

Gascoyne Coast Bioregion

Regional Management Overview

The Gascoyne coast bioregion is home to the State's major trawl fisheries for prawns and scallops in Shark Bay and Exmouth Gulf. In addition, the region supports the important Shark Bay snapper and beach seine fisheries, which provide most of the pink snapper and whiting catch for the State. A fishery for blue swimmer crabs, primarily based in Carnarvon, is also developing.

The major change in the Gascoyne bioregion over the past 12 months was the introduction of new management arrangements in the Shark Bay Snapper Managed Fishery. Changes are embodied in the Shark Bay Snapper Fishery Management Plan Amendment 2000. These changes have modernised the management arrangements by moving them to a fully unutilised, output-managed framework.

Trialling of bycatch reduction devices (BRDs) continued in the Shark Bay and Exmouth Gulf Prawn Managed Fisheries, with full BRD implementation anticipated for the Shark Bay Prawn Managed Fishery in the 2002 season. The bycatch action plan for the Shark Bay Prawn Managed Fishery was approved by the Minister for Fisheries for release for public consultation, and work commenced on bycatch action plans for the Exmouth Gulf Prawn and Shark Bay Scallop Managed Fisheries. BRD trials also commenced with the Shark Bay Scallop Managed Fishery.

Ministerial approval was received for the Exmouth Gulf Prawn Managed Fishery to formally adopt the Vessel Monitoring System in 2002.

The wetline fishery in the Gascoyne bioregion operates in a number of areas:

- Demersal line fishing;
- Mackerel (primarily by trolling);
- Beach seining and near-shore gillnetting.

The demersal line fishery takes a range of demersal fish species, including emperors and baldchin groper, 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). Mackerel are also taken by 'wetliners' as well as by operators in the two managed finfish fisheries.

There is also a take of fish by beach seining and near-shore gillnetting 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

The compliance program focuses on ensuring that industry adheres to the various input controls, which include size limits, fishing gear types and closed/nursery areas. Fisheries Officers from Denham, Carnarvon and Exmouth conduct routine inspections including land

patrols, sea patrols and aerial surveillance to ensure compliance with the management arrangements. They also conduct education sessions prior to fishing seasons with masters and relevant support staff of individual industries.

The Shark Bay prawn and scallop fleet consists of 41 licensed fishing vessels, though numbers can fluctuate due to licensee commitments elsewhere in the State. Compliance within the fleet was further enhanced in 2000/2001 with the implementation of the Vessel Monitoring System. The VMS uses satellites to relay real-time information regarding a vessel's position, and records past movements. A total of 21 warnings were issued to vessels in 2000/2001 for VMS-related offences. Four prosecutions are currently pending relating to fishing in closed waters.

VMS is currently being trialled within the Exmouth Gulf Prawn Managed Fishery, with full implementation scheduled to take place for the 2002 season.

The Shark Bay Snapper Managed Fishery is one of only three fisheries in the State to be managed on a quota-based system (output controls). Fisheries Officers conducted routine inspections of 'unloads' of pink snapper to confirm weights of fish. Other inspections carried out consisted of licence checks (commercial fisherman's licence, fishing boat licence and managed fishery licence), and gear checks to ensure fishing gear and equipment met management specifications.

Regional Research Overview

In addition to the research projects and activities noted in the research summary for each individual fishery, there has been a major focus during 2000/2001 on assessing the general wetline catch in each bioregion. This assessment, undertaken utilising the CAES database, indicates that around 14% of the State's wetline catch was reported from the Gascoyne coast bioregion during 1999/2000. The top ten species include Spanish mackerel (53 tonnes), other mackerel (35 tonnes), sea mullet (33 tonnes), spangled emperor (28 tonnes), western sand whiting (18 tonnes), sweetlip emperor (17 tonnes), red emperor (12 tonnes), unspecified trevally (12 tonnes) and tailor (11 tonnes). An interim management plan is currently being developed for the troll fishery for mackerel, details of which are reported under the north coast bioregion (pp. 82-6). Most other demersal species are taken by vessels targeting pink snapper in the region's oceanic managed fishery for that species (see pp. 53-5). Most of the mullet and whiting catches were reported from the area between the northern boundary of the beach seine fishery and Carnarvon.



Commercial Fisheries

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 27 boats in the fishery also catch 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 Shark Bay Prawn Managed 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 granted to licensees prior to the start of the 2001 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 currently being discussed with industry. The fishery is continuing with its trialling of bycatch reduction devices during the 2001 season, using a BRD in one of the two nets. Trials with two BRDs will commence in late 2001.

The 2001 fishing season commenced on 14 March and is scheduled to close on 28 October. 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 five 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 protect tiger prawn breeding stocks and prevent the fishing of small prawns.

Cooperative management of the fishery is achieved through the provision of advice by the Shark Bay Prawn Management Advisory Committee. The advice provided allows for the management arrangements to be better tailored for achieving the maximum economic return from the prawn resource as well as maintaining sustainability of the fishery and ensuring cost-effective management.

Governing Legislation/Fishing Authority

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

Consultation Process

Shark Bay Prawn Management Advisory Committee
Agency–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 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.

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

Shark Bay Prawn Managed Fishery Status Report

Prepared by M. Kangas and E. Sporer

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 2000 season, which opened on 13 March and closed on 4 November.

A recruitment survey within the closed area south of the Carnarvon/Peron Line and extended nursery area (ENA) was used to determine the extent of the ENA to be opened. The entire ENA was opened together with the Carnarvon/Peron Line on 27 April. The ENA was closed to fishing on 1 August to protect juvenile king prawns.

Denham Sound was closed to trawling from 1 May and reopened on 1 August. The Torbay Line within Denham Sound opened on 1 August and remained open until the end of the season (4 November).

Main fishing method

Otter trawl.

RETAINED SPECIES

Commercial production (season 2000): 2,250 tonnes

Landings

The total landings of major penaeids for the 2000 season were 2,250 tonnes, comprising 1,555 tonnes of king prawns, 689 tonnes of tiger prawns and 6 tonnes of endeavour prawns. There were also 152 tonnes of minor penaeids (coral prawns) landed.

King prawn landings for 2000 were 12% higher than the five-year average (Shark Bay Prawn Figure 2). This may

be due to higher than average catch rates of king prawns at the start of the fishing season, after heavy rainfall and water runoff from the Gascoyne and Wooramel Rivers during early March apparently increased their vulnerability to trawling.

