may only be harvested by hand or diving by licensed commercial fishers operating under the authority of a Fishing Boat Licence that is listed on the Instrument of Exemption.

The maximum number of divers (per endorsed fishing boat licence) allowed to dive for beche-de-mer at any one time is four, with a maximum number of six crew allowed on the vessel.

There are six target species of beche-de-mer harvested in Western Australia. At present, the minimum target lengths for these commercial beche-de-mer species are based on the Northern Territory’s minimum sizes, which have been set based on size at sexual maturity.

A comprehensive ESD assessment of this fishery has been undertaken to identify any potential sustainability risks requiring direct management. The only issue identified through this process related to the breeding stock levels of beche-de-mer. Boxed text in this status report provides the annual assessment of performance for this issue.

### Research summary

Current research is focused on reporting of annual catch and effort statistics. A daily catch and effort logbook has been tested and designed for the fishery and was implemented in 2007. The logbook obtains species-specific, fine-scale catch and effort data and appropriate environmental information, such as depth fished.

## Retained Species

### Commercial landings (season 2009):

**121 tonnes (live weight)**

### Landings

In 2010 the total beche-de-mer catch was 121 t live weight (Beche-de-mer Table 1), a decrease of 6% over last years catch of 129 t, mainly due to less catch from the newly developing redfish fishery, although catch increased in the traditional sandfish fishery.

On a species-specific level, the 121 t catch was made up of 35 t (29%) *Holothuria scabra* and 86 t (71%) *Actinopyga echinites* (Beche-de-Mer Figure 1). This is the fourth year that *A. echinites* has been caught in high numbers and represents a continued new target species within the fishery.

### Fishing effort/access level

Similar to the last three seasons (2007-09), only 2 licensed vessels fished for beche-de-mer in 2010. This represents 33% of the potential number of vessels that have an endorsement to fish.

Total effort was 1053 hours fished – about 25% lower than in 2009 and approximately 40% below the average of the last 6 years (Beche-de-mer Table 1). A total of 754 hours was spent on sandfish, and 299 hours on Redfish (Beche-de-mer Table 1). The effort is spatially separate as these species occupy different habitats.

## Stock Assessment

**Assessment complete:** Yes

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

**Breeding stock levels:** Adequate

The overall catch rate for beche-de-mer (diving only in 2010) was 115 kg/hour, which is the highest in the history of the fishery. The principal reason for this was the continued development of a new target species (deepwater redfish), which had a CPUE of 289 kg/hour. There was also a higher catch rate in the existing sandfish fishery (46 kg/hour), associated with reduced fishing for this species over the last 3 years (Beche-de-mer Figure 1).

Estimates of Maximum Sustainable Yield (MSY) of sandfish were obtained for the entire WA fishery and Kimberley sub-regions using a biomass dynamics model. Current average catch of sandfish is below the MSY (Beche-de-mer Table 2), indicating that the level of fishing is sustainable. However, large variability in the estimates of  $q$  (0.21 – 0.57) for the same species suggests that a cautious interpretation of the model outputs is required. The model is updated with new data every year.

*Species specific performance indicators that relate to breeding stock maintenance were developed for the first time in 2010. These replaced the old performance indicators for the entire fishery. The old indicators were catches remaining in the range 50 – 150 t and catch rate remaining above 80 kg/crew day. In 2010, both the total catch (121 t) and catch rate (378 kg/crew day) measures were met. The species performance measure for the Sandfish fishery are catches remaining in the range 20 – 100 t and catch rate remaining above 25 kg/hour. In 2010, both the catch (35 t) and catch rate (44 kg/hr) measures were met. The species performance measure for the Redfish fishery are catches remaining in the range 40 – 150 t and catch rate remaining above 60 kg/hour. In 2010, both the catch (86 t) and catch rate (289 kg/hr) measures were met.*

## Non-Retained Species

**Bycatch species impact:** Negligible

Given the selective method of fishing used (diving or wading, collection by hand only), no bycatch species are known to be taken in this fishery.

**Protected species interaction:** Negligible

There are currently no protected species known to be impacted by this fishery.

## Ecosystem Effects

**Food chain effects:** Negligible

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

In addition, predation on the beche-de-mer is relatively infrequent due to the toxins present in their body tissues. It is highly unlikely these animals are a major diet for higher-order predators, due to these toxins acting as an effective defence system.

