

# GASCOYNE COAST BIOREGION

## ABOUT THE BIOREGION

The marine environment of the Gascoyne Coast bioregion represents a transition between the fully tropical waters of the North West Shelf and the temperate waters of the west coast. Offshore ocean temperatures range from about 22°C to 28°C, while the inner areas of Shark Bay regularly fall to 15°C in winter. The major fish stocks are generally tropical in nature, with the exceptions of the temperate species, pink snapper, whiting and tailor, which are at the northern end of their range off Shark Bay.

The coastline is characterised by high cliffs in the southern half changing to fringing coral reefs in the north. Coastal waters are generally high-energy in terms of wave action due to the strong trade wind system. The Exmouth Gulf section of the Gascoyne Coast bioregion is seasonally influenced by extreme tropical summer cyclones, while the Shark Bay end of the bioregion receives very infrequent cyclones, but is affected at times by river outflows from inland cyclone-based summer rainfall. The limited local rainfall comes mostly from the northern edge of winter storm fronts.

The waters off the Gascoyne Coast are also strongly influenced by the unusual southward-flowing Leeuwin Current, generated by flow from the Pacific through the Indonesian archipelago. This tropical current becomes evident in the North West Cape area and flows along the edge of the narrow continental shelf where, coupled with low rainfall and run-off plus the north flowing Ningaloo current creates the highly diverse Ningaloo Reef system and fish fauna associated with the latter.

The outer area of the large marine embayment of Shark Bay is also influenced by the warm winter current. The inner waters of the embayment are hypersaline, owing to the high evaporation and low rainfall of the adjacent desert areas. The World Heritage-listed Shark Bay is unusual for its extreme hypersalinity at the bay heads, the extensive Wooramel seagrass bank, and associated banks and channels. The sea floor of both Shark Bay and the continental shelf is typically sandy compared to Exmouth Gulf, which has more mud areas and greater turbidity.

The Gascoyne region has been identified as one of the 18 world 'hotspots' in terms of tropical reef endemism and the threats facing them. The article ranks this region of Western Australia as the second most diverse marine environment in the world in terms of tropical reef species, and also indicates that it is subject to the second lowest level of environmental threat of the 18 areas that were investigated.

The Ningaloo reef in the north of the region is the largest continuous reef in WA and is one of the most significant fringing reefs in Australia. The bioregion also has extensive areas of mangroves, mostly in Exmouth Gulf while extensive seagrass beds are located in a number of areas.

## SUMMARY OF FISHING AND AQUACULTURE ACTIVITIES

Commercial fishing is a very significant industry in the region, with three of the State's more valuable fisheries – the Shark Bay Prawn, Exmouth Gulf Prawn and Shark Bay Scallop fisheries – landing combined catches valued in the range of \$40 – \$50 million annually. These trawl based fisheries have operated sustainably in the region since the mid-1960s and are internationally recognised as 'best practice' in terms of both management and research. The fishery for blue swimmer crabs which operates throughout the waters of Shark Bay, has grown in the last decade to currently be the largest Western Australian crab fishery.

The Gascoyne Coast bioregion also has an offshore demersal scalefish fishery and the Denham-based beach seine fishery which have operated since the 1960s, and provide a significant proportion of the catch of the pink snapper and whiting for the state. The demersal line fishery that originally targeted pink snapper has developed over the past decade into a broader fishing sector taking other demersal finfish species including emperors, cods and deeper water species such as goldband snapper (jobfish). These are all managed as the Gascoyne Demersal Scalefish Fishery. Formal management arrangements for the mackerel fishery that operates in this bioregion were introduced in 2004.

The special features of the Gascoyne coast, coupled with the warm, dry winter climate and accessible fish stocks, have made it a focal point for winter recreation by the Western Australian community. Fishing is a key component of many tourist visits. A full range of angling activities is available, including beach and cliff fishing (e.g. Steep Point and Quobba), embayment and shallow-water boat angling (e.g. Shark Bay, Exmouth Gulf and Ningaloo lagoons), and offshore boat angling for demersal and larger pelagic species (e.g. off Ningaloo).

Recreational fishing is predominantly for tropical species such as emperors, tropical snappers, groupers, mackerels, trevallies and other game fish. Some temperate species at the northern end of their ranges, such as pink snapper, tailor and whiting, provide significant catches, particularly in Shark Bay.

In addition, the Gascoyne Coast bioregion supports extensive scuba diving and snorkelling activities, particularly inside the coral lagoons of the Ningaloo reef system. Specialised 'eco-tourism' activities include whale shark and manta ray observation at Ningaloo and dolphin and dugong viewing in Shark Bay.

Aquaculture development in the Gascoyne is largely restricted to the production of pearls and pearl oysters in the major embayments. Hatchery production of oysters is of critical importance in this region, driven by the irregular and therefore unreliable recruitment of both large species of pearl oysters in the wild. Hatcheries in Carnarvon and Exmouth supply significant quantities of *Pinctada maxima* spat to pearl

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farms in Exmouth Gulf and the Montebello Islands, while several hatcheries supply juveniles of the blacklip pearl oyster *Pinctada margaritifera* to the bioregion's developing black pearl farms.

## ECOSYSTEM MANAGEMENT

Extensive trawl closures inside the 200m depth zone in the Shark Bay and Exmouth region provide protection to sensitive benthic habitat, including coral reef, sand flats and seagrass beds of the continental shelf. These areas provide significant fish nursery, breeding and feeding habitat (Gascoyne Ecosystem Management Figure 1). The extent of these areas means that 35% of the entire shelf region (< 200 m) of the Gascoyne Coast Bioregion could be classified as a marine protected area with an IUCN category of IV (as per Dudley, 2008<sup>1</sup>; Gascoyne Ecosystem Management Table 1). The effective area that is not trawled is, however, much greater such that over 90% of the waters less than 200 m depth are not trawled (Gascoyne Ecosystem Management Table 1).

In addition to the trawl based, benthic habitat management protection, specific commercial fishing regulations implemented in the 1970s and 1980s preclude the use of large-mesh gillnets and long-lines throughout the region, to prevent the incidental entanglement of dugongs and turtles which inhabit the region. These controls have also provided protection for the large shark species which are a feature of this region. More recently, bycatch reduction devices ('grids') installed in trawl nets have increased the protection for sharks, rays and the occasional turtle encountered on the trawl grounds.

There are also a number of other 'formal' marine protected areas in this bioregion that have been established under both the Conservation and Land Management Act 1984 and the Fish Resources Management Act 1994 (see Gascoyne Ecosystem Management Figure 2). These include the Ningaloo and Shark Bay marine parks, the Murion Islands Marine Management Area, and the Quobba and Miaboolya Beach Fish Habitat Protection Areas.

The Commonwealth Government's Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) is also undertaking a process of identifying additional protected areas for Commonwealth waters between Shark Bay and the Northern Territory border. The Draft Plan is expected to include proposed marine protected areas, and has been released for a 3 month public consultation period.

The Commonwealth Government's Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) has also undertaken a Marine Bioregional Planning process for Commonwealth waters between Shark Bay and the Northern Territory border. The federal minister for the environment has recently announced the final reserve network proposed for the north-west which spans the Gascoyne and North Coast bioregions.

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

## ECOSYSTEM BASED FISHERIES MANAGEMENT

### Identification of Ecological Assets/Resources using the EBFM framework

Under the Integrated Marine and Coastal Regionalisation for Australia scheme, the bioregion has been divided into 4 meso-scale regions: Zuytdorp, Shark Bay, Ningaloo, and Exmouth Gulf (IMCRA, V 4.0, 2006). This sub-regional scale of management has now been adopted by the Department through the implementation of an Ecosystem Based Fisheries Management (EBFM) framework (Fletcher, et al., 2010)<sup>2</sup> see How to Use section for more details.

In terms of ecological assets (= resources), the Department utilises the following categories for the IMCRA regions within the Gascoyne Bioregion:

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

For some assets a finer level of division of the IMCRA ecosystems is used by the Department. This incorporates the recent management initiatives to recognise that there are 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). The full set of ecological assets identified for ongoing monitoring are presented in Gascoyne Ecosystem Management Figure 3.

### Risk Assessment of Ecological Assets

The EBFM process identifies the ecological assets in a hierarchical manner such that the assets outlined Gascoyne Ecosystem Management Figure 3 are often made up of individual components at the species or In some cases at the stock level. The risks to each of the individual 'stocks' or lower level components are mostly detailed in the individual fishery reports presented in the remainder of this section of the document. The following table (Gascoyne Ecosystem Management Table 2) provides an overview and cumulative assessment of the current risks to the ecological assets of the Gascoyne Coast Bioregion, at a bioregional level and provides a mechanism for reporting on their status and the fisheries management arrangements that are being applied.

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<sup>2</sup> Fletcher, W.J., Shaw, J., Metcalf, S.J. & D.J. Gaughan (2010) An Ecosystem Based Fisheries Management framework: the efficient, regional-level planning tool for management agencies. Marine Policy 34 (2010) 1226–1238

These bioregional level risks are now used by the Department as a key input into the Department's Risk Register which, combined with an assessment of the economic and social values and risks associated with these assets, is integral for use in the annual planning cycle for assigning priorities for activities across all Divisions in this bioregion.

## Summary of Monitoring and Assessment of Ecosystem Assets

The Department is a contributor and supporter of the extensive ecological research and monitoring that has been undertaken in the Ningaloo Marine Park, much of which was funded by the recently completed WAMSI Node 3 (see [www.WAMSI.org.au](http://www.WAMSI.org.au) for full details).

Each of the fisheries is undertaking monitoring that feeds into the assessment of the various assets outlined above. It is expected that the community structure analyses completed as part of the FRDC project by Hall and Wise (2011)<sup>1</sup> will become a regular part of the monitoring of this bioregion. It is also expected that the biodiversity trawl surveys will be repeated at regular intervals.

The Ranked Risk Assessment of Multiple Fisheries (RRAMF) was tested for the Gascoyne Coast Bioregion of Western Australia using fishery-independent data for general teleost and elasmobranch bycatch; and fishery-dependent data for threatened, endangered and protected species (TEPs). This method allows ranking of bycatch species within each fishery and the accumulation of the ranks across multiple fisheries by incorporating the relative impact of each fishery. This study found no high or unacceptable risks (Evans and Molony, 2010)<sup>2</sup>.

Currently there are no introduced marine pest monitoring programs being undertaken in the Gascoyne Coast bioregion. However, ongoing research includes an assessment of the likelihood of a marine pest being introduced into ports and quantification of the risk associated with recreational vessels for the introduction and translocation of marine pests into this bioregion. Further detail may be found in the Appendix section entitled "Activities of the Marine Biosecurity Research Unit during 2011/12".

### GASCOYNE ECOSYSTEM MANAGEMENT TABLE 1

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

Total Area of Shelf	Area of shelf equivalent to IUCN marine protected area <= category IV (%)	Maximum area of actual trawling activity	Total area of habitat effectively protected from direct damage (%)
15800 sq nm	5600 sq nm (35%)	1100 sq nm	14700 sq nm (93%)

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

<sup>2</sup> Evans, R. and Molony, B. W. 2010. Ranked Risk Assessment for Bycatch in Multiple Fisheries: a Bioregional Risk Assessment Method. Fisheries Research Report No. 212. Department of Fisheries, Western Australia. 88pp..

**GASCOYNE ECOSYSTEM MANAGEMENT TABLE 2**

**RISK LEVELS FOR EACH ASSET.**

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

**Ecosystem Structure and Biodiversity**

Ecosystem	Aquatic zone	Risk	Status and Current Activities
Zuytdorp	Marine	LOW	An assessment of the community structure and trophic level of all commercially caught fish species in the Gascoyne Bioregion over the past 30 years through an FRDC project found no evidence of systematic changes that could be evidence of an unacceptable impact on this ecosystem (Hall and Wise, 2011) <sup>1</sup> .
Ningaloo	Marine	LOW	See above. In addition, a significant level of research and monitoring is being undertaken in the Ningaloo marine park region by DEC, CSIRO, AIMS and universities.
Exmouth Gulf	Marine	LOW	There is significant protection for all sensitive habitats and restrictions on the level of impacts that can occur in less sensitive habitats. A major project surveying biodiversity on and off the trawl grounds in Exmouth indicated that trawled areas have similar diversity to the larger adjacent untrawled areas. The ecosystem in this region could be at risk if a number of proposed developments are implemented.
Shark Bay Gulfs	Marine	LOW	There is significant protection for all sensitive habitats and restrictions on the level of impacts that can occur in less sensitive habitats. A major project surveying biodiversity on and off the trawl grounds in Shark Bay indicated that trawled areas have similar diversity to the larger adjacent untrawled areas.

**Captured fish species**

Captured Species	Aquatic zone	Ecological Risk	Status and Current Activities
	Nearshore (0-20m depth)	MODERATE	This indicator species for this suite (e.g. whiting) are all considered to have adequate breeding stocks, fishing catch and effort has been occurring at the same acceptable levels for over 40 years and there are no additional risks that have been identified. Annual catch and effort monitoring is continuing.
Finfish	Inshore demersal (20-250m depth)	MODERATE	The key indicator species for this suite is pink snapper which is currently in a rebuilding phase and spangled emperor, in northern part of the bioregion, is considered to be suffering overfishing (but the overall stock is at an acceptable level). Pink snapper are sampled to provide representative catch-at-age data for used in an integrated stock assessment model which is updated every 3 years (most recently in 2012). Comprehensive research on spangled emperor and goldband snapper has generated 'weight of evidence' based assessments. Monitoring of commercial catches and age structure is continuing and further research is planned to refine estimates of the key biological parameters

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

Captured Species	Aquatic zone	Ecological Risk	Status and Current Activities
	Offshore demersal (>250m depth)	MODERATE	Concerns around deeper-water species (e.g. ruby snapper, various cods) are largely due to uncertainty in the stock status of these species and their long-lived, slow growing life histories. The main risk to these stocks comes from potential increases in fishing by Commonwealth licensed trawlers who operate outside of 200 m depth and the current discussions about altering this line.
	Pelagic	MODERATE	The stock status and fishing levels on these species (e.g. Spanish mackerel) are both at acceptable levels
	Shark Bay Gulf Demersals	MODERATE	The spawning biomass of pink snapper has returned above the target level (40%) in both the Eastern Gulf and Denham Sound but remained below the threshold level (30%) in Freycinet. These inner gulf stocks are monitored using daily egg production method [DEPM] surveys to estimate spawning biomass approximately every 3-5 years and intermittent surveys of recreational catch. It is possible that grass emperor will be added to the set of indicators for this suite.
	Nearshore (Crabs)	MODERATE	There are a number of issues related to resource sharing and gear conflicts between the Shark Bay crab trap and Shark Bay prawn and scallop trawl fisheries. A recent (2011 stock assessment) concluded that there was conflicting evidence about the level of impact the current catch levels were having on the stock. Subsequent to this review, the relative abundance of all size classes of crabs in Shark Bay declined significantly. The reasons for this unexpected and substantial decline appear to be linked to several adverse extreme environmental events and this has already had a significant impact on the 2011/12 fishing season. .
Invertebrates	Prawns and Scallops	MODERATE	Management of the prawn and scallop fisheries is based on input controls which include limited entry, seasonal and area openings and closures, gear controls. Permanently closed nursery areas within the fishery prevent the fishing of small size prawns while spatio-temporal closures serve to maintain tiger prawn breeding stocks above the threshold abundance level. To ensure that sufficient stock remained for spawning, the fishing arrangements provide a threshold catch rate limit for the scallop fleet to cease fishing. All the stocks of prawns are at acceptable levels. The stock of scallops, however, declined significantly after the 2011 season had ended and this is likely to have been generated by the same set of environmental conditions that affected the crab stocks
	Pearl Oysters	MODERATE	The recent stock levels of pearl oysters in this region have been low. Recovery management arrangements have already been implemented and minimal catches have been taken in recent years.

**Protected species**

Protected species	Species	Risk	Status and Current Activities
Protected non 'Fish' species	Turtles/ Sea Snakes	LOW	While protected species including dugongs, turtles and sea snakes occur in the Gascoyne region area, only sea snakes and occasionally turtles are encountered in the trawl catches. Both of these species are typically returned to the sea alive. Grids are now compulsory, which has largely eliminated the capture of any turtle or other large animal. The number of turtles captured now is very low and most of these are returned alive. Turtle captures and their status at release are monitored and reported.
	Mammals	NEGLIGIBLE	There are no recorded captures of mammals by the trawl fisheries in this bioregion.

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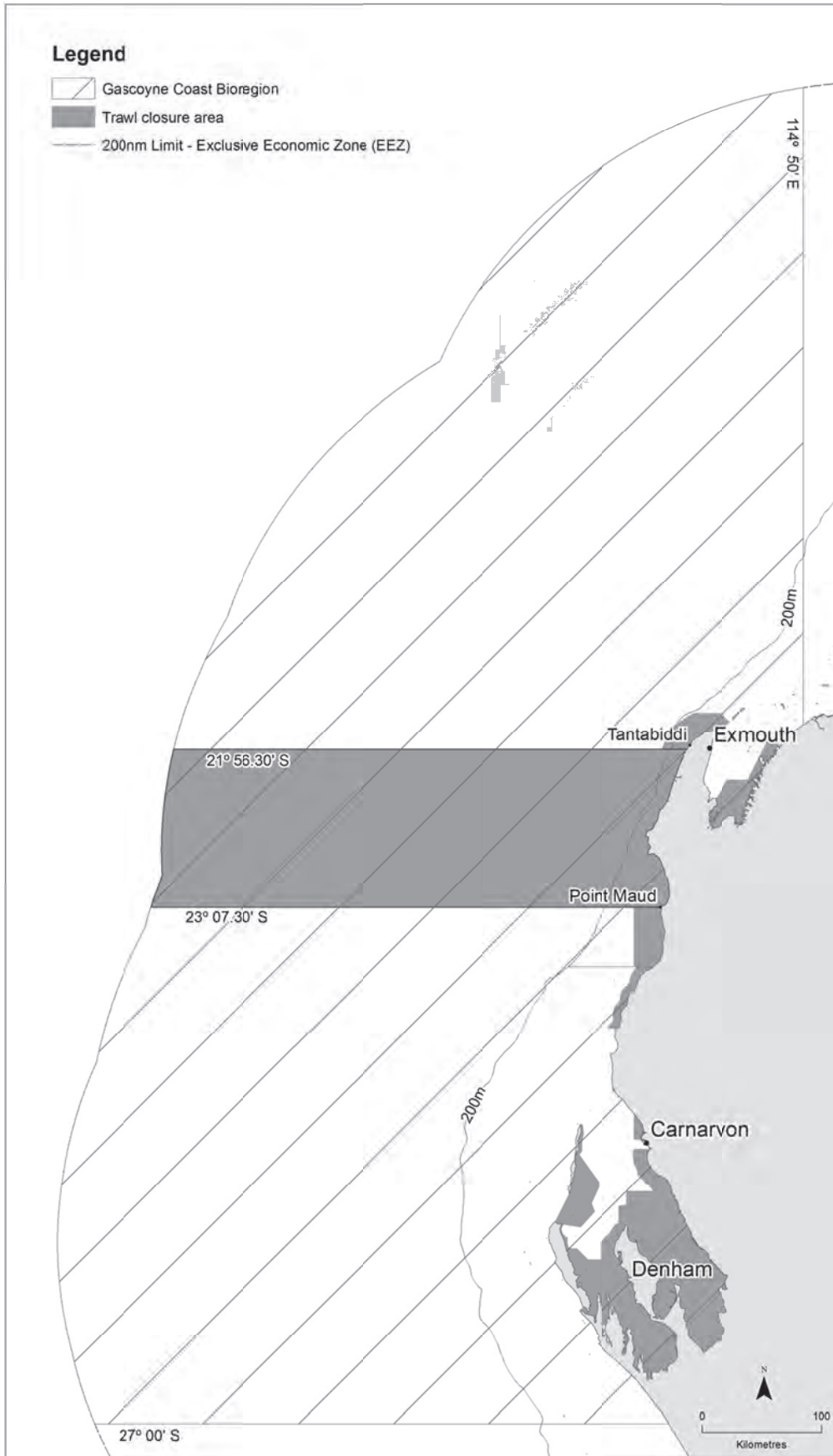
Protected species	Species	Risk	Status and Current Activities
Protected 'Fish' Species	Fish	LOW	There are no protected fish species (including syngnathids) specifically at risk in this region.

**Benthic habitat**

Benthic Habitat	Category	Risk	Status and Current Activities
Exmouth Gulf	Sand Mud Sponge	LOW	There is a large permanent closure to trawling on the eastern and southern sides of the Gulf which protect sensitive habitats that operate as nursery areas. In the area open, trawling effort is focused in the deeper central and north-western sectors of Exmouth Gulf. Owing to the predominantly mud and sand habitats of the trawl grounds, the trawl gear has relatively little physical impact. The total area trawled each year has to remain below 40%. The area trawled each year is monitored.
Shark Bay Gulfs	Sand Sponge	MODERATE	The majority of sponge/coral habitats and other sensitive habitats are now contained within specific trawl closures and there are limits to the trawled area to less than 40% of the sand habitats. The area trawled each year is monitored.
	Seagrass	NEGLECTIBLE	There are extensive, permanent closures in the Shark Bay fishery covering all inshore seagrass areas.
Ningaloo	Sand Coral	LOW	There are no trawl activities in these areas. The main risk is to coral habitat from tourism and other boating related activities.
Zuytdorp	Sand Reef	NEGLECTIBLE	There are few direct impacts to these habitats.