Tiger prawn landings were 6% higher than the five-year average but within the expected catch range (400–700 tonnes) for this species. The average catch of tiger prawns has been 514 tonnes since the inception of the closure to early seasonal fishing inside the Carnarvon/Peron line, whereas the average catch for the previous 10 years (1980–1989) had been 303 tonnes.

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 2000 totalled 120 tonnes whole weight. All Shark Bay Prawn Managed Fishery boats have Shark Bay Scallop Managed Fishery Class B licences.

By-product landings were 43 tonnes of blue swimmer crab, 19 tonnes of squid, 13 tonnes of cuttlefish, 19 tonnes of tuna (wetlining), 2 tonnes of kingfish and a small quantity of other miscellaneous finfish species.

Fishing effort

Effort recorded in the 2000 daily logbooks for the fleet showed nominal effort as 52,049 hours, which was a reduction of 5,264 hours when compared with the last five years' average effort (57,313 hours). Fishing effort is being monitored with the aim of reducing ineffective trawl hours whilst maintaining high catch levels, thus reducing overall effort to improve economic efficiency within the prawn trawl fleet.

Catch rate

Catch rates of 29.9 kg/hr for king prawns and 13.2 kg/hr for tiger prawns were recorded for the 2000 season. King prawn catch rates were similar to last year, whereas the average tiger prawn catch rate was 24% up from last year. Tiger prawn catch rates were exceptionally high in the beginning of the fishing season, possibly as a result of the high water flow into the bay with the flooding of the Gascoyne and Wooramel Rivers in early March, moving tiger prawns out on to the fishing ground earlier than usual.

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 are being incorporated to improve understanding of the SRR for the king prawn stock, and we continue to employ an examination of catch trends to support our evaluations. 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 tonnes respectively.

Exploitation status: Fully exploited

Breeding stock levels: Adequate

Owing to the multi-species nature of this fishery, levels of exploitation of both king and tiger prawn stocks are being carefully monitored with the aim of achieving maximum sustainable catches simultaneously. The tiger prawn closure area introduced during the 1996 season was again implemented from 1 July to 4 November (Shark Bay Prawn Figure 1).

Current stock and recruitment studies indicate that the king prawn stock remains at a point where recruitment is not affected by spawning stock levels. At the current level of exploitation, fluctuation in annual king prawn harvest is likely to result from effort levels and environmental variations, and not from abundance of spawning stock.

In contrast, the recruitment levels of tiger prawns during the 1980s were affected by reduced spawning stock biomass. Management practices have been employed to increase the survival of these spawning stocks.

A reduction in the fleet size from 35 to 27 boats through the buy-back scheme introduced in 1990, together with the new area closures introduced in that year, appear to have benefited tiger prawn stocks. Tiger prawn catches have returned to the levels achieved in the 1970s, in the range of 400–700 tonnes. Changes in the efficiency of the fishing fleet must 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 moving the stock on to the fishing grounds from inshore areas early, thereby allowing the fishery to deplete the spawning stock well before the spawning season starts in August.

NON-RETAINED SPECIES

Bycatch species impact: Medium

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. Trialling and implementation of secondary bycatch reduction devices will 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. Loggerhead turtles are occasionally taken, but the short trawl duration (approximately 60 minutes) required in Shark Bay to accommodate the high prawn catch rates and the clogging



Commercial Fisheries

effects of dead wire weed means that the turtles too can be returned to the sea alive. The implementation of bycatch reduction devices (grids) into the fishery during 2002/03 should eliminate the occasional capture of turtles in trawl nets.

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. These factors indicate that the removal of these volumes of prawns is unlikely to impact on higher-order predators which are also likely to utilise the finfish discards.

Habitat effects: **Low**

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. Trawling occurs over approximately 40% of the habitat occupied by adult prawns, but less than 20% of inner Shark Bay as a whole, 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). In terms of the overall licensed area of the fishery, the fleet is operating over less than 10%.

This fact, combined with the hard sand habitats and very low levels of benthic fauna characteristic of the Shark Bay trawl grounds, means that the typical impact of the trawls is minimal.

SOCIAL EFFECTS

The estimated employment for the year 2000 was 135 skippers and crew. There are also prawn processing and support staff employed at Carnarvon and Fremantle.

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year (2000): **\$42.7 million**

Wholesale prices for prawns vary depending on the type of product and the market forces operating at any one time. Generally, the value of prawns was higher than in 1999 and average ex-boat prices were as follows:

King prawns	\$17.30/kg
Tiger prawns	\$22.90/kg
Endeavour prawns	\$12.90/kg
Coral prawns	\$4.70/kg

FISHERY GOVERNANCE

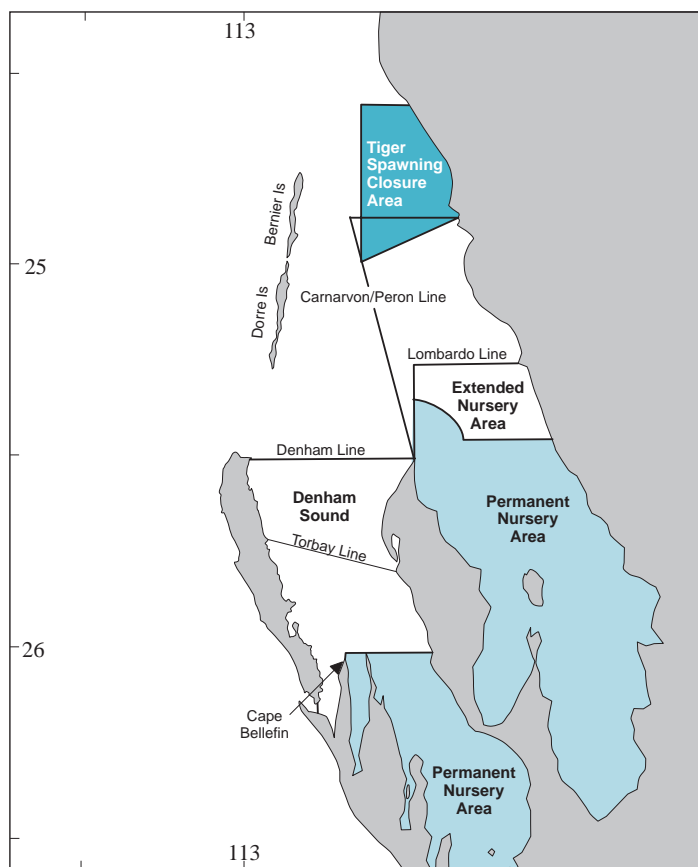
Acceptable catch range: **1,501–2,330 tonnes**

Under current effort levels and normal environmental conditions, and based on the 10-year range of catches since the restructuring of the fishery to 27 licences (1990/91), the acceptable catch range for major penaeids is 1,501–2,330 tonnes. Acceptable catch ranges for individual species are king prawns 1,100–1,600 tonnes, tiger prawns 400–700 tonnes and endeavour prawns 1–30 tonnes. The Leeuwin Current index continues to be high, which would indicate that the catch of king prawns will be maintained at the higher end of the range during the 2001 season.