**Habitat effects:** Negligible

Divers collect beche-de-mer as they drift over the bottom; there is minimal impact on the habitat as divers are highly selective in their fishing effort and no fishing gear or lines contact the seabed. The vessels work during the day and anchor at night, usually further inshore where they are protected from the open ocean that is subject to higher seas and wind. Most fishers are mindful of the habitat they choose to anchor over, so they avoid more diverse bottom habitat.

There are some areas where fishers can access beche-de-mer by wading through shallow water mangrove lagoons and estuaries. This is a minor component of the fishery. This method may be applied in areas of the Kimberley that are accessible and prone to extreme tidal movements. Wading usually occurs on soft sandy substrates, with minimal impact on these habitats.

## Social Effects

In 2010, two vessels with a total of nine crew were working in the fishery. Additional individuals are employed for the processing of the product. These activities are mostly located in the Northern Territory where the fishing fleet is based.

## Economic Effects

**Estimated annual value (to fishers)**

**for year 2010:** \$330,000

The estimated annual value for 2010 was \$333,000 based on an average product price of \$10.00/kg for sandfish (gutted and boiled) or \$3.33/kg live weight, and \$7.50 for redfish (\$2.50/kg live weight). This is only a farm gate value and the



## NORTH COAST BIOREGION

catch from the fishery supports a substantial processing and value-adding sector.

### Fishery Governance

**Sandfish catch range:** 20 – 100 tonnes

**Redfish catch range:** 40 – 150 tonnes

Current fishing level of 86 tonnes for Redfish and 35 tonnes for Sandfish are both within the target ranges.

#### New management initiatives (2010/11)

The species-specific information on catch and effort from the daily logbook, implemented in 2007, has facilitated the

development of species-specific management response and performance indicators in 2010 and these will be refined in 2011.

### External Factors

The remoteness of the currently fished stock and the large tidal ranges where it occurs are natural barriers to uncontrolled expansion of fishing of beche-de-mer. Marine park planning processes may also impact on the potential extent of the fishery.

#### Contributors

A. Hart, D. Murphy and R. Green.

### BECHE-DE-MER TABLE 1

Catch and effort of Beche-de-mer in Western Australia since 1995.

Year	Live Wt (t) (all species)	Hours fished (all methods)	Live Wt (t) (Sandfish)	Hours fished (Sandfish)	Live Wt (t) (Redfish)	Hours fished (Redfish)	Live Wt (t) (Teatfish)
1995	93	2,972	93	2,972	0		0
1996	257	3,938	257	3,938	0		0
1997	382	7,493	371	7,403	9	90	2.8
1998	310	9,030	310	9,030	0		0
1999	176	5,470	176	5,470	0		0
2000	83	2,255	83	2,255	0		0
2001	90	2,434	88	2,414	2	20	0.2
2002	87	3,235	87	3,235	0		0
2003	122	4,877	121	4,867	1	10	0
2004	81	2,117	81	2,117	0		0.2
2005	78	1,876	75	1,876	0		0
2006	58	2,662	55	2,632	3	30	0.3
2007	113	1,804	26	976	87	828	0
2008 <sup>^</sup>	196	1,544	27	448	169	1096	0
2009	129	1,423	31	701	98	722	0
<b>2010</b>	<b>121</b>	<b>1,053</b>	<b>35</b>	<b>754</b>	<b>86</b>	<b>299</b>	<b>0</b>