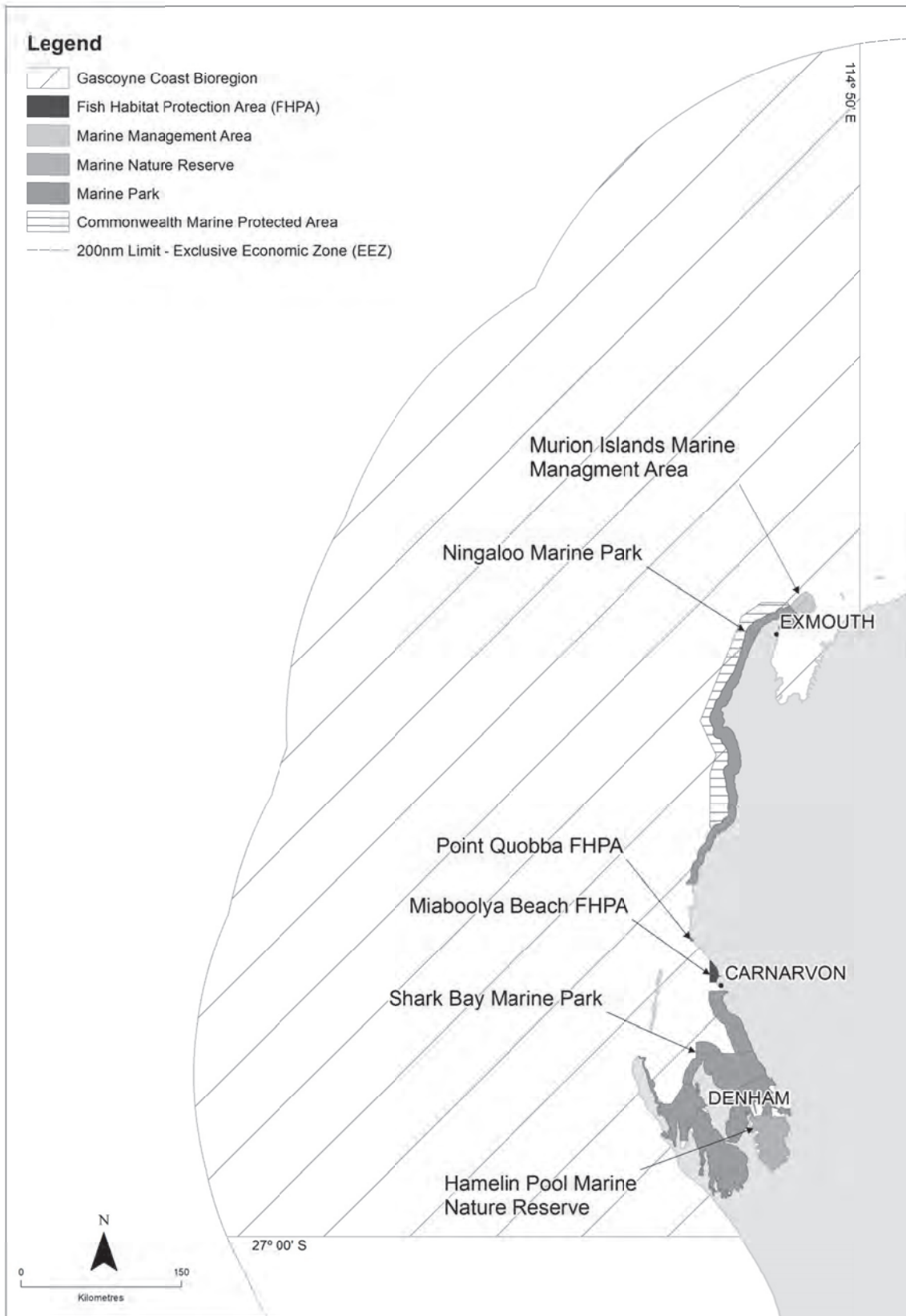
**External Drivers**

External Drivers	Risk	Status and Current Activities
Introduced Pests and Diseases	LOW	This issue is not currently identified as being as high a risk as in some other WA bioregions due to lower level of international and interstate shipping.
Climate	MODERATE in short term	Being a transitional region, the biota in this bioregion are at enhanced risk of being affected by climate change. Projects to examine potential impacts on this bioregion are now underway or planned
	HIGH in medium term	



**GASCOYNE ECOSYSTEM MANAGEMENT FIGURE 1**

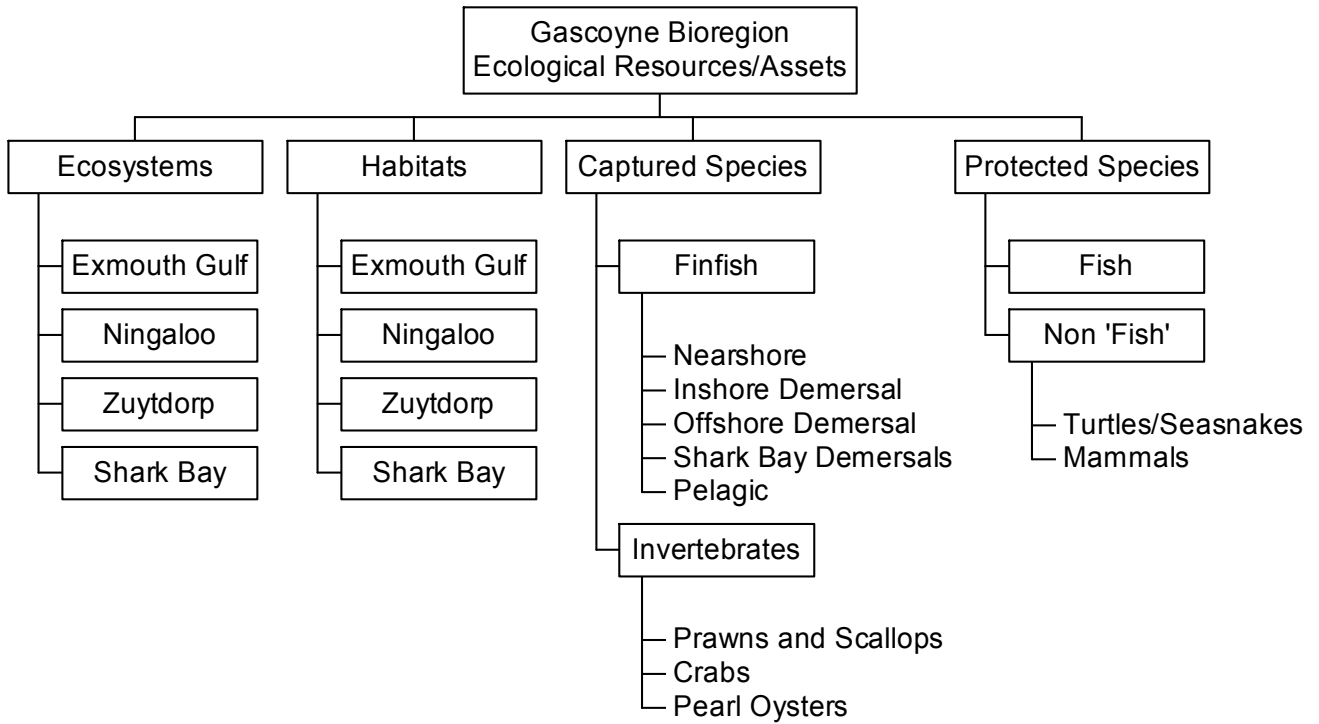
Map showing areas permanently closed to trawling in the Gascoyne Coast bioregion. The areas permanently closed are consistent with IUCN marine protected area category IV.



**GASCOYNE ECOSYSTEM MANAGEMENT FIGURE 2**

Map showing current and proposed marine parks and FHPAs in the Gascoyne Coast





**GASCOYNE ECOSYSTEM MANAGEMENT FIGURE 3**

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

## FISHERIES

## Shark Bay Prawn and Scallop Managed Fisheries Status Report

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

Main Features			
<b>Status</b>		<b>Current Landings</b>	
Stock level		King Prawns	1310 t
Prawn	Adequate	Tiger Prawns	689 t
Scallop	Adequate	Endeavour Prawns	15 t
Fishing level		Scallops	295 t
Prawn	Acceptable		
Scallop	Acceptable		

## Fishery Description

The Shark Bay Prawn Managed Fishery is the highest producing Western Australian fishery for prawns. It targets the western king prawn (*Penaeus latisulcatus*) and brown tiger prawn (*Penaeus esculentus*) and takes a variety of smaller prawn species including endeavour prawns (*Metapenaeus* spp.) and coral prawns (various species).

The Shark Bay Scallop Managed Fishery catches the saucer scallop (*Amusium balloti*), and is usually WA's most productive scallop fishery. These two managed fisheries are limited entry and both use low opening, otter trawls as the fishing method and incorporate in-season real time management to ensure sustainability and maximise economic efficiency.

### Governing legislation/fishing authority

*Shark Bay Prawn Management Plan 1993*

Shark Bay Prawn Managed Fishery Licence

*Shark Bay Scallop Management Plan 1994*

Shark Bay Scallop Managed Fishery Licence

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

### Consultation process

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

### Boundaries

The boundaries of the Shark Bay Prawn Managed Fishery and the Shark Bay Scallop managed Fishery are located in and near the waters of Shark Bay as presented in Shark Bay Prawn and Scallop Figures 1 & 2. These diagrams outline the boundaries of the two fisheries plus show all the area closures (both temporary and permanent) and the specific areas trawled in the 2011 season.

### Management arrangements

Management of the prawn and scallop fisheries is based on input controls, which include limited entry, seasonal and area openings and closures, gear controls and limits on crew numbers. Both fleets undertake trawl fishing using otter trawl systems. Each fleet has a separate standard net size and gear configuration. Within the Shark Bay Scallop Managed Fishery in 2011 the Minister adopted a formal catch share management objective for the annual scallop catch between A Class (scallop only) and B Class (scallop and prawn) boats of 70% and 30% respectively.

Bycatch reduction devices ('grids') are mandatory for all prawn and scallop trawl nets. In addition, secondary bycatch reduction devices (fish escape devices) are mandatory for nets of prawn boats because they fish with small size mesh codends. Scallop boats have larger 100 mm mesh codends resulting in only a small amount of bycatch being taken during trawl operations and therefore do not require the secondary devices.

Prawn and scallop fishery management arrangements are designed to keep effort at levels that will maintain sufficient spawning stock levels of target species and achieve optimal yields. Management arrangements are also aimed at catching prawns and scallops at the best size and condition for the market, thereby maximising the economic return. The prawn fleet operates under an exemption from both the net size and the 375-hull unit rule to provide for trawl gear amalgamation

using quad trawl gear configuration to generate improved economics. In late 2010, a Voluntary Fisheries Adjustment Scheme (VFAS), for the Shark Bay Prawn Managed Fishery was approved resulting in the removal of 9 licences from the fishery, reducing the fleet from 27 to 18 Licensed Fishing Boats. This was formalised in early 2011. The purpose of the VFAS was to improve the long-term economic efficiency through a reduction in the number of licences and by consolidating fishing gear onto 18 boats. The restructure has also resulted in an 8% reduction of the total headrope capacity for the fishery.

Scallop boats are authorised to operate with two 12.8 metre nets (7 fathoms) and boat units no greater than 375, but the scallop fleet also operates under an exemption from the 375-hull unit rule. The total net headrope capacity for the scallop fleet was 358.4 metres (196 fathoms). In late 2010, a VFAS for the Shark Bay Scallop Managed Fishery was approved and three licenses were removed from the fishery reducing the fleet from 14 to 11 licenses in early 2011 resulting the total net headrope capacity of the A Class Scallop fleet being reduced to 281.6 metres (154 fathoms).

The Research Division of the Department of Fisheries carries out daily monitoring of the scallop fleet catch to provide advice on when to close areas based on the threshold catch rates. This is the major real time component of the management strategy to control spatial and temporal fishing effort. The Vessel Monitoring System (VMS) continues to monitor the activity of all licensed fishing boats in this fishery.

The Commonwealth Government's Department of Sustainability Environment Water Populations and Communities (SEWPaC), has assessed the fisheries under the provisions of the EPBC Act 1999 and has accredited the fisheries for a period of five years (re-assessment in 2013), allowing product from the fisheries to be exported from Australia. The comprehensive ESD assessment of these fisheries found that the only material risks requiring direct management actions to ensure acceptable performance were the breeding stock levels of the targeted prawn and scallop species, bycatch species impacts, protected species interactions (including loggerhead turtles), habitat effects and provisioning effects. Boxed text in this status report provides the annual assessment of performance measures/indicators for each of these issues.

The 2011 prawn season fishing arrangements provided a season opening date on 3 March and closing 10 October providing a total of 171 nights fishing. During the season the fishing strategy involved flexible arrangements and voluntary rolling area openings, based on assessment of both king and tiger prawn size through fishery-independent surveys. The tiger prawn spawning area (TPSA) closed on 25 June.

The 2011 scallop season commenced 9 April and fishing ceased on 17 April when the average catch rate (based on the last 2 days of fishing) of 408 kg/hr was reached. Denham Sound was not opened to scallop fishing during the 2011 season because of low scallop abundance in that area.

### Research summary

To complete research and monitoring activities the Shark Bay region is separated into two sectors for both prawn and scallops - Northern Shark Bay and Denham Sound. All data

are analysed separately for each sector of the fishery because the stocks of both these species within these regions appear to have little connectivity.

### Prawns

The yearly cycle of operation for the prawn fishery is dynamic as it depends on the strength and timing of recruitment therefore the opening and closing dates for the fishing seasons vary each year depending on environmental conditions, moon phase and the results of fishery-independent surveys to estimate recruitment strength. The timing and spatial pattern of the fishing season allows the harvesting of the current season's recruits and the large residual prawns not caught in the previous fishing season. Permanently closed nursery areas within the fishery prevent the fishing of small prawns and provide habitat preservation, while spatio-temporal closures serve to maintain tiger prawn breeding stocks above the threshold abundance level.

Non-fishing periods occur around the full moon, commonly known as moon closures. These moon closure periods are variable and can range from five to ten days and are set out in the season arrangements. King prawns are sensitive to light, which makes them less active around the full moon and hence less catchable. Industry has voluntarily extended these closures to increase economic efficiency by shifting fishing effort away from these times of reduced catch rate.

From early August onwards, the Extended Nursery Area (ENA) is closed to protect smaller prawns (primarily king prawns) moving onto the trawl grounds from the nursery area. In addition, the Denham Sound opening occurs in July/August each year, which gives protection to these smaller prawns early in the season allowing a higher spawning biomass in this region.

### Scallops

The scallop catch is taken by boats licensed to take only scallops (11 A class licences) and boats that also fish for prawns in the Shark Bay Prawn Managed Fishery (18 B class licences).

The opening date of the scallop fishing season is a compromise between maintaining breeding stock levels (measured by a pre-season survey of stock abundance and commercial catch rates during the fishing season) and the seasonal decline in meat condition associated with spawning.

An early opening has the aim of increasing the total weight of scallops caught by taking them at a time when the meat size is large prior to spawning. However, in some years there may be a need to assess meat size and condition before the season commences to meet these criteria. To ensure that sufficient stock remains for spawning, the fishing arrangements provide a threshold catch rate for the cessation of scallop fishing (400 kg meat/24 hour period in northern Shark Bay and 450 kg meat/night time fishing period in Denham Sound).

Research activities continue to focus on stock assessment and annual monitoring of the target stocks, particularly tiger prawns and scallop stocks. All boats complete detailed daily log books, and these, together with pre-season fishery-independent recruitment surveys and in-season surveys of size composition and spawning stock, provide the information for monitoring the status of the stocks. In-season prawn surveys have proved to be valuable in ensuring that the prawns are targeted at an optimal market size.

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Determining the status of the scallop stock in Shark Bay also requires real-time monitoring of catch levels to ensure the threshold catch rate levels and catch shares are both achieved. In addition, an annual research survey is carried out in November, which, together with existing detailed biological knowledge, enables an annual catch forecast to be provided. These survey data are also used as the basis for the management arrangements to take into account fishing scallops at an optimum size and allows for an adequate spawning stock to remain for the following year. A minimum estimated catch availability level for Denham Sound and northern Shark Bay has also been set to determine if commercial fishing can commence each season.

A FRDC project on research into prawn/scallop gear interactions, scallop and prawn larval movement patterns in Shark Bay and potential effects of area closures in scallop/prawn management commenced in March 2008 and was completed in 2012.

## Retained Species

### Commercial production (season 2011)

<b>Prawns</b>	<b>2014 tonnes</b>
<b>Scallops</b>	<b>295 tonnes (whole weight)</b>

### Landings

#### Prawns

The total landings (whole weight) of major prawn species for this fishery was 2014 tonnes, comprising 1310 tonnes of king prawns, 689 tonnes of tiger prawns and 15 tonnes of endeavour prawns (Shark Bay Prawn and Scallop Figure 3). In addition, 117 t of coral prawns (various species, but mainly *Metapenaeopsis crassissima*) were landed. These total landings of major prawn species were higher than the interim target catch range set in 2009 (950 – 1450 t) but within the historical target catch range (1501 to 2330 tonnes). The target total catch levels are still being reviewed to reflect current fishing/targeting strategies and effort levels under normal environmental conditions.

King prawn landings (1310 t) were within the historical target catch range (1100 to 1600 tonnes). In 2010/11 the environmental conditions were unprecedented with higher than average water temperatures (by up to 4-5 degrees Celsius) in Shark Bay in early 2011 combined with two flood events. These appear to have increased prawn survival and increased recruitment levels. These events also increased prawn catchability and the flooding triggered prawns to be available on the trawl grounds earlier than normal and at a smaller size on average.

Tiger prawn landings (689 tonnes) were also within the historical target catch range (400-700 tonnes) but above the average catch of 533 tonnes over the last 16 years (1995-2010).

The king and tiger prawn catch rates during the combined recruitment surveys (March and April) in 2011 were the highest observed since 2001 and therefore the anticipated catches of both species were expected to be higher than seen in recent years. The relationship between survey indices and landings continues to be reviewed.

#### Scallops

The total scallop landings for this fishery, which includes the

catch from both A and B Class scallop boats, was 295 t (whole weight) (Shark Bay Prawn and Scallop Figure 4). All scallops landed were from northern Shark Bay (Red Cliff and North West Peron areas). A Class boats landed 206 t (70%) and the B Class boats landed 89 t. The 2010 scallop survey provided a 2011 catch prediction of 1340 t of scallop (whole weight) for northern Shark Bay. The catch prediction for Denham Sound was 155 t, below the 250 t level established as the minimum catch for scallop fishing to be undertaken in Denham Sound so no fishing took place in Denham Sound or “the Leads” area this season.

#### By-product

By-product landings from the prawn fleet included 293 t of blue swimmer crab (*Portunus armatus*), 2 t of coral crabs (*Charybdis feriata*), 14 t of squid, 20 t of cuttlefish, 1 t of bugs (*Thenus australiensis* and *parindicus*), < 1 t of octopus and mixed finfish species.

The blue swimmer crabs total season landings by the prawn boats were lower compared to the 2010 season landings (338 t). The monthly retention trend showed that there was a decline in abundance in the later months of the season.

By-product landings for the A class boats in the scallop fishery included 2 t of blue swimmer crabs (*P. armatus*), and < 1 t of bugs (*T. australiensis* and *parindicus*).

#### Fishing effort/access level

Eighteen prawn boats operated in 2011. All boats fished with quad gear configuration (four, 10.1 m nets). The mean annual total effort recorded historically by 27 prawn boats between 1990 and 2004 inclusive is 44,864 hours, fishing with twin gear (prior to 1990, the fleet consisted of 35 boats). An adjustment was made to the nominal effort for the increased headrope (37.5% per boat) towed by the 18 quad boats with the 2011 adjusted effort being 36,061 hours (twin-gear equivalent). This adjusted effort is lower than last year and the lowest seen since 1968 and well below the mean effort between 1990 and 2004. The impact of gear amalgamation means that effective effort has not reduced as much as nominal effort.

The cost of fishing (mainly high fuel prices and high value of the Australian dollar) has reduced effort due to economic reasons. The prawn season arrangements provided 170 nights fishing, however, only 162 nights were used. This was mainly because 11 boats ceased fishing at the September moon closure (7 to 16 September) and these boats only fished 146 nights.

The nominal effort recorded by the 9 A Class boats in 2011 was 1,393 hours. This is a marked decline of effort from previous years and has been compounded by both the reduction in the number of boats and low abundance and poor quality of scallops available. The effort is standardised as all boats tow 12.8 m (7 fathom) headrope nets.

**Recreational component:** Nil

## Stock Assessment

**Assessment complete:** Yes

**Assessment level and method:**

**Level 4 - Direct survey/catch rate**

**Breeding stock levels:**

<b>King prawns</b>	<b>Adequate</b>
<b>Tigers prawns</b>	<b>Adequate</b>
<b>Scallops:</b>	<b>Adequate</b>

**Prawns**

The catch per unit of effort for the prawn fishery can be used as an indicator to monitor changes in stock levels from year-to-year. Spawning stock and recruitment indices are derived from survey data and commercial catch rate levels of tiger prawn spawning stock from logbook data. The conservative tiger prawn threshold catch rate levels are in place to maintain spawning stock above acceptable levels. Logbooks provide information on the daily catch (kg) of target species and effort (hours trawled) expended in specific fishing areas. Catch per unit effort can then be derived for each fishing area by each boat by species. Fishery-independent surveys are undertaken for king and tiger prawn stocks, which are monitored and assessed for size and catch rates from recruit surveys in March and April, king prawn surveys in Denham Sound in June and July, and tiger prawn breeding stock surveys in July and August. Fishery-independent recruitment surveys are undertaken as fishery-dependent data on key recruitment grounds is no longer available. Historically, fishing occurred in these grounds from 1 March and commercial catch rate information provided information on recruitment trends, however since late 1990s, no fishing occurs in these areas early in the season. The information is also used to determine the extent of areas to be opened to fishing to meet prevailing market requirements. These data will also be used in the future to forecast a predicted catch range for tiger and king prawns. The spawning stock surveys are undertaken to verify tiger prawn catch rates after the TPSA is closed to fishing. Some of the king prawn breeding stock is also protected by this closure and their catch rates are also recorded during the surveys.

**Catch rate assessment**

The overall king prawn catch rate of 36.2 kg/hr (for adjusted effort equivalent to twin gear units) in 2011 was higher than last year's rate of 27.5 kg/hr. The overall tiger prawn catch rate of 19.1 kg/hr was also a significant increase compared to 10.3 kg/hr in 2010. These catch rates indicate that the fishery is healthy, was fished efficiently and reflected the favourable environmental conditions in 2011.

**Survey assessment and breeding stock levels**

Fishery-independent recruitment index for tiger and king prawns in 2011 was higher than observed in 2010 and was reflected in the improved catches in 2011.

To maintain adequate tiger prawn breeding stock levels the, Tiger Prawn Spawning Area (TPSA) is closed when the mean catch rate reaches the threshold level. The threshold catch rate was conservatively adjusted for quad gear (four 10.1m nets) in 2007 (from 20 kg/hr) to 27.5 kg/hr, with a range of 25 to 30 kg/hr. In 2011, the daily catch rate was difficult to assess due to the sporadic fishing effort by boats in the TPSA. The tiger prawn catch rates in the fishing area directly south of the TPSA were deemed adequate to allow fishing to continue in the TPSA into June.

Two standard spawning stock surveys are generally undertaken around the third moon phase in July and August, in the TPSA. In 2011 survey catch rates for tiger prawns were

23.7 kg/hr in July and 18 kg/hr in August with a mean catch rate of 20.8 kg/hr, all below the threshold level. While the breeding stock level of tiger prawns is still considered adequate, both the threshold level and potentially even the specific area defined as the TPSA may need to be reviewed.

The catch rates for both tiger and king prawns decreased from July to August, indicating very little migration into the area in the latter part of the season and below-threshold catch rates in the TPSA. In consultation with industry, the TPSA was not re-opened during October (the last fishing period for the season) as occurred in 2010.

The king prawn catch rates were 19.9 kg/hr and 17.6 kg/hr respectively with a mean catch rate of 18.8 kg/hr which is within the historical range for this species (16-29 kg/hr). King prawn stock remains above the level where recruitment is affected by spawning stock levels and it is therefore adequate. Fluctuations in the annual king prawn harvest are most likely to have resulted from varying effort levels and environmental effects on recruitment, not from the spawning stock abundance.

Variable quantities of minor penaeids (predominantly coral prawns) are retained, depending on the catch of the target species. Owing to the small size of these species, it is likely that the majority of the stock is able to pass through the trawl mesh, suggesting that the overall exploitation is low and that breeding stock levels will therefore be adequate. Due to the low market prices received for these minor species their retention is minimal.

*The main performance measures for the prawn fishery relate to maintenance of breeding stocks for each of the major target prawn species. In 2011, the breeding stock indicator for tiger prawns was below the threshold level of 25-30 kg/hr but still considered adequate. The king and tiger prawn annual landings were within the historical target range.*

**Scallops**

Scallops mature at about one year of age and spawning typically occurs from April to November. Fishing is therefore controlled to ensure that sufficient scallops remain through the key spawning season (April to July), which is the critical period for generating the forthcoming seasons recruits.

The catch rate of 29.7 kg/hr from A class boats (based on scallop meat weight which is 20% of the whole scallop weight) was relatively low compared to recent years since 2004, when the fishing strategy changed.

