

# GASCOYNE COAST BIOREGION

## REGIONAL MANAGEMENT OVERVIEW

The Gascoyne coast bioregion is home to the State's major trawl fisheries, with managed fisheries for prawns and scallops occurring in Shark Bay and Exmouth Gulf. In addition, the region supports the important Shark Bay Snapper and Shark Bay Beach Seine and Mesh Net Managed Fisheries, which respectively provide most of the pink snapper and whiting catch for the State. An experimental fishery for blue swimmer crabs, based primarily in Carnarvon but operating throughout the waters of Shark Bay, is also being developed.

Key Commercial Program activities in the Gascoyne bioregion over the past 12 months have included:

- continued implementation of bycatch reduction devices in the trawl fisheries, with full implementation of grids and trials of fish escapement devices;
- refinement of the operational process of the Memorandum of Understanding for the Exmouth Gulf Prawn Managed Fishery to improve its functionality;
- completion of the report addressing the principles of ecological sustainability (in line with the requirements of the *Environment Protection and Biodiversity Conservation Act 1999*) for the Shark Bay Snapper Managed Fishery; and
- development of responses to public comments on the ecological sustainability reports for the Exmouth Gulf Prawn, Shark Bay Prawn and Shark Bay Scallop Managed Fisheries, and addressing of requirements arising from the ecological sustainability accreditation of these fisheries.

The Gascoyne bioregion is also home to an active wetline fishery, operating in a number of areas and incorporating:

- demersal line fishing;
- mackerel fishing (primarily by trolling); and
- beach seining and some near-shore gillnetting.

The demersal line fishery takes a range of demersal fish species, including emperors, baldchin groper/tuskfish and, more recently, the deep-water-dwelling goldband snapper (jobfish) from boats operating purely as wetliners (i.e. no form of access other than the fishing boat licence), as well as from boats operating in the two managed finfish fisheries (Shark Bay Snapper and Shark Bay Beach Seine and Mesh Net Managed Fisheries). The management arrangements for the wetline fishery will be considered in the review of wetline fishing announced by the Minister in September 2002.

Mackerel (generally narrow-barred and broad-barred Spanish mackerel) are also taken by a number of wetliners who specifically target this high-value fish, as well as by the operators working in the two managed finfish fisheries.

A new interim management plan for this fishery is likely to be implemented at the beginning of 2004.

There is also a small take of fish by beach seining using hand-hauled nets north of the northern boundary of the Shark Bay Beach Seine and Mesh Net Managed Fishery.

## REGIONAL COMPLIANCE AND COMMUNITY EDUCATION OVERVIEW

Compliance activities relating to the commercial fisheries of the Gascoyne coast bioregion are conducted by Fisheries Officers from offices located in Exmouth, Carnarvon and Denham. Compliance activities in the region comprise a mix of at-sea inspections of commercial operations in relation to their authorisations, catch, fishing gear and time/area of operation, in addition to land-based inspections of authorisations, catch (type and amount), fish processing factories, retail outlets and catch consignment deliveries. The various trawl fisheries operating in the region are also monitored remotely through the Department's satellite-enabled Vessel Monitoring System and, in some cases, quota monitoring systems.

Major fisheries serviced in the region include the Shark Bay Prawn, Shark Bay Scallop, Exmouth Gulf Prawn, Shark Bay Snapper and Shark Bay Beach Seine and Mesh Net Managed Fisheries, the experimental Shark Bay inshore crab fishery, and various wetline operations. Officers utilise the 9.5 m patrol vessel *John Brockman*, the 8 m patrol vessel *Gnulli* and a variety of small dinghies to conduct regular inshore at-sea inspections. From time to time there is a need to utilise the Department's larger seagoing patrol vessels for more extensive at-sea operations.

### Activities during 2001/02

During 2001/02, Regional Services personnel undertook 7,593 hours of compliance work in commercial fisheries in the Gascoyne coast bioregion (Gascoyne Commercial Compliance Table 1), excluding work conducted for the Australian Fisheries Management Authority in Commonwealth fisheries. The major percentage of these hours comprised duties performed in relation to trawl fishery compliance activities.

During 2001/02, Fisheries Officers recorded 508 field contacts with commercial fishing operations and 1,217 office contacts with commercial fishers. In the course of the year officers issued 8 infringement warnings and 21 infringement notices, while a further 18 cases were progressed as prosecution actions against commercial fishers.

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## GASCOYNE COMMERCIAL COMPLIANCE TABLE I

Summary of compliance and educative contacts and infringement types in commercial fisheries within the Gascoyne coast bioregion during the 2001/02 financial year.

CONTACT WITH THE COMMERCIAL FISHING COMMUNITY	NUMBER
Hours delivered in bioregion	7,593
Fisher field contacts by Fisheries Officers	508
District Office contacts by Fisheries Officers	1,217
Fishwatch reports *	26
<b>OFFENCES DETECTED</b>	
Infringement warnings	8
Infringement notices	21
Prosecutions	18

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

The region's major fisheries continued to be the focus of the majority of investigations resulting in prosecution action during the year. In particular, the Shark Bay Prawn and Scallop Managed Fisheries generated a number of VMS-related offences requiring investigation and in some cases prosecution.

However, a number of other commercial fisheries, including the Exmouth Gulf Prawn and Shark Bay Snapper Managed Fisheries and the wetline fishery, also required varying levels of investigation. The wetline compliance problems were generally restricted to a small number of fishers using unlicensed personnel as crew and/or incorporating the catches of recreational fishers in their consignments. The Shark Bay Snapper Managed Fishery, following stricter and more comprehensive management arrangements introduced in late 2000, generated several offences relating mainly to non-compliance with quotas or failure to complete correct catch and disposal records. A number of fishers were also investigated for authorisation-related offences.

### Initiatives in 2002/03

2002/03 saw the Gascoyne bioregion's management staff working together with participants in the Exmouth Gulf Prawn Managed Fishery to complete a series of risk assessment workshops and meetings. The meetings allowed those involved to work through issues associated with levels of compliance funding and servicing for the fishery and resulted in both the Department and industry gaining a better understanding of one another's priorities, obligations and expectations, with a view to ensuring effective formulation and delivery of appropriate compliance projects.

The introduction of VMS into the Exmouth Gulf Prawn Fishery management arrangements during the 2002 season necessitated extra training in VMS-related matters for staff working at the Exmouth District Office. This training was able to build on experience gained over the past three years since the Shark Bay prawn and scallop trawl fisheries began using VMS. Additionally, the Department has been working to

review the most appropriate strategy to deal with VMS-related offences. This has included the development of new protocols and processes incorporating staff from the Gascoyne bioregion, the Perth-based VMS centre and the Prosecutions Section, and is already producing benefits for those handling these matters.

## REGIONAL RESEARCH OVERVIEW OF WETLINE FISHING

The CAES database indicates that around 12% of the State's wetline catch was reported from the Gascoyne coast bioregion during 2001/02. The top ten species comprised goldband snapper (*Pristipomoides multidentis*) 69 t, Spanish mackerel (*Scomberomorus commerson*) 49 t, pink snapper (*Pagrus auratus*) caught outside of the Shark Bay Snapper Managed Fishery 43 t, sea mullet (*Mugil cephalus*) 19 t, rosy jobfish (*Pristipomoides filamentosus*) 17 t, red emperor (*Lutjanus sebae*) 12 t, northern bluefin tuna (*Thunnus tonggol*) 10 t, grey mackerel (*Scomberomorus semifasciatus*) 6 t, nor-west snapper (Lethrinidae) 6 t and spangled emperor (*Lethrinus nebulosus*) 6 t.

An interim management plan for the troll fishery for mackerel, details of which are reported under the north coast bioregion (pp. 97–102), will commence in 2004. Most of the other demersal species are taken by vessels targeting pink snapper in the region's oceanic managed fishery for that species (see pp. 64–67). The majority of the mullet catches were reported from the area between the northern boundary of the beach seine fishery and Carnarvon.

## Shark Bay Prawn Managed Fishery

### Management Summary

The Shark Bay Prawn Managed Fishery targets western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*Penaeus esculentus*) and a variety of smaller prawn species including coral prawns (various species) and endeavour prawns (*Metapenaeus* spp.). King prawns are the dominant species, comprising about 70% of the catch. Tiger prawns make up most of the remaining 30%. The fleet also catches between 20% and 30% of the annual scallop catch in Shark Bay.

Most large king and tiger prawns are exported whole or headless to Asia (Japan) and Europe, while the Australian markets take most of the smaller king and coral prawns. The fishery has an annual value of around \$25–30 million, although the value of the catch fluctuates according to catch levels, the prices of prawns on world markets, and exchange rates.

Management of the fishery is based on limited entry, crew limitations, gear controls, season and area openings and closures, moon phase closures and daily fishing time controls.

A Ministerial exemption was again granted to licensees prior to the start of the 2003 season, exempting operators from the 375 boat unit rule currently provided for under the Shark Bay

Prawn Management Plan 1993. Management responses to the longer-term removal of the 375 boat unit rule are being discussed with industry. An exemption was also granted to allow licensees to trial 'bison' otterboards (as opposed to standard flat wooden otterboards) during the 2003 season.

Bycatch reduction devices (specifically grids) continue to be fully implemented during the 2003 season. Vessels operating in the fishery are required by way of a condition on the managed fishery licence to fish with a grid in each net. Trials of secondary bycatch reduction devices or fish escapement devices (FEDs) (for example, square mesh panels) are also occurring during the 2003 season. It was necessary to provide an exemption to provide for such trials given that the meshes associated with the FEDs are greater than provided for in the legislation.

The 2003 fishing season commenced on 6 March and is scheduled to close on 1 November. The timing of the opening of the season allows the harvest of large residual prawns which were not caught in the previous year's season. Within the main fishing period, there are various subsidiary openings and closures which are aimed at catching prawns at appropriate sizes and protecting the stock from recruitment over-fishing.

Since the 1999 season, moon closures have been made more variable, changing from a standard three-day period to between three and seven days over the full moon. This change is aimed at increasing economic efficiency by shifting fishing effort away from the period where catch rates are reduced and a greater proportion of the catch is soft-shelled and therefore less marketable. Permanent nursery area closures within the fishery prevent the fishing of small prawns while two spatio-temporal closures serve to protect tiger prawn breeding stocks. The Vessel Monitoring System continues to be an integral part of the fishery's management strategy and provides the mechanism to give effect to the various closures in the fishery.

The Shark Bay Prawn Management Advisory Committee has been replaced by the Joint Trawl Management Advisory Committee (JTMAC), which covers the Shark Bay Prawn, Shark Bay Scallop, and Exmouth Gulf Prawn managed fisheries. Given the overlap between the three Gascoyne trawl fisheries it was considered more efficient to merge the previously separate MACs. The JTMAC, which provides high-level advice to the Minister on the management of these fisheries, held its inaugural meeting in February 2003. The JTMAC process provides for management arrangements to be better tailored to maintaining the sustainability of the fishery, ensuring cost-effective management and achieving the maximum economic return from the prawn resource. Detailed fishery management matters (e.g. opening/closing dates, spatial and temporal closures) are now dealt with directly between the Department and licensees.

Environment Australia has declared the fishery as being managed in an ecologically sustainable manner under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999*. While subject to a variety of recommendations, this approval allows product from the fishery to be exported for a five-year period.