<sup>^</sup> Diving only method used in recent years

**BECHE-DE-MER TABLE 2**

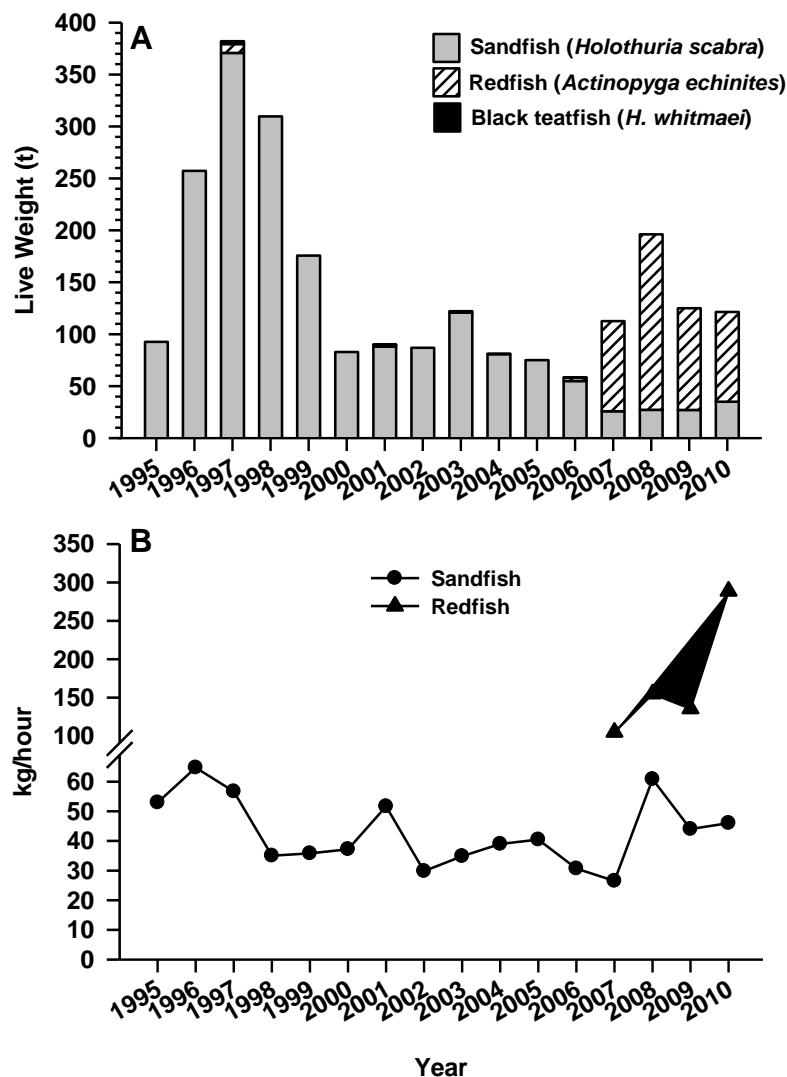
Estimates of Maximum Sustainable Yield (MSY) of sandfish in the Western Australian Beche-de-Mer fishery.

Area	MSY (t)	Current average catch (2005-2009) (t)	Parameter estimates*		
			r	K (t)	q
Entire Fishery	139	43	0.820	970	0.21
Kimberley region (Grid 1425 and 1426)	70	37	0.95	418	0.57

\* r – intrinsic rate of increase

k – carrying capacity (Virgin biomass)

q – catchability or fishing power

**BECHE-DE-MER FIGURE 1**

A) Production (tonnes/live weight) by species, and B) catch rate (kg per crew day) from the Western Australian Beche-de-mer fishery

## NORTH COAST BIOREGION

### AQUACULTURE

#### Regional Research and Development Overview

Aquaculture in the north coast bioregion is dominated by the production of pearls from the species *Pinctada maxima* (south-sea pearls). This industry sector utilises both wild-caught and hatchery-reared oysters for the production of cultured pearls. The wild-stock fishery is reported in the North Coast bioregion section of this volume.

The Department of Fisheries also has a major role in the management and regulation of pearl hatcheries, seeding activities and pearl oyster farm leases.

A Memorandum of Understanding (MOU) between the Western Australian and Northern Territory fisheries ministers was signed in June 2006. The MOU recognises that WA and the NT comprise the entire Australian south-sea pearling industry and that product from both jurisdictions supplies the same market.

The operator of a fish farm producing barramundi (*Lates calcarifer*) in Cone Bay is successfully increasing production following approval by the EPA to increase output to 1,000 tonnes per annum. The operator is planning to gradually increase its production capability to 5,000 tonnes per annum, subject to receiving the requisite environmental approvals.

A demonstration project culturing marine microalgae for the production of bio-fuels, omega-3 lipid and protein biomass has recently started near Karratha. The company is planning for significant increases in scale and production capability in the future.

The Department of Fisheries continues to oversee the development of several indigenous aquaculture projects in this region, targeting the aquaculture of barramundi in sea-cages and earthen ponds, cherabin (*Macrobrachium rosenbergii*), edible rock oysters (*Saccostrea* sp.) and ornamental species including coral and live rock.

## COMPLIANCE AND COMMUNITY EDUCATION

The North Coast is one of the largest bioregions in WA – stretching from Onslow to the Western Australia/Northern Territory border with over 2600 kilometres of coastline.