EXTERNAL FACTORS

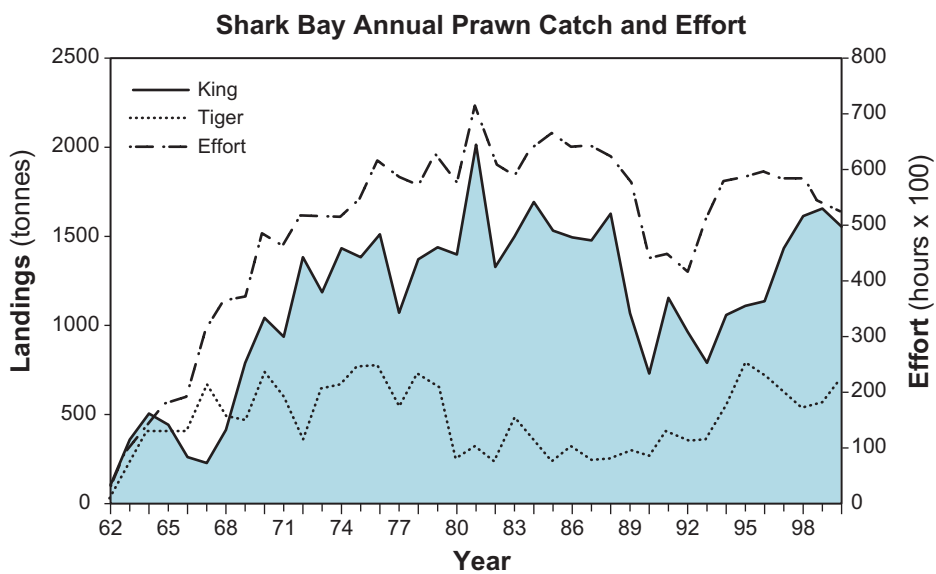
The catches of prawns in Shark Bay are particularly stable compared with other penaeid fisheries. The major environmental factor influencing these stocks appears to be the flow of the Leeuwin Current along the outside of the embayment. A relationship between current strength (as measured by Fremantle sea level) and king prawn catches has been identified and is being refined as a method for improving catch forecasts.

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.



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, 1962–2000.



Commercial Fisheries

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 2001 fishing season commenced on 10 April and is proposed to close in early November. Within the main fishing period, there are various subsidiary area openings and closures which are aimed at maximising the long-term yield from the fishery, particularly of tiger prawns. These closures also protect breeding stocks as well as maximising the catch of larger prawns suitable for export.

Since the 1999 season, moon closures have been made more variable, changing from a standard three-day period to between three and five 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.

Management controls also include limited entry and gear restrictions as well as controls on vessel size and power. Licensees in the Exmouth Gulf Prawn Managed Fishery have been granted an Exemption to permit trials with quad gear (four smaller nets). Depending on the results of these trials, the Exmouth Gulf Prawn Management Plan 1989 may be amended to allow for more flexible gear configurations (without altering the total headrope). Trials with bycatch reduction gear are in progress in the fishery in the 2001 season.

Cooperative management of the fishery is achieved through the provision of advice by the Exmouth Gulf Prawn Management Advisory Committee. The advice provided allows for the management arrangements to be better tailored for achieving the maximum economic return from the prawn resource as well as maintaining sustainability of the fishery and ensuring cost-effective management.

Governing Legislation/Fishing Authority

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

Consultation Process

Exmouth Gulf Prawn Management Advisory Committee
Agency–industry meetings

RESEARCH SUMMARY

Research activities focused on stock assessment and surveys to monitor both annual recruitment of tiger prawns and spawning stocks. All boats completed detailed research logbooks which, together with survey data and factory records, provide the database for managing the fishery.

During the past year, collaborative research has been undertaken with industry on assessing devices to reduce

unwanted bycatch. Work is also being undertaken with industry and CSIRO on assessing the possibility for stock enhancement of the tiger prawn population.

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

Exmouth Gulf Prawn Managed Fishery Status Report

Prepared by M. Kangas and E. Sporer

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 2000 season, two fewer than in 1999. All boats towed 4.5 fathom quad gear (four nets). The fleet headrope length has been adjusted so as not to exceed previous effort levels, and 6 fathoms of headrope were unused.

The fleet commenced fishing on 2 April in Area A (predominantly king prawn grounds), but moved to Area B (predominantly tiger prawn grounds) on 6 April due to the small size of the king prawns. During the season, Area B was fished for several periods (6–19 April, 12–15 May, 29–30 May and 27 June). On each occasion when the catch rate of tiger prawns from Area B fell below the sustainable threshold level (16 kg/hr), the prawn fleet voluntarily ceased fishing in this area. On 12 June, a restricted portion of Area B was opened for one night for banana prawn fishing. On 28 June, Area B closed to fishing at a catch rate of 10.2 kg/hr. Area C north of the A-line opened on 28 May and remained open until the closure of the season. Fishing ceased in all areas on 5 November. The season officially closed at 8.00 a.m. on 11 November.

Main fishing method

Otter trawl.

RETAINED SPECIES

Commercial production (season 2000): 565 tonnes

Landings

The total annual prawn landings from Exmouth Gulf for the 2000 season were 565 tonnes, a decrease of 51% on

the five-year mean of 1,027 tonnes and down 62% on last year's combined landings of 1,467 tonnes. Lower than average catches were achieved for all major prawn species, with 299 tonnes of king prawns, 82 tonnes of tiger prawns and 122 tonnes of endeavour prawns landed (Exmouth Gulf Prawn Figure 2). The king and tiger prawn catches were the lowest since 1981 and 1983 respectively. However, the banana prawn catch of 62 tonnes was the highest catch recorded for this species (Exmouth Gulf Prawn Figure 2).