### **Governing Legislation/Fishing Authority**

Shark Bay Prawn Management Plan 1993  
Shark Bay Prawn Managed Fishery Licence

### **Consultation Process**

Joint Trawl Management Advisory Committee  
Department–industry meetings

## **Research Summary**

Research activities continued to focus on stock assessment and monitoring the status of the prawn stocks, particularly tiger prawns. All boats completed detailed research logbooks, which together with pre-season and spawning stock surveys, made up the database for monitoring the fishery.

A collaborative project with industry to review the impact of trawling on non-target species has been evaluating gear modifications to reduce bycatch and improve product quality. A further FRDC-funded project is examining the biodiversity of bycatch in trawled and untrawled areas of Shark Bay.

The following status report summarises the research findings for this fishery.

## **Shark Bay Prawn Managed Fishery Status Report**

*Prepared by E. Sporer and M. Kangas*

### **FISHERY DESCRIPTION**

#### **Boundaries and access**

The boundaries of this managed fishery are the waters of the Indian Ocean between latitudes 23°34' S and 26°30' S and adjacent to Western Australia on the landward side of the 200 m isobath (Shark Bay Prawn Figure 1).

Twenty-seven boats are licensed to engage in prawn trawling in this fishery and all licences were active in the 2002 season, which opened on 6 March and closed on 21 October.

Recruitment surveys in March and April within the closed area south and east of the Carnarvon/Peron Line and the extended nursery area (ENA) were used to determine the extent of this area to be opened. The Carnarvon/Peron area was opened on 11 April. Owing to small prawn size the ENA remained closed to fishing until 6 May. The ENA closed to fishing on 1 August to protect juvenile king prawns.

Denham Sound opened on 6 March, with trawling restricted to the area north of the Torbay Line, and closed from 1 May. The Sound, including the Torbay Line, reopened on 1 August and remained open until the end of the season (21 October).

#### **Main fishing method**

Otter trawl.

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## RETAINED SPECIES

**Commercial production (season 2002): 2,075 tonnes**

### Landings

The total landings of major penaeids for the 2002 season were 2,075 t, comprising 1,554 t of king prawns, 510 t of tiger prawns and 11 t of endeavour prawns. There were also 102 t of minor penaeids (coral prawns) landed.

The 2002 landings represent a substantial increase compared to 2001, with the catch of king, tiger and endeavour prawns within the acceptable catch range. King prawn landings for 2002 were close to the five-year average (1,516 t) (Shark Bay Prawn Figure 2) whilst the tiger prawn landings were slightly lower than the five-year average (561 t).

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 mesh, suggesting that the overall exploitation is low.

Scallop landings by the prawn fleet in 2002 totalled 371 t whole weight. All Shark Bay Prawn Managed Fishery boats have Shark Bay Scallop Managed Fishery Class B licences.

By-product landings included 155 t of blue swimmer crab (*Portunus pelagicus*), 29 t of squid, 19 t of cuttlefish, 21 t of tuna (wetlining), 8 t of mulloway (*Argyrosomus hololepidotus*) and a small quantity of other miscellaneous finfish species.

### Fishing effort

Effort recorded in the 2002 daily logbooks for the fleet showed nominal effort as 49,494 hours, which was a reduction of 4,818 hours when compared with the last five years' average effort (54,312 hours). Fishing effort is being monitored with the aim of reducing ineffective trawl hours whilst maintaining high catch rate levels, thus reducing overall effort to improve economic efficiency within the prawn trawl fleet. There were seven moon closure periods consisting of three, five and seven days providing a total of 192 nights' fishing. Following consultation with the Research Division and industry, the August and September moon closure periods were extended from seven to ten days, and together with the voluntary early closure, only a total of 182 nights were actually fished. Although the number of fishing days (and thus trawl hours) has been reduced during the 2002 season, effective effort is high. The catch and effort in this fishery requires vigilant monitoring of both king and tiger prawn stocks to maintain effective effort at current levels.

### Catch rate

A catch rate of 31.4 kg/hr for king prawns was observed, which was the highest catch rate since 1964. This, in part, reflects the reduction in fishing during periods of low catch rate aimed at increasing economic efficiency.

The 2002 tiger prawn catch rate of 10.3 kg/hr was higher than the 2001 season (7.4 kg/hr) and comparable to that of the years 1991–2000 (mean 10.4 kg/hr). The 2002 season catch rates

have also been affected by extended full moon closures which are designed to reduce periods of ineffective effort whilst maintaining sustainability of the species in this fishery.

**Recreational component:**

**Nil**

**Stock assessment completed:**

**Yes**

The king and tiger prawn stocks are fully exploited. For tiger prawns, this assessment is supported by the position of recent indices of recruitment and spawning stock with respect to the accepted spawning stock–recruitment relationship (SRR). Environmental factors, in particular the variation in the strength of the Leeuwin Current (see below), are being examined to improve the understanding of variations in the SRR for the king prawn stock. We continue to examine catch trends to enhance our evaluations and longer-term predictions. Indications are that at current effort levels, catches of king and tiger prawns are likely to remain in the vicinity of 1,500 and 500 t respectively.

**Exploitation status:**

**Fully exploited**

**Breeding stock levels:**

**Adequate**

The multi-species nature of this fishery requires the levels of exploitation for both king and tiger prawn stocks to be carefully monitored to simultaneously achieve the maximum sustainable catches. Current stock and recruitment studies indicate that the king prawn stock remains at a point where recruitment is not affected by spawning stock levels. Thus, at the current level of exploitation, most fluctuations in the annual king prawn harvest are likely to have resulted from varying effort levels and environmental effects on recruitment, not from the abundance of the spawning stock.

In contrast, the recruitment levels of tiger prawns during the 1980s were demonstrably affected by reduced spawning stock biomass. Management practices have subsequently been employed to increase the level of these spawning stocks. The spatial extent of the Tiger Prawn Spawning Area (TPSA) was re-examined and divided into two areas, southern and northern, during the 2001 season (Shark Bay Prawn Figure 1). The southern area is regarded as the prime area for spawning tiger prawns. Furthermore it was agreed, in consultation with industry, to close the spawning areas using a catch rate threshold level of 10 kg/hr instead of an arbitrary date, which had been the practice prior to 2001.

Two standardised research surveys (to confirm commercial catch rates derived from logbook information) were carried out on 4 and 18 June 2002 to obtain the catch rate of tiger prawns, which provided the basis for closure of the southern spawning area on 23 June. The average catch rate of tiger prawns for the surveys in 2002 was 15.5 kg/hr compared to 10.2 kg/hr in 2001. In 2001, because the TPSA was closed on 19 June, the threshold catch rate was maintained throughout July and August in the TPSA. In 2002, however, fishing was allowed in the TPSA during the period 18–23 June, and a subsequent survey on 30 July indicated the catch rate had declined to only 3.6 kg/hr in the TPSA (which is still above the SRR trigger level of 2 kg/hr). In future, therefore, the TPSA will close immediately after survey confirmation of the threshold catch rates (10 kg/hr) being reached. This regime of

surveys and closure will continue for a minimum of three years (2001–2003 inclusive) to allow an analysis of its usefulness in protection of spawning stock.

The northern spawning area, which is aligned with the northern portion of the original 1996 TPSA, was not closed during the 2002 season because a survey could not be completed in the area and it was anticipated that low fishing activity would occur there. The season average commercial catch rate (10.3 kg/hr) and the total catch for tiger prawns was within expectations. Furthermore, the fishing arrangements provided larger sizes and good quality prawns during the season.

Changes in the efficiency of the fishing fleet must still be monitored carefully to ensure that tiger prawn spawning stocks are not reduced below optimal levels. This is particularly the case during high rainfall events, when the vulnerability of stocks appears to be increased by the stock moving on to the fishing grounds from inshore areas early, thereby allowing the fishery to deplete the spawning stock well before the prime spawning period starts in August.

## NON-RETAINED SPECIES

### Bycatch species impact: Moderate

Bycatch composition is dominated by dead wire weed, which breaks off the extensive shallow Wooramel seagrass bank annually over summer, and small fish species mostly not exploited by other sectors. Small blue swimmer crabs and other crustacean species are also taken in significant quantities but are generally released alive. Overall bycatch loads are medium relative to other subtropical trawl fisheries at about 4–8 times the prawn catch. A study on the bycatch of trawled and untrawled areas of Shark Bay is under way and will further document bycatch abundance and composition during 2002/03. Trialling and implementation of fish escapement devices (square mesh panels in cod-ends) should further reduce the quantity of small fish retained in trawls.

### 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 generally returned to the sea alive. The full implementation of bycatch reduction devices (grids) into the fishery during 2002 has eliminated the occasional capture of turtles in trawl nets. However, there is a short period of time in a specific area that is grid-exempt. This area generally has low occurrence of turtles, minimising captures during this time, and the short trawl duration (approximately 60 minutes) required in Shark Bay to accommodate the high prawn catch rates and the clogging effects of dead wire weed means that any turtles caught can be returned to the sea alive.

## ECOSYSTEM EFFECTS

### Food chain effects: Low

Although the exploitation rates of the retained target species are high, such species have very high natural mortality rates and make up a relatively low proportion of the 'fish'

biomass on the trawl grounds. Thus, most prawn predators are opportunistic due to these natural variations in prawn populations. Consequently, it is not likely that the commercial take of prawns impacts significantly on the upper trophic levels within the Shark Bay ecosystem.

### Habitat effects: Moderate

As a result of the extensive permanent and temporary closures first introduced via the management plan in the 1960s and 1970s respectively (Shark Bay Prawn Figure 1), the fleet operates in only 5% of the overall licensed area of the fishery. Inside Shark Bay, trawl fishing is focused in the deeper areas of the central bay, north of Cape Peron and in the northern area of Denham Sound. In 2002, the total area trawled within Shark Bay was approximately 885 square nautical miles which represents less than 20% of inner Shark Bay. This, combined with the fact that the majority of these trawl grounds are on hard sand habitats which characteristically have very low levels of benthic fauna, means that the typical impact of the trawls is minimal.

## SOCIAL EFFECTS

The estimated employment for the year 2002 was 135 skippers and crew. There are also prawn processing and support staff employed at Carnarvon and Fremantle. This industry, in conjunction with the other trawl fisheries for prawns and scallops in the Gascoyne bioregion, is a major contributor to regional employment.

## ECONOMIC EFFECTS

### Estimated annual value (to fishers) for year (2002): \$30 million

Wholesale prices for prawns vary depending on the type of product and the market forces operating at any one time. Generally, the price of prawns was lower than in 2001 except for tiger prawns, and average ex-boat prices were as follows:

King prawns	\$13.10/kg
Tiger prawns	\$18.25/kg
Endeavour prawns	\$9.00/kg
Coral prawns	\$2.00/kg

## FISHERY GOVERNANCE

### Acceptable catch range: 1,501–2,330 tonnes

Under current effort levels and normal environmental conditions, and based on the 10-year range of catches following the restructuring of the fishery to 27 licences (1990), the acceptable catch range for major penaeids is 1,501–2,330 t. Acceptable catch ranges for individual species are king prawns 1,100–1,600 t, tiger prawns 400–700 t and endeavour prawns 1–30 t. The total prawn catch and the catch of the three individual species during 2002 were within the acceptable ranges set. Monitoring of the tiger prawn stock will still be regarded as a high priority in this fishery and the collaborative initiative with industry to refine the TPSA closure system will continue.