The catch rate threshold was 400 kg/day fishing period in northern Shark Bay and scallop fishing ceased 17 April at an average catch rate of 408kg/hr (based on the last 2 days of fishing) leaving an adequate residual level of spawning stock. The 2010 annual scallop survey provided a catch prediction for the 2011 season in the northern area of 1340 t (range 1070-1600 t) whole weight. The shell height measurements showed that the stock was predominantly recruits (small size shell) with low numbers of residual scallops. The size structure of scallops and low abundance of residuals indicated that the season should have opened later than it did

## GASCOYNE COAST BIOREGION

on 9 April. In Denham Sound, recruitment levels were low and the residual numbers were extremely low for a predicted catch of only 31 t meat weight. The low catch prediction for Denham Sound was deemed below the level (50 t meat weight) to allow scallop fishing this season in this area.

*The performance measure is to ensure adequate breeding stock levels. This is achieved by cessation of fishing at the appropriate catch rate thresholds. The current cut-off catch rates continue to be reviewed. As the Denham Sound catch prediction was below the minimum abundance level for fishing, this area remained closed for the 2011 season. Also the fishing strategy has aimed at leaving part of the stock to be carried over to the following year providing a buffer in case of low recruitment and this should remain part of the sustainable fishing strategy.*

### Projected scallop catch next season (2012):

#### Nil tonnes (whole weight)

The catch projection for the 2012 season is based on the 2011 annual survey results. In northern Shark Bay, observed recruitment was very low. The catch prediction for this area is 42 t meat weight but this is predominantly recruitment with few residual scallops. In Denham Sound, both recruitment and residual levels were low and provided a low overall index giving a predicted catch of 11 t meat weight. Therefore the catch prediction for the fishery is at a very low level such that all the available stock should remain for spawning with no scallop taken. This low recruitment appears due to the extreme environmental conditions of early 2011 in Shark Bay due to the very strong La Niña and strong Leeuwin Current.

The catch predictions are based on catch trends involving historic fishing practices. These estimates are being revised to take into account management changes since 2005 that have been significantly altered by the timing that fishing occurs and allowing carryover of scallops.

## Non-Retained Species

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

### Prawn trawlers

Bycatch composition for the prawn fishery is dominated by dead wire weed, which breaks off from the extensive shallow Wooramel seagrass bank annually over summer. The bycatch also contains a number of small size fish species mostly not taken by other sectors. Small blue swimmer crabs and other crustacean species are also taken in significant quantities but are generally returned to the sea alive. Overall bycatch taken in trawl nets are moderate relative to other subtropical trawl fisheries at about 4–8 times the prawn catch. Grid and secondary bycatch reduction devices (square mesh panels in cod-ends) are fully implemented and should further reduce the quantity of small fish retained in trawls. A comprehensive research survey found no significant difference in invertebrate or finfish abundance or diversity between trawled and untrawled areas.

*The two performance measures for the fishery relate to: (i) its impact on biodiversity through the take of non-target (bycatch) species, and (ii) its impact on associated species, e.g. dolphins, through the discarding of bycatch (provisioning). In the case of biodiversity, a major project surveying bycatch species on and off the trawl grounds has been completed. Data analysis indicates that trawled areas have similar diversity to the larger adjacent untrawled areas, indicating that the performance indicator will be met. For provisioning, the indicator has been met due to the lower and more targeted trawl effort and implementation of BRDs in the fleet. Both actions have reduced the rate of discards relative to the pre-BRD period.*

### Scallop trawlers

The total bycatch of fish and other fauna is minimal for the scallop fishery owing to the legislated design of the nets (which use 100 mm mesh) and the relatively short duration of the fishery.

**Protected species interaction:** **Low**

Although protected species including whales, dolphins, dugongs, turtles and sea snakes are particularly abundant in Shark Bay generally, only sea snakes are seen regularly in the trawl catches in certain areas, and these are mostly returned to the sea alive. There has been a focus on improved reporting of interaction with protected species by fishers and in 2011, 119 sea snakes were reported as captured and returned to the sea alive and 24 were dead. The full implementation of bycatch reduction devices (grids) in the fishery since 2002 has generally eliminated the occasional capture of turtles in trawl nets.

*One performance measure for the fishery is for 90% of turtles from non-BRD nets to be returned alive. These fisheries have BRDs (grids) in all nets so this performance measure is no longer valid. For the 2011 season 15 turtles were recorded as caught in nets in the prawn fishery and were recorded as being returned to the sea alive. For the scallop fishery, no turtle was reported as being taken in scallop nets.*

## Ecosystem Effects

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

Although the harvest rates of the retained target species are high, such species have very high natural mortality rates and make up a relatively small proportion of the 'fish' biomass on the trawl grounds. Thus, most prawn and scallop predators are opportunistic due to these natural variations in prawn and scallop populations. Consequently, it is considered unlikely that the commercial take of prawns and scallops impacts significantly on the upper trophic levels within the Shark Bay ecosystem. The reduced levels of effort now used by the fishery, combined with the modifications to gear to reduce unwanted catch, will have further reduced the potential for indirect food chain impacts to occur.

**Habitat effects:**

<b>Prawn fishery</b>	<b>Moderate</b>
<b>Scallop fishery</b>	<b>Low</b>

There are extensive permanent and temporary closures in the Shark Bay trawl fisheries. The total area inside Shark Bay is 4652 nm<sup>2</sup> and represents 38% of the total fishery area (including closed areas). (Shark Bay Prawn and Scallop Figure 1).

**Prawn trawlers**

The prawn fleet operates in approximately 7% of the overall fishery boundaries. The permitted trawl area inside Shark Bay is 1768 nm<sup>2</sup> and represents 38% of inner Shark Bay (excluding the closed areas) but trawling does not occur across this whole region. Trawl fishing is focused in the deeper areas (predominantly sand/shell habitats) of the central bay, north and northeast of Cape Peron and in the northern area of Denham Sound. The majority of sponge/coral habitats are contained within specific trawl closures to protect these areas.

**Scallop trawlers**

The scallop fleet operates in approximately 3% of the overall fishery. The permitted trawl area inside Shark Bay is 1483 nm<sup>2</sup> and represents 32% of inner Shark Bay (excluding the closed areas) but actual trawling occurs in a much smaller area than this. Trawl fishing is focused in predominantly sand/shell habitats of the central bay, northwest of Cape Peron and in most years in the northern area of Denham Sound. The majority of sponge/coral habitats are contained within specific trawl closures to protect these areas.

*Performance measures for habitat impact relate to the spatial extent of prawn trawling within Shark Bay's sand/shell and coral/sponge habitats. Both the prawn and scallop fleet permitted trawl areas are below the 40% level of the inner Shark Bay area. Most sponge/coral habitats in Shark Bay are now protected by fishery permanent closures, which will limit the actual trawl area below 40% at any time. In 2011 the performance measure was met as the total area trawled within inner Shark Bay by the prawn fleet was approximately 778 square nautical miles or 17% of inner Shark Bay and the scallop area trawled was approximately 109 square nautical miles or 3% of the inner Shark Bay.*

**Social Effects**

These industries are a major contributor to regional employment. During 2011, approximately 100 skippers and other crew were employed in the prawn fishery. There are also approximately 100 processing and support staff directly employed at Carnarvon. Nor West Seafood is based in Carnarvon with administration, wharf and engineering staff based at the small boat harbour and a processing factory at Babbage Island. Approximately 70% of their work force is permanent. The prawn sector also utilises, wherever possible, Western Australian service companies providing engineering supplies, packaging, transport logistics, ship stores and fuel. For the scallop sector approximately 100 skippers and other crew are employed for the relatively short period in the region with support staff in Geraldton and Fremantle.

**Economic Effects****Estimated annual value of major prawn and scallop for 2011:**

<b>Prawns</b>	<b>Level 5 - &gt; \$20 million (\$25.6 million)</b>
<b>Scallops</b>	<b>Level 2 - \$1 - 5 million (\$1.5 million)</b>

The value of the fishery including crabs, coral prawns, scallops, squid and bugs to the prawn fleet is \$28.2 million. The estimated value of the scallop only fleet is \$1.5 million

Ex-vessel prices for prawns vary, depending on the type of product and the market forces operating at any one time, and average ex-boat prices were as follows:

King prawns	\$11.90/kg
Tiger prawns	\$14.60/kg
Coral prawns	\$3.80/kg
Scallops	\$5.00/kg
Crabs	\$5.80/kg

**Fishery Governance****Target catch range:**

<b>Prawns (Historical range)</b>	<b>1501 – 2330 tonnes</b>
<b>Prawns (New interim range)</b>	<b>950 – 1450 tonnes</b>
<b>Scallop</b>	<b>1250 – 3000 tonnes whole weight</b>

Under previous effort levels, normal environmental conditions and based on catches in the 1990s following the restructuring of the fishery to 27 licences, the target catch range had been set for major penaeids at 1501 – 2330 t. Similarly, the target catch ranges for individual species were king prawns 1100 – 1600 t, tiger prawns 400 – 700 t and endeavour prawns 1 – 30 t.

The focus by industry is now to target larger size prawns, the resulting effort shift has reduced expected total landings to around the 950 to 1450 t under normal environmental conditions compared to historical catch ranges. After three years of below historical target total landings the 2010 and 2011 king and tiger prawn total landings (2014 t) have returned to be with the historical overall catch range. The interim range will be reviewed over the next three years (2012 to 2015) inclusive, and a new target catch range developed for the combined prawn catch and individual target species.

The scallop target catch range remains at approximately 1250 – 3000 t whole weight, based on catches over the five-year period 1995 – 1999. This period excludes the high catches of the early 1990s (Shark Bay Scallop Figure 4), apparently created by an unprecedented four years of El Niño conditions.

The projected catch for next season (265 t) whole weight, based on a pre-season survey, is below the target catch range.

**New management initiatives (2011)**

Implementation of a fixed catch share between the A (70%) and B (30%) Class boats.

## External Factors

Increasing costs of fishing and lower returns due to the global economic climate and competition from imported and locally aquaculture small prawns, has focussed harvesting practices on targeting larger prawns during efficient catch rate periods and shifting the emphasis to domestic markets rather than export markets.

Increased fishing costs (fuel prices and high value of the Australian dollar and coupled with declining prawn prices in real terms), has lead industry maximise the return from all species taken in the fishery where possible, particularly scallops and blue swimmer crabs.

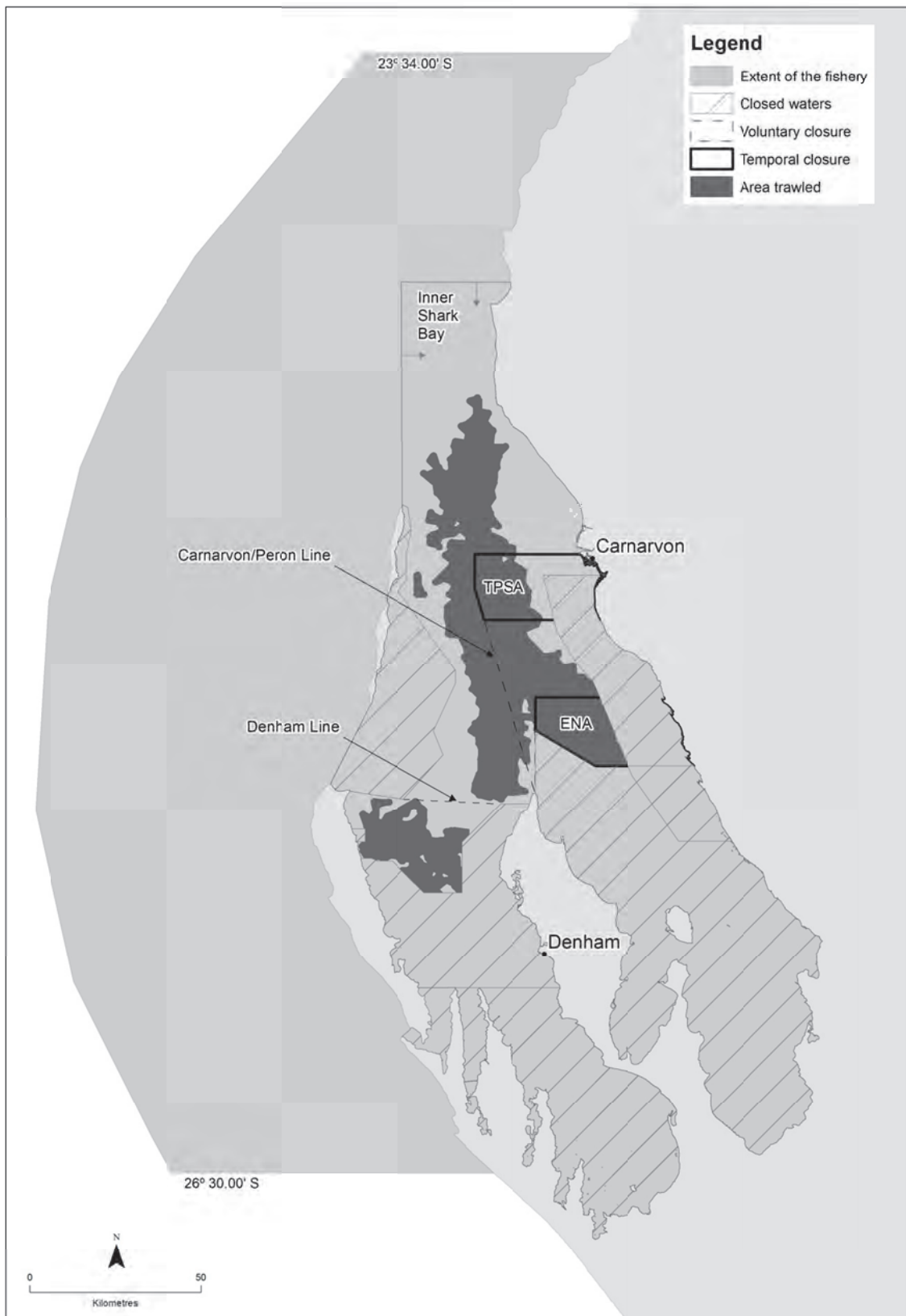
The major environmental factor influencing these stocks appears to be the flow of the Leeuwin Current along the outside of the embayment. A relationship between current strength (as measured by Fremantle sea level) and king prawn catches has been identified and may be used to indicate broad catch trends. The theory is that higher current flows increase water temperatures, which may increase the growth and catchability of the prawns. A relationship exists between sea level (at Fremantle) and the recruitment of scallops in Shark Bay, particularly in the Red Cliff area. Generally, high sea

levels corresponding to strong Leeuwin Current correlate with poor recruitment.

In 2011 the environmental conditions were favourable for both king tiger prawns. Rainfall produced two flooding events over the summer months (December 2010 and February 2011) and these would have triggered the migration of prawns from inshore areas onto the trawl grounds. Also, higher turbidity will have increased survival of juvenile prawns in nurseries. With the early arrival of tiger prawns on the trawl grounds and higher survival, high catch rates of tiger prawns in the early months of fishing occurred in 2011 and this was when most of the stock was taken. The strong La Niña conditions have generally resulted in below-average scallop recruitment and in 2011 increased water temperatures and flooding events may have contributed to high mortality of residual scallops in Shark Bay.

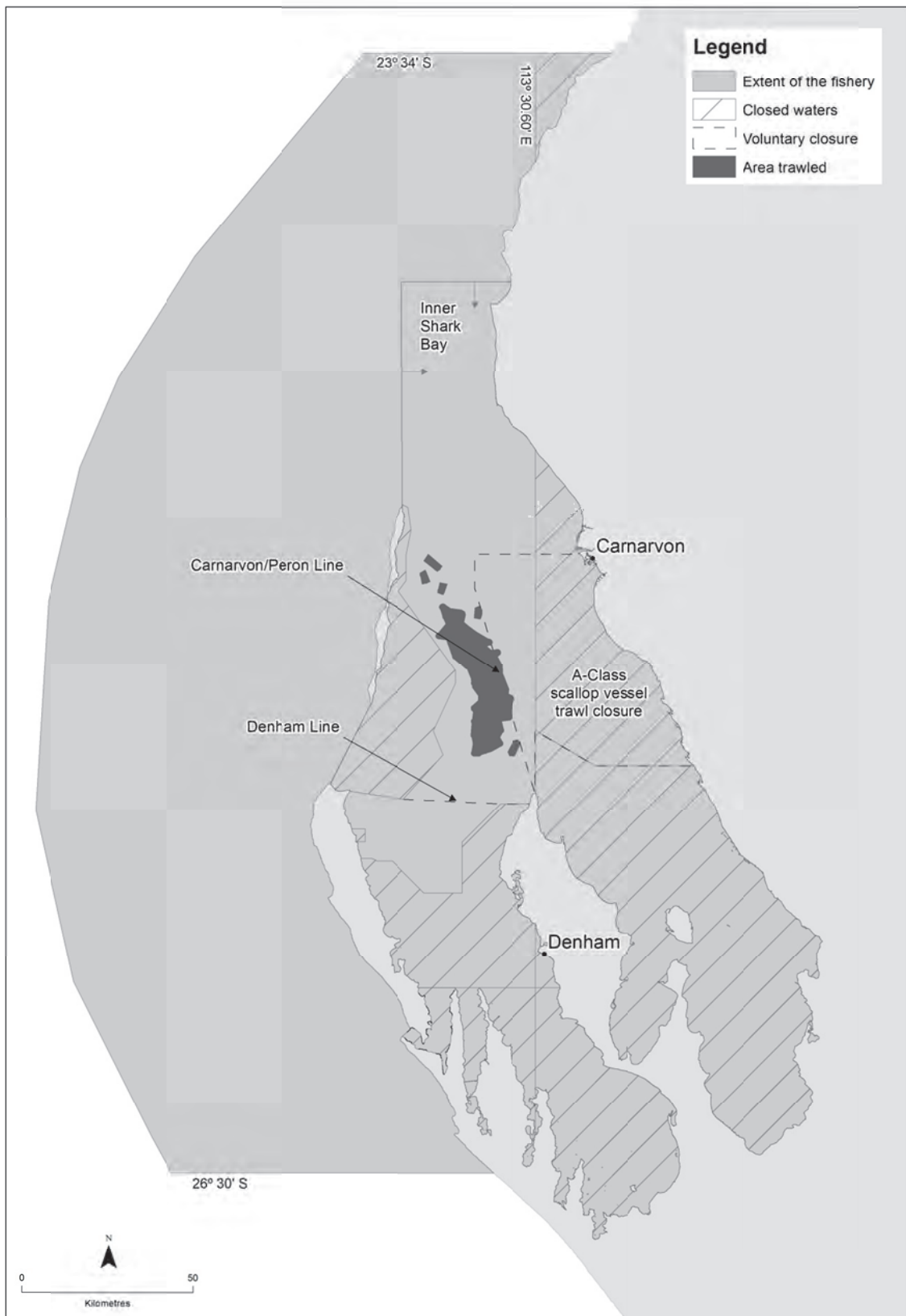
The Department of Fisheries is currently examining the mechanisms that control recruitment success in greater detail, in order to explain more of the inter-annual variation that occurs.





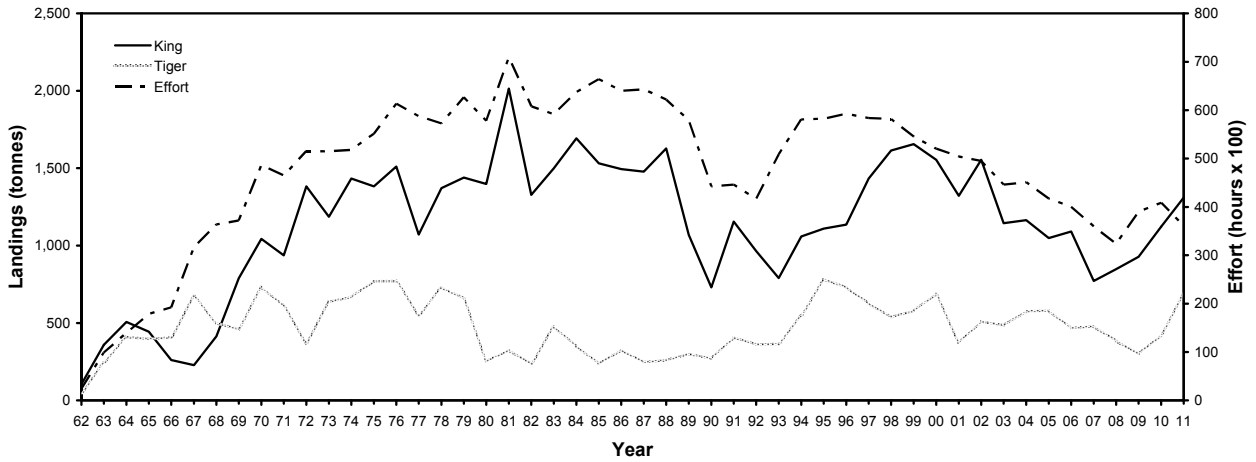
**SHARK BAY PRAWN AND SCALLOP FIGURE 1**

The main boundaries of the Shark Bay Prawn Fishery, Inner Shark Bay, TPSA, ENA, trawl closures, permitted trawl area (extends out to the 200m isobath) and area trawled in 2011.



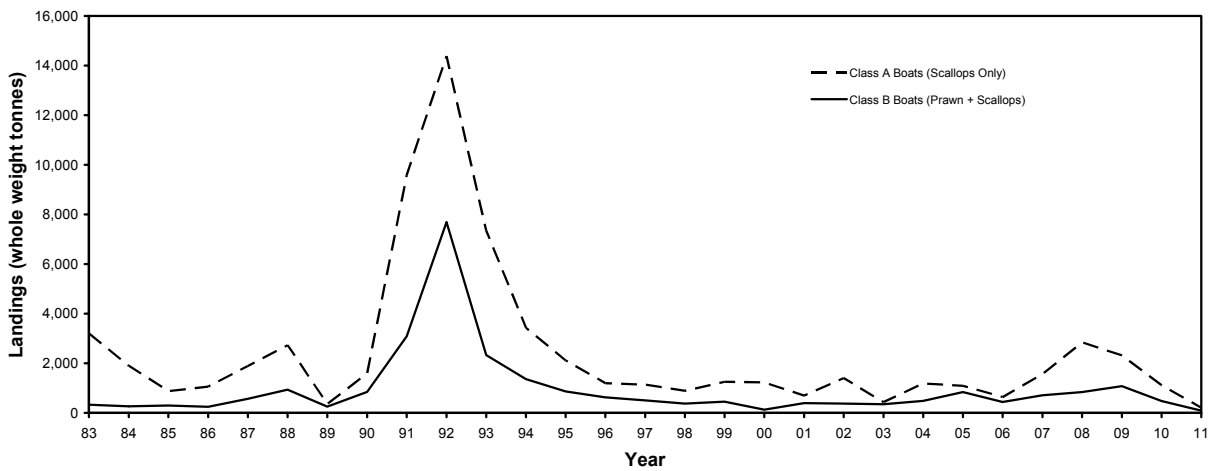
**SHARK BAY PRAWN AND SCALLOP FIGURE 2**

The main boundaries of the Shark Bay Scallop Fishery, permitted trawl area (extends out to the 200m isobath) and area trawled in 2011.



**SHARK BAY PRAWN AND SCALLOP FIGURE 3**

Shark Bay Prawn Managed Fishery annual landings and effort (adjusted to twin gear units) 1962 – 2011.