The North Coast Bioregion has many biodiversity rich areas including the Rowley Shoals, Montebello Islands, Barrow Islands and hundreds of islands and atolls. These areas attract many people – especially for fishing.

Tourism is a major part of the coastal towns in the North Coast with over 600,000 additional people visiting the area each year. The transient population usually increases in the cooler months from May to October including international, interstate and intrastate tourists.

Many of the towns in this bioregion support mining communities where the majority of the population are fly in/fly out. Surveys have shown that a large proportion of mining community and tourists take part in fishing while visiting the bioregion.

Three district offices located in Kununurra, Broome and Karratha provide compliance and education across the region with eleven permanent Fisheries and Marine Officers and one Community Education officer. During the peak season from May to October additional two officer mobile patrols also operate in the area. Compliance is delivered to several sectors including commercial and recreational fisheries, pearling, aquaculture, fish habitat and bio-security.

The North Coast Region is sparsely populated in most areas with much of the terrain remote and difficult to access. Remote patrols are undertaken for up to two weeks at a time to get to these areas. Specialised equipment is required for patrols including four wheel drive vehicles and a variety of vessels for inshore coastal and inland waters, when offshore patrols are conducted a 23 metre vessel is utilised.

A range of compliance duties are carried out in the bioregion including investigations, catch, licence, gear, processor, retail and transport inspections. These are carried out through roadside checks, land & sea patrols and aerial surveillance.

FMOs not only spend time on compliance but also dedicate time to community education by maintaining a presence at a variety of expos, fishing competitions and community fairs. Annual fairs are held throughout the bioregion with the Department represented every year at most events.

The community education officer coordinates and manages the Fisheries Volunteer program for the Northern Region and is heavily involved in the education of school-aged children and the community. In-school and school holiday programs are the main method of reaching students in both the Pilbara and Kimberley, while attendance at shows and local events target the broader community.

Fisheries Volunteers are trained community members who educate the public on bag and size limits and a variety of other fishing rules.

### Activities during 2009/10

During 2009/10, the North Coast bioregion's FMOs delivered a total of 2,575 officer hours of active compliance patrol time (North Coast Compliance Table 1). - a small decrease from the previous year (North Coast Compliance Figure 1). FMOs also achieved 8,533 personal compliance contacts with the fishers and non-fishers across the recreational and commercial sectors.

In the commercial sector FMOs undertook prosecution action as a result of compliance operations in 2009/10. This resulted in 10 infringements notices being issued and 3 matters resulting in prosecution action.

Compliance inspections were also carried out on Pearl oyster fishing and seeding operations, during transport of Pearl oysters and at various Pearl oyster lease sites. Considerable travel time is required to reach many of the lease sites, due to their remote locations.

In the recreational sector 138 infringement warnings were issued, 61 infringement notices and 8 matters resulted in prosecution action.

Fisheries Volunteers from across the Karratha District were provided with training and support.

### Initiatives in 2010/11

The Department will open an office in Kununurra Staffed by one FMO who will carry out Patrols with staff from other

agencies such as Department of Environment and Conservation and the Department of Transport. This will greatly enhance the ability of the Department to conduct education and compliance activities in the East Kimberley.

The Department will establish a Northern Region Mobile Patrol, the patrol comprising of two FMO's who will focus entirely on recreational fisheries compliance and education throughout the Northern Region.

A newly established Fremantle based Statewide Mobile Patrol Unit will be based in the Pilbara District from July to September and will focus on recreational fishers operating in the area.

The Departments other Statewide Mobile Patrol, will continue to provide recreational compliance patrols across the Northern Region during peak fishing periods.

The North Coast bioregions FMOs will continue to use a risk assessment based approach to fisheries compliance to ensure areas and activities of a high risk of non-compliance are targeted.

FMOs will continue to assist with ongoing checks of bio-security of vessels entering the states' waters for introduced marine pests.

Improved engagement with short and long term visitors to the Kimberley through a targeted education program.

Increase communication with and introduce an education campaign targeted at recreational fishers on international ships that enter Northern Ports.