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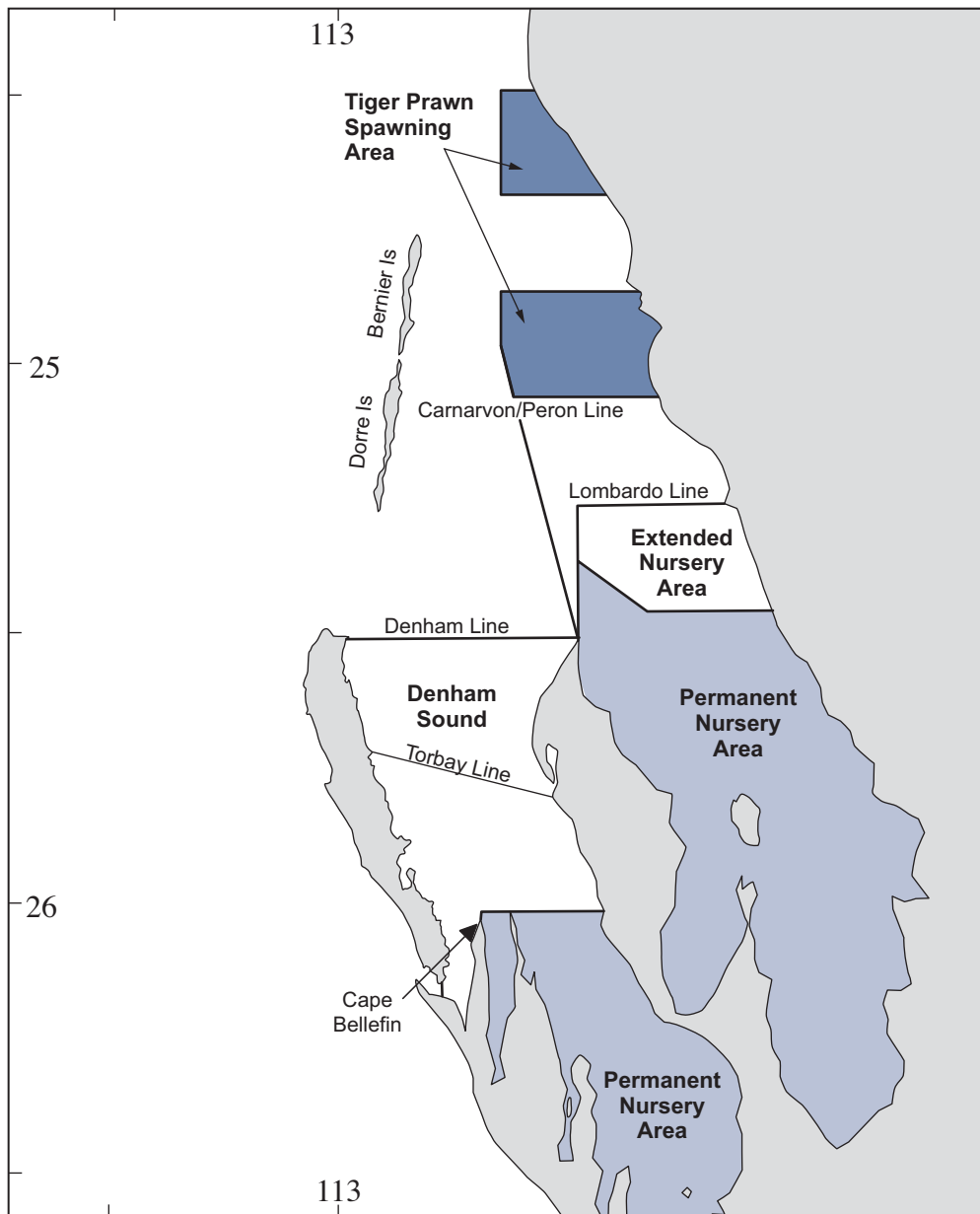
## EXTERNAL FACTORS

The catches of prawns in Shark Bay are relatively stable compared with other penaeid fisheries. 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 Leeuwin Current also appears to affect scallop recruitment, which can cause a redirection in effort away from

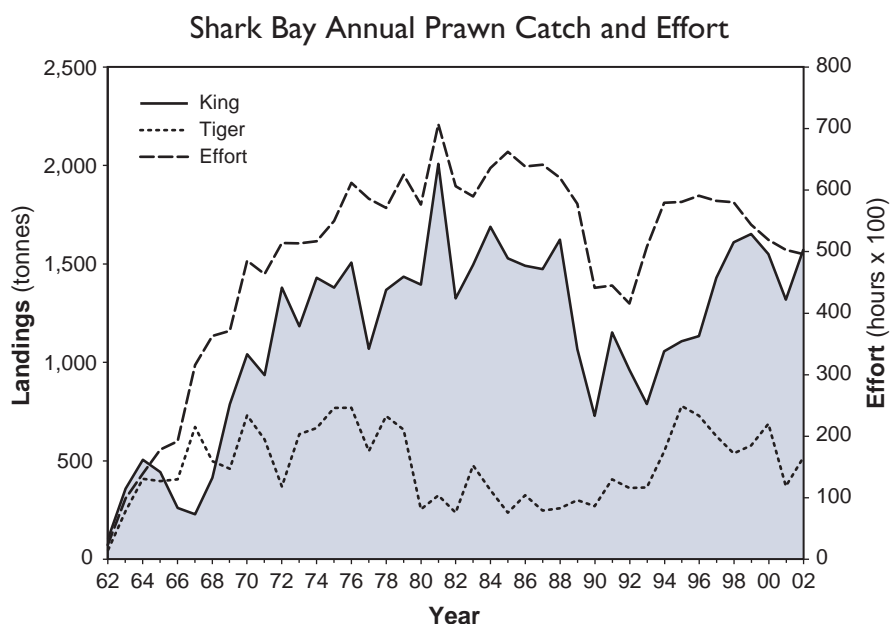
prawn areas and artificially lower prawn catches when scallops are very abundant.

Cyclone effects including high rainfall events may also influence prawn catches as strong river flows (Gascoyne and Wooramel Rivers) can flush prawns (particularly brown tiger prawns) from inshore seagrass areas out on to trawl grounds. At these times more wire weed is also encountered on the trawl grounds, which influences fishing patterns.



SHARK BAY PRAWN FIGURE 1

Boundaries of the Shark Bay Prawn Managed Fishery.



**SHARK BAY PRAWN FIGURE 2**

Shark Bay Prawn Managed Fishery annual prawn catch and effort, 1962–2002.

## Exmouth Gulf Prawn Managed Fishery

### Management Summary

The Exmouth Gulf Prawn Managed Fishery targets western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*Penaeus esculentus*), endeavour prawns (*Metapenaeus* spp.) and banana prawns (*Penaeus merguensis*).

The 2003 fishing season commenced on 1 April and is scheduled to close on 15 November. The more flexible fishing arrangements trialled in the 2002 season are continuing during the 2003 season. This provides industry with the flexibility to maximise tiger prawn size (and hence market value) while maintaining the existing monitoring and tiger prawn breeding stocks catch threshold protocols. The Memorandum of Understanding between industry and the Department continues to ensure accountability.

Management controls also include limited entry and gear restrictions as well as controls on vessel size and power. Licensees in the fishery have again been granted an exemption to continue trialling quad gear (four smaller nets). It is likely that the Exmouth Gulf Prawn Management Plan 1989 will be amended during the 2003 season to allow for more flexible gear configurations (through unitisation without altering the total headrope in the fishery). The Vessel Monitoring System continues to be an integral part of the fishery's management strategy.

Bycatch reduction devices (specifically grids) continue to be fully implemented during the 2003 season by way of a condition on the managed fishery licence. It is expected that secondary bycatch reduction devices or fish escapement devices (for example, square mesh panels) will be trialled later in the 2003 season.

The Department, in association with industry, is also in the process of preparing an application to the Commonwealth's Department of Agriculture, Forestry and Fisheries Australia in order to gain certification from the US Department of State that the fishery is BRD-compliant in terms of potential turtle captures. This will allow licensees to export product to the US market. Industry has also installed additional 'hopper' sorting systems on vessels, which improves the survival of some bycatch species. There are now seven vessels which have hopper systems.

The Exmouth Gulf Prawn Management Advisory Committee has been replaced by the Joint Trawl Management Advisory Committee, which covers the Exmouth Gulf Prawn, Shark Bay Prawn and Shark Bay Scallop Managed Fisheries. Given the overlap between the three Gascoyne trawl fisheries it was considered more efficient to merge the previously separate MACs. The JTMAC, which provides high-level advice to the Minister on the management of these fisheries, held its inaugural meeting early in 2003. The JTMAC process provides for management arrangements to be better tailored to maintaining the sustainability of the fishery, ensuring cost-effective management and achieving the maximum economic return from the prawn resource. Detailed fishery management matters (e.g. opening/closing dates, spatial and temporal

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closures) are now dealt with directly between the Department and licensees.

Environment Australia has declared the fishery as being managed in an ecologically sustainable manner under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999*. While subject to a variety of recommendations, this approval allows product from the fishery to be exported for a five-year period.

## Governing Legislation/Fishing Authority

Exmouth Gulf Prawn Management Plan 1989  
Exmouth Gulf Prawn Managed Fishery Licence

## Consultation Process

Joint Trawl Management Advisory Committee  
Department–industry meetings

## Research Summary

Research activities continue to focus on stock assessment and surveys to monitor both annual recruitment of tiger prawns and residual spawning stock levels. All boats completed detailed research logbooks which, together with survey data and factory records, provide the database for managing the fishery. A pre-season survey of the king prawn stocks was also undertaken in collaboration with industry to assist with developing harvesting strategies.

Collaborative research has continued with industry on assessing devices to reduce unwanted bycatch. The Department and industry continued the monitoring of juvenile tiger prawn habitats (seagrass/algal communities) and their regeneration after being depleted by the effects of cyclone Vance in 1999.

The following status report summarises the research findings for this fishery.

## Exmouth Gulf Prawn Managed Fishery Status Report

Prepared by E. Sporer and M. Kangas

### FISHERY DESCRIPTION

#### Boundaries and access

The boundaries of the Exmouth Gulf Prawn Managed Fishery are *'the waters of the Indian Ocean and Exmouth Gulf below high water mark lying south of a line starting at Point Murat and extending northeasterly to the southern extremity of South Muiron Island; thence generally northeasterly along the southeastern shore of that island to its easternmost extremity; thence northeasterly to the southern extremity of North Muiron Island; thence northeasterly and northerly along the southeastern and eastern shores of that island to its northern extremity; thence easterly to the northern extremity of Serrurier Island; thence generally southerly along the western shores of that island to its southern extremity; thence southeasterly to the southern extremity of Locker Island and then due south to the mainland'* (Exmouth Gulf Prawn Figure 1).

There were 13 boats licensed to operate in the Exmouth Gulf Prawn Managed Fishery during the 2002 season. All boats towed 4.5 fathom quad gear (four nets).

The 2002 season arrangements allowed for a maximum of 200 fishing nights with a minimum of 28 non-fishing nights for moon closures around the full moon (four nights each moon closure period). The entire fleet, however, utilised only 183 nights for the season.

The scheduled season arrangements saw the season officially opened on 6 April 2002 and closed on 20 November 2002. The fishing patterns were flexible with voluntary closures following an assessment, through surveys, of king and tiger prawn size and abundance in different areas. Therefore, the fleet actually commenced fishing on 16 April, in Areas A and B. The fishing grounds were progressively opened using results from both research and industry-initiated surveys. These surveys also provided data leading to opening times and extent of the tiger prawn fishing grounds to be trawled within Areas B and C.

