

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.

The major changes in the Gascoyne bioregion over the past 12 months have included:

- Formal introduction of Vessel Monitoring System and bycatch reduction device requirements into the management arrangements for the Exmouth Gulf Prawn Managed Fishery.
- Development and implementation of a Memorandum of Understanding between the Department of Fisheries and industry for the Exmouth Gulf Prawn Managed Fishery, allowing greater flexibility to industry in relation to their specific fishing arrangements, for the purposes of adding value to their catch/product.
- Introduction of further requirements regarding the use of BRDs in the Shark Bay Prawn and Shark Bay Scallop Managed Fisheries, whereby they are now formally required to fish with a BRD in each of their nets (prawn) or in one net (scallops – but moving to two nets in 2003).

Additionally, management effort has been focused on:

- Preparation of reports addressing the principles of ecological sustainability (in line with the requirements of the *Environment Protection and Biodiversity Conservation Act 1999*) for the Exmouth Gulf Prawn, Shark Bay Prawn, Shark Bay Scallop and Shark Bay Snapper Managed Fisheries.
- Commencement of the development of a draft plan of management for the experimental inshore crab fishery in Shark Bay.

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);
- Beach seining and near-shore gillnetting.

The demersal line fishery takes a range of demersal fish species, including emperors and baldchin groper/tuskfish, 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 (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.

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

Compliance activities relating to the commercial fisheries of the Gascoyne coast bioregion are conducted by Fisheries Officers working out of 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 VMS 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 patrol vessels for more extensive at-sea operations.

Activities during 2000/01

During 2000/01, Department of Fisheries Regional Services personnel delivered 6,051 hours to compliance activities for Gascoyne coast bioregion commercial fisheries (Gascoyne Commercial Compliance Table 1). This figure excludes any time spent working on compliance issues for the Australian Fisheries Management Authority (Commonwealth and/or jointly managed fisheries), aquaculture compliance, or duties concerned with fish habitat protection. The major percentage of these hours comprised duties performed in relation to trawl fishery compliance activities.

During the period 1 January through to 30 June 2001, Fisheries Officers recorded 103 field contacts with commercial fishing operations and 124 office contacts with commercial fishers. Over the full year (1 July 2000 through to 30 June 2001), 3 infringement warnings and 8 infringement notices were issued, while a further 7 cases were progressed as prosecution actions against commercial fishers.

The majority of investigations resulting in prosecution action during 2000/01 were related to the Shark Bay Prawn and Scallop Managed Fisheries. These were largely offences detected by the VMS. However, during the year a number of other commercial fisheries in the bioregion, including the Exmouth