Recorded landings of by-product were 59 tonnes of coral prawns, 10 tonnes of squid, 2 tonnes of cuttlefish, 6 tonnes of blue swimmer crab, 4 tonnes of shark and small quantities (less than one tonne each) of bugs, octopus and finfish species including mackerel and cobia.

Fishing effort

Total nominal effort for the 2000 season was 27,415 hours. Two boats were removed from the fishery to compensate for the full introduction of quad gear for this season, with 6 fathoms less of overall headrope towed in the fishery during 2000. The comparable effort in twin-gear terms was 33,380 hours, which was slightly lower than in 1999. The lower effort for 2000 reflected the lower stock abundance and the decision to cease fishing on 5 November, six days earlier than the nominated closing date of 11 November.

Catch rate

Catch rates for king and tiger prawns were low. The catch rates in twin-gear terms, after adjusting for changes in configuration from twin to quad gear, were 9 kg/hr for king prawns, 2.5 kg/hr for tiger prawns and 3.6 kg/hr for endeavour prawns.

Recreational component: Nil

Stock assessment complete: Yes

The king and tiger prawn stocks are fully exploited. For tiger prawns, this assessment is supported by the recent indices of recruitment and spawning stock with respect to the accepted SRR. The SRR and the environment are not examined in Exmouth Gulf for the king prawn stock; however, examination of catch trends continues to support evaluations.

The king prawn stock was slightly below the range normally predicted for this fishery. This may be attributed to the redistribution of the stock into areas not normally trawled as a result of the strong impact of Cyclone Steve during March 2000.

The tiger prawn stock during 2000 was low, with very little recruitment to the fishery being evident despite good breeding stock in 1999. Most of the prawns surveyed during the recruitment period in 2000 were residual stock (larger individuals). The longer-term impacts of Cyclone Vance (March 1999) on nursery habitats appear to have had a negative effect on tiger prawn recruitment in 2000. Inshore sampling by CSIRO in late 1999 found very low numbers of juvenile tiger prawns, indicating low settlement/survival rates in nursery areas. The level of the tiger prawn stock was monitored very closely during May

and June 2000 using daily logbook data. Fishing ceased in the tiger prawn area before the abundance of tiger prawns was severely reduced. After closure to commercial fishing, surveys of spawning stock levels were conducted using two commercial boats which indicated that the spawning stock was below the threshold level of 16 kg/hr (in twin-gear terms).

Exploitation status: Fully exploited

Breeding stock levels: Adequate

King prawn breeding stocks continue to be adequate. However, low recruitment levels and continuing concerns about tiger prawn stocks necessitated the close monitoring of catch rates in Areas B and C during 2000. Fishing in these areas was restricted to only 19 nights to ensure that average catch rates did not fall much below the ideal cutoff level of 16 kg/hr. This catch rate has been determined from historical data as that needed to ensure a full breeding stock remains in spring of that year.

Standardised spawning surveys were again conducted in August, September and October of 2000, and indicated catch rates for tiger prawns averaging 10.3 kg/hr in the area. This was lower than the ideal catch rate level, but still considered reasonable given the very low recruitment which was available.

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. 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.

Protected species interaction: Low

While protected species including dugongs, turtles and sea snakes are 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. Trialling of grids and secondary bycatch reduction devices commenced in 2000 to improve the quality of the prawn catch by minimising the capture of large animals and reducing the volume of overall bycatch species retained in the trawls.

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 to the high natural mortality and variable biomass levels of prawns resulting from naturally occurring cyclone events.

Habitat effects: Low

The trawling effort is focused in the deeper central and north-western sectors of Exmouth Gulf and occurs over about 35% of the licensed fishery area and about 30% of the target species habitat. An extensive permanent trawl



Commercial Fisheries

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 2000 was 52 skippers and crew. Processing and support staff are also based in Exmouth Gulf and Fremantle.

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year 2000:
\$9.6 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	\$17.30/kg
Tiger prawns	\$22.90/kg
Endeavour prawns	\$12.90/kg
Coral prawns	\$4.70/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 tonnes). Acceptable catch ranges for individual species are king prawns 350–500 tonnes, tiger prawns 250–550 tonnes and endeavour prawns 120–300 tonnes (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.

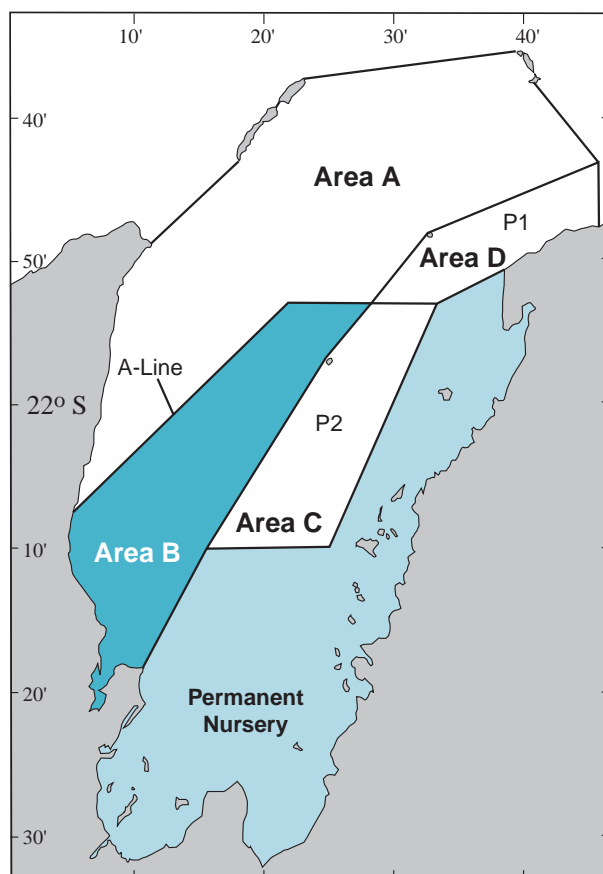
EXTERNAL FACTORS

Several factors have contributed to the lower than average season in the Exmouth Gulf prawn fishery in 2000. The tiger prawn catch was well below the acceptable range for the species, king prawns slightly below, and endeavour prawns at the lower end of the acceptable range, while conversely the banana prawn catch was the highest recorded from the fishery. These perturbations have been driven by the impact of cyclone events in the summers of 1998/99 and particularly 1999/2000, and are reminiscent of the situation that existed in the 1960s when cyclone frequency was at a similar level.