These consultative, survey-based fishing arrangements enable a rapid response to resource fluctuations, and in turn provide a conservative and sustainable approach to stock management. The arrangements still involved a mandatory closure of the tiger prawn spawning area when the tiger prawn catch rate reached 19 kg/hr (quad gear catch rate), or on August 1, whichever occurred first.

A total of 17 extra nights were not fished during the season. This included the first 10 nights after the official opening date (6–15 April), two extra nights from extended moon closure periods, one night because of a strong wind warning, and the voluntary ending of the season four days early on 16 November. In addition, Exmouth recorded heavy rainfall (304.6 mm) in the 24-hour period between 3 and 4 June which resulted in flooding that caused damage to a number of trawlers moored at the marina. Twelve boats did not fish during these two nights, and two boats were not able to fish until 12 June due to the severe damage inflicted by the flood.

#### Main fishing method

Otter trawl.

### RETAINED SPECIES

**Commercial production (season 2002): 809 tonnes**

#### Landings

The total prawn landings from Exmouth Gulf for the 2002 season were 809 t, an increase on last year's combined landings of 670 t, and comprised 244 t of king prawns, 395 t of tiger prawns and 170 t of endeavour prawns landed (Exmouth Gulf Prawn Figure 2). King prawn catches were still below the acceptable range. Surveys and monitoring of the king prawn stocks have been instigated to review whether the low catches are a result of changes in the fishing strategy over the past two years (targeting tiger prawns at the start of the season), or if a longer-term effect of Cyclone Vance is impacting catches. There was an increase in the catch of both tiger and endeavour prawns in 2002 compared to 2001 when catches were still

recovering from the negative affects of Cyclone Vance upon the juvenile prawn habitat. These improvements in tiger prawn catches in the past two years are considered to reflect the improvement in nursery habitats.

Recorded landings of by-product included 48 t of coral prawns, 12 t of blue swimmer crab (*Portunus pelagicus*), 8 t of squid, 5 t of cuttlefish, 4 t of bugs (*Thenus orientalis*), 1 t each of shark and octopus and an insignificant amount of mixed finfish species.

### Fishing effort

Total nominal effort for the 2002 season was 26,358 hours. The equivalent effort in twin-gear terms, after adjusting for changes in configuration from twin to quad gear, was 32,440 hours, which was slightly lower than in 2001 (33,284 hours). Most of this reduced effort is attributed to the loss of boat time due to damage resulting from the flooding of the marina.

### Catch rate

The catch rate in twin-gear terms for king prawns was 7.5 kg/hr, at the low end of the range for this species. The catch rates of 12.2 kg/hr for tiger prawns and 5.3 kg/hr for endeavour prawns were well above those in 2001.

**Recreational component:**

Nil

**Stock assessment complete:**

Yes

The king and tiger prawn stocks have been fully exploited each year, as regular surveys permit variations to the management arrangements to optimise the catch. For tiger prawns, this process is also supported by survey-based indices of recruitment and spawning stock with respect to the accepted SRR. Endeavour prawns, a secondary target species whose distribution overlaps that of tiger prawns, are exploited to varying levels depending on the abundance of (and hence the fishing effort applied to) the more valuable tiger prawns.

The king prawn catch in 2002 was below the acceptable catch range (350–550 t) for the third year running, having fallen back to the levels seen in the 1970s and 1980s. The reasons for this are being investigated. A regular sampling regime is being developed, with a high level of collaboration from industry, to monitor the king prawn stocks during 2003 and assess whether the reduced catches are due to a change in fishing strategy (i.e. early targeting of tiger prawns).

The tiger prawn catch during 2002 was within the acceptable range, and appears to have recovered from the cyclone-induced low of 2000. The damaging impacts of Cyclone Vance on nursery seagrass habitats severely affected recruitment in 2000, but a high proportion of the structured habitats inshore have been regularly surveyed and shown to have recovered, resulting in much improved recruitment in 2002. Length-frequency distributions from recruitment surveys show a higher proportion of recruits than residual prawns, which is the normal pattern expected. The catch in 2002 was achieved while maintaining a significant biomass of spawning stock (approximately 100 t) during the spring period (August–October).

The effective effort on tiger prawns has increased in the last three years from a low of 15,200 hours in 2000 to 27,600 hours in 2001 and 31,100 hours in 2002, coinciding with increased stock levels. The effective effort in 2002 is similar to the mean effective effort observed between 1990 and 1997 (30,500 hours) even though the nominal hours have decreased by 10% on average. This implies increased efficiency to target tiger prawns in the current fleet, probably due to within-season surveys, flexible spatial openings and fleet manipulation.

The endeavour prawn stock was moderately fished in 2002 as a portion of the tiger prawn grounds in Area C was opened for a longer period, providing increased access to endeavour prawn stocks compared to 2001.

**Exploitation status:**

**Fully exploited**

**Breeding stock levels:**

**Adequate**

King prawn breeding stock levels in the fishery are maintained at adequate levels through the controls on effort and the extended breeding period and low overall catchability of the species.

Tiger prawn breeding stock levels are maintained at adequate levels by within-season management action each year. This strategy, which maintains the biomass of tiger prawns for spawning above the historically determined biological reference point, utilises a cut-off threshold catch rate of 19 kg/hr quad gear (16 kg/hr standard twin gear). During 2002, tiger prawn catch rates were closely monitored from May to August and the tiger prawn grounds closed on 1 August. Subsequent standardised tiger prawn breeding stock surveys from August to October showed an October CPUE of 21.2 kg/hr in the main spawning grounds, i.e. well above the threshold level. After consultation with industry, the tiger prawn area was re-opened for ten nights' fishing (1–10 November inclusive). This was done to investigate the effect on recruitment in the following season from having a harvest strategy that maintained relatively high levels of prawns during spawning season (August–October) but allowed these to be fished to levels below the 19kg/hr threshold after the spawning season had finished.

Consequently, there was an agreement with industry to use a lower cut-off threshold of 14 kg/hr during this November period. A survey was completed in the tiger prawn spawning area to confirm that the catch rate was greater than 14 kg/hr after fishing had closed. The recruitment of tiger prawns for the 2003 season will be assessed in the light of this new strategy.

Endeavour prawn breeding stocks in the fishery are considered to be at adequate levels as their distribution largely overlaps that of the tiger prawns, with the result that the tiger prawn closure also protects a significant portion of the endeavour prawn breeding stock each year. Endeavour prawns are also considered to be resilient to fishing pressure due to their smaller size and low catchability similar to king prawns.

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## Projected catch next season (2003): 540–810 tonnes tiger prawns

The catch prediction for tiger prawns is based on the historic relationship between recruitment survey indices (early and late March and early April) and the season's landings (April–November of the same year). For 2003, the projected tiger prawn catch is 540–810 t, which should be close to the highest catch of tiger prawns in the last 25 years.

## 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. Trialling of secondary bycatch reduction devices will continue to improve the quality of the prawn catch by reducing the volume of overall bycatch species retained in the trawls. In addition, five boats used hoppers (in-water sorting systems) during 2002 which improves bycatch survival and product quality.

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

While protected species including dugongs, turtles and sea snakes can be found in this general area, only sea snakes and occasionally turtles are encountered in the trawl catches. Both species are typically returned to the sea alive. Moreover, grids will be compulsory in 2003 which should eliminate the capture of any turtle or other large animal.

## ECOSYSTEM EFFECTS

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

Although the prawn species are managed at relatively high levels of annual exploitation, the impact of the catch on local food chains is unlikely to be significant in view of the high natural mortality and variable biomass levels of prawns resulting from naturally occurring cyclone events.

### Habitat effects: **Low**

Historically the fishery impacted on shallow water areas (< 12 m) 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. During 2002, 38% of the licensed fishery area and only about 35% of the target species habitat was fished. An extensive permanent trawl closure in the shallow eastern and southern sectors accounts for 28% of the licensed fishery area, and there is also a series of temporary closures to regulate the size and quantity of prawns taken.

Owing to the predominantly mud and sand habitats of the trawl grounds, the trawl gear has relatively little impact. Overall, the nature of this particular trawl fishery and the very tight controls on effort indicate that its environmental effect is likely to be low.

## SOCIAL EFFECTS

The estimated employment for the year 2002 was 52 skippers and 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 and contributes to the economic viability of the Exmouth township.

## ECONOMIC EFFECTS

### Estimated annual value (to fishers) for year 2002: \$11.7 million

The ex-vessel prices for prawns vary depending on the type 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 companies which own the boats undertaking direct marketing of the product into overseas markets. For this reason, the product prices quoted can only be estimates. Estimated prices were as follows:

King prawns	\$14.30/kg
Tiger prawns	\$16.70/kg
Endeavour prawns	\$9.00/kg
Coral prawns	\$2.00/kg

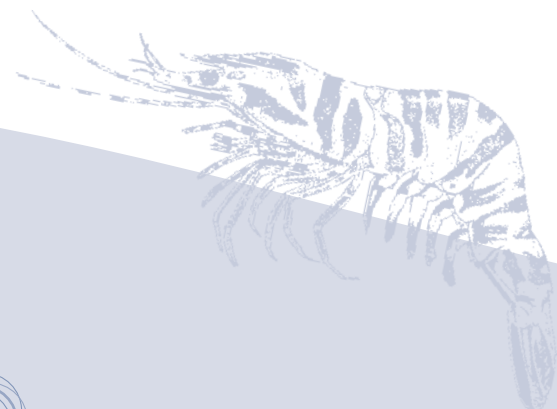
## FISHERY GOVERNANCE

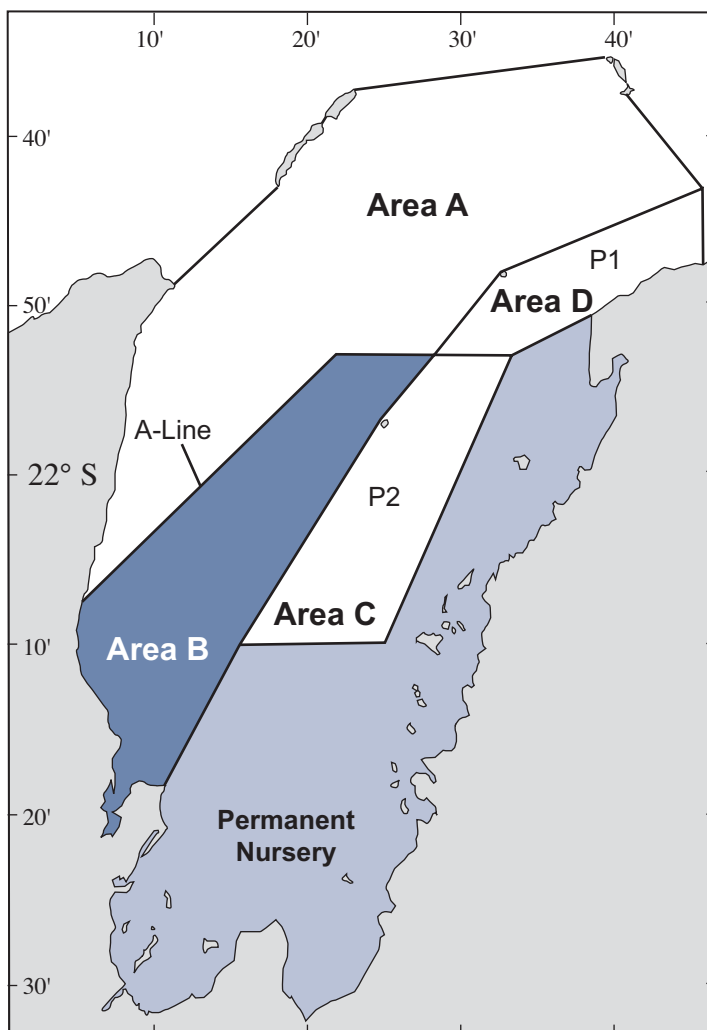
### Acceptable catch range: **771–1,276 tonnes**

Under current fishing effort levels, the acceptable catch range for major penaeids is that of the late 1990s (771–1,276 t). Acceptable 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 figures are for normal environmental conditions and are generally based on a five- to 10-year average.