# NORTH COAST BIOREGION

## NORTH COAST COMPLIANCE TABLE 1

This table gives a summary of compliance and educative contacts and detected offences within the North Coast bioregion during the 2009/10 financial year

PATROL HOURS DELIVERED TO THE BIOREGION	2,575 Officer Hours
CONTACT WITH THE COMMERCIAL FISHING COMMUNITY*	
Field contacts by Fisheries & Marine Officers	47
Infringement warnings	0
Infringement notices	10
Prosecutions	3
CONTACT WITH THE RECREATIONAL FISHING COMMUNITY	
Field contacts by Fisheries & Marine Officers	7,621
Infringement warnings	138
Infringement notices	61
Prosecutions	8
OTHER FISHING-RELATED CONTACTS WITH THE COMMUNITY**	
Field contacts by Fisheries & Marine Officers	865
Fishwatch reports***	19
VMS (Vessel Days)****	7,494

\* Pearling contacts are excluded from these totals and detailed in North Coast Compliance Table 2.

\*\* Contacts are classified according to the specific fishery, which is usually clearly delineated as being either commercial or recreational. The "other fishing related contacts within the community" category is used where multiple fisheries are contacted and it is not possible to accurately classify the contacts into one specific fishery – typically, the majority of contacts are these contacts are recreational in nature (e.g. personal contacts in marine parks), but contacts made in relation to fish kills, shark patrols and inspections of commercial fish wholesale and retail premises, etc, are also included in this category. This table includes contacts made by *PV Walcott*. Contacts made by *PVs Hamelin* and *McLaughlan* are included in West Coast Compliance Table 1.

\*\*\* This represents the total number of Fishwatch reports, both commercial and recreational, since the service provider reporting mechanism cannot differentiate between sectors. It also includes any calls relating to the Northern Inland bioregion that were referred to Karratha or Broome district staff.

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

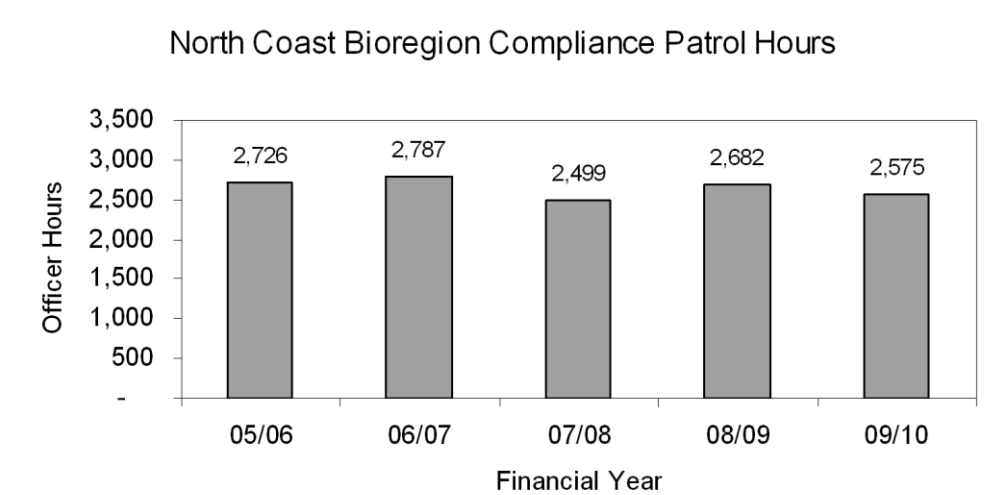
## NORTH COAST COMPLIANCE TABLE 2

This table gives summary statistics for pearling compliance in all bioregions in the 2009/10 fishing season.

Total compliance hours*	2,132 Officer Hours
Field contacts by Pearling Officers	17
Letters of Warning issued**	1
Prosecutions	0

\* Includes all time spent on compliance-related tasks by District Staff, e.g. investigations, prosecutions, etc. but does not include 45 days of pearling activities by *PV Walcott*.

\*\* No legislative capacity to issue infringement notices



#### **NORTH COAST COMPLIANCE FIGURE 1\***

This figure gives the “On Patrol” officer hours showing the level of compliance patrol activity delivered to the North Coast bioregion over the previous five years. The 2009/10 total gives the patrol hours in the bioregion that resulted in the contacts detailed in Table 1 and Table 2. The totals exclude time spent on other compliance-related tasks, e.g. travel time between patrol areas, preparation and planning time.

\*Does not include “on-patrol” hours delivered by PV Walcott (1,450 in 2009/10).

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