The very low tiger prawn catch was, however, also due in part to the management controls which ensured that sufficient tiger prawns were left to become the spawning stock for 2000. Secondly, the need to close the tiger prawn grounds early to protect the breeding stock significantly reduced access to the endeavour prawn stock

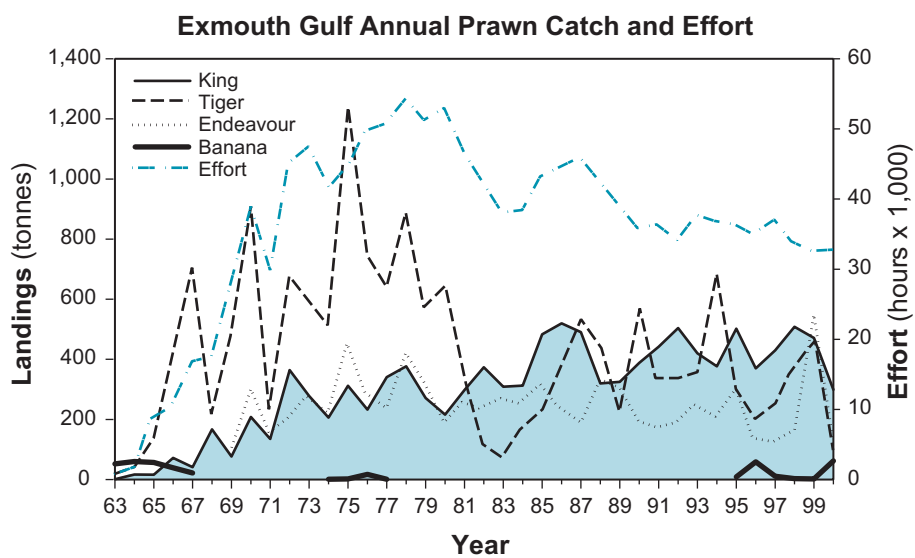
and to a lesser extent the king prawn stock, resulting in a low total catch for the 2000 season.

Two boats were removed from the fishery and the remaining 13 boats moved to quad trawl gear in 2000 under an Exemption. This change permitted the Exmouth Gulf fleet to gain in efficiency by having fewer trawlers and lower fuel usage overall while maintaining its catching ability. This is part of an approved trial to ascertain the most efficient net configuration, and will be reflected in amended management arrangements for the fishery, which may be based on unitisation of the trawl headrope length. These changes will be monitored carefully to ensure that tiger prawn spawning stocks are maintained above historically set targets.



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, 1963–2000.



Commercial Fisheries

Shark Bay Scallop Managed Fishery

MANAGEMENT SUMMARY

The Shark Bay Scallop Managed Fishery is historically Western Australia's most valuable scallop fishery, based on the take of southern saucer scallop (*Amusium balloti*). 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, whilst 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 2001 scallop fishing season commenced on 28 April and is scheduled to close 28 October, the same day as the Shark Bay Prawn Managed Fishery. Other management measures include limited entry, area closures, gear controls and crew limits.

Catch in this fishery varies widely depending on the strength of recruitment, 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).

A cooperative approach to the development of management strategies in this fishery is achieved through the Shark Bay Scallop Management Advisory Committee, which includes representatives from both the Shark Bay Scallop and Shark Bay Prawn Managed Fisheries.

Bycatch reduction device trials are being undertaken during the 2001 season.

Governing Legislation/Fishing Authority

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

Consultation Process

Shark Bay Scallop Management Advisory Committee
Agency–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 receipts provided by industry. In addition, an annual research survey is carried out which, together with existing detailed biological knowledge, enables a catch forecast to be provided annually.

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

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 2000 scallop season commenced on 3 May and officially closed on 4 November. However, trawling for scallop by Class A boats had ceased by the end of June because of poor quality and small meat size.

Main fishing method

Otter trawl.

RETAINED SPECIES

Commercial production (season 2000):

1,345 tonnes whole weight

Landings

The total scallop catch for this fishery was 1,345 tonnes whole weight. The Class A fleet (all 14 boats fished in 2000) caught 1,220.5 tonnes whole weight or 90.7% of the total catch, with the Class B fleet taking 124.5 tonnes whole weight (Shark Bay Scallop Figure 1). Low quantities of by-product (less than one tonne each of bugs, blue swimmer crabs and cuttlefish) were recorded for the Class A fleet during 2000.

Fishing effort

The total effort recorded by the Class A boats in 2000 was 9,893 hours, the lowest recorded since 1991. This was because the scallop boats did not fish beyond the end of June, when the remaining scallops showed small meat size and poor condition.

Catch rate

A mean catch per unit effort of 123 kg/hr (whole weight) was recorded for the Class A fleet. This efficient catch

rate was maintained as a result of the decision to cease fishing in 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 in 1999 was at the low end of the range, as measured using the data from the November scallop survey. This level of recruitment was reflected in the catch taken in 2000; however, the catch projection was not realised because the small meat size of the scallops produced a lower than expected ratio of total meat to whole weight. The fishing effort was also 21% lower than the previous year. The remaining stock from the 2000 season may be beneficial for the scallop industry as it should provide additional catch of the residual scallops in 2001.

Exploitation status: Fully exploited

Breeding stock levels: Adequate

The management arrangements for the fishery over past years have ensured that some spawning has occurred each year before the bulk of the stock has been taken. Annual variations in recruitment seem to be dominated by environmental factors that are believed to be correlated inversely with the strength of the Leeuwin Current.

Projected catch next season (2001):
1,000–1,700 tonnes whole weight

The catch projection range for the 2001 season is approximately 1,000–1,700 tonnes whole weight, based on the November 2000 survey which indicated that recruitment was lower than last year but residual stock was higher due to the lower level of fishing in 2000.

NON-RETAINED SPECIES

Bycatch species impact: Low

Owing to the legislated design of the nets (100 mm mesh), fish bycatch is minimal.