**SHARK BAY PRAWN AND SCALLOP FIGURE 4**

Shark Bay Scallop Managed Fishery annual landings 1983 – 2011.

# Exmouth Gulf Prawn Managed Fishery Status Report

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

Main Features			
Status		Current prawn Landings	
Stock level	Adequate	Tiger	749 t
		Kings	97 t
Fishing level	Acceptable	Endeavours	130 t

## Fishery Description

The Exmouth Gulf Prawn Managed Fishery uses low opening, otter prawn trawl systems within the sheltered waters of Exmouth Gulf to target western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*Penaeus esculentus*), endeavour prawns (*Metapenaeus* spp.) and banana prawns (*Penaeus merguensis*).

### Governing legislation/fishing authority

*Exmouth Gulf Prawn Management Plan 1989*

Exmouth Gulf Prawn Managed Fishery Licence

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

### Consultation process

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

### Boundaries

The main boundaries for the Exmouth Gulf Prawn Managed Fishery are shown in Exmouth Gulf Figure 1. This diagram outlines the boundaries of the fishery, the areas where trawling is permitted, the areas actually trawled in 2011, the Tiger Prawn Spawning Area (TPSA) which is closed for part of the season, and the areas permanently closed to trawling.

### Management arrangements

Management of this fishery is based on input controls, including limited entry, seasonal and area openings and closures, moon closures and gear controls. Management arrangements are designed to keep fishing effort at levels that will maintain a sufficient spawning biomass of prawns (particularly tiger prawns). The process for in-season fishing area opening/closing is dynamic and involves real-time management between the Department's Research Division

and the industry. Opening and closing dates varying each year, depending on environmental conditions, moon phases and the results of fishery-independent pre-season surveys that provide a catch prediction. The Department's Vessel Monitoring System (VMS) monitors the activities of all boats during the season.

Maximising economic efficiency continues to drive fleet restructure within the fishery, with less than 10 boats operating in the fishery during the 2010 season, involving headrope allocation being redistributed among the remaining boats. In recent seasons, management arrangements have provided for a fishing period of about 200 nights with a minimum of 28 non-fishing nights for moon closures during the period. For the 2011 season, official opening and closing dates were formally set at 1 May and 30 November respectively, providing a maximum of 181 nights (allowing five nights closure each full moon) for fishing. The season actually commenced on 8 May, based on results from pre-season surveys and it closed at 0800 hrs on 17 November. There were spatio-temporal closures during the early part of the season (April – July) to avoid fishing on small prawns.

Stringent measures are in place to ensure that spawning stock levels for tiger prawns are maintained at adequate levels and that the prospects of both recruitment and growth over-fishing are avoided. These measures will continue to be applied, while incorporating a flexible fishing regime to optimise size and value of prawns.

Bycatch reduction devices (BRDs) are mandatory in this fishery, with all boats required, by a condition on the managed fishery licences, to fish with a 'grid' and a secondary fish escapement device (FED) fitted in each net. Industry, in association with the Department, successfully gained certification from the US Department of State in 2008 of its BRD-compliance, for reducing the potential for turtle captures. This certification allows licensees to export product to the US market. Since 2002 industry has also used 'hopper' in-water sorting systems, which, provide an improved quality of prawns and reduced mortality for some bycatch species.

The Commonwealth Government's Department of Sustainability Environment Water Populations and Communities (SEWPaC), assessed the fishery in 2008 as being sustainable under the provisions of the EPBC Act 1999. This has provided the export accreditation for the fishery for a period of five years. The comprehensive ESD assessment of this fishery identified the only risks that

required specific management actions to ensure adequate performance were the breeding stock levels of target prawn species, bycatch species impacts, habitat and provisioning effects. Boxed text in this status report provides the annual assessment of performance measures/indicators related to these issues.

## Research summary

Research activities continue to focus on stock assessment and surveys to monitor annual recruitment of tiger prawns, spawning stock levels and a pre-season survey of king prawn sizes to assist with harvesting strategies (these are detailed above in the management arrangements). An annual catch prediction for tiger prawns is also provided using an index derived from the recruitment survey data. Monitoring of fishing activity is undertaken in real time and using threshold catch rates to determine the specific timing of the closure of the tiger prawn spawning area. All boats complete detailed daily logbooks, which, together with survey data and factory catch unload records, provide a major source of information for managing the fishery. The joint evaluation and implementation of gear modifications to reduce bycatch and improve product quality is ongoing.

King prawn breeding stock levels in the fishery are maintained at adequate levels during normal environmental conditions through controls on fishing effort, their extended breeding period and lower catchability of the species compared to tiger prawns. Pre-season surveys for king prawns have been established since 2002 to provide an index of recruitment into the fishery and provide a catch prediction and understanding of prawn movement in this fishery. In 2011 two pre-season recruitment surveys were conducted and will be repeated in 2012 to improve the data series. Consideration may also be given to expanding sampling during the spawning stock surveys. The effect of the record high water temperatures in the Gascoyne region in early 2011 and their possible effect on the record low abundance of king prawns will also be examined.

## Retained Species

### Commercial production (season 2011):

**976 tonnes**

### Landings

The total landings of major penaeids for the 2011 season were 976 t, comprising 97 t of king prawns, 749 t of tiger prawns, 130 t of endeavour prawns and 3 t of banana prawns. The tiger prawn landings were well above the normal catch range (250-550 t) and fourth highest record since the 1960's and the highest in over 30 years. Endeavour prawn landings were at the lower end but within the normal catch range of 120-300 t, however king prawn landings were well below the target catch range (350-500 t). The king prawn landings are the lowest they have been since the late 1960's, a trend that is consistent with other north-west prawn fisheries. The continued low king prawn landings is a concern, however, because of the trend of low annual landings since Cyclone Vance.

Recorded landings of by-product were; 58 t of blue swimmer crab (*Portunus armatus*), 6 t of squid, 2 t of bugs (*Thenus*

*australiensis*), and <1 t of coral prawns and octopus. The coral prawn catch is the lowest on record and is largely due to the high concentrations of tiger prawns with fishing effort focusing in areas where coral prawns are not in high abundance.

Recorded landings of blue swimmer crabs were higher this season compared to the last five years but within the historical range. Crabs and other byproduct are taken incidentally and are variable depending on abundance available on the trawl grounds each year. There appeared to be relatively high crab abundance on the trawl grounds possibly due to being flushed onto trawl grounds (due to high rainfall in the early part of the season). Fishers retain crabs at a minimum size of approximately 137 mm spine to spine measurement (compared to the recreational minimum size of 127mm). The larger minimum size was introduced on a voluntary basis into this fishery in 2007.

### Fishing effort/access level

In 1990 a Voluntary Fishery Adjustment Scheme (VFAS) for the Exmouth Prawn Managed Fishery was approved and 3 Licenses were removed from the fishery reducing the fleet from 19 to 16 Licenses. The total allocation of net headrope capacity was reduced to 438.91 m (240 fathoms), based on 16 boats each towing 27.43 m (15 fathoms) of net headrope in twin gear configuration.

In 1998 industry fleet restructures commenced and boats commenced trialling a more efficient trawl gear configuration, quad gear, to improve the economic efficiency of the fleet. By 2000, all boats were towing quad gear. The boat numbers were gradually reduced between 1998 and 2007 to nine boats in 2007. When these quad gear trials were completed, the total capacity of net headrope was reduced by 10% to 395 m (216 fathoms) to account for a quad gear net efficiency increase. This aimed to retain total effective effort at levels observed historically. During this fleet restructure phase a second VFAS was approved in 2009 removing one more licence from the fishery.

Since 2007, active boat numbers in the fishery have remained at nine, fishing with a total headrope capacity of 376.73 m (206 fathoms). However, to date not all nine boats have towed the same size nets.

In 2011 nine boats operated towing a total of 376.73 m (206 fathoms) of net headrope. There were two different net headrope sizes towed, 10.97 m (6 ftm) and 10.06 m (5.5 ftm) because five of the nine boats cannot tow the 10.97 m nets. Boat numbers and net sizes for each boat have remained consistent since 2007. Total nominal effort for the 2011 season was 13,221 hours. The adjusted effort (to twin gear) was 20,532 hours, which is the lowest since 1968. Fishing effort in 2011 was at the expected level for the total landings because the king prawn abundance was low therefore only moderate effort was expended on this species. Usually effort on king prawns is focused towards the latter part of the season when their abundance peaks during late August and September. However because of low catch rates of king prawns this year effort was primarily applied onto the tiger prawns instead, which experience a very good abundance this season.

## Stock Assessment

**Assessment complete:** Yes

**Assessment level and method:**  
Level 4 - Direct survey/catch rate

**Breeding stock levels:** Adequate

**Projected catch next season (2012):**  
175 (140-210) tonnes tiger prawns

The standardised catch per unit effort data from the fishery is an indicator of abundance, and can be used to monitor changes in stock levels from year to year. The average catch and catch rate is compared to a ten-year reference point (1989 to 1998) for each species. The tiger and king prawns stocks are also assessed each year using standardised recruitment and breeding stock surveys.

### Catch assessment

The adjusted catch rate of 37.1 kg/hr for tiger prawn is much higher than the reference catch rate of 10 kg/hr. The high catch rates of tiger prawns reflect their high abundance because of favourable environmental conditions for this species. This was also reflected in an endeavour prawn catch rate of 6.4 kg/hr, which is above the reference point catch rate of 5.6 kg/hr. Although both tiger and endeavour prawns occupy similar inshore structured habitats the effort was focused on tiger prawns rather than endeavour prawns because tiger prawns are a much higher value. Therefore the endeavour prawn catch rate may not represent the actual abundance of this species because of the fleet fishing strategy focusing on tiger prawns. The season ceased according to the catch rate threshold of tiger prawns.

The adjusted catch rate 4.8 per kg/hr, for king prawns is below the reference catch rate level of 11.7 kg/hr. The king prawn total landings were below the acceptable catch range and there is some concern for the king prawn stock, however, fishing effort does not appear to be the cause of the decline in annual landings at current effort levels. Fishery-independent surveys are undertaken to measure the recruitment strength and logbook spatial and catch and effort information is used during the spawning phase to review the stock status and to understand the distribution of king prawns in the gulf.

The season commenced in early May, which was later than previous seasons and king prawns were fished conservatively because fishing in the northern area (key king prawn fishing grounds) was limited. In the early part of the season effort was reduced because of the later opening date and areas of small prawns were closed to fishing to ensure that size and quality were maintained. Also, fishing was restricted by an informal spatial closure on king prawns in the latter part of the season because of low abundance to maintain some spawning stock.

### Survey assessment

The tiger and king prawn stocks are also assessed each year using standardised surveys, which permits variations to the management plan using flexible real-time arrangements within the season to optimise catch and size grades and ensure sustainability.

For tiger prawns, this process involves analysis of survey-based indices of recruitment and spawning stock, which are assessed against the spawning stock recruitment relationship.

The catch prediction for tiger prawns is based on the relationship between recruitment survey indices (early and late March and early April) and the season's landings (April–November of the same year). The projected tiger prawn catch range for 2011 was 480 to 720 tonnes. For the 2011 season the annual total landings were slightly above the prediction range. The tiger prawn breeding stock levels are maintained at adequate levels by monitoring the tiger prawn catch rates to determine when fishing should cease in the main tiger prawn fish grounds. This strategy maintains the spawning biomass of tiger prawns above the historically determined biological reference point. The present cut-off threshold catch rate is 25 kg/hr based on 6-fathom nets in quad gear configuration (which is reduced to 19 kg/hr after 1 November).

During 2011, tiger prawn catch rates were monitored from July to August and the central Tiger Prawn Spawning Area (TPSA) and Eastern Area closed on 11 August. Three standardised tiger prawn breeding stock surveys are carried out from August to October each year. The first two of three standardised tiger prawn breeding stock surveys carried out in August and September had an average quad gear CPUE of 61.7 kg/hr and 108.6 kg/hr in the spawning areas (Q1 and Q2 respectively). As there were low catch rates of king prawns in the Northern Area of the fishery and the catch rate of tiger prawns was well above the threshold of 25 kg/hr, part of the central TPSA west of the Heron line, was opened for fishing from 2 to 9 October inclusive. For this period of fishing the actual quad gear catch rates started at 140 kg/hr and declined to 60 kg/hr and the breeding stock level was maintained well above the threshold level. The August, September and October Q1 area surveys showed a quad gear CPUE of 63.4 kg/hr, 59.9 kg/hr and 52.0 kg/hr respectively with an average catch rate of 58.4 kg/hr overall. The spawning survey regime extends to the central Gulf (Q2 area) and the mean spawning indices for the three surveys were higher than in Q1 at 103 kg/hr. The tiger prawn spawning area and the eastern were then re-opened for fishing on 23 October and when fishing ceased in southern gulf the whole fishery was closed on 8 November. The tiger prawn catch rate when fishing ceased was 33 kg/hr, above the end-of-season catch rate threshold of 19 kg/hr however, it was considered appropriate to cease at this time as the fleet effort was concentrated within a small area maintaining a higher catch rate than if effort was spread into areas with lower catch rates.

The 2012 tiger prawn recruitment survey index was the lowest observed (13.3 kg/hr) since the inception of surveys with the next lowest in 2001 (13.9 kg/hr) after Cyclone Steve following a major perturbation from Cyclone Vance in March 1999. The spawning stock index in 2011 was high so there is no indication of recruitment overfishing occurring and therefore environmental effects will be examined to assess the cause of the low recruitment.

There is no formal stock assessment for endeavour prawns, a secondary target species whose distribution overlaps that of tiger prawns, and they are fished to varying levels depending on the abundance of (and hence the fishing effort applied to) the more valuable tiger prawns. The breeding stocks of endeavour prawns are considered to be at adequate levels because their distribution overlaps that of the tiger prawns and the tiger prawn closures also protect a significant portion of the endeavour prawn breeding stock each year. In addition, endeavour prawns are also considered to be more resilient to

fishing pressure due to their smaller size and lower catchability and less targeting than the tiger and king prawns.

*The main performance measures for the fishery relate to maintenance of breeding stocks for each of the major target prawn species. In 2011 the breeding stock indicators (catches within specified ranges) for tiger and endeavour prawns were met. The king prawns were below the target range, however there is a conservative harvesting strategy in place for this species. Low banana prawn landings recorded corresponded to the rainfall over the summer months.*

### Non-Retained Species

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

Bycatch levels for Exmouth Gulf are relatively low by tropical trawl fisheries standards, with few species of significance to other fishing sectors being taken. Trialing of secondary bycatch reduction devices continues (including square mesh cod-end nets) in order to reduce the volume of overall bycatch species retained in the trawls improving the quality of the prawn catch. In addition, all boats used hoppers (in-water catch sorting systems), which add another level of improvement for bycatch survival and product quality. Fishing adjusted effort in 2011 was the lowest seen since 1970.

*The two performance measures for the fishery relate to (i) its impact on biodiversity through the take of non-target (bycatch) species, and (ii) its impact on associated species, e.g. dolphins, through the discarding of bycatch (provisioning). Analysis indicates that trawled areas have similar diversity to the larger adjacent untrawled areas (even though abundances may vary), indicating that the performance indicator will be met. For provisioning, the indicator has been met due to the lower and more targeted trawl effort and implementation of BRDs in the fleet. Both actions have reduced the rate of discards relative to the pre-BRD period.*

**Protected species interaction:** **Low**

While protected species including dugongs, turtles and sea snakes, occur in the general area, only sea snakes and occasionally turtles are encountered in the trawl catches. Both species are typically returned to the sea alive. Grids are now compulsory, which has largely eliminated the capture of any turtles or other large animals. In addition, secondary bycatch reduction devices (square mesh panels) were implemented in all nets in 2005. Twenty eight turtles were reported as being caught in nets during 2011 and all were returned back to the sea alive. There has been a focus on improved reporting of interaction with protected species by fishers. In 2011, 449 sea snakes were reported as captured and returned to the sea alive and 48 were dead. Twenty three sawfish and 4 syngnathids were also reported.

### Ecosystem Effects

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

Although the prawn species are managed to relatively high levels of annual harvest, the impact of the catch on local food chains is unlikely to be significant in view of the high natural mortality, extent of non-trawled nursery areas and variable biomass levels of prawns resulting from variable environmental conditions, such as cyclone events.

**Habitat effects:** **Low**

Historically, the fishery has impacted on some shallow water areas (less than 12 m in depth) containing sponge habitats, but the refocusing of the fishery into deeper waters to take larger prawns since the early 1980s has reduced this interaction. The trawling effort is now focused in the deeper central and north-western sectors of Exmouth Gulf. Owing to the predominantly mud and sand habitats of the trawl grounds, the trawl gear has relatively little physical impact. Overall, the nature of this particular trawl fishery and the very tight controls on effort indicate that its environmental effect is now likely to be low.

*Performance measures for habitat impact relate to the spatial extent of trawling within the licensed area of the Exmouth Gulf fishery. In 2011 the performance measure was met as the total area trawled, at approximately 335 square nautical miles (29%) per cent of Exmouth Gulf, was below the 40% level.*

### Social Effects

The estimated employment in the fishery for the year 2011 was 27 including skippers and other crew. Additional processing and support staff are also based in Exmouth Gulf and Fremantle. Within the Exmouth area, the fishery is one of the major regional employers contributing to the economic viability of the Exmouth township.

### Economic Effects

**Estimated annual value of major prawns for 2011: Level 4 - \$10 - 20 million (\$10.9 million)**

Ex-vessel prices for prawns vary, depending on the type and quality of product and the market forces operating at any one time. In this fishery there is a high degree of vertical integration, with the fishing company, which own the boats undertaking direct marketing of the product into overseas markets. For this reason, the prices quoted for prawns can only be estimated, however prices are likely to be similar to those received for product from Shark Bay Prawn Managed Fishery. The total estimated value of the fishery includes byproduct (\$11.2 million). Estimated prices for prawns were as follows:

King prawns	\$11.50/kg
Tiger prawns	\$12.00/kg
Endeavour prawns	\$6.00/kg
Coral prawns	\$3.00/kg

## Fishery Governance

**Target catch range:** 771 – 1,276 tonnes

**Current fishing level:** Acceptable

Under current fishing effort levels, the target catch range for major penaeids is 771–1,276 t so the total catch of 779 t is within the range. The long-term target catch ranges for individual species are king prawns 350–500 t, tiger prawns 250–550 t and endeavour prawns 120–300 t (noting that maximum or minimum catches do not occur for all species simultaneously). These overall and individual figures are generally based on a 10-year average (1989-1998). Tiger prawns were above the species range, however, the catch prediction was very high (480-720 t) indicating that the season landings could be above the target range. Endeavour prawns were within each species range but king prawns were well below the target catch range. The survey catch rates were indicating low abundance however, no index for catch prediction is yet available for this species but will be reviewed in 2012.

### New management initiatives (2012)

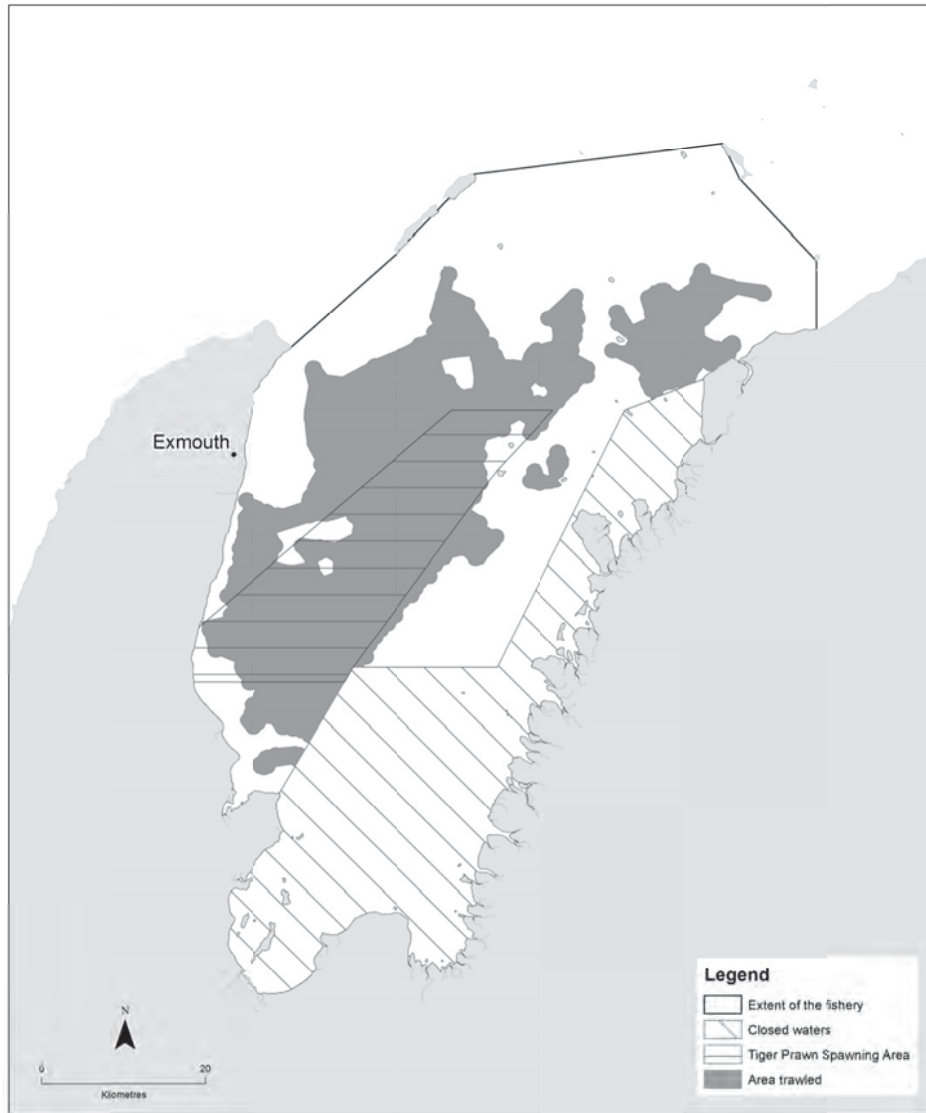
The Department is progressing a management plan amendment in consultation with the licensee to incorporate quad trawl gear arrangements.

## External Factors

Increasing costs of fishing and lower returns due to the global economic climate and competition from imported and Australian aquacultured small prawns, has focussed fishing harvesting strategies on targeting larger prawns during efficient catch rate periods and shifting the emphasis to domestic markets rather than export markets. A slight increase in the price for prawns provided some increases in the value of the fishery in 2011.