## EXTERNAL FACTORS

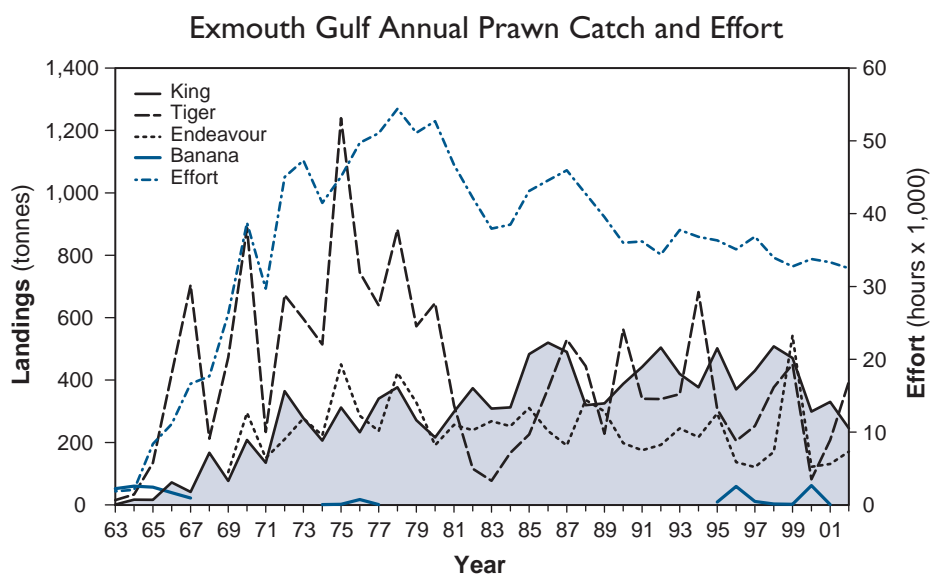
Changes to the nursery seagrass habitat in the eastern area of Exmouth Gulf following Cyclone Vance in 1999 appear to have had a significant effect on the productivity of the Gulf. Surveys of the juvenile tiger prawn habitat were undertaken in the spring of 1999, 2000 and 2001 by CSIRO and in early 2003 by the Department of Fisheries, all in conjunction with industry. The results of the CSIRO surveys indicated an increasing trend in seagrass biomass, from 1.2% in 1999 to 10.3% in 2000 and 40% in 2001, while over 60% cover was observed in many areas in 2003.





**EXMOUTH GULF PRAWN FIGURE 1**

Boundaries of the Exmouth Gulf Prawn Managed Fishery.



**EXMOUTH GULF PRAWN FIGURE 2**

Exmouth Gulf Prawn Managed Fishery annual landings and effort, 1963–2002.

## Shark Bay Scallop Managed Fishery

### Management Summary

The Shark Bay Scallop Managed Fishery is based on the take of southern saucer scallop (*Amusium balloti*), and is usually Western Australia's most valuable scallop fishery. The catch is taken by vessels licensed to take only scallops (14 class A licences) and vessels which also fish for prawns in the Shark Bay Prawn Managed Fishery (27 class B licences).

Management of the fishery is aimed at catching scallops at the best size and condition for the market, thereby maximising the economic return, while maintaining breeding stock levels. The scallop stock commences spawning in mid-April (continuing through until the end of November) and meat condition declines as spawning continues. Therefore, the opening date of the season is a compromise between breeding stock levels (measured by a pre-season survey of stock abundance) and the seasonal decline in meat condition associated with spawning.

The 2003 scallop fishing season commenced on 20 May and is scheduled to close on 1 November (the same day as the Shark Bay Prawn Managed Fishery), although it is likely that the dedicated class A vessels will cease fishing around June or July when catch rates become uneconomic. Primary management measures include limited entry, area closures, gear controls and crew limits. The Vessel Monitoring System continues to be an integral part of the fishery's management strategy for the control of spatial and temporal closures.

Bycatch reduction devices (specifically grids) were fully implemented at the start of the 2003 season by way of a condition on the managed fishery licence. Trials and implementation of secondary BRDs are not considered necessary in the fishery at this stage, given the large mesh size used (i.e. 100 mm mesh compared with 50 mm mesh used in the prawn fishery).

Catch in this fishery varies widely depending on the strength of recruitment, which is thought to be influenced by the strength of the Leeuwin Current. Most of the catch is marketed to south-east Asia as frozen scallop meat (roe-off).

The Shark Bay Scallop Management Advisory Committee has been replaced by the Joint Trawl Management Advisory Committee, which covers the Shark Bay Scallop, Shark Bay Prawn and Exmouth Gulf Prawn Managed Fisheries. Given the overlap between the three Gascoyne trawl fisheries it was considered more efficient to merge the previously separate MACs. The JTMAC, which provides high-level advice to the Minister on the management of these fisheries, held its inaugural meeting early in 2003. Detailed fishery management matters (e.g. opening/closing dates, spatial and temporal closures) are now dealt with directly between the Department and licensees.

Environment Australia has declared the fishery as being managed in an ecologically sustainable manner under the

provisions of the *Environment Protection and Biodiversity Conservation Act 1999*. While subject to a variety of recommendations, this approval allows product from the fishery to be exported for a five-year period.

### Governing Legislation/Fishing Authority

Shark Bay Scallop Management Plan 1994  
Shark Bay Scallop Managed Fishery Licence

### Consultation Process

Joint Trawl Management Advisory Committee  
Department–industry meetings

### Research Summary

Research for monitoring the status of the scallop stock in Shark Bay is based on detailed research logbook records and factory receivals provided by industry. In addition, an annual research survey is carried out in November each year which, together with existing detailed biological knowledge, enables an annual catch forecast to be provided.

A collaborative project with industry to review the impact of trawling on non-target species has been evaluating gear modifications to reduce bycatch and improve product quality. A further FRDC-funded project is examining the biodiversity of bycatch in trawled and untrawled areas of Shark Bay.

The following status report summarises these research findings.

## Shark Bay Scallop Managed Fishery Status Report

Prepared by M. Kangas and E. Sporer

### FISHERY DESCRIPTION

#### Boundaries and access

The outer boundaries of the fishery encompass 'the waters of the Indian Ocean and Shark Bay between 23°34' south latitude and 26°30' south latitude and adjacent to Western Australia on the landward side of the 200 m isobath, together with those waters of Shark Bay south of 26°30' south latitude'. Within these general areas, scallop trawling only occurs in waters east of the outer islands of Shark Bay, in depths between 16 m and 40 m. In addition to the outer shelf region, a reef area eastward of the Naturaliste Channel, between the northern end of Dirk Hartog Island and the southern end of Bernier Island, is also closed to scallop (and prawn) trawling; and no scallop trawling is allowed east of a line extending northward from Cape Peron to the mainland.

Fourteen boats with Class A licences (scallop only) and 27 boats with Class B licences (prawn and scallop) are endorsed to fish the waters of Shark Bay and Denham Sound. The boundaries for Class A boats are the waters of Shark Bay and Denham Sound west of longitude 113°30'36" E and north of a line running due east from the northern extremity of Cape Bellefin to Peron Peninsula (see Shark Bay Prawn Figure 1).

The 2002 scallop season commenced on 6 May in Denham Sound, and remained open for 10 days for scallop fishing only. Owing to the fishing arrangements for the opening of the extended nursery area for prawns, no Class B scallop boat fished the Denham area in May. Fishing for scallops commenced on the main fishing grounds in Shark Bay on 16 May. Trawling for scallops by Class A boats had ceased by the end of June because of low catch rates. Denham Sound was re-opened on 1 August but with only one Class A scallop boat fishing, and for one night only. The Shark Bay scallop season officially closed on 21 October.

### Main fishing method

Otter trawl.

## RETAINED SPECIES

**Commercial production (season 2002):**  
1,770 tonnes whole weight

### Landings

The total scallop landings for this fishery, for both A and B Class scallop boats, were 1,770 t whole weight, of which 1,300 t were taken from the Red Cliff and North West Peron grounds and the remaining 470 t from Denham Sound during the 10 days of fishing in May. This overall catch was within the acceptable range set and also within the projected range based on the pre-season survey. It represents an increase of 700 t compared to the catch in 2001.

The Class A fleet (all 14 boats fished in 2002) caught 1,399 t or 79% of the total catch, with the Class B fleet taking 371 t (Shark Bay Scallop Figure 1). Low quantities of by-product (8.5 t of blue swimmer crabs, *Portunus pelagicus*, 3.1 t of cuttlefish and 2.7 t of bugs, *Thenus orientalis*) were also recorded for the Class A fleet during 2002.

### Fishing effort

The total effort recorded by the Class A boats in 2002 was 11,284 hours, a 30% increase on the very low effort in 2001.

### Catch rate

A mean catch per unit effort of 124 kg/hr (whole weight) was recorded for the Class A fleet in 2002 compared to 81 kg/hr in 2001. This efficient catch rate was maintained as a result of the decision to cease fishing by the end of June.

**Recreational component:** Nil

**Stock assessment complete:** Yes

The status of the stock is determined from a pre-season survey of recruitment and residual stock carried out in November–December. This survey enables the start date of the fishery to be determined and allows management of the spawning stock. Recruitment of juveniles to the stock was at the low end of the range, as measured using the data from the November 2001 scallop survey. This low recruitment, apparently due to environmental conditions, resulted in a 2002 catch that was within the range projected. This follows a strong Leeuwin Current in 1999–2001, a feature which has previously been

correlated with low recruitment and is therefore not considered to reflect the impact of fishing. The survey design and analysis of the data provides separate catch forecasts for the Shark Bay (Red Cliff and North West Peron) and Denham Sound areas. This allows separate opening dates to be determined for each area to optimise scallop catches each season.

**Exploitation status:** Fully exploited

**Breeding stock levels:** Adequate

The management arrangements for the fishery are designed to ensure significant spawning has occurred each year before the bulk of the stock has been taken. Although the breeding stock level was low in 2002 as a result of the low recruitment, it is considered adequate to provide recruitment in the normal range for 2003.

**Projected catch next season (2003):**  
1,200–1,900 tonnes whole weight

The catch projection for the 2003 season is based on the November 2002 survey. On the main fishing ground in Shark Bay, observed recruitment was similar to last year, providing a catch range forecast for this area of approximately 1,000–1,500 t whole weight. Higher recruitment was observed in the Denham Sound area, giving a predicted catch range of 200–400 t whole weight. The catch projection for the fishery as a whole is therefore in the range 1200–1,900 t whole weight.