Protected species interaction: Low

Protected species, occasionally captured, are released alive due to the relatively short duration of trawls. During 2000, preliminary grid trials to minimise the capture of large animals were undertaken on commercial boats.

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 (estimated 30%) of the typically bare sand habitat associated with concentrations of this species. As a result of the small area impacted and the short-term impact of the gear on sand habitats, the overall effect of fishing is low.

SOCIAL EFFECTS

The estimated employment for the year 2000 was 182 skippers and crew. There are also processing and support staff employed at Carnarvon, Fremantle and Geraldton.

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year 2000:
\$7.1 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 \$5.25/kg whole weight or \$26.25/kg meat weight. Meat weight is 20% of whole weight.

FISHERY GOVERNANCE

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

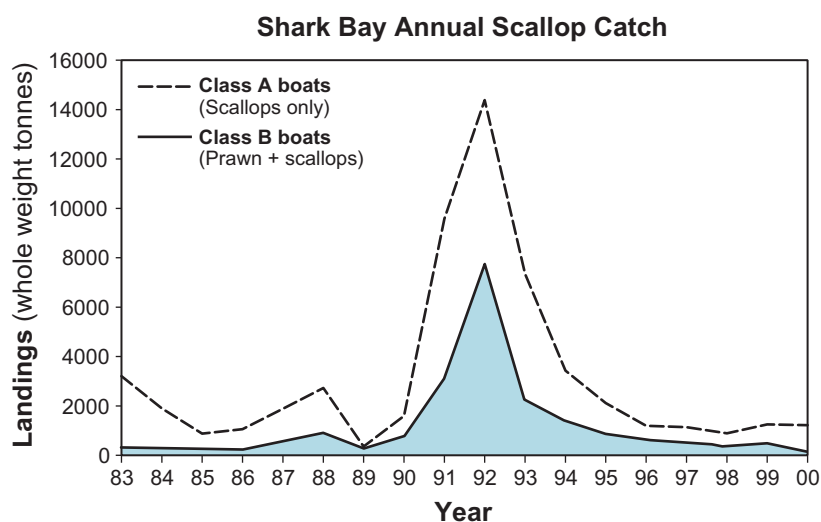
The acceptable catch range is approximately 1,250–3,000 tonnes whole weight, based on catches over the five-year period 1995–1999. This period excludes the artificially high catches of the early 1990s (Shark Bay Scallop Figure 1), apparently created by an unprecedented three years of El Niño conditions. The expected catch for next season is based on a pre-season survey, as indicated above.

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 and 2000 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 low catch for the 2000 season was expected; however, it was further reduced by the small meat size of the scallops and the resultant lower fishing effort. 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.



Commercial Fisheries



SHARK BAY SCALLOP FIGURE 1

Annual scallop landings by fleet for the Shark Bay Scallop Managed Fishery, 1983–2000.

Shark Bay Beach Seine and Mesh Net Managed Fishery

MANAGEMENT SUMMARY

This fishery operates in the waters of Shark Bay and takes a mixed catch of whiting, mullet, tailor and yellowfin bream. Entry to 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. Effort is driven by market needs as opposed to fish availability, with catches conforming to commercially acceptable size limits which are above the legal minimum size for 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

Agency–industry meeting

RESEARCH SUMMARY

Research monitoring of the status of the stocks taken in the 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 (whiting) being fished at sustainable

levels. The fishery, although relatively small-scale, makes a significant contribution to the Denham economy and community. 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. Ayvazian 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 April 2000, 11 unit-fishing boat 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 2000):
All finfish 300.1 tonnes
Whiting 126.6 tonnes

Landings

Whiting is the main target species in Shark Bay, although the overall catch consists primarily of two species of whiting, sea mullet, tailor and bream. Thus assessments of the fishery have been based historically on the total whiting catch and effort data (Shark Bay Beach Seine Figure 1). Landings during 2000 were 126.6 tonnes of whiting. Landings have increased over the 1999 catch and are similar to the 1997 catch of 122 tonnes. The current catch is the highest reported between 1989 and the present. The 2000 total catch for the Shark Bay beach seine and haul net fishery of 300.1 tonnes has increased from the 1999 reported catch and is slightly lower than the 1997 catch of 325 tonnes, which was at the highest level reported during the past 10 years (Shark Bay Beach Seine Figure 2). Among the landings of other species from this fishery, mullet (106.1 tonnes) ranked second to whiting, followed by tailor (38.9 tonnes) and bream (8.7 tonnes). There were 19.8 tonnes of fish of other species.

Fishing effort

During 2000, there was an average of seven boats fishing per month, expending a total 1,187 days of fishing effort (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 2000.

Catch rate

CPUE (based on nominal effort) for the whiting fishery has increased during the past 10 years, with only minor annual fluctuations. The present CPUE is 106.7 kg/boat day for the whiting fishery, which is a slight increase over 1999. The increase in catch rate of whiting during the 1990s may be related to increased efficiency following the introduction of jet boats (Shark Bay Beach Seine Figure 1). The CPUE for the overall Shark Bay beach seine and haul net fishery increased steadily between 1989 and 1995. After 1997, there was a gradual decline in the CPUE values, until the current season saw an increase to 252.8 kg/boat day (all species) (Shark Bay Beach Seine Figure 2).

Recreational component: < 5%
 The Gascoyne Recreational Fishing Survey conducted in 1998/99 (Sumner et al., in press) estimated a catch of approximately 100 tonnes by shore- and boat-based

recreational fishers from the inner gulfs of Shark Bay, consisting mainly of pink snapper, black snapper (grass emperor), narrow-barred Spanish mackerel, spangled emperor and tailor. Smaller quantities of baldchin groper, whiting species, western butterflyfish, mullets and Queensland school mackerel are included in this total. The commercial catch for the same area in the calendar year of 1998 was about 250 tonnes; however, it was dominated by whiting, mullet, tailor and bream, most of which were not major components of the recreational take. Less than 2 tonnes of pink snapper was taken by the commercial fishery. The recreational catch of the main commercial species was approximately 4% of the combined recreational and commercial catch of these species. For more details on the Gascoyne Recreational Fishing Survey, see pp. 135-42.