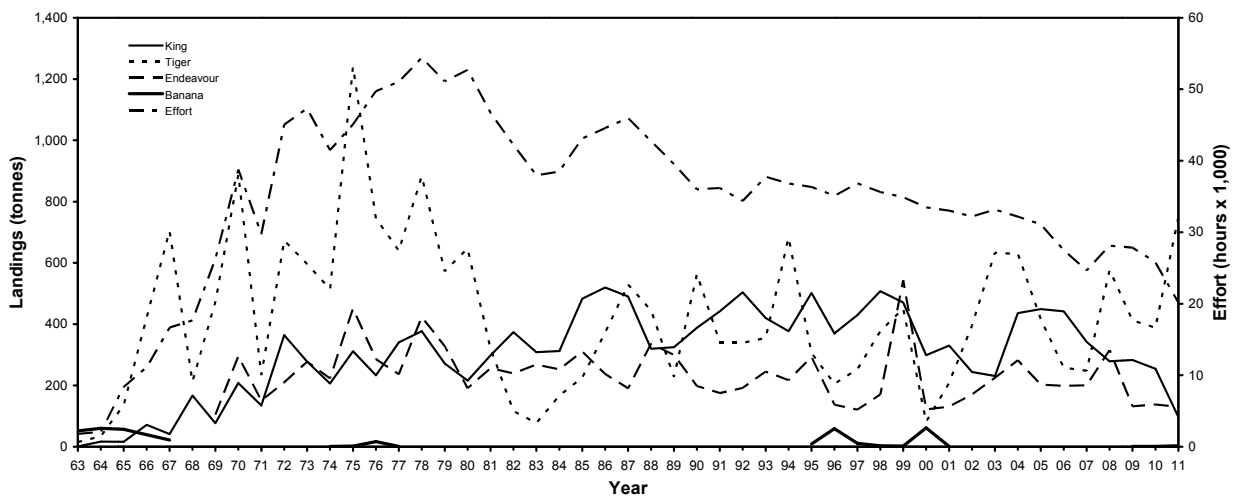
Cyclones appear to have a significant effect on the productivity of Exmouth Gulf. Cyclone impacts can be either positive or negative. Early (December to January) cyclones can have a negative impact (high mortality) on small size prawns in the shallow nursery areas. The positive effect is that the water becomes turbid and prawn mortality reduces and prawns are triggered to move out into the trawl grounds. It is considered likely that there will be other environmental factors, yet to be fully investigated, that will affect the spawning stock – recruitment relationship. Environmental conditions were favourable for tiger and banana prawn species during the 2011 season with high summer rainfall (388 mm Dec 2010 to Mar 2011; 20-yr average 124 mm) and possibly warmer temperatures.





**EXMOUTH GULF PRAWN FIGURE 1**

The main boundaries of the Exmouth Gulf Prawn Fishery, extent of fishery closed waters, TPSA (Q1 and Q2), and area trawled in 2011.



**EXMOUTH GULF PRAWN FIGURE 2**

Exmouth Gulf Prawn Managed Fishery annual landings and adjusted effort (twin-gear), 1963 – 2011.

# Gascoyne Demersal Scalefish Fishery Status Report

G. Jackson, R. Marriott, E. Lai and C. Lunow.

Main Features			
<b>Status</b>		<b>Current Landings (2011)</b>	
Stock level		Pink snapper:	
Pink snapper	Recovering	Commercial	237 t (2011)
Goldband snapper	Adequate	Recreational	31 t (2007)
Spangled emperor	Adequate	Charter	12 t (2011)
Fishing Level		Goldband snapper:	
Pink snapper	Acceptable	Commercial	53 t (2011)
Goldband snapper	Acceptable	Recreational	10-20 t (2007)
Spangled emperor		Charter	6 t (2011)
North Gascoyne	Unacceptable		
South Gascoyne	Acceptable	Spangled emperor:	
		Commercial	4 t (2011)
		Recreational	30 t (2007)
		Charter	6 t (2011)

## Fishery Description

The Gascoyne Demersal Scalefish Fishery encompasses commercial and recreational (line) fishing for demersal scalefish in the continental shelf waters of the Gascoyne Coast Bioregion (Gascoyne Demersal Scalefish Fishery Figure 1).

Since 1 November 2010, the Gascoyne Demersal Scalefish Managed Fishery (GDSF) has incorporated the pre-existing pink snapper quota system from the Shark Bay Snapper Managed Fishery (SBSF) plus the previously open access area south of Coral Bay.

Commercial vessels in these waters historically focussed on the oceanic stock of pink snapper (*Pagrus auratus*) during the winter months. The GDSF licensed vessels fish throughout the year with mechanised handlines and, in addition to pink snapper, catch a range of other demersal species including goldband snapper (*Pristipomoides* spp., mainly *P. multidentis*), red emperor (*Lutjanus sebae*), emperors (Lethrinidae, includes spangled emperor, *Lethrinus nebulosus*, and redthroat emperor, *L. miniatus*), cods (Serranidae), ruby snapper (*Etelis carbunculus*), pearl perch (*Glaucosoma burgeri*), mulloway (*Argyrosomus japonicus*), amberjack (*Seriola dumerili*) and trevallies (Carangidae).

A limited number of licensed charter vessels and a large number of recreational vessels fish out of Denham, Carnarvon and around the Ningaloo area (Coral Bay, Tantabiddi and Exmouth) and catch a similar range of demersal species.

## Governing legislation/fishing authority

### Commercial

*Gascoyne Demersal Scalefish Management Plan 2010*

Gascoyne Demersal Scalefish Managed Fishery Licence

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

### Recreational

*Fish Resources Management Act 1994, Fish Resources*

*Management Regulations 1995* and subsidiary legislation

## Consultation process

### Commercial

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

### Recreational

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

## Boundaries

### Commercial

The GDSF operates in the waters of the Indian Ocean and Shark Bay between latitudes 23°07'30"S and 26°30'S (Gascoyne Demersal Scalefish Fishery Figure 1). GDSF vessels are not permitted to fish in inner Shark Bay. No state-licensed commercial vessels are permitted to fish between 21°56' and 23°07'30"S ('Point Maud-Tantabiddi Well' closure). Management arrangements for the West Coast Demersal Scalefish Fishery (WCDSF) permit a limited number of commercial vessels to operate in waters up to the southern boundary of the GDSF (26°30'S).

### Recreational

The recreational fishery (which includes activities by licensed charter vessels) operates in all Gascoyne waters with the exception of Sanctuary Zones, Marine Nature Reserves and Conservation Areas within the Ningaloo and Shark Bay Marine Parks.

## Management arrangements

### Commercial

The Gascoyne Demersal Scalefish Management Plan 2010 (the Plan) was implemented on 1 November 2010. The Plan superseded the Shark Bay Snapper Management Plan 1994 and provides a more effective management framework for the sustainable use of all demersal scalefish stocks in the Gascoyne Coast Bioregion. The 'open-access' wetline fishing operations previously undertaken in waters between 23°34'S and 23°07'30"S (Gascoyne Demersal Scalefish Fishery Figure 1) are also incorporated within the GDSF Management Plan (see Fisheries Management Paper No. 224 for further details).

Within the Gascoyne Demersal Scalefish Managed Fishery, pink snapper are managed through output controls based on an Individual Transferable Quota system. Pink snapper quota units operate from 1 September to 31 August ('quota-year'), with a total of 5,102 units in the fishery. There is a requirement to hold a minimum of 100 units of pink snapper to be able to operate within the fishery which has been carried over from the previous Shark Bay Snapper Management Plan.

Demersal scalefish other than pink snapper are currently managed using an interim effort cap of 30 days per 100 units of pink snapper quota which restricts total fishing effort and is applied as a non-transferable licence condition. A dedicated non pink snapper demersal scalefish entitlement system is being developed by the Department in consultation with WAFIC and licensees.

An Environmental Protection and Biodiversity Conservation Act assessment for the SBSF was first completed in 2003, and the fishery was re-accredited in 2009 for a further 5 years (next scheduled review in 2014).

Minimum legal lengths apply to many of the commercial target species (e.g. pink snapper, red emperor and emperors).

### Recreational

The recreational fishery (including charter vessels) is managed using maximum and minimum size limits, daily bag, trip and possession limits and limitations on the use of certain fishing gears. Since 2 March 2010, all persons fishing from a powered boat anywhere in the state have been

required to hold a Recreational Fishing from Boat Licence or fish in the company of a licence holder.

## Research summary

Catch and effort monitoring for this fishery includes analyses of commercial 'daily/trip' returns for GDSF licensed vessels, catch-disposal records (only for pink snapper to monitor individual quotas), 'monthly' catch and effort returns for charter vessels, and recreational survey data (where available).

The commercial catch and effort data reported here covers all commercial line fishing within Gascoyne waters between 114°50'E and 26°30'S. The reporting season used for commercial catches is the pink snapper quota-year, i.e. September 1 2010 - August 31 2011 (referred to as 'season 2011'). Charter catches are reported for the calendar year. For recreational fishers, the most recent<sup>1</sup> survey information available of boat-based recreational fishing within the Gascoyne Coast Bioregion is used which was undertaken between April 2007 and March 2008 (this equates to the commercial 'season 2007').

Research undertaken by the Department of Fisheries on the retained species in each Bioregion is now focussed on selected indicator species. For demersal scalefish in the Gascoyne, these indicators have been selected to represent the inshore demersal suite (20-250 m) using a risk-based approach based on the relative vulnerability of the species/stock to fishing activities (DoF 2011<sup>2</sup>). In the Gascoyne Coast Bioregion, pink snapper, goldband snapper and spangled emperor (*Lethrinus nebulosus*) are the indicator species for the inshore demersal suite.

**Pink snapper:** Detailed research on the oceanic pink snapper stock and the associated SBSF was undertaken throughout the 1980s and early 1990s. Commercial catches are sampled throughout the year to provide representative catch-at-age data. An integrated stock assessment model has been used to determine stock status since 2003 and is updated every 3 years (most recently in 2012). A Western Australian Marine Science Institute (WAMSI) project investigated the relationships between pink snapper stocks from Shark Bay to the South Australian border based on genetics and otolith chemistry.

**Goldband snapper:** Comprehensive research on goldband snapper commenced in 2007 as part of a Gascoyne Integrated Fisheries Management (IFM) project. A 'weight of evidence' based assessment has been completed and externally reviewed (Marriott et al in press). Monitoring of commercial catches and age structure is continuing and further research is planned to refine estimates of the key biological parameters.

**Spangled emperor:** Comprehensive research on spangled emperor commenced in 2007 also as part of the Gascoyne IFM project. A 'weight of evidence' based assessment has

<sup>1</sup> Results of the Integrated Survey of Boat-based Recreational Fishing 2011\_12 will be available in late 2012.

<sup>2</sup> DOF 2011 Resource Assessment Framework (RAF) for Finfish Resources in Western Australia. Fisheries Occasional Publication No. 85, Department of Fisheries, Perth.

## GASCOYNE COAST BIOREGION

been completed and externally reviewed (Marriott et al in press). Limited monitoring of recreational catches landed at fishing tournaments is on-going.

### Retained Species

#### Commercial landings (season 2011):

<b>Total</b>	<b>374 tonnes</b>
<b>Pink snapper</b>	<b>237 tonnes</b>
<b>Goldband snapper</b>	<b>53 tonnes</b>
<b>Spangled emperor</b>	<b>4 tonnes</b>
<b>Other species</b>	<b>81 tonnes</b>

The total commercial catch of 374 t taken in the Gascoyne Coast Bioregion in 2011 included 237 t of pink snapper (oceanic stock, TACC = 277 t), plus 138 t of other species including 53 t of goldband snapper, 4 t of spangled emperor and 81 t of other scalefish species (Gascoyne Demersal Scalefish Table 1). This is significantly lower than the total of 477 t taken by this fishery last season mostly due to the significant decrease in the catch of goldband snapper (105 t in 2010).

#### Recreational catch estimate (includes charter sector):

<b>Pink snapper</b>	<b>ca. 40 tonnes</b>
<b>Goldband snapper</b>	<b>c.a. 15-25 tonnes</b>
<b>Spangled emperor</b>	<b>ca. 30-40 tonnes</b>

In 2011 the recreational catch of pink snapper (oceanic stock) reported by licensed charter boats was 12 t (similar to catch in 2010, significantly lower than the 22 t taken in 2007). In 2007/08, an estimated 31 t of pink snapper (oceanic stock) was taken by recreational vessels fishing in Gascoyne waters (excluding inner gulfs of Shark Bay). The total catch of this stock of pink snapper taken by recreational and charter vessels in the Gascoyne is therefore assumed to be approximately 40 tonnes.

The recreational catch of goldband snapper reported by charter boats in 2011 was 6 t (similar to 2010, compared to 8 t in 2007). The recreational catch of goldband snapper in 2007/08 is estimated to have been between 10-20 t making the total catch for these sectors in the Gascoyne to be between 15-25 tonnes.

The recreational catch of spangled emperor reported by charter boats in 2011 was 6 t (similar to 2010, no information on catch in 2007). In 2007/08, an estimated 30 t of spangled emperor was taken by recreational vessels fishing in Gascoyne waters. The total catch of spangled emperor taken by recreational and charter vessels in the Gascoyne is therefore assumed to be approximately 30-40 tonnes.

#### Fishing effort/access level

##### Commercial

At the start of the season there were 55 licences with pink snapper quota although only 17 vessels actively participated in fishing (19 in 2010). These vessels (all are required to hold a minimum of 100 units of pink snapper quota to be able to operate in the waters of the GDSF) fished for a total of 793 days in waters between 23°34'S and 26°30'S between

September 1 2010 and August 31 2011. The level of effort targeted at pink snapper varies on a seasonal basis, historically peaking in June–July, when the oceanic stock aggregates to spawn. Pink snapper catch rates are assessed annually using 'standard boat days', i.e. days fished by quota-holding vessels that caught more than 4 t each of pink snapper by line during the period June–July. Vessels that met these criteria fished for 280 boat days during June–July in 2011 (similar to 2010).

##### Recreational

Total recreational boat fishing effort (fisher days) across the entire Gascoyne in 2011 was assumed to be similar to that estimated from the last recreational fishing survey (April 2007 - March 2008), i.e. ca. 240,000 fisher days.

### Stock Assessment

#### Assessment complete:

<b>Pink snapper</b>	<b>Yes</b>
<b>Goldband snapper</b>	<b>Yes</b>
<b>Spangled emperor</b>	<b>Yes</b>

#### Assessment level and method:

<b>Pink snapper</b>	<b>Level 2 - Catch Rates (annual)</b>
	<b>Level 5 - Composite Assessment (2011)</b>
<b>Goldband snapper</b>	<b>Level 1 - Catch (annual)</b>
	<b>Level 3 - Fishing Mortality (2010)</b>
<b>Spangled emperor</b>	<b>Level 1 - Catch (annual)</b>
	<b>Level 3 - Fishing Mortality (2010)</b>

#### Breeding stock levels:

<b>Pink snapper</b>	<b>Recovering</b>
<b>Goldband snapper</b>	<b>Adequate</b>
<b>Spangled emperor</b>	<b>Adequate</b>

**Pink snapper:** An integrated stock assessment model was developed for this stock in 2003 which indicated that the spawning biomass of the oceanic stock was at a depleted level (< target level in 2002-2003). The most recent assessment using this method (completed in 2012) indicated that the spawning biomass in 2011 was above the threshold level (30% of the unexploited spawning biomass). The model estimated that at 2011 harvest levels (total annual catch ca. 300 t), the target level (40% of the unexploited spawning biomass) would be reached by 2014-2015. The next assessment is scheduled to be completed in 2014.

Prior to the development of the integrated assessment model, the breeding stock was assessed using a pink snapper catch rate based on catch and effort information from the peak of the spawning season (June–July) only. It is recognised that the use of catch rate as an index of pink snapper abundance must be treated with caution, due to the aggregating behaviour of the stock during the winter spawning period.

This indicator was used in the original EPBC Act assessment of the SBSF with an inaugural trigger level set at a minimum of 500 kg pink snapper/standard boat day. Since the reductions in quota were implemented in the mid 2000s, the pink snapper catch rate (GDSF vessels fishing in June–July

only) has fluctuated around 550 kg/day. The 2011 season it has continued this trend at 564 kg pink snapper/standard boat day (see also box below).

*The current performance measure for the Gascoyne Demersal Scalefish Fishery is that the pink snapper catch rate for the peak months (June–July) should not fall below a minimum trigger level of 500 kg pink snapper/standard boat day. Catch rates had a slight downwards trend through the 1990s but the early 2000s saw a clear decline reaching a low of 450 kg pink snapper/standard boat day in 2004. Since that time (TACC was reduced significantly in 2004 and reduced again in 2007), catch rates have increased to an average value of about 550 kg/day with yearly fluctuations. In 2011 the catch rate was 564 kg pink snapper/standard boat day, above the minimum trigger level (500 kg pink snapper/standard boat day).*

**Goldband snapper:** Historical catch rate data from the SBSF were found to be uninformative for use as an index of relative abundance for this species. Several more years of daily trip logbook data (implemented in January 2008) will provide the minimum basis of a time series of catch rates for examining trends in relative stock biomass. A ‘weight of evidence’ approach, based on an assessment of fishing mortality ( $F$ ), has been used to assess the stock. Sufficient data from sampling the commercial fishing catches in both the 2006 and 2008 quota years were available for this analysis. Estimates of  $F$  for both years were within the target range, indicating that fishing was not having an unacceptable impact on the age structure of the population at that time. The completed ‘weight of evidence’ assessment has now been externally reviewed and will be made available as a Fisheries Research Report in late 2012 (Marriott et al. in press).

The approximately 50% reduction in the commercial catch in 2011 is explained by a reduction in the level of effort targeting this species. The total goldband snapper catch is now well below the sustainable limit recommended for this species in this bioregion (100–120 t, see Marriott et al. in press for details). Breeding stock levels and fishing level are currently assessed as adequate.

**Spangled emperor:** Commercial catch rate data for spangled emperor were found to be uninformative as an index of abundance. A ‘weight of evidence’ approach, based on an assessment of fishing mortality, was used to assess stock status based on data collected primarily in 2007. Estimates of fishing mortality ( $F$ ) indicated that in the South Gascoyne,  $F$  was close to the target level while in the North Gascoyne,  $F$  was above the limit level, suggesting that localised over-fishing was occurring north of Point Maud. Relatively few individual spangled emperor older than 10 years old were sampled from the North Gascoyne in 2007, indicating that older fish had been removed by fishing, at least from areas outside of sanctuary zones of the Ningaloo Marine Park. That  $F$  exceeded the limit level indicated, given the available evidence, that the current level of fishing on the spangled emperor population in the North Gascoyne exceeds sustainable levels. The spangled emperor breeding stock is estimated to be at an acceptable level for the bioregion overall noting significant reductions in the relative numbers of older (breeding age) spangled emperor in the North

Gascoyne due to localised depletions. The completed ‘weight of evidence’ assessment has now been externally reviewed and will be made available as a Fisheries Research Report in late 2012 (Marriott et al. in press).

## Non-Retained Species

### Bycatch species impact

**Negligible**

The commercial catch consists of a large number of demersal species of medium to high market value; therefore there are few species captured by the fishery that are not retained.

Commercial operators must return any sharks caught and are not permitted to use wire trace, in order to minimise interactions with sharks.

### Protected species interaction

**Negligible**

As line fishing is highly selective, interactions with protected species by commercial, charter and recreational fishers in the GDSF are low. Commercial GDSF and charter fishers are required to record protected species interactions in their logbooks. During 2011, commercial fishers in the GDSF caught one grey nurse shark, which was released alive. The charter fishery in this bioregion reported no interactions.

## Ecosystem Effects

### Food chain effects

**Low**

Pink snapper are generalist feeders and just one of a number of such species inhabiting the continental shelf waters in this Bioregion. Food chain effects due to fishing for pink snapper are considered to be low because the quota system restricts GDSF catches to a relatively small percentage of the total biomass. The juvenile components of the stock are likely subject to large, mostly-environmentally driven fluctuations in abundance even in the absence of fishing, resulting in significant variability in annual recruitment strength. A recent study (Hall and Wise, 2011)<sup>1</sup> of finfish community structure in this bioregion found no evidence of material changes.

### Habitat effects

**Negligible**

The nature of the fishery, targeting aggregations of adult pink snapper and other demersal scalefish using hooks and lines, means that the commercial fishery has virtually no direct impact on benthic habitats.

<sup>1</sup> Hall, N.G. & Wise, B.S. (2011). Development of an ecosystem approach to the monitoring and management of Western Australian fisheries FRDC Report 2005/063. Fisheries Research Report 215 Department of Fisheries, Western Australia. 112pp.

## Social Effects

The pattern of fishing by GDSF vessels in 2011 was similar to previous years and reflects the focus on pink snapper during the peak season and fishing deeper water for other species at other times of the year.

In 2011, 11 vessels fished for more than 10 days during the peak season with average crew of 2-3. Commercial fishing and associated fish processing are important sources of local employment in Denham and Carnarvon.

Shark Bay and Ningaloo are popular recreational fishing destinations and both locations are major tourist attractions especially during the winter months and school holidays.

## Economic Effects

### Estimated annual value (commercial sector) for

**2011: Level 2 - \$1 - 5 million**

The gross value of production (GVP) of the commercial component of the Gascoyne Demersal Scalefish Fishery was in the range \$1-5 million in 2011. While a dollar value is difficult to assign to recreational and charter catches at this stage, the availability of demersal target species underpins the local recreational fishing-based tourism industry and generates significant income for the regional economy.

## Fishery Governance

### Commercial:

#### Current effort level Pink snapper (season 2011):

**Acceptable**

#### Current catch level Goldband (season 2011):

**Acceptable**

#### Target catch (and effort) range:

**Pink snapper 277 tonnes/380-540 days**

**Goldband snapper 50-120 tonnes (preliminary)**

In 2011, GDSF vessels with pink snapper quota required 419 boat days to catch 237 t of pink snapper (oceanic stock, TACC = 277 t).

The average catch rate at 564 kg pink snapper/boat day during the peak season for the 2011 was above the performance measure (500 kg/standard boat day). This catch rate-based performance measure will be re-assessed when sufficient higher resolution (daily/trip catch and effort returns) data are available, likely as part of the next EPBC Act fishery review export accreditation review (due in September 2014). The catch of Goldband snapper in 2011 was within the preliminary acceptable range.

### Recreational:

#### Current effort level (2007/08):

**Pink snapper Acceptable**

**Goldband snapper Acceptable**

**Spangled emperor**  
**Unacceptable (North Gascoyne)**  
**Acceptable (South Gascoyne)**

Estimates of fishing mortality (based on data from 2007/08) indicate localised depletion of spangled emperor is occurring north of Point Maud outside of the sanctuary zones.

## New management initiatives (2011/12)

As noted previously, the GDSF Management Plan 2010 was implemented on 1 November 2010, superseding the Shark Bay Snapper Management Plan 1994. The Plan provides the Department with the ability to manage all demersal scalefish stocks, whereas the Shark Bay Snapper Management Plan 1994 had the legal capacity to regulate only the take of pink snapper. The Plan also incorporated the last unregulated 'open access' line fishery in the Bioregion in south of Coral Bay, resulting in all commercial line fishers in the southern Gascoyne operating under a consistent set of management arrangements.

While the first phase of the Plan has been implemented, and includes a formal pink snapper entitlement system (in the form of individual transferable quota) it still requires a second form of entitlement to be introduced to more explicitly regulate the take of other demersal scalefish. The development of an entitlement framework with the capacity to regulate catches of other scalefish, in particular goldband snapper, that can work in combination with the existing ITQ system for pink snapper is currently underway.

A statewide recreational boat fishing licence was introduced in March 2010. A statewide integrated recreational fishing survey (included a phone diary survey based on the database of licensed boat fishers) was carried out between January 2011 and February 2012. Results of this study that will include estimates of recreational catches of the key species will be available in late 2012.

Integrated Fisheries Management (IFM) processes in the Gascoyne are likely to commence in late 2012 including consideration of sectoral catches of demersal scalefish and other relevant issues in the Bioregion.