## NON-RETAINED SPECIES

**Bycatch species impact:** Low

Owing to the legislated design of the nets (which use 100 mm mesh) and the relatively short duration of the fishery, the total bycatch of fish is minimal.

**Protected species interaction:** Low

Protected species, occasionally captured, are released alive due to the relatively short duration of trawls. During 2002, grids were installed into one net to minimise the capture of large animals on Class A scallop boats, and full implementation is planned to take place in 2003. Once this occurs the risk to these species will be negligible.

## ECOSYSTEM EFFECTS

**Food chain effects:** Low

The ecosystem impacts of saucer scallop fisheries are unlikely to be significant, taking into account the typically high annual variation in abundance of the species and the high natural mortality associated with short life-cycles and natural death in the third year of life.

**Habitat effects:** Low

The scallop fleet operates over a limited portion of the licensed fishing area, primarily in the oceanic centre section of Shark Bay. Fishing is concentrated on a small sector of the typically bare sand habitat associated with concentrations of this species. In 2002, 14% of the area available for trawling was fished. As a result of the small area impacted and the short-term impact of the gear on sand habitats, the overall effect of fishing on benthic habitats is low.

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## SOCIAL EFFECTS

The estimated employment for the year 2002 was 190 skippers and crew. There are also processing and support staff employed at Carnarvon, Fremantle and Geraldton. This and other trawl fisheries in the Gascoyne generate a major component of employment in the region.

## ECONOMIC EFFECTS

**Estimated annual value (to fishers) for year 2002:  
\$5.8 million**

The wholesale price of scallops varies depending on the type of product (grade and meat condition) and the market forces operating at any one time. The average price for scallops was \$3.30/kg whole weight or \$16.50/kg meat weight. Meat weight is 20% of whole weight.

## FISHERY GOVERNANCE

**Acceptable catch range: 1,250–3,000 tonnes whole weight**

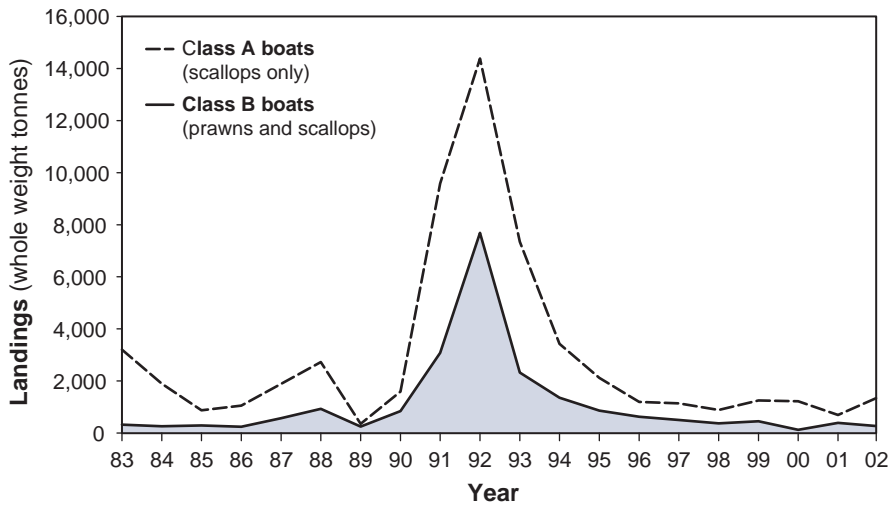
The acceptable catch range is approximately 1,250–3,000 t whole weight, based on catches over the five-year period

1995–1999. This period excludes the high catches of the early 1990s (Shark Bay Scallop Figure 1), apparently created by an unprecedented three years of El Niño conditions. The projected catch for next season, based on a pre-season survey, is at the middle to lower end of this acceptable catch range.

## EXTERNAL FACTORS

A relationship exists between sea level (at Fremantle) and the recruitment of scallops in Shark Bay. Generally, high sea levels (corresponding to strong Leeuwin Current) correlate with poor recruitment. The 1999–2002 recruitment was low due to poor environmental conditions. There is a need to examine the mechanisms that control recruitment success in greater detail in future projects in order to explain more of the inter-annual variation that occurs. The recovery of this fishery to average catch levels (similar to those before the peak years of 1991–1993) is expected if environmental conditions (including the El Niño/Southern Oscillation index) become favourable.

Shark Bay Annual Scallop Catch



## SHARK BAY SCALLOP FIGURE 1

Annual scallop landings by fleet for the Shark Bay Scallop Managed Fishery, 1983–2002.



# Shark Bay Beach Seine and Mesh Net Managed Fishery

## Management Summary

The Shark Bay Beach Seine and Mesh Net Managed Fishery operates in the waters of Shark Bay and takes a mixed catch of whiting (*Sillago schomburgkii* and *S. analis*), sea mullet (*Mugil cephalus*), tailor (*Pomatomus saltatrix*) and yellowfin bream (*Acanthopagrus latus*). Entry into the fishery is limited, with restricted, family-only transfers and gear limitations. A unit in the fishery comprises one primary vessel, a maximum of three netting dinghies and a maximum team size of three fishers. Most of the catch is marketed through the fish processing factory in Denham which sets weekly delivery quotas and commercially acceptable size limits which are frequently above the legal minimum size for the species concerned.

### Governing Legislation/Fishing Authority

Shark Bay Beach Seine and Mesh Net Management Plan 1994  
Shark Bay Beach Seine and Mesh Net Managed Fishery  
Licence

### Consultation Process

Department–industry meeting

## Research Summary

Research monitoring of the status of the stocks taken in this fishery is undertaken annually using industry-based data coupled with the extensive scientific knowledge gained from previous research. Overall the fishery has remained relatively stable over the past decade with the main target species being fished at sustainable levels. The fishery, although relatively small-scale, makes a significant contribution to the Denham economy and community. A comprehensive ESD report on this fishery has been completed as the basis of an application to meet the requirements of the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*. This process determined performance indicators based on catch and catch rates for each of the four main species in the fishery (whiting, tailor, sea mullet and yellowfin bream). The following status report summarises the research findings for this fishery.

## Shark Bay Beach Seine and Mesh Net Managed Fishery Status Report

Prepared by S. Ayzajian and G. Nowara

### FISHERY DESCRIPTION

#### Boundaries and access

The boundaries of this fishery are 'the waters of Shark Bay from high water mark lying -

(a) south of a line drawn from the northernmost point of Cape Inscription on Dirk Hartog Island due east to the mainland; and

(b) east of a line drawn from Surf Point on Dirk Hartog Island to Steep Point on the mainland; but excluding the waters of Shark Bay due south of a line drawn west of the highwater mark of Kopke Point on the mainland to the highwater mark on the mainland south of Petit Point on Peron Peninsula'.

At May 2002, 11 fishing-unit licence holders were registered in the beach seine and mesh net fishery and were based at Denham. The fishery is also subject to net length and mesh size controls. The legislation indicates that:

- the mesh not be less than 48 mm for taking whiting;
- the mesh not be less than 86 mm for taking mullet; and
- the mesh not be greater than 38 mm and not less than 26 mm throughout and the net shall not be more than 200 m in total length and have a pocket no more than 30 m in length when used to take garfish.

### Main fishing method

Beach seine and haul net.

### RETAINED SPECIES

#### Commercial production (season 2002):

**All finfish 300 tonnes**  
**Key target species 280 tonnes**

### Landings

The 2002 total catch for the Shark Bay beach seine and haul net fishery of 300 t represents an increase of 41 t compared to the 2001 reported catch (Shark Bay Beach Seine Figure 1). There is no long-term trend in the pattern of total landings from this fishery over the past 12 years with catches averaging 280 t per year (Shark Bay Beach Seine Figure 1). The total landings during 2002 included 99.7 t of whiting, together with a substantial catch of sea mullet (135.8 t), 26.9 t of tailor and 17.4 t of yellowfin bream. The remaining reported landings of 20.5 t comprised over 20 different species of finfish.

Whiting, which is the main target species in Shark Bay, comprises nearly one-third of the total catch and includes both *Sillago schomburgkii* and *S. analis*. Assessments of the fishery have previously been based only on the total whiting catch and effort data (Shark Bay Beach Seine Figure 2) but this has now expanded to include analyses of three additional target species – sea mullet, tailor and yellowfin bream (Shark Bay Beach Seine Table 1).

### Fishing effort

During 2002, there was an average of seven boats fishing per month, expending a total of 1,253 days of fishing effort for the year (Shark Bay Beach Seine Figure 2). The overall trend in fishing effort in the Shark Bay beach seine and haul net fishery has been a decline to a low point in 1995, followed by a slight increase from 1995 to 2002.

### Catch rate

The CPUE (based on nominal effort) for the overall Shark Bay beach seine and haul net fishery increased steadily between

# GASCOYNE COAST BIOREGION

1990 and 1995. Following the 1995 peak there has been a slight downward trend in the CPUE values. The 2002 season catch rate was 239.7 kg/boat day (all species) (Shark Bay Beach Seine Figure 1).

The CPUE for the whiting fishery showed a rising trend during the 1990s to levels greater than 110 kg/day, but has declined since 2000 to its current level of 79.5 kg/boat day (Shark Bay Beach Seine Figure 2). The catch rates for the other three species have also been assessed and are all within acceptable levels (Shark Bay Beach Seine Table 1).

## Recreational component: < 1%

A 12-month survey of boat-based recreational fishing in Shark Bay between May 2000 and April 2001 (Sumner and Malseed 2001) estimated a total recreational catch of finfish of 50 t, taken in 35,000 fisher days. The estimated catch consisted of pink snapper (25.3 t), black snapper (11.6 t), baldchin groper (3.2 t), mulloway (3.2 t), Queensland school mackerel (1.4 t), tailor (0.8 t), whiting (0.4 t), mullets (0.4 t) and 3.7 t of other species. When the boat-based recreational catch of those species that are targeted by the commercial fishery (whiting, tailor, sea mullet, yellowfin bream) is compared with the commercial catch of those same species from the closest calendar year (2000), it is seen to make up approximately 0.6% of the combined commercial and recreational landings.

A further survey carried out during the following 12 months, between May 2001 and April 2002 (Sumner and Malseed 2002), estimated a total boat-based recreational catch of 50 t, taken in 34,000 fisher days. Of those species taken by the recreational fishers which are targeted by the commercial sector, an estimated catch of 1.1 t of tailor, 0.8 t of whiting and 0.3 t of sea mullet were taken recreationally. The recreational component of the combined commercial and recreational catch for these species was 0.9%.

The proportion of catch taken by the recreational sector is therefore assessed to be less than 1%, although this does not include shore-based catches and is consequently a minimum estimate.

## Stock assessment completed: Yes

The current level of whiting exploitation by the fishery (100 t at 79 kg/day) is within the acceptable catch range and above the catch rate threshold of 70 kg/day, both of which are based on 50 years of data.

The catch levels (27 t) and the catch rate (20.4 kg/day) of tailor by the fishery in 2002 were both within the long-term acceptable catch range (25–40 t) and above the catch rate trigger point (18 kg/day). Whilst the catch and catch rate were relatively low compared with the past few years, they were still high compared with historical levels.

The 2002 catch of 136 t of sea mullet is within the acceptable catch range (85–155 t) and the current catch rate of 79 kg/day is well above the trigger level (50 kg/day). The continuation of the stable catch levels and catch rates in recent years indicates that the level of sea mullet exploitation by the fishery is sustainable.