Stock assessment completed: **Yes**

A preliminary yield-per-recruit stock assessment has been conducted for the western sand whiting (*Sillago schomburgkii*) stock in Shark Bay. Biological data were incorporated from research by Lenanton (1970). A more detailed evaluation of the current status of the fishery cannot be achieved with the data currently available, however the increasing trend in CPUE resulting from the reduced effort levels during the early 1990s indicates that the stock is being fished within its productive capacity.

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 catches of whiting over recent years provide a good indication that the breeding stock is being maintained.

NON-RETAINED SPECIES

Bycatch species impact: **Low**

The fishery operates throughout its licence area but with a very low level of effort as its specifically targets schools of fish. As a result of the gear type used and the method of operation, there are no bycatch issues or physical habitat impacts associated with this fishery. Overall the fishery has minimal effect on the Shark Bay ecosystem.

Protected species interaction: **Low**

As nets are actively set and hauled, if any protected species are caught they are immediately released.

ECOSYSTEM EFFECTS

Food chain effects: **Not assessed**

Habitat effects: **Negligible**

Nets are set and hauled over shallow sand banks and have no lasting effect on the habitat.

SOCIAL EFFECTS

During 2000, the average number of fishers in the Shark Bay Beach Seine and Mesh Net Fishery was 18.8. Fishing and associated local processing is one of the major sources of employment for the Denham community.



Commercial Fisheries

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year (2000):
All finfish \$911,000
Whiting \$490,000

FISHERY GOVERNANCE

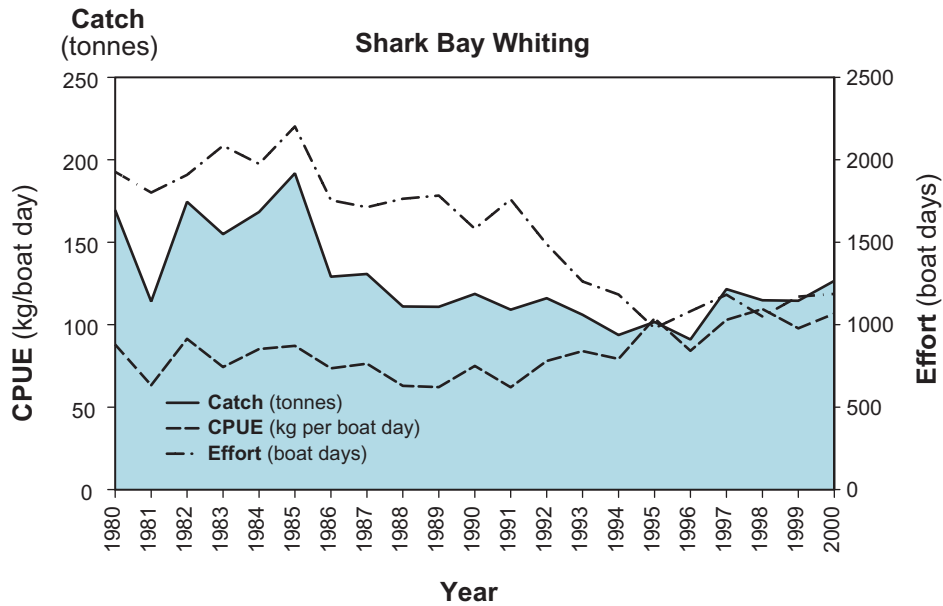
Acceptable catch range: Whiting 95–140 tonnes

The acceptable catch range under the current management regime is 95–140 tonnes of Shark Bay whiting. The projection is 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%. Future annual catch values which fall outside of this range will be investigated. Where consecutive values occur outside of the range, changes to the management arrangements may need to be considered.

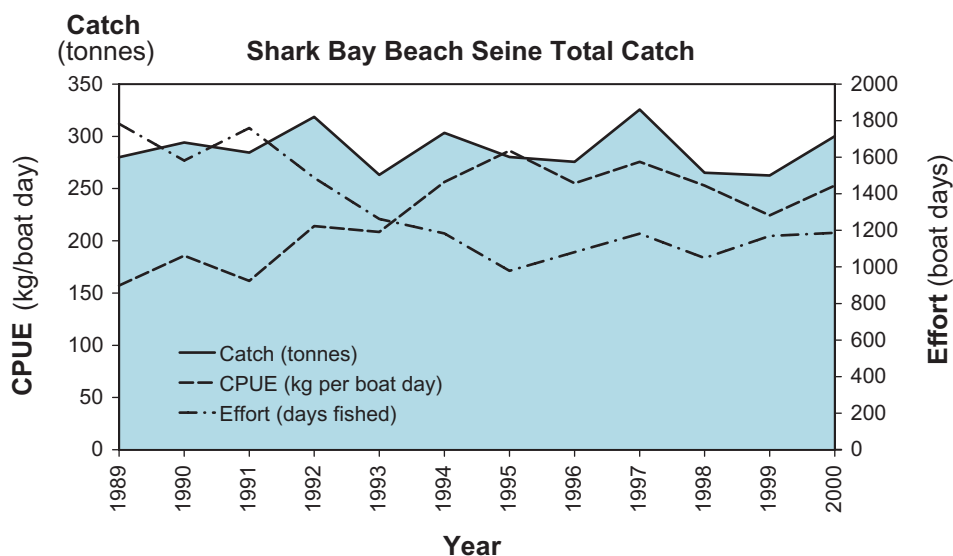
EXTERNAL FACTORS

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



SHARK BAY BEACH SEINE FIGURE 1

The annual catch (tonnes), effort (boat days) and catch per unit effort (CPUE, kg/boat day) for whiting from Shark Bay over the period 1989–2000.



SHARK BAY BEACH SEINE FIGURE 2

The annual catch (tonnes), effort (boat days) and catch per unit effort (CPUE, kg/boat day) for the total finfish fishery of Shark Bay over the period 1989–2000.

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.

In 2001, new management arrangements were introduced under the provisions of the Shark Bay Snapper Fishery Management Plan Amendment 2000. The fishery is now quota-managed on a year-round basis, and a minimum holding of 100 quota units applies. Units are transferable, although a number of governing policies and principles exist.

The amendment simplifies the complex management and administrative arrangements previously in place while providing more flexibility for both industry and Fisheries WA.

Governing Legislation/Fishing Authority

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

Consultation Process

Agency–industry meeting

RESEARCH SUMMARY

Detailed research on the offshore snapper fishery was undertaken during the 1980s and provides the scientific knowledge base for management. A new FRDC-funded

project which commenced in July 2000 will utilise data collected since the 1980s to assess the potential for increased yields from this oceanic snapper stock. Until the results from this research become available, monitoring of the fishery will continue to be undertaken annually using CAES data.