## External Factors

Under the Offshore Constitutional Settlement, commercial vessels licensed by the Commonwealth may operate in state waters outside the 200 m isobath as part of the Western Deepwater Trawl Fishery (WDWTF). In the 2008/09 season total effort in this fishery was 482 hours of trawling with ruby snapper making up the majority (28 tonnes) of the scalefish catch (Wilson et al. [eds] 2010)<sup>1</sup>. Recent information on catches of pink snapper taken or returned by WDWTF vessels fishing in waters >200 m off the Gascoyne coast is not available (last reported catch of pink snapper was <0.5 t in 2006).

Climate change has the potential to impact fish stocks in range of ways including, with temperate species such as pink snapper, affecting spawning patterns and influencing their

<sup>1</sup> Wilson DT, Curtotti R and Begg GA (eds) (2010) Fishery status reports 2009: status of fish stocks and fisheries managed by the Australian Government, Australian Bureau of Agricultural and Resource Economics - Bureau of Rural Sciences, Canberra.

geographic distribution (latitude shift). A review of the impacts and responses to marine climate change in Australia has been undertaken by CSIRO (see [www.oceanclimatechange.org.au](http://www.oceanclimatechange.org.au)). In addition, a 3-year FRDC-funded project is currently assessing the effects of climate change on key fisheries in Western Australia. The key species that will be considered in relation to the consequences of climate change as part of this project include

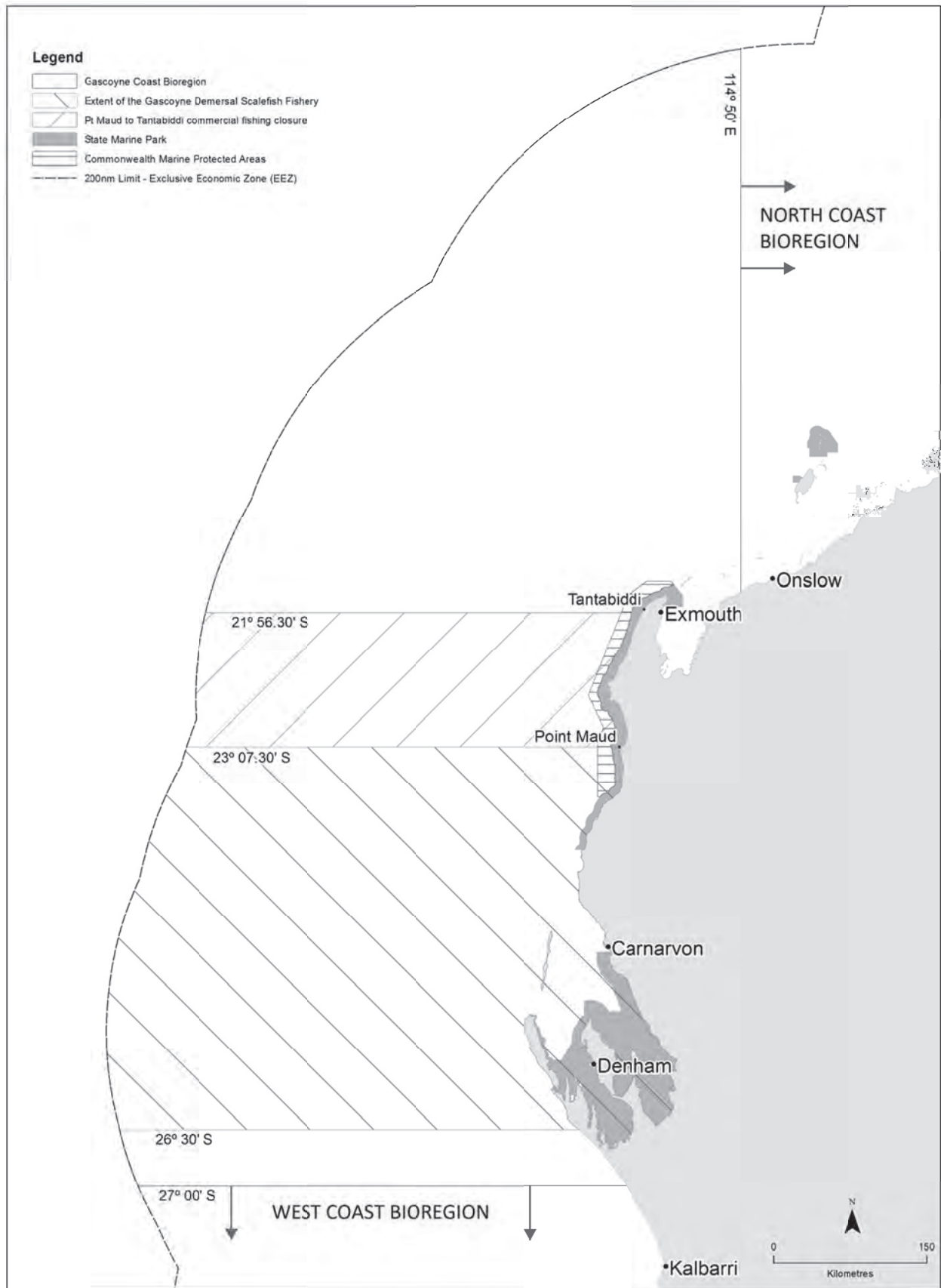
pink snapper, goldband snapper and spangled emperor. A recent collaborative study with CSIRO used modelling to investigate the potential influence of long-term increases in water temperatures and cyclone activity on spangled emperor in the Ningaloo Marine Park.

#### GASCOYNE DEMERSAL SCALEFISH FISHERY TABLE 1

Total commercial catches of demersal scalefish species other than pink snapper taken in Gascoyne waters between 2001/02 and 2010/11 (excludes mackerels, sharks and tunas). Units are tonnes.

Species	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Goldband snapper	110.0	310.7	250.4	239.8	105.8	107.2	121.1	143.8	104.6	53.2
Red emperor	21.3	18.6	21.3	18.5	19.4	17.0	12.8	11.7	9.8	8.2
Spangled emperor	23.1	20.4	15.2	13.5	18.1	7.0	7.0	3.3	3.8	3.7
other emperors	25.7	25.8	37.4	31.8	29.2	34.3	26.8	13.8	9.2	10.4
Cods	29.7	38.0	39.2	27.9	21.9	21.5	15.0	9.5	13.4	11.4
Other	85.9	90.5	95.4	82.0	78.1	77.1	65.8	64.8	72.9	50.7
Total	295.7	504.0	458.9	413.5	272.5	264.1	248.5	246.9	213.7	137.5

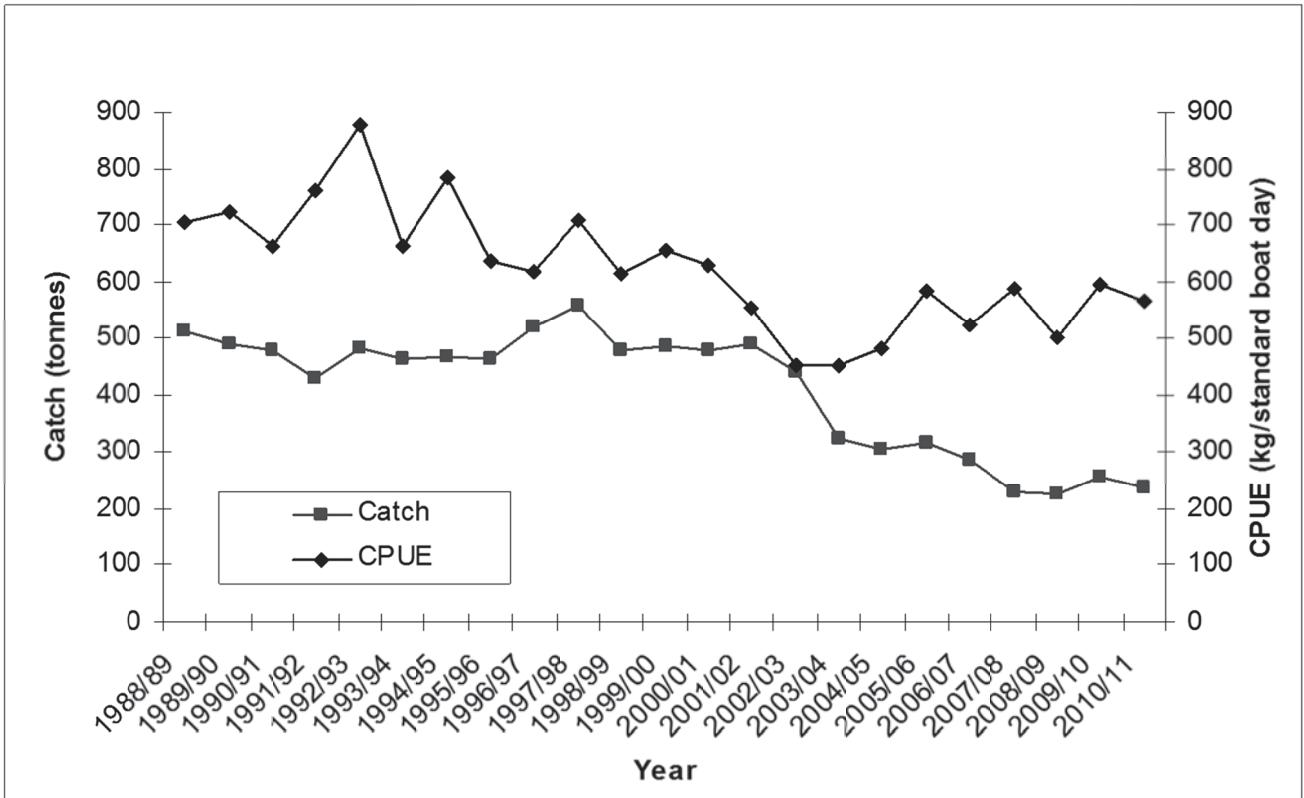
GASCOYNE COAST BIOREGION



**GASCOYNE DEMERSAL SCALEFISH FISHERY FIGURE 1**

Waters of Gascoyne Coast Bioregion including Gascoyne Demersal Scalefish Fishery and 'Point Maud to Tantabiddi Well' fishing closure. Commercial line fishing in waters between 26°30'S and 27 °00'S has been managed as part of West Coast Demersal Scalefish Fishery since January 2008.





**GASCOYNE DEMERSAL SCALEFISH FISHERY FIGURE 2**

Gascoyne pink snapper catch and catch per unit effort by season from 1988/89 to 2010/11. Units are kg whole weight of pink snapper per standard boat day. The CPUE for vessels line fishing for pink snapper in June-July (peak season) is incorporated in the stock assessment model used for the oceanic pink snapper stock.

# Inner Shark Bay Scalefish Fishery Status Report

G. Jackson, J. Norriss and C. Lunow

Main Features	
<b>Status</b>	<b>Current Landings</b>
Stock level:	Commercial (2011)
Whiting Adequate	Whiting 105 t
Mullet Adequate	Mullet 108 t
Tailor Adequate	Tailor 16 t
Yellowfin bream Adequate	Yellowfin bream 9 t
Pink snapper Eastern Gulf – Adequate	Pink snapper 2 t
Denham Sound – Adequate	
Freycinet Estuary – Recovering	Recreational (Pink snapper only)
Fishing Level:	Eastern Gulf 4 t (2010)
Whiting Acceptable	Charter 0.5 t (2011)
Mullet Acceptable	Denham Sound 6 t (2010)
Tailor Acceptable	Charter 0.5 t (2011)
Yellowfin bream Acceptable	Freycinet 1.5 t (2010)
Pink snapper Eastern Gulf – Acceptable	Charter nil (2011)
Denham Sound – Acceptable	
Freycinet Estuary – Acceptable	

## Fishery Description

The Inner Shark Bay Scalefish Fishery encompasses commercial and recreational fishing for scalefish species within the waters of the Eastern Gulf, Denham Sound and Freycinet Estuary in inner Shark Bay (Inner Shark Bay Fishery Figure 1). This includes the activities of the Shark Bay Beach Seine and Mesh Net Managed Fishery (SBBSMNF) and the Inner Shark Bay Recreational Fishery.

The SBBSMNF operates from Denham and uses a combination of beach seine and haul net gears to mainly take four species/groups: whiting (*Sillago schomburgkii* and *S. analis*), sea mullet (*Mugil cephalus*), tailor (*Pomatomus saltatrix*) and yellowfin bream (*Acanthopagrus latus*).

Most recreational fishing is boat-based using rod & line or handline. The key recreational species are pink snapper (*Pagrus auratus*), black snapper (grass or blue-lined emperor, *Lethrinus laticaudis*), western butterflyfish (*Pentapodus vitta*), whiting (*Sillago* spp.), Queensland school mackerel (*Scomberomorus queenslandicus*), tailor, blackspot tuskfish (bluebone, *Choerodon schoenleinii*) and estuary cod (slimy cod or goldspotted rockcod, *Epinephelus coioides*). A limited number of licensed charter vessels operate out of Denham (mostly fishing in the oceanic waters off Cape Inscription) and Monkey Mia.

### Governing legislation/fishing authority

#### Commercial

Shark Bay Beach Seine and Mesh Net Management Plan 1992

Shark Bay Beach Seine and Mesh Net Managed Fishery Licence

#### Recreational

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

#### Consultation process

##### Commercial

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

##### Recreational

Consultation processes are now facilitated by Recfishwest under a Service Level Agreement although the Department undertakes direct consultation with the community on specific issues (e.g. Shark Bay Inner Gulf Pink Snapper Working Group, convenes every 3 years).

#### Boundaries

The areas covered by this report are shown in Inner Shark Bay Fishery Figure 1. Fishing is not permitted in the Hamelin Pool Nature Reserve or in sanctuary zones, recreational zones or special purpose zones within the Shark Bay Marine Park.

## Management arrangements

### Commercial

The SBBSMNF is managed through input controls in the form of limited entry and gear restrictions (e.g. vessel size, net length and mesh size). A unit in the fishery comprises one primary vessel, a maximum of three netting dinghies and a maximum fishing team of three individual fishers.

Commercial line fishing for pink snapper and other species has not been permitted in these waters since 1996 (see 'Gascoyne Demersal Scalefish Fishery').

### Recreational

For most species, the recreational fishery is managed using the normal combination of daily bag, possession, size and gear limits. For pink snapper more complex arrangements are used within the Eastern Gulf, Denham Sound and Freycinet Estuary (Inner Shark Bay Fishery Figure 1). These stocks are managed separately with explicit Total Allowable Catch (TAC) targets. In 2010, the TACs for pink snapper were as follows:

Eastern Gulf	15 tonnes (approx. 12 tonnes recreational, 3 tonnes commercial)
Denham Sound	15 tonnes (approx. 12 tonnes recreational, 3 tonnes commercial)
Freycinet Estuary	5 tonnes (approx. 1,400 fish, i.e. 1,050 recreational and 350 commercial)

### Research summary

The stocks of pink snapper within the inner gulfs have been the focus of a comprehensive research program since 1996/97. Since 2002, integrated stock assessment models have been used to separately assess the status of the Eastern Gulf, Denham Sound and Freycinet Estuary stocks, and to determine appropriate levels of TAC. These assessments are updated every 3 years.

Estimates of recreational catch and effort have been derived from 'on-site' recreational fishing surveys involving interviews with boat crews returning to the Monkey Mia, Denham, and Nanga boat ramps. Surveys were undertaken each year between 1998 and 2010 (no surveys were conducted in 1999 and 2009).

Catches of pink snapper taken by licensed commercial and charter vessels are derived from compulsory monthly catch returns. The status of the four SBBSMNF target species (whiting, sea mullet, tailor, yellowfin bream) is monitored each year using data from commercial catch returns coupled with the extensive scientific knowledge gained from research dating back to the 1960s. Performance indicators for the SBBSMNF in the form of acceptable catch ranges and CPUE trigger levels were determined as part of an ESD risk-based assessment that was undertaken in 2002-03 for Departmental purposes.

Research on pink snapper in the inner gulfs is now limited to a monitoring level and involves using daily egg production method (DEPM) surveys to estimate spawning biomass every 3-5 years. At the most recent meeting of the Shark Bay Inner Gulf Pink Snapper Working Group (September 2011), the Department committed to completing a DEPM survey in each of the three areas to enable the stock assessments to be updated prior to the next scheduled meeting (2014).

## Retained Species

### Commercial landings (season 2011):

<b>Whiting</b>	<b>105 tonnes</b>
<b>Mullet</b>	<b>108 tonnes</b>
<b>Tailor</b>	<b>16 tonnes</b>
<b>Yellowfin bream</b>	<b>9 tonnes</b>
<b>Pink snapper</b>	<b>2 tonnes</b>

The total commercial catch taken by SBBSMNF licensed vessels in 2011 was 250 t (similar to 2010). This comprised 105 t of whiting, 108 t of sea mullet, 16 t of tailor, 9 t of yellowfin bream and 12 t of other mixed scalefish species that included 2 t of pink snapper (taken as bycatch in net fishing gears).

### Recreational catch estimates (including charter, 2011)

<b>Pink snapper</b>	<b>Eastern Gulf ca. 4 tonnes</b>
	<b>Denham Sound ca. 6 tonnes</b>
	<b>Freycinet Estuary ca. 1.5 tonnes</b>
<b>Black snapper</b>	<b>ca. 10 tonnes</b>

As a direct result of management intervention, including the introduction of TAC-based management in 2003, recreational catches of pink snapper have decreased significantly since 1998.

Based on results of the most recent recreational fishing survey in 2010, the estimated recreational catch of pink snapper was approximately 4 tonnes in the Eastern Gulf, approximately 6 tonnes in Denham Sound and approximately 1 tonne in the Freycinet Estuary. The estimated recreational catch of black snapper in 2010 was approximately 10 tonnes (all areas combined).

In 2011, approximately 0.5 t of pink snapper was taken both in Denham Sound and the Eastern Gulf by licensed charter vessels; no charter boat catches were reported from the Freycinet Estuary. A total catch of <0.5 t of black snapper (all three areas combined) was reported by charter vessels in 2011.

### Fishing effort/access level

#### Commercial

In 2011, of the 12 SBBSMNF licenses, only six vessels were actively involved in fishing (similar to 2010).

Fishing effort in the SBBSMNF again declined slightly in 2011 (986 boat days) compared with 2010 (1,041 boat days) and 2009 (1,118 boat days).

#### Recreational

In 2010, boat-based recreational fishing effort in the inner gulfs was estimated at approximately 37,000 boat fisher hours (compared to an estimated 33,000 fisher hours in 2007).

## Stock Assessment

### Assessment complete

Whiting	Yes
Mullet	Yes
Tailor	Yes
Yellowfin bream	Yes
Pink snapper	Yes
Black snapper	Yes

### Assessment level and method:

Whiting/Mullet/Tailor/Yellowfin bream  
 Level 2 - Catch, Catch Rate

Pink snapper  
 Level 5 - Composite Assessment (2011)

Black snapper Level 3 - Fishing Mortality (2005)  
 Level 1 - Catch (2010)

### Breeding stock levels

Whiting	Adequate
Mullet	Adequate
Tailor	Adequate
Yellowfin bream	Adequate
Pink snapper	Eastern Gulf - Adequate Denham Sound - Adequate Freycinet - Recovering
Black snapper	Adequate

**Whiting, Mullet, Tailor, Yellowfin bream:** Assessment of the four main SBBSMNF target species is based on annual analysis of the commercial catch and effort data. A target range of annual catch and a CPUE trigger level have been determined for the fishery overall and for each species separately (Inner Shark Bay Fishery Table 1).

The total catch (all species) was 250 tonnes in 2011 and was within the target range (235–335 tonnes). The overall CPUE of 253 kg/boat day (all species) was similar to the long-term average since 1990 (230 kg/boat day). The catch and CPUE for whiting in 2011 (105 tonnes, 107 kg/boat day), mullet (108 tonnes, 109 kg/boat day) and yellowfin bream (9 tonnes, 9 kg/boat day) were all within the respective target (catch) ranges and above the minimum (CPUE) trigger levels. The tailor catch (16 tonnes) was again below the target range and the CPUE (17 kg/boat day) also below the minimum trigger level. While some level of reduction in natural abundance cannot be discounted, the recent low landings for tailor are mostly attributable to local processing restrictions.

**Pink snapper:** DEPM surveys that directly estimate pink snapper spawning biomass were conducted annually in the Eastern Gulf, Denham Sound and Freycinet Estuary during the period 1997-2004 and periodically since. Most recently, DEPM surveys were conducted in the Eastern Gulf in 2009 and in Denham Sound and Freycinet Estuary in 2010. Research trawl surveys, to monitor variation in juvenile

recruitment, have been conducted each year since 1996. Integrated assessment models have been used to assess the status of the three stocks in relation to the management target (40% of the unexploited spawning biomass) since 2002. The most recent assessments (2011) estimated the spawning biomass of pink snapper was above the target level (40%) in both the Eastern Gulf and Denham Sound but while improving was still below the threshold level (30%) in the Freycinet Estuary.

**Black snapper:** Based on age-structure data collected in 2005, fishing mortality (F) was estimated to be around the threshold level (F=M, natural mortality). More recent information on F for this species is not available but there is no information from recent catch data that would suggest the situation has changed.

## Non-Retained Species

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

Bycatch is minimal in the SBBSMNF because netting operations selectively target specific schools of fish. Based on experience, fishers can determine the species and size of the school, and the size of individual fish within the school, before deploying the net. Fish are readily observed in the very shallow near-shore waters of Shark Bay. Non-target species and under-sized fish are avoided in most cases.

**Protected species interaction** **Negligible**

As nets are actively set and hauled, if any protected species such as dugongs, dolphins or marine turtles are caught (rarely) they are immediately released.

## Ecosystem Effects

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

The overall catch levels in the fishery have been relatively stable over several decades, despite a long-term reduction in effort, suggesting that recruitment of the main target species has not been significantly affected by fishing mortality. The total biomass of the key target species appears sufficient to maintain trophic function in these waters.

**Habitat effects** **Negligible**

Seine nets are set and hauled over shallow sand banks, including intertidal areas. Sand habitats are naturally dynamic environments with resident infauna adapted to cope with regular physical disturbances. Combined with the low frequency of fishing in any one location, this indicates that the fishery is unlikely to have a lasting effect on the habitat.

## Social Effects

### Commercial

Currently around 20 fishers are employed in the SBBSMNF based on six managed fishery licenses actually operating. Fishing and associated fish processing is an important source of local employment - the fishery, although relatively small-scale, makes a significant contribution to the Denham economy and community.

**Recreational**

Shark Bay is a very popular tourist destination, especially during the winter months and school holidays: data indicate that approximately 30% of all visitors participate in recreational fishing during their stay.

**Economic Effects**

**Estimated annual value (commercial sector) for 2011** **Level 2 - \$1 - 5 million**

**Commercial**

The gross value of production (GVP) of the SBBSMNMF in 2011 was estimated in the range \$1-5 million.

**Recreational**

While a dollar value is difficult to assign to recreational and charter catches, the availability of quality fishing underpins the tourism industry and generates significant income for the regional economy.

**Fishery Governance****Commercial**

**Current effort level (2011):** **Acceptable**

**Target catch range (2011):**

**All species (ex Pink snapper) 235–335 tonnes**

**Pink snapper** **Eastern Gulf 3 tonnes**  
**Denham Sound 3 tonnes**  
**Freycinet 1.2 tonnes**

Total fishing effort in SBBSMNMF declined to 986 boat days in 2011 (1,041 boat days in 2010 and 1,118 in 2009).

The total commercial catch (ex. pink snapper) in 2011 at 250 t was within the acceptable target range (235–335 t). At this time, this fishery is considered to present a low risk to the sustainability of the finfish and other ecological resources of inner Shark Bay, and as a consequence is a low research/management priority.