Catches of western yellowfin bream have been relatively stable since 1968 at an average of 8.7 t per year. Over the last 15 years, from 1988 to 2002, catch has ranged from 5.6 t (in 1995) to 17.4 t (in 2002) with an overall stable trend. Such stability over a relatively long period suggests that this catch range is sustainable.

In summary, the catches and catch rates in 2002 for the four main species have each remained within their acceptable range. It is therefore concluded that this fishery is currently harvesting these species in a sustainable fashion.

## Exploitation status: Fully exploited

## Breeding stock levels: Adequate

As the legal minimum length for Shark Bay whiting is equivalent to the 50% selection point of the 48 mm mesh used in this fishery, virtually all of the catch is made up of mature fish. Consistent levels of catch of all four target species over recent years provide a good indication that the breeding stocks are being maintained.

## NON-RETAINED SPECIES

## Bycatch species impact: Low

The fishery operates throughout its entire licence area but with a very low level of effort as it specifically targets schools of fish. Bycatch is likely to be minimal because seine netting is a highly selective method of fishing. Fishers can determine the species and size of the school, and the size of individual fish within the school, before shooting the net. Fish are easily observed in the very clear waters of Shark Bay. Therefore, schools of non-target species and under-sized fish can usually be avoided.

## Protected species interaction: Negligible

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

## ECOSYSTEM EFFECTS

## Food chain effects: Low

The overall catch levels of scalefish by the fishery have been relatively stable over several decades, which suggests that total scalefish recruitment to Shark Bay has not been affected by removals. Also, predatory species (e.g. dolphins, larger scalefish) are abundant in the Bay, which suggests that the fishery has not reduced prey levels for these species. Therefore, the total biomass of key species in the region is probably being maintained at a level sufficient to maintain trophic function.

## Habitat effects: Negligible

Seine nets are set and hauled over shallow sand banks, including intertidal areas. Sand habitats are naturally dynamic environments and resident infauna are adapted to cope with physical disturbances. Combined with the low frequency of fishing in any one location, this indicates that the fishery would have no lasting effect on the habitat.

## SOCIAL EFFECTS

During 2002, the average number of fishers in the Shark Bay Beach Seine and Mesh Net Managed Fishery was 20. Fishing and associated local fish processing is one of the major sources of employment for the Denham community.

## ECONOMIC EFFECTS

**Estimated annual value (to fishers) for year (2002):**  
**All finfish \$817,000**  
**Whiting \$353,000**

## FISHERY GOVERNANCE

**Acceptable catch ranges:**  
**Key target species 210–353 tonnes**

Under the current management regime, the acceptable catch range for the key target species in this fishery is 210–353 t. Acceptable catch ranges for individual species are whiting 95–140 t, tailor 25–40 t, sea mullet 85–155 t and yellowfin bream 5–18 t. These ranges were derived by double exponential smoothed forecasting of past annual catches to 1998 and the variation of observations around the predictions. The confidence intervals are set at 80%. If annual catches fall outside these ranges an investigation into the cause will

be triggered which, if required, may lead to changes in the management arrangements.

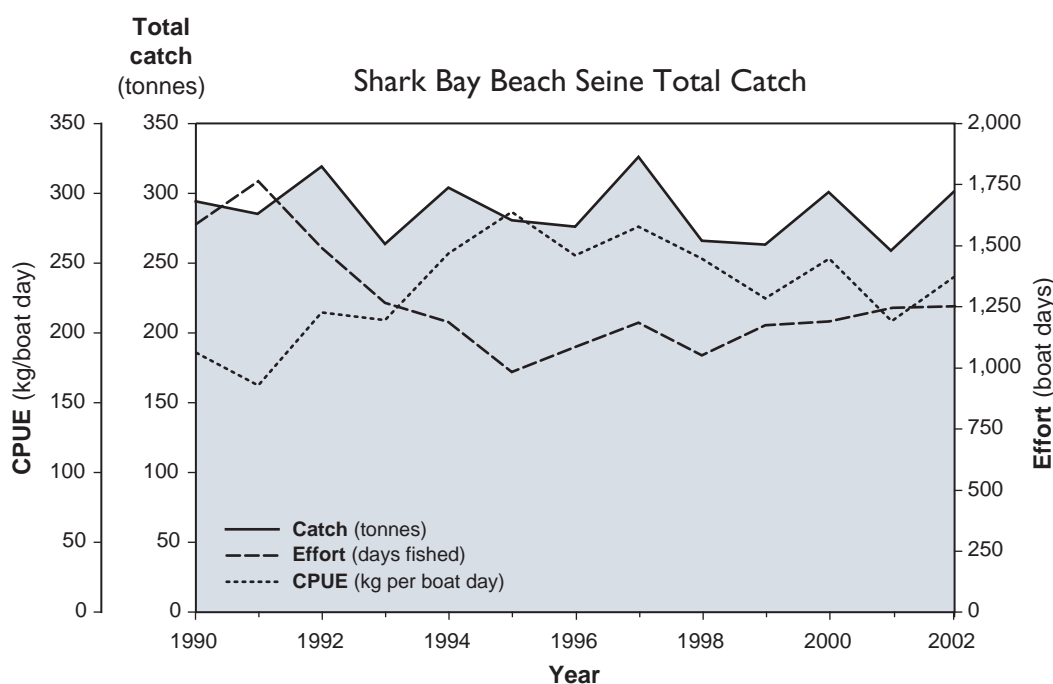
## EXTERNAL FACTORS

The inner Shark Bay environment which supports the finfish stocks exploited by this fishery is particularly stable as a result of its low-rainfall desert location. The production from the fishery is therefore mostly a reflection of fishing effort (predominantly commercial) rather than any large environmentally driven variations in recruitment.

### SHARK BAY BEACH SEINE TABLE I

The annual catch per unit effort (CPUE, kg/boat day) and the trigger level for key species from Shark Bay over the period 1998–2002.

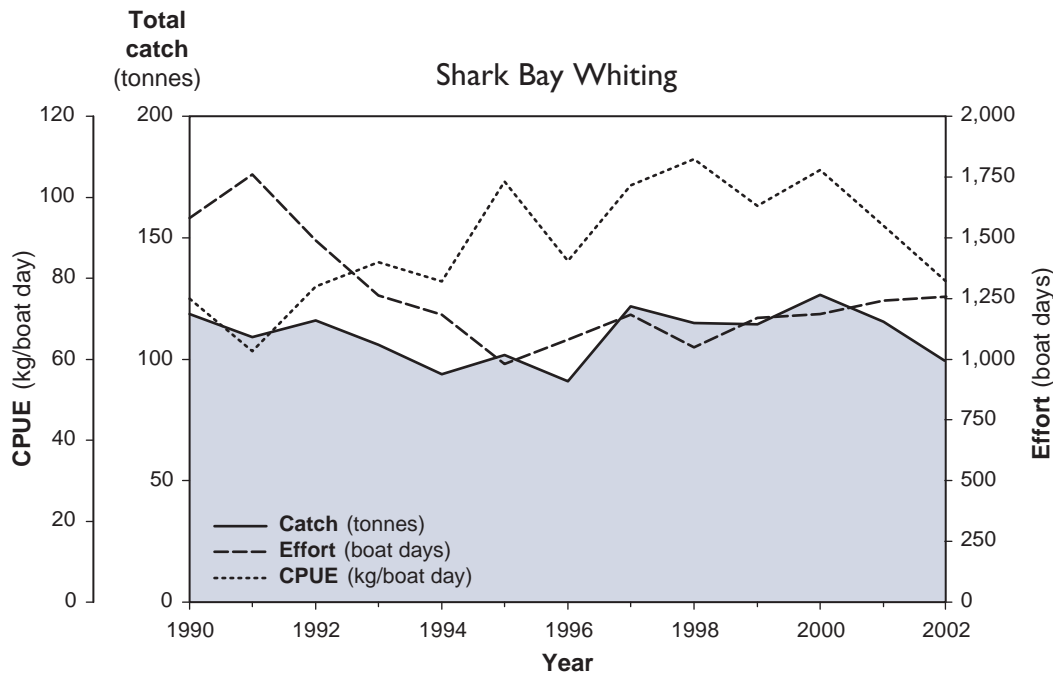
SPECIES	TRIGGER LEVEL (kg/day)	1998	1999	2000	2001	2002
Whiting	70	109	97	106	92	79
Tailor	18	33	32	32	21	21
Mullet	50	109	98	107	93	80
Bream	5	7.6	5.9	7.3	6.2	13



### SHARK BAY BEACH SEINE FIGURE I

The annual catch (t), effort (boat days) and catch per unit effort (CPUE, kg/boat day) for the total finfish fishery of Shark Bay over the period 1990–2002.

# GASCOYNE COAST BIOREGION



**SHARK BAY BEACH SEINE FIGURE 2**

The annual catch (t), effort (boat days) and catch per unit effort (CPUE, kg/boat day) for whiting from Shark Bay over the period 1990–2002.

## Shark Bay Snapper Managed Fishery

### Management Summary

The Shark Bay Snapper Managed Fishery has been in operation since the late 1980s and has been managed using a mix of input and output controls. The annual (1 September to 31 August) total allowable catch of pink snapper (*Pagrus auratus*) is currently set at 563,750 kg, which equates to 110 kg for each of the 5,125 units. The ongoing sustainability of the fishery is currently under review and a reduction in TAC is expected in the coming year.

A final application has been submitted to Environment Australia for the fishery as part of EA's ecological sustainability reporting process under the *Environment Protection and Biodiversity Conservation Act 1999*. A public comment period was conducted during early 2003 and a formal assessment is currently being undertaken by EA.

#### Governing Legislation/Fishing Authority

Shark Bay Snapper Management Plan 1994  
Shark Bay Snapper Managed Fishery Licence

#### Consultation Process

Shark Bay Snapper Managed Fishery Working Group  
Department–industry meeting

### Research Summary

Detailed research on the offshore snapper fishery was undertaken during the 1980s and provides the scientific knowledge base for management. An FRDC-funded project which commenced in July 2000 has utilised the age data collected since the 1980s to assess the potential for increased yields from this oceanic snapper stock. The preliminary results from this research are now available.

Catch and effort monitoring data, the ESD report and the preliminary results from the FRDC project have been used to compile this status report.

## Shark Bay Snapper Managed Fishery Status Report

Prepared by M. Moran

### FISHERY DESCRIPTION

#### Boundaries and access

The Shark Bay Snapper Managed Fishery operates in the waters of the Indian Ocean between latitudes 23°34' S and 26°30' S and in the waters of Shark Bay north of Cape Inscription. Catches of snapper in the peak fishing season (May–August) were formerly subject to individual quotas, while gear controls applied in the off-peak season. Since 2001, the whole year's catch has been subject to a single TAC and

individually transferable quotas. The snapper quota for 2002 was set at 563.7 t.

### Main fishing method

Mechanised headline.

## RETAINED SPECIES

**Commercial production (season 2002): Snapper 487 tonnes  
Other species 158 tonnes**

### Landings

The Shark Bay Snapper Managed Fishery operates on the ocean stock of snapper, which is distinct from the inner Shark Bay stocks. Commercial catches of snapper from the ocean stock in 2002 were slightly higher than the previous year, at 487 t compared with 467 t in 2001. The snapper fishery also took 158 t of other finfish species compared with 105 t in 2001. Moreover, the composition of this catch differed from 2001 by having a high component of outer-shelf species such as goldband snapper (*Pristipomoides* spp.). The outer-shelf fishery has grown rapidly since it began in 2000. The catch of these other species is detailed in Shark Bay Snapper Table 1.

### Fishing effort

The effectiveness of fishing effort varies markedly on a seasonal basis, peaking in June and July. Fishing effort in the managed snapper fishery, calculated as the total catch for the year divided by the May–August CPUE, was 1,320 standard May–August boat days in 2002, compared with 894 days in 2001. This level of effort to take the catch of 487 t falls outside the acceptable range of 820–950 days used to take the average 500 t catches of the 1990s.

This high effort to take the smaller than average catch is an indicator of low abundance of snapper and was a trigger for the review of the fishery which is currently in progress.

### Catch rate

An improved method of calculation has been used in this year's report to more accurately reflect fishing effort targeted mainly at snapper. This was considered necessary because fishers' monthly catch returns report total line-fishing effort, without distinguishing between effort targeted at snapper and that targeted at other demersal scalefish. In the new calculation, only catch and effort figures for boats which caught 4 t or more of snapper in the two-month peak period were used. Consequently, historic catch rate levels will not reflect those reported previously.

The average catch per boat day for licensed vessels during the peak months (June–July) was 555 kg in 2002. This is approximately 21% lower than the average catch rate observed during the 1990s of 700 kg/boat day (Shark Bay Snapper Figure 1).

**Recreational component:** **7.5%**

The Gascoyne Recreational Fishing Survey, conducted between April 1998 and March 1999 (Sumner et al. 2002),

estimated that the boat-based recreational catch of snapper from the oceanic stock was 14 t, approximately 2.5% of the commercial catch. In addition, there is a recreational catch of oceanic pink snapper taken on charter boats. This was reported to be 24 t (5% of the commercial catch) in 2002.

For the genetically distinct inner bay stocks of snapper (not covered by this status report), most of the catch is taken by recreational fishers and is now subject to separate management arrangements. Research to assist the management of these stocks is reported in the recreational fisheries section on pp. 161–164.

**Stock assessment completed:** **Yes**

The oceanic pink snapper stock is now considered to be over-exploited. A stock production model assessment of this stock completed in the mid-1980s estimated the maximum sustainable annual yield to be around 600 t. The average commercial catch during the past 15 years has, however, only been approximately 500 t. One of the main objectives of the FRDC-funded project which commenced in July 2000 was to use more advanced age-structured modelling techniques to assess the potential for increased yields from this stock. The preliminary results from this project indicate, however, that the 600 t value was probably an over-estimate of the sustainable yield. Thus, the stock appears to have been declining slowly since the early 1990s, despite commercial landings of only 500 t. Consequently, the total allowable catch will be revised downwards based on the final results of this project.

One clear result is that, as for other snapper stocks in Australia and New Zealand, the levels of annual recruitment can be highly variable. There was a peak in recruitment during the early 1990s, following which recruitment levels declined to reach relatively low levels by the late 1990s. These low levels of recruitment came at a time when there were still adequate breeding stock levels (i.e. > 40% unfished level, see below) and are therefore most likely attributable to environmental effects on the survival rate of eggs, larvae and early juveniles. Additional fishery data from 2001, 2002 and 2003 will be used to update the stock assessment and provide advice for ongoing management prior to the peak fishing season in 2004.

An additional threat to the fishery's sustainability may be posed by the rapidly expanding activity of the wetline fleet, which is not licensed to land pink snapper taken within the boundaries of the fishery, and therefore releases them at sea. At the depths fished, most returned snapper die, with a consequent increase in the total fishing mortality.

**Exploitation status:** **Over-exploited**

**Breeding stock levels:** **Inadequate**

Snapper breeding stock level for the oceanic stock has been estimated as part of the current FRDC project to be currently below 30% of the unfished level. The target for species such as snapper is to maintain breeding stock levels above 40% of the unfished level. Appropriate management actions to initiate restoration of the stock to this level will be taken in 2004 based on the final results of this project.

# GASCOYNE COAST BIOREGION

Given the very rapid increases in catch of the outer-shelf component of the wetline fishery in this area (Shark Bay Snapper Figure 2), the sustainability of some deep-water scalefish species may also be of concern. Although there are insufficient data to assess the status of these species at present, the issue requires immediate management attention and careful monitoring in the future.

## NON-RETAINED SPECIES

**Bycatch species impact:** Negligible

There is very little discarding of unwanted bycatch in the managed snapper fishery, as virtually all the catch consists of demersal fish with a medium to high market value. However, pink snapper itself may now have become the discarded bycatch of the wetline boats, with potential negative effects for sustainability of the stock (see 'External Factors').

**Protected species interaction:** Negligible

The line fishing methods used do not catch any protected species

## ECOSYSTEM EFFECTS

**Food chain effects:** Low

Food chain effects are considered to be low because the quota system restricts catches to a small percentage of the total biomass of snapper. While the stock is currently going through a low period, corrective management action will be taken to restore the adult stock to above 40% of its unfished level. Juvenile and sub-adult stocks have not been affected by the snapper fishery as the catch of under-size fish is minimal.

**Habitat effects:** Negligible

The nature of the fishery, targeting aggregations of adult snapper using hooks and lines, means that the fishery has no impact on the habitat.

## SOCIAL EFFECTS

Nine boats fished both peak and off-peak seasons (about nine months) with an average crew of 3. This rose during the peak season (four months) to a total of 25 boats (including 9 trawlers) with an average crew of 5.

## ECONOMIC EFFECTS

**Estimated annual value (to fishers) for year (2002):**  
**\$3 million**

The value of the pink snapper taken in the fishery was \$2.25 million, while other finfish species added a further \$750,000.

## FISHERY GOVERNANCE

**Acceptable effort range:** 709–930 days

Based on catch per unit effort levels during the period 1990–2000, the acceptable effort range to take the 2003 total allowable commercial catch of 563.7 t would be 709–930 standard June–July boat days. This range has been estimated using an improved set of catch rates developed in 2002. However, the range may be revised following the current review of the fishery.

## EXTERNAL FACTORS

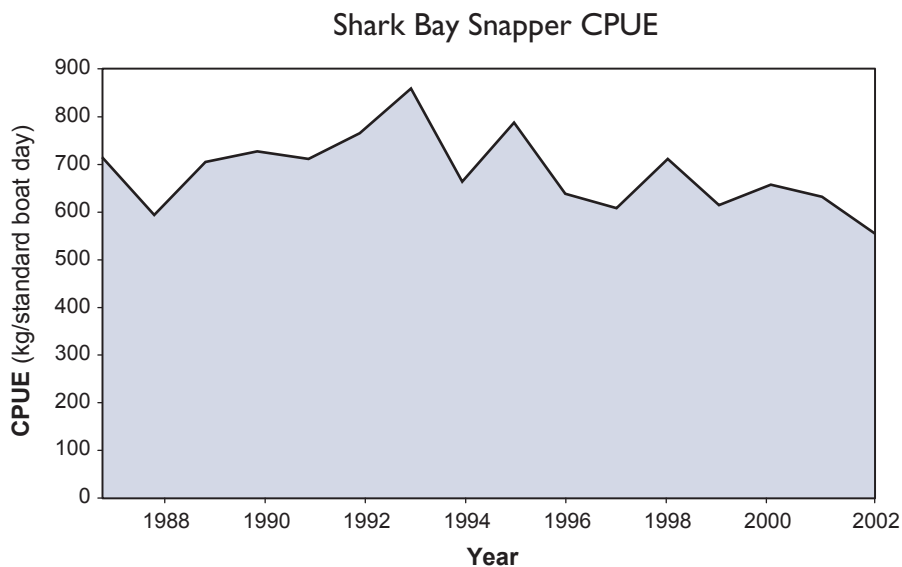
Wetline boats operating in the region (i.e. commercial line-fishing boats without a Shark Bay Snapper Managed Fishery licence) have been taking increasing catches of scalefish species other than snapper in recent years. A considerable, but unknown, quantity of snapper are therefore caught and returned to the sea by these fishers, many of which will not survive. This increased mortality on the stocks is likely to be an additional threat to the sustainability of the snapper fishery.

Under the Offshore Constitutional Settlement, Commonwealth-licensed trawlers may operate in the region outside the 200 metre isobath. A trawler has been operating consistently in the region of the managed snapper fishery in recent years and also catches an unknown quantity of snapper.

## SHARK BAY SNAPPER TABLE I

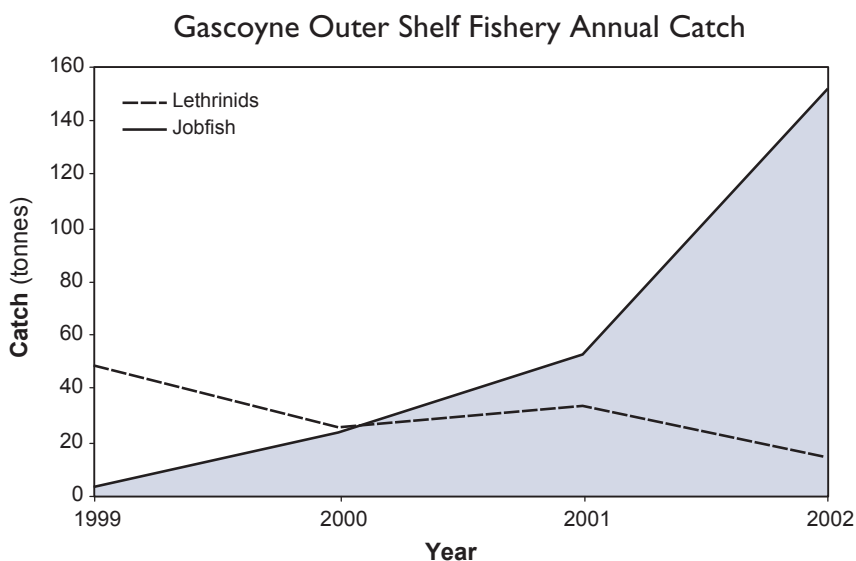
Catches in the years 2001 and 2002 by Shark Bay Snapper Fishery licensed boats, in the area between 23° S and 26° S, of species other than pink snapper (excluding mackerels which are reported on pp. 97–102).

SPECIES		TONNES 2001	TONNES 2002
Emperors	Lethrinidae	31.1	27.0
Mulloway	Sciaenidae	15.9	21.4
Cods	Serranidae	11.3	19.8
Red emperor	<i>Lutjanus sebae</i>	9.1	9.5
Trevallies	Carangidae	8.1	9.3
Jobfish	<i>Pristipomoides</i> spp.	5.1	42.1
Other		24.4	28.7
<b>Total</b>		<b>105.0</b>	<b>158.0</b>



**SHARK BAY SNAPPER FIGURE 1**

Catch per unit effort by year from 1987 to 2002 for the Shark Bay Snapper Managed Fishery. Units are kg whole weight of pink snapper per standard boat day. As catchability varies markedly throughout the year, peaking in June and July when the fishing effort is focused on snapper, the CPUE for line fishing from June–July is used as the index of abundance.



**SHARK BAY SNAPPER FIGURE 2**

The increasing catches in the area between 23° S and 26° S, by non-holders of Shark Bay Snapper Managed Fishery licences, of deep-water snappers (= jobfish, goldband snapper) and decreasing catches of inner-shelf emperors (lethrinids), illustrating the expansion of the wetline fishery in the region and the shift of focus from the inner to the outer shelf.