The monitoring data is used to provide the 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. There are 24 licences, but some boats have several managed fishery licences aggregated on one fishing boat licence. Shark Bay prawn and scallop trawlers are also permitted to catch up to one tonne of snapper per year. Catches of snapper in the peak fishing season (May–August) have been subject to individual quotas, while gear controls applied in the off-peak season. The peak season catch in 2000 was 393 tonnes and the off-peak catch was 95 tonnes. Commencing with 2001, the whole year's catch will be subject to individual quotas.

Main fishing method

Mechanised handline.

Commercial Fisheries

RETAINED SPECIES

Commercial production (season 2000): 488 tonnes

Landings

The managed snapper fishery operates on the ocean stock of snapper which is distinct from the inner Shark Bay stocks. Catches of snapper from the ocean stock in 2000 were slightly higher than the previous year, at 488 tonnes compared with 450 tonnes in 1999. Catches are generally limited more by market capacity than availability of fish. The snapper fishery also took 106 tonnes of other finfish species in 2000. The catch of other species is detailed in Shark Bay Snapper Table 1.

Fishing effort

The effectiveness of fishing effort varies markedly on a seasonal basis. Fishing effort in 2000 was 845 standard June–July line boat days compared with 712 days in 1999 and 984 days in 1998.

Catch rate

The catch per line boat day of the managed fishery licensed boats for the peak months (June–July) was 578 kg in 2000, close to the the average for the 1990s of 593 kg/boat day, compared with 632 kg/boat day in 1999 (Shark Bay Snapper Figure 1).

Recreational component: 4% (approx.)

The Gascoyne Recreational Fishing Survey, conducted between April 1998 and March 1999 (Sumner et al., in press), has estimated the recreational catch from the offshore stock at 14 tonnes, approximately 2.5% of the commercial catch. In addition, there is a recreational catch of offshore pink snapper from charter boats, reported to be 5.7 tonnes from a total charter catch of 32 tonnes.

For the genetically distinct inner bay stocks (not covered by this status report), most of the catch is recreational and is now subject to separate management arrangements. Research for management of these stocks is reported in the recreational fisheries section on pp. 139-41.

Stock assessment completed: Yes

The pink snapper stock is close to fully exploited. A stock production model assessment in the mid-1980s estimated maximum sustainable yield at around 600 tonnes, whereas the average annual commercial catch for the 1990s was 503 tonnes. The new FRDC-funded project commenced in July 2000 will assess the potential for increased yields from this oceanic pink snapper stock.

Exploitation status: Fully exploited

Breeding stock levels: Adequate

Snapper breeding stock level for the ocean stock is not measured directly; however, there are no indications of insufficient breeding stock from the catch rates, locations fished or size frequency. This is in contrast to the inner Shark Bay stocks, where the breeding stock level has been seriously impacted by recreational fishing.

NON-RETAINED SPECIES

Bycatch species impact: Negligible

Virtually all the catch consists of demersal fish with a medium to high market value, therefore there is no significant discarding of unwanted species.

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 insignificant because the quota system restricts catches to a small percentage of the total biomass of snapper.

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

Seven boats fished both peak and off-peak seasons (about nine months) with an average crew of three. This rose during the peak season (four months) to a total of 13 boats with an average crew of five.

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year (2000): \$2.7 million

The value of the pink snapper taken by the fishery in 2000 was \$2.24 million, while other scalefish species added a further \$0.45 million.

FISHERY GOVERNANCE

Acceptable effort range: 820–950 days

The total allowable commercial catch under the new year-round quota system is 550 tonnes. Effort is likely to be around 820–950 standard June–July line boat days. It is expected that the new management arrangements will facilitate utilisation of latent effort, e.g. from the Shark Bay prawn and scallop trawler fleet.

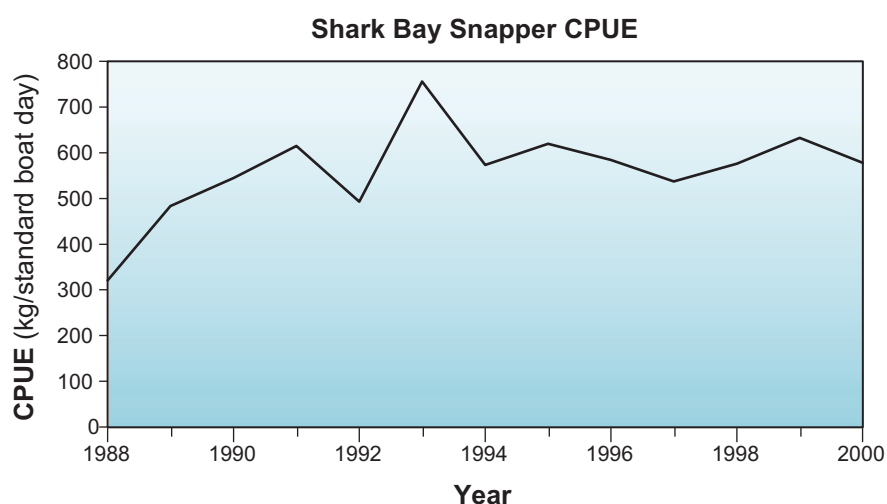
EXTERNAL FACTORS

Japanese demand for snapper has been declining in recent years and efforts have been made to explore other overseas and Eastern States markets.

SHARK BAY SNAPPER TABLE 1

Catches in the year 2000 by Shark Bay Snapper Managed 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. 82-6).

Species	Tonnes
Mulloway	20.7
Cod, various species	12.1
Trevally, various	9.3
Sweetlip emperor	8.4
Spangled emperor	6.0
Red emperor	5.7
Baldchin groper	3.0
Pearl perch	2.5
Blue-spot emperor	2.0
Tailor	1.9
Sea perch, various	1.7
Flagfish	1.6
Cobia	1.6
Dhufish	1.5
Blue-lined emperor	1.1
Shark, various	1.0
Scalefish, other	13.4
TOTAL	106.0



SHARK BAY SNAPPER FIGURE 1

Catch per unit effort by year from 1988 to 2000 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, the CPUE for line fishing in June and July is used as the index of abundance.