Commercial catches of pink snapper taken as bycatch by SBBSMNMF vessels in 2011 were either nil or significantly below their allocation within the respective pink snapper TACs (2 tonnes in Denham Sound, nil catch in Eastern Gulf and Freycinet Estuary).

**Recreational**

**Target catch range (2011):**

**Pink snapper** **Eastern Gulf 12 tonnes**  
**Denham Sound 12 tonnes**  
**Freycinet Estuary 3.8 tonnes**

Recreational catches of pink snapper were assumed to be similar to those estimated in 2010 (no survey undertaken in 2011) and therefore within the respective TACs in each area.

In 2011, a total of 478 applications were received for Freycinet Estuary management quota tags with a total of 944 tags (total available 1,050) allocated to recreational fishers.

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

As an outcome of the 'Wetline Review' (see Fisheries Management Paper No. 224 for details), a management plan will be developed for a Gascoyne Inshore Net Fishery. The Plan will incorporate the existing SBBSMNF, the Exmouth Gulf Beach Seine Fishery and commercial net fishing in the Carnarvon area as separate zones under a single management plan.

Using the information from the recreational fishing from boat licence introduced in 2010, a statewide integrated recreational fishing survey (included a phone diary survey based on the database of licensed boat fishers) was carried out between January 2011 and February 2012. This study will generate estimates of the recreational catches of key species within the Gascoyne region which will be available in late 2012.

In October 2011, the Shark Bay Inner Gulf Pink Snapper Working Group met to discuss recent research data and provide suggestions on management for the next three year period 2012-2014. Given the stock status is above the 40% breeding stock target limit, and as the annual recreational catch estimate was below the 12 tonne target the working group recommended an increase in the recreational bag limit for inner gulf pink snapper. The Department is currently considering the Working Group's advice in light of the recommendations from the statewide review of recreational rules.

Integrated Fisheries Management (IFM) issues in the Gascoyne is likely to commence in late 2012 and Consideration of sector catches of demersal scalefish will include consideration of the inner Shark Bay Fishery as well as other demersal scalefish fisheries in the Bioregion.

**External Factors**

The inner Shark Bay environment is particularly stable as a result of its typically low-rainfall, arid environment but is occasionally affected by irregular flood events such as occurred in the Gascoyne and Wooramel Rivers in late 2010 and again in early 2011. The impact of these events on key target species in inner Shark Bay remains to be fully determined but the abundances of some target species tend to be relatively stable, with fishery production mostly determined by levels of fishing effort. Other species including pink snapper, yellowfin bream and possibly tailor appear to be influenced by environmentally driven variations in recruitment.

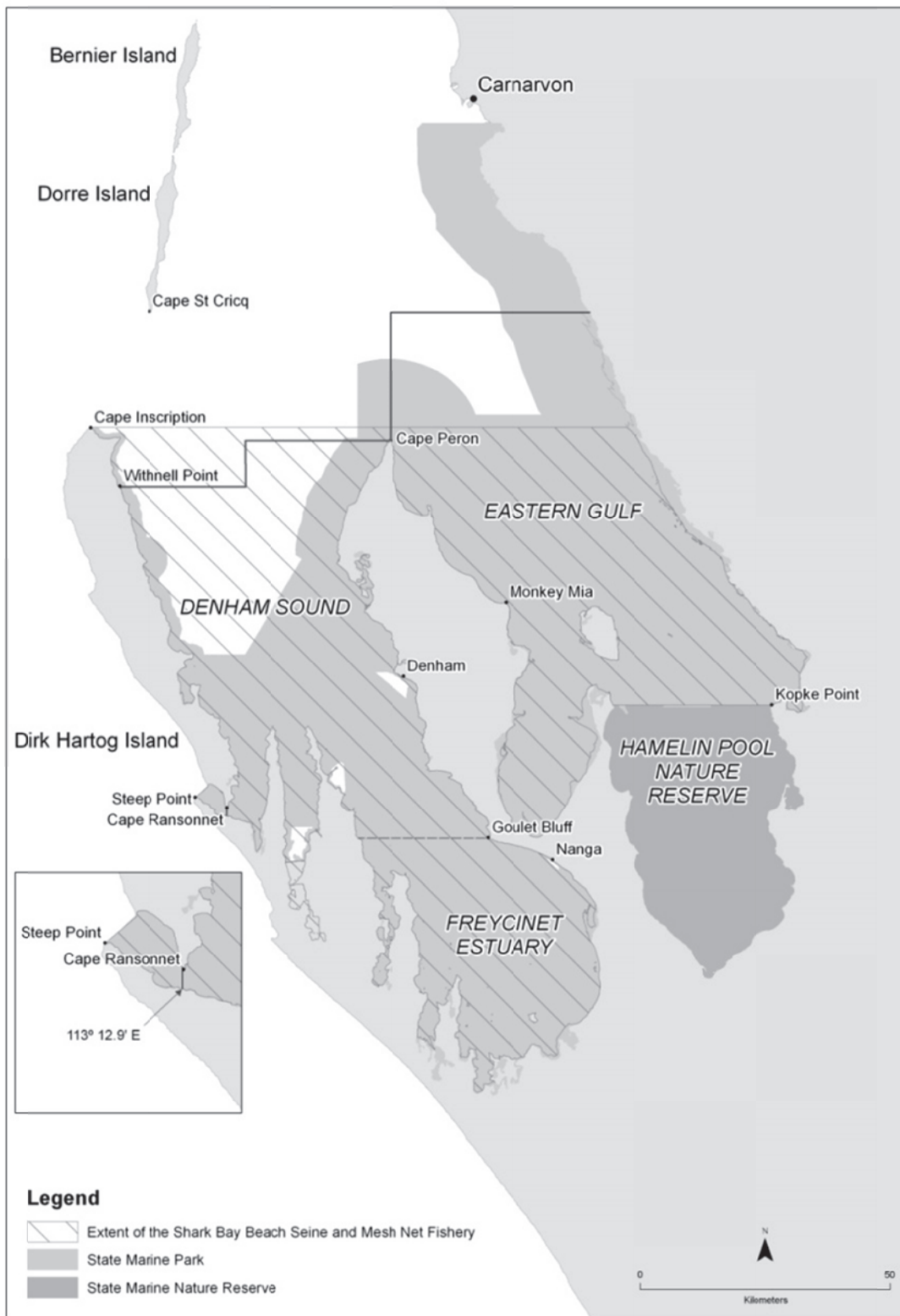
Climate change has the potential to impact fish stocks in range of ways including, with temperate species such as pink snapper, affecting spawning patterns and influencing their geographic distribution (latitude shift). A review of the impacts and responses to marine climate change in Australia has been undertaken by CSIRO (see [www.oceanclimatechange.org.au](http://www.oceanclimatechange.org.au)). A 3-year FRDC-funded project has recently commenced that will assess the effects of climate change on key fisheries in Western Australia. The key fishery species that will be considered in relation to the consequences of climate change as part of this project include pink snapper and tailor.

**INNER SHARK BAY SCALEFISH FISHERY TABLE 1**

Annual catch and acceptable catch range (tonnes) (upper), and annual CPUE and minimum trigger level (kg/boat day) (lower) for key species taken by Shark Bay Beach Seine and Mesh Net Managed Fishery vessels for the period 2002-2011.

Species	Acceptable catch range	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Whiting	93-127	100	107	119	116	113	102	117	112	116	105
Mullet	77-144	136	149	143	85	62	91	107	104	95	108
Tailor	25-40	26	28	24	19	21	23	23	17	16	16
Bream	7-15	17	24	27	27	23	14	8	8	10	9

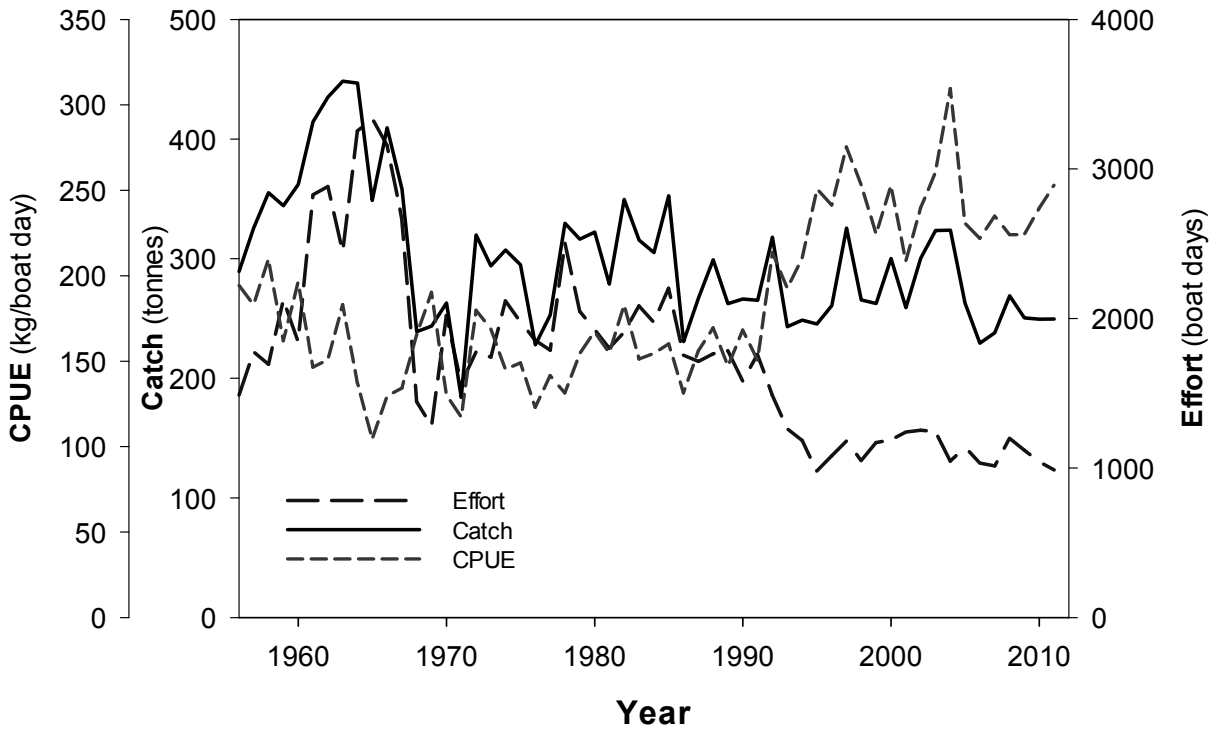
Species	Trigger level	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Whiting	75	80	86	114	102	110	100	98	100	112	107
Mullet	62	108	120	137	74	60	90	89	93	92	109
Tailor	21	21	22	23	17	20	22	19	15	15	17
Bream	5	14	19	26	23	22	14	6	7	10	9



**INNER SHARK BAY SCALEFISH FISHERY FIGURE 1**

The commercial (scalefish) and recreational fishing areas of inner Shark Bay.

**Shark Bay Beach Seine and Mesh Net Total Catch**



**INNER SHARK BAY SCALEFISH FISHERY FIGURE 2**

The total annual catch, effort and catch per unit effort (CPUE) for the Shark Bay Beach Seine and Mesh Net Managed Fishery over the period 1990–2011.



# Gascoyne Coast Blue Swimmer Crab Fishery Status Report

D. Johnston, D. Harris, C. Syers and C. Lunow.

Main Features			
<b>Status</b>		<b>Current Landings</b>	
Stock level		Commercial catch	890 t
Shark Bay	Under review	Shark Bay trap fleet	496 t
Exmouth	Adequate	Shark Bay trawl fleet	364 t
		Exmouth Gulf trawl fleet	30 t
<b>Fishing Level</b>			
Shark Bay	Under Review	Recreational catch	Minimal

## Fishery Description

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

Blue swimmer crabs are targeted commercially using a variety of fishing gear, but most dedicated crab fishers in WA now use purpose-designed crab traps. Operators in the Shark Bay Crab (Interim) Managed Fishery are only permitted to use 'hourglass' traps. Each of the State's prawn and scallop trawl fisheries that operate in this region may also retain crabs. Recreational crab fishers in the Gascoyne bioregion mainly use drop nets or scoop nets.

Crabbing activity in the Gascoyne Coast bioregion is centered in the embayments of Shark Bay and Exmouth Gulf. The Shark Bay Crab (Interim) Managed Fishery has developed into the largest crab fishery in WA.

### Governing legislation/fishing authority

#### Commercial

*Shark Bay Crab Fishery (Interim) Management Plan 2005*

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

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

*Shark Bay Prawn Management Plan 1993*

*Shark Bay Scallop Management Plan 1994*

Commonwealth Government *Environment Protection and Biodiversity Conservation Act 1999* (Wildlife Trade Order – Shark Bay Interim Managed Fishery only)

#### Recreational

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

### Consultation process

#### Commercial

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

#### Recreational

Recreational consultation processes are now facilitated by Recfishwest under a Service Level Agreement although the Department continues to undertake direct consultation with the community on specific issues

### Boundaries

The Shark Bay Crab Interim Managed Fishery covers the waters of Shark Bay north of Cape Inscription, to Bernier and Dorre Islands and Quobba Point (Gascoyne Coast Blue Swimmer Crab Figure 1). In addition, two fishers with long-standing histories of trapping crabs in Shark Bay are permitted to fish in the waters of Shark Bay south of Cape Inscription.

The boundaries of the Shark Bay Prawn, Shark Bay Scallop and Exmouth Gulf Prawn Managed Fisheries, which also retain blue swimmer crabs, are described in the relevant status reports specific to the trawl fisheries elsewhere within this document.

### Management arrangements

Commercial access to blue swimmer crab stocks in WA is governed by a series of separate management arrangements provided for under the legislative framework of the *Fish Resources Management Act 1994*. Individual fisheries are managed under an input control system, primarily through the regulation of licence and trap numbers or length of headrope of trawl net. Supplementary controls cover what species can be retained, any associated minimum size limits, gear specifications, and area, seasonal and daily time restrictions. The principal management tool employed to ensure adequate

## GASCOYNE COAST BIOREGION

breeding stock involves having minimum size limits well above the size at sexual maturity. Male blue swimmer crabs in Shark Bay become sexually mature at 115 mm carapace width, while females become sexually mature below 100 mm carapace width. Setting the commercial minimum size at 135 mm carapace width is designed to ensure adequate egg production for associated blue swimmer crab stocks under typical environmental conditions.

There are five crab trap licences in Shark Bay under the Shark Bay Crab Fishery (Interim) Management Plan 2005 which sets the number of traps that can be fished, fishery specific spatial closures, gear specifications and other controls. These licences are consolidated onto three active vessels. Two permit holders, who have a long standing history of crab fishing south of Cape Peron (south of the existing waters of the Shark Bay Crab Interim Managed Fishery [SBCIMF]), have a Fishing Boat Licence (FBL) condition that allows them to fish in these waters but with no more than 200 traps. At no time, however, may they each use more than 300 traps in total across all of the waters of Shark Bay.

Management controls for the trawl fisheries that retain blue swimmer crabs in the Gascoyne Coast bioregion, namely the Shark Bay Prawn, Shark Bay Scallop and Exmouth Gulf Prawn Managed Fisheries, are based on limited entry, seasonal and area closures, and gear controls including bycatch reduction devices (grids) and these are fully described in the relevant status reports within this document. The Department of Fisheries' vessel monitoring system (VMS) continues to monitor the activities of all trawlers in these fleets.

A third comprehensive ESD assessment of the Shark Bay fishery was completed in June 2011. The Federal Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) approved the fishery to export product for a further five years until September 2016, subject to several conditions and recommendations - for details refer to: <http://www.environment.gov.au/coasts/fisheries/wa/shark-bay/index.html>.

Recreational fishing for blue swimmer crabs in WA is managed through a series of input and output controls. As with commercial fishing, the principal management tool employed to sustain an adequate breeding stock is a minimum size limit well above the size at sexual maturity. A minimum legal size limit of 127 mm carapace width applies in the waters of the Gascoyne Coast bioregion, along with a bag limit of 20 crabs per person or 40 crabs per boat. Restrictions also govern gear types that can be used to take blue swimmer crabs.

### Research summary

Data for the assessment of blue swimmer crab stocks in the Gascoyne bioregion are obtained from trap fishers' statutory monthly catch and effort returns and voluntary daily logbooks, and trawl fisher's statutory daily logbooks. Department of Fisheries' research staff also conduct quarterly catch monitoring surveys aboard commercial crab trap vessels in Shark Bay, and a fishery-independent trawl survey that covers some of the commercial crab habitat is conducted annually during late November/early December.

Some base-line information on the biology and ecology of blue swimmer crabs has been generated by a number of Fisheries Research and Development Corporation (FRDC)-funded projects conducted by the Department of Fisheries and Murdoch University over the past decade. An FRDC project completed in early 2005 produced a preliminary stock assessment of the Shark Bay blue swimmer crab fishery.

An external scientific review of the available blue swimmer crab research data for Shark Bay was conducted in May 2011. The review highlighted current stock trends in the fishery and gaps in the current knowledge. An accurate assessment of sustainable catch levels could not be provided due to insufficient scientific data. As a result of this uncertainty, management options for the commercial trap and trawl sectors are being considered until a more robust stock assessment can be completed. An FRDC project (FRDC 2012/015) to assess the stock status of crabs in Shark Bay was submitted in 2011 and funding has recently been approved. This fishery-independent research program will commence in July 2012 and run for three years.

## Retained Species

### Commercial landings (season 2010/11):

	890 tonnes (total)
<b>Shark Bay trap fleet</b>	<b>496 tonnes</b>
<b>Shark Bay trawl fleet</b>	<b>364 tonnes</b>
<b>Exmouth Gulf</b>	<b>30 tonnes</b>

The total commercial catch for the Gascoyne bioregion during 2010/11 was 890 t, representing a slight increase on the 2009/10 catch of 888 t. This catch accounted for 82% of the state commercial blue swimmer crab catch of 1087 t for 2010/11 (refer to West Coast Blue Swimmer Crab Figure 1 in the West Coast Blue Swimmer Crab Fishery Report).

The annual catch from the Shark Bay crab trap fishery for 2010/11 was 496 t, a 7% decrease on the 2009/10 catch of 529 t (Gascoyne Coast Blue Swimmer Crab Figure 2, 3). Landings from the Shark Bay trawl fleet were 364 t in 2010/11, an 11% increase on the 2009/10 catch of 323 t.

A total of 30 t of blue swimmer crabs was landed in the Exmouth Gulf region during 2010/11, a 173% increase on the previous year's catch of 11 t (Gascoyne Coast Blue Swimmer Crab Figure 2). All of the crab catch was landed as by-product from prawn trawlers, with no commercial trap fishing undertaken in Exmouth Gulf during 2010/11.

### Recreational catch:

**Gascoyne Bioregion** < 1 % of total

A recreational boat-ramp survey monitoring crabbing in the Gascoyne Coast bioregion was carried out during 1998/99. The survey provided a recreational blue swimmer crab estimate of approximately 1 tonne, representing less than 1% of the total catch. Most of the recreational catch was taken in the inner gulfs of Shark Bay, in and around the townships of Denham and Monkey Mia. A subsequent recreational fishing survey was conducted in the Gascoyne region between March 2007 and March 2008, and analysis of the collected data is expected to be published in the near future.

Information on recreational blue swimmer catches in the inner gulfs of Shark Bay has also been derived from recreational surveys targeting pink snapper conducted in 2000/01, 2001/02, 2005/06, 2006/07 and 2007/08. While the surveys were restricted to boat fishers only who used boat ramps in Monkey Mia, Denham and Nanga, the limited data that was collected also suggested that the recreational crab catch in the lower gulfs was minimal compared with the take by commercial fishers operating in the same area. The surveys provided recreational catch estimates of between 0.3-1.9 t of blue swimmer crabs for the gulf regions.

A small amount of recreational crabbing also occurs in Exmouth Gulf.

**Fishing effort/access level**

Effort in the Shark Bay Crab Interim Managed Fishery decreased during 2010/11, as operators continued to maximize profitability by capitalizing on peak catch periods. Shark Bay crab trap fishers reported a total of 284,400 traplifts for 2010/11 (Gascoyne Coast Blue Swimmer Crab Figure 3) – a 19% decrease on the 352,550 traplifts reported for the previous year.

Effort in the Shark Bay Prawn, Shark Bay Scallop and Exmouth Gulf Prawn Managed Fisheries, are described in the relevant status reports elsewhere within this document.

**Stock Assessment**

**Assessment complete:**

**Shark Bay:** **Yes**

**Assessment level and method:**

**Level 3 - Catch rate/Size Distributions**

**Breeding stock levels:**

**Shark Bay:** **Adequate**

**Shark Bay:** The Shark Bay Crab Fishery (trap and trawl sectors) has developed rapidly in the last 10 years to become Australia’s highest producing blue swimmer crab fishery, with peak landings in 2010 of 828 t valued at over AU\$6 million. During the developmental phase of the commercial trap fishery, catches grew steadily in line with increases in fisher knowledge, gear development and fishing effort, from 87 t (1998) to 564 t (2005). In 2005, the trap fishery transitioned to interim managed status and trap catches have stabilized at around 500 t. During 2010/11, the mean trap catch rate of blue swimmer crabs was 1.74 kg/traplift, a 16% increase on the 2009/10 catch rate of 1.50 kg/traplift (Gascoyne Coast Blue Swimmer Crab Figure 3). The Shark Bay prawn fishery has taken crabs since inception. The level of retained catch was relatively low up until 2001 (89 t), but has since increased steadily to 338 t in 2010.

Conflicting evidence exists as to the sustainability of current total harvest levels in the data collected in the Shark Bay crab trap fishery. Linear relationships of nominal and standardized effort against commercial catch for the trap fleet over the past decade suggest the Shark Bay crab stock is yet to show signs of excessive fishing effort, and that fluctuations in catch are dependent on changes in effort and environmental conditions. Conversely, potential signs of high exploitation include:

standardised catch rates of crabs from fishery-independent trawl surveys decreasing in the last three years; a decrease in mean standardized carapace widths of crabs from both commercial trap monitoring surveys and fishery-independent trawl surveys; a reduction in the proportion of extra large male crabs in the commercial catch; and a downward trend in the standardized commercial trap catch rate in the Eastern Gulf. Concern also exists over the level of latent effort in the fishery, with the trap sector currently operating at 70-80% of its potential effort and the capacity for further increases in crab landings by the trawl fleet.

It is noted here that after the completion of the 2010/11 season in July 2011, the relative abundance of all size classes of crabs in Shark Bay declined significantly. The reasons for this unexpected and substantial decline are yet to be fully understood but may be linked to several adverse extreme environmental events (sustained low salinity associated with intensive flooding and very warm waters up to 4-5°C above average associated with a very strong La Niña event) that occurred during the summer of 2010/11. This decline has already had a significant impact on the 2011/12 fishing season and full details will be provided in the 2012/13 Report.

**Exmouth Gulf:** Catch and effort on blue swimmer crabs in the Exmouth Gulf prawn fishery has been relatively stable, and the stocks are considered to be at acceptable levels.

The minimum legal size at first capture (127 mm carapace width for recreational fishers; 135 mm carapace width for commercial fishers based on industry agreement) for crab fisheries in the Gascoyne Coast Bioregion is set well above the size at first maturity (95 – 115 mm carapace width) of the resident stocks. Consequently, breeding stock levels are expected to be adequate to maintain stocks in all current fishing areas under normal environmental conditions.

The breeding stocks in the Gascoyne Coast bioregion are also supported by the influence of the warmer waters that occur at these latitudes which extends the spawning period over the whole year, than, whereas spawning is restricted to the late spring and early summer months on the lower West Coast.

*The performance measure for the Shark Bay fishery requires that the breeding stocks be maintained. The breeding stock is measured as adult crab abundance (catch per unit effort - CPUE). The CPUE in the Shark Bay fishery for 2010/11 was 1.74 kg/trap lift – well above the performance measure of 1.0 kg/trap lift. This level of breeding stock has proven adequate to support ongoing recruitment to the fishery. However, extreme adverse environmental events over the summer of 2010/11 have had a negative impact on stock levels during the second half of 2011 and into 2012.*

**Non-Retained Species**

**Bycatch species impact**

**Negligible**

Hourglass traps are purpose-designed to minimise the capture of undersized blue swimmer crabs and non-target species and are therefore an inefficient way to capture fish, the majority of which are able to escape through the entrance gaps when the pot is soaking or being hauled.

Small numbers of fish are infrequently captured in crab pots, but the fishers are not permitted to retain them. The low

## GASCOYNE COAST BIOREGION

number of fish caught and returned by crab fishers is considered to pose a negligible risk to these stocks.

Impacts from discarded bycatch from trawl fisheries that retain crabs as a by-product is dealt with in those sections of this report specific to the trawl fisheries.

**Protected species interaction** **Negligible**

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

## Ecosystem Effects

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

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

**Habitat effects** **Negligible**

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

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

## Social Effects

During 2010/11, approximately 15 people were employed as skippers and crew on vessels fishing for blue swimmer crabs in the Gascoyne Coast bioregion. Additional employment for some 30-35 workers has been created in Carnarvon through the development of post-harvest processing of the crab catch.

## Economic Effects

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

**Level 3 - \$5 - 10 million (\$5.0 million)**

Blue swimmer crab landings from the Gascoyne Coast bioregion during 2010/11 were worth \$5.0 million, a 24% increase on the \$4.04 million generated during 2009/10.

The economic value of commercial blue swimmer crab fishing to the State of Western Australia for the 2010/11 financial year was estimated to be \$6.35 million – an 18% increase on the estimated \$5.37 million generated in 2009/10.

The average beach price for green crabs in the Gascoyne fisheries for the year was around \$5-5.80/kg.

While the majority of the product was sold through local and inter-state markets, several Shark Bay fishers have been developing markets in Asia.

## Fishery Governance

**Target catch (or effort) range:**

**Shark Bay: Under Development**

A review of these blue swimmer crab fisheries is being undertaken and target catch ranges will be set.

**Current fishing (or effort) level: Shark Bay - N/A**

Conflicting evidence exists as to the sustainability of current total harvest and effort levels in the data collected in the Shark Bay crab trap fishery. While there is sufficient biomass and productivity within the blue swimmer crab stock in Shark Bay to sustain a significant commercial fishery, the current challenge for the research and management of this fishery is to clarify the causes for the recent decline, and establish the appropriate harvest strategy to ensure the future sustainability of the stock.

With the termination of the Exmouth Gulf Developing Crab Fishery and only a moderate retention of crabs from the Exmouth Gulf trawl fleet, the current level of effort in Exmouth Gulf is considered acceptable.

## New management initiatives (2011/12)

The Shark Bay Crab Interim Management Plan was extended to 31 August 2013 to provide more time to resolve a number of issues related to resource sharing between the Shark Bay crab trap and Shark Bay prawn and scallop trawl fisheries. Joint commercial industry meetings were held in 2012 to consider possible catch share allocations between crab trap and trawl fishers in Shark Bay. The meetings identified a need for an independent workgroup to provide advice on those specific catch share allocations which the Department of Fisheries is now looking to engage.

To address the reduction in stocks following the environmental perturbations in late 2011 a voluntary no take of crabs was negotiated between the Department of Fisheries and the Trap and trawl fishers taking effect on 24 April 2012. The results of regular research trawl and trap surveys will be used to reassess the stock condition and performance measures are being drawn up to determine when stocks reach a suitable level to support commercial fishing again. Appropriate management action will be considered when the fishery resumes including catch and/or effort controls. Recreational fishing has not been restricted during this voluntary commercial closure due to the very low impact of that sector on the stock.

## External Factors

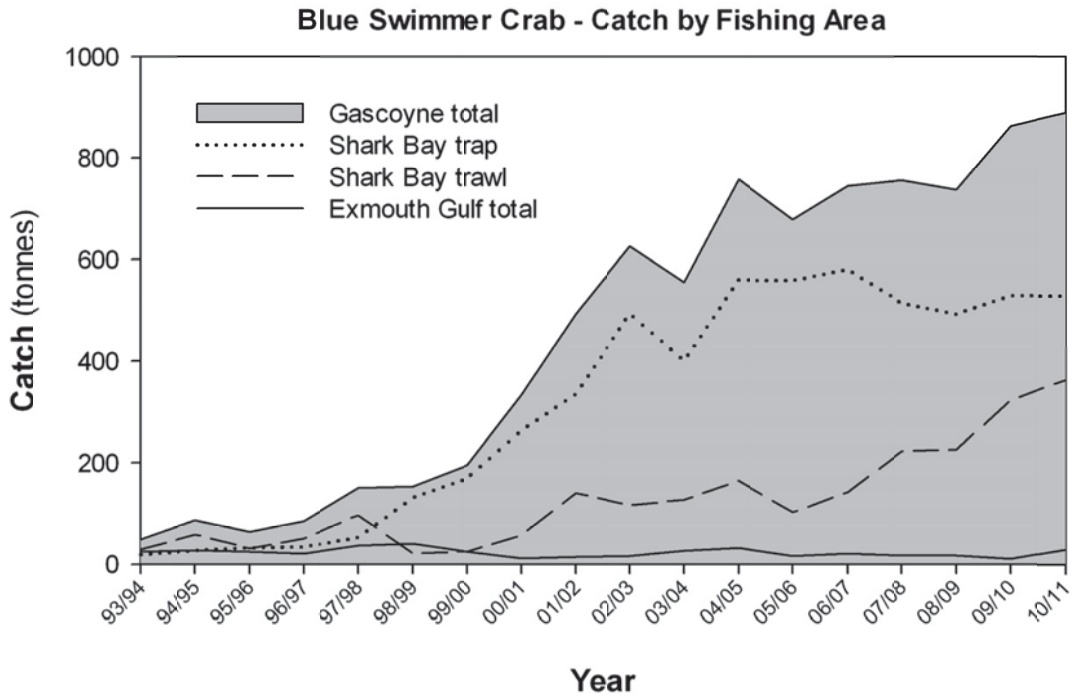
Levels of recruitment to many of the crab fisheries fluctuate considerably. While the causes of these variations are not fully understood, it is considered most likely due to environmental influences on spawning success and larval survival through to recruitment. The relationship between environmental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

The negative effects on the crab stocks from the marine heatwave (very warm waters up to 4-5°C above average associated with a very strong La Niña event) combined with the flood events that occurred during the summer of 2010/11 are currently being examined.



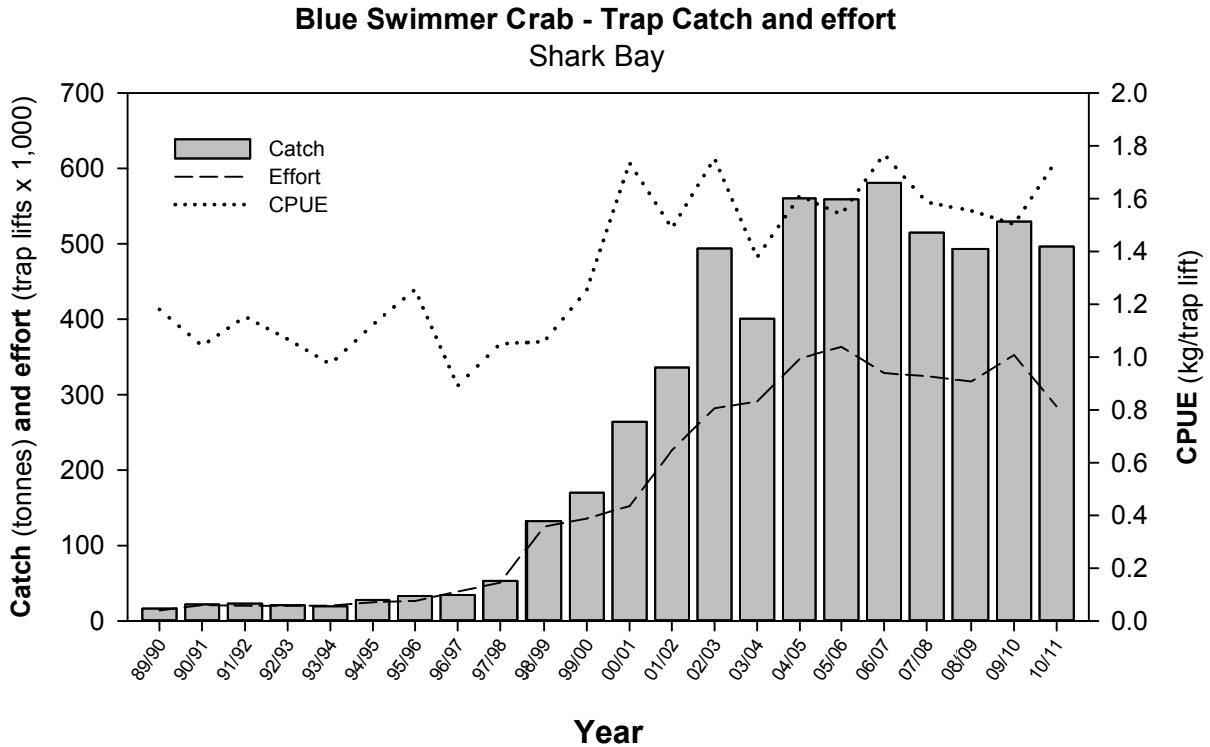
**GASCOYNE COAST BLUE SWIMMER CRAB FIGURE 1**

Extent of the Shark Bay Crab (Interim) Managed Fishery. Two additional 200-trap exemptions allow for fishing in the western and eastern gulfs south of Cape Peron.



**GASCOYNE COAST BLUE SWIMMER CRAB FIGURE 2**

Commercial catch history for the blue swimmer crab (*Portunus armatus*) fisheries in the Gascoyne Coast bioregion of Western Australia since 1993/94.



**GASCOYNE COAST BLUE SWIMMER CRAB FIGURE 3**

Blue swimmer crab trap catch (t), effort (trap lifts x 1,000) and catch per unit effort (kg/trap lift) in Shark Bay since 1989/90.

# AQUACULTURE

## Regional Research and Development Overview

The main focus of the Department of Fisheries in the Gascoyne continues to be on the regulation of the regional pearling industry, including the blacklip oyster *Pinctada margaritifera*, which now complements the major State industry sector built on the silver lip pearl oyster (*Pinctada maxima*).

A local aquaculture sector is emerging, focusing on the production of aquarium species, including coral and live

rock. This developing sector is regulated according to the policy entitled *The Aquaculture of Coral, Live Rocks and Associated Products*.

A start-up project is investigating the production of artemia (brine shrimp) and a small-scale project is growing limited quantities of diadromous and marine species for local markets.

# COMPLIANCE AND COMMUNITY EDUCATION

Compliance and community education services in the Gascoyne Coast Bioregion are delivered by Fisheries and Marine Officers (FMOs), Community Education Officers (CEOs) and associated management and administrative support staff based at District Offices in Denham, Carnarvon and Exmouth. During 2010/11 the three district offices supported a total of eleven FMO positions allocated to deliver services to several client groups including commercial and recreational fisheries, marine parks, pearling and aquaculture operations and fish habitat protection areas. The region covers approximately 2700 kilometres of the Western Australian (WA) coastline, some 13% of the WA coast. The various coastal landscapes represent some of the most remote, isolated, pristine and dangerous marine and terrestrial environments in the State.

A significant aspect of the regions work is the provision of compliance services to the State's Marine Parks. The Gascoyne Coast Bioregion has two of WA's most iconic and significant Marine Parks, Ningaloo Marine Park and the associated Commonwealth Marine Park, Shark Bay Marine Park and the associated World Heritage Area. These two Marine Parks occupy just over 70% of the Gascoyne Coast Bioregion. In partnership with the Department of Environment and Conservation (DEC), FMOs monitor and deliver compliance and education programs covering some 30 Sanctuary Zones and Marine Managed Areas and other protected areas.

FMOs undertake regular land, air and sea patrols using a compliance delivery model supported by a risk assessment process and associated operational planning framework. Throughout the bioregion they employ specially equipped four-wheel-drive vehicles, quad bikes and small towable vessels. They also make use of sophisticated surveillance, mapping and GPS equipment to assist in evidence gathering. This includes high-powered telescopes and photographic mapping technology. A high visibility Recreational Fishing Mobile Patrol has been added to the Gascoyne pool of resources. This dedicated education and enforcement unit patrols the coast from Onslow through to Kalbarri.

FMOs at Exmouth make extensive use of the 13-metre Patrol Vessel (PV) the PV *Edwards* to conduct compliance activities throughout the Gascoyne bioregion. FMOs in

Denham use an 8 metre PV and in Carnarvon a 7.3-metre rigid inflatable boat is used to conduct at-sea inspections in Shark Bay and within the Southern aspects of the Ningaloo Marine Park and Commonwealth Marine Park. In all 3 Districts FMOs spend approximately 100 days a year at sea on patrol duties. Large patrol vessels (greater than 20 m in length) also assist FMOs at various times of the year for offshore patrols, especially in the Shark Bay Prawn and Scallop Fisheries; this accounted for 12 days of at-sea patrols in 2010/11. FMOs also conduct aerial surveillance, dive inspections, at-sea and on-land catch, licence, gear and marine safety inspections, and attend community events as well as school education programs.

Management of the Shark Bay Crab Fishery is an emerging issue for the region. The fishery is the largest in Australia and requires management across a number of separate managed fisheries, including the prawn, scallop and crab fishery itself. The floods of December 2010 and February 2011 had an impact on the Carnarvon and Shark Bay areas and also appear to be having an affect on crab numbers. Further research by the DoF will assist in planning future management and compliance strategies.

The sustainability of the Shark Bay Snapper Managed Fishery, which has become the Gascoyne Demersal Scalefish Fishery, continues to be a high priority and major management challenge. The monitoring of commercial catch quota via the "Catch and Disposal Record" (CDR) process remains a pivotal part of the management process, as does the inspection of catch landed ashore in accordance with the CDRs. Recreational snapper tags in the Freycinet Estuary area continue to be another positive method for managing the pink snapper recovery in this area. Ensuring fair and equitable access to the fishery for both commercial and recreational fishers whilst ensuring the sustainability of the species remains a high priority for the Gascoyne Management team and FMOs in the region.

The continuing recovery of the Shark Bay Inner Gulf pink snapper stocks has been supported by the efforts of the Department's staff in the Gascoyne Coast Bioregion and the officers of the Denham District in particular.

FMOs continue to support and maintain important and long-term relationships with the community through their

## GASCOYNE COAST BIOREGION

participation in community events and the coordination of educational and interpretive activities during peak periods utilising Community Education Officers (CEOs) throughout the bioregion. These peak periods commence in late March and finish in early October. During this peak season, fishing competitions like the *Carnarfin*, *Shark Bay Fishing Fiesta* and *Gamex*; and community events such as the *Whale Shark Festival* and *Gascoyne Expo* provide high exposure community education opportunities for FMOs and CEOs. FMOs make a substantial contribution to the pre-season preparations of the Shark Bay and Exmouth trawl fleets by providing advice, pre-season briefings and inspections of vessels, fishing and safety equipment.

The Department's satellite-based vessel monitoring system (VMS) continues to be a central compliance and management tool enabling positional surveillance and monitoring of commercial vessels and provides an important safety tool for fishers in case of emergency. The VMS allows for fishery-specific management plan closures to be monitored remotely by triggering an alarm should a boundary be crossed or an unauthorized activity be detected. FMOs can program their inspection regimes and apply their investigation methods more efficiently by using the facilities provided by VMS. The expansion of the VMS into other fisheries such as the Gascoyne Demersal Scalefish and mackerel fisheries has ensured that a higher and more effective rate of compliance is achieved.

### Activities during 2010/11

During 2010/11 FMOs delivered a total of 6,944 hours of "in-field" compliance activity (Gascoyne Coast Compliance Table 1 which excludes Gascoyne pearling compliance activities which are reported in the North Coast Bioregion), (Gascoyne Coast Compliance Patrol Hours Figure 1). The total budgeted hours for compliance were not delivered by FMOs in the region during 2010/11. This was due again to staff shortages for significant periods of time during the year. It has been demonstrated in previous years that the ongoing positive effects of a stable FMO work group have resulted in a better working relationship between fishers and FMOs, especially commercial fishers, however previous efforts might be at risk because of the ongoing issue of staff shortages. Commercial and recreational fishers alike continue to provide positive feedback that the routine attendance of familiar FMOs in their workplace and recreational fishing locations has led to a better understanding and knowledge of the regulations and a higher rate of compliance.

In delivering compliance services to the Gascoyne, FMOs under the management of the Compliance Manager make use of a risk assessment and intelligence analysis-driven model to compliance planning and prioritization. All the existing Operational Compliance Plans (OCP) were reviewed and updated during the 2010/11 year using this model. Several other OCPs were completed, including the Gascoyne/Pilbara Recreational Fishing plan focussing effort on Onslow and the Commonwealth Ningaloo Marine Park. This continues to be the model for delivering compliance across the agency and continues to provide the most effective and efficient method for a planned and measurable approach to compliance delivery.

The OCP's deliver agreed outcomes and provide a more accountable and realistic process for budget creation and the actual services that are to be delivered.

OCPs have been operating for several years now in the Exmouth Gulf Prawn Fishery, Shark Bay Prawn Fishery, Shark Bay Scallop Fishery, Shark Bay Crab Interim Managed Fishery, Gascoyne Aquaculture and Pearling Fishery, and, for the management of the Ningaloo Marine Park, Shark Bay Marine Park and Commonwealth Ningaloo Marine Park. A more targeted effective and relevant compliance service in terms of both cost and activities was delivered using this planning and delivery process.

FMOs delivered compliance activities directed at commercial fisheries mostly through pre-season inspections, catch inspections and quota monitoring, as well as at-sea inspections and investigations resulting from suspected breaches detected via the VMS and intelligence led operations. FMO effort was again directed at building stronger relationships with industry through higher levels of contact both at sea and in port. The number of suspected breaches of closed waters detected through the VMS and other monitoring methods has remained at a moderately high level in 2010/11. However, compliance overall is assessed as being at an acceptable level across all the fisheries except for the Shark Bay Prawn Fishery where issues regarding VMS compliance remain an ongoing concern. Compliance staff assess that the commercial fishing industry continues to demonstrate a positive approach to complying with regulations and playing their part to ensure the sustainability of their fisheries. A total of 8 infringement warnings and 5 infringement notices were issued and 4 prosecutions were instigated from a total of 206 field contacts with commercial fishers. Field contacts were lower than 2009/10 because of the previously highlighted staff shortages.

The monitoring of marine park activities with respect to recreational fisheries has divided the recreational fishing compliance program from a stand-alone program into two distinct programs, one with a marine park focus. FMOs increased their compliance activities in relation to both Ningaloo Marine Park and Shark Bay Marine Park in line with the increased importance and focus of government on marine parks across the State. The number of infringement warnings (72) was significantly lower than in previous years, however infringement notices issued (180) increased. No prosecutions were instigated. This was achieved from a total of 11,810 recreational fishing field contacts, which reflects the increased importance placed on recreational fishing and marine parks in general across the Gascoyne. Recreational fisher contacts were approximately 20% higher than in 2009/10.

Three Recreational Fishing Mobile Patrols from outside the region were again active in the Gascoyne in 2010/11. "Mobile 1" provides a dedicated mobile recreational fishing patrol using specialized remote-area-equipped vehicles and surveillance equipment. "Mobile 1" patrols operated mainly in the Denham and Carnarvon Districts, working in a coordinated approach with District Officers to provide greater coverage and improved compliance outcomes. The focus for this unit was again on education and enforcing management arrangements for Shark Bay Inner Gulf pink snapper and the Gnarrloo Bay area. Two Mobile Patrols from the Metro Region patrolled the Gascoyne Region increasing the effective contact rate at the peak of the season.



**Initiatives in 2011/12**

For the 2011/12-year a number of initiatives across the Gascoyne Bioregion have been planned. These include: -

- Address the management and compliance aspects associated with the Shark Bay Crab Fishery;
- Continue to focus on a more Intelligence based and Tactical approach to compliance delivery, especially in marine parks and recreational fishing;
- Improve the level of FMOs investigation and prosecution skills and experience;
- Increase effort in terms of education and enforcement in the Onslow and Eastern Exmouth Gulf area;
- Improve recruitment and retention practises to attract and retain staff in the Gascoyne;
- Complete construction of new Denham Fisheries and DEC building.

**GASCOYNE COAST COMPLIANCE TABLE 1**

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

PATROL HOURS DELIVERED TO THE BIOREGION	6,944 Officer Hours
CONTACT WITH THE COMMERCIAL FISHING COMMUNITY	
Field Contacts by Fisheries & Marine Officers	206
Infringement warnings	8
Infringement notices	5
Prosecutions	4
CONTACT WITH THE RECREATIONAL FISHING COMMUNITY	
Field Contacts by Fisheries & Marine Officers	11,810
Infringement warnings	72
Infringement notices	180
Prosecutions	0
OTHER FISHING-RELATED CONTACTS WITH THE COMMUNITY*	
Field Contacts by Fisheries & Marine Officers	529
Fishwatch reports**	6
VMS (Vessel Days)****	7,829

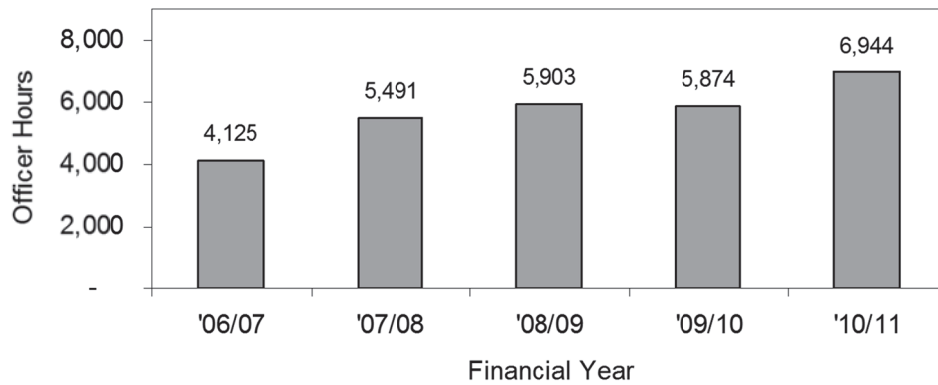
\*Contacts are classified according to the specific fishery, which is usually clearly delineated as being either commercial or recreational.

The "Other" category is used where multiple fisheries are contacted and it is not possible to accurately classify the contacts into one specific fishery – typically, the majority of these contacts are recreational in nature (e.g. personal contacts in Marine Parks), but contacts made in relation to fish kills, shark patrols and inspections of commercial fish wholesale and retail premises etc. are also included in this category.

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

\*\*\*\* 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.

Gascoyne Coast Bioregion Compliance Patrol Hours



**GASCOYNE COAST COMPLIANCE FIGURE 1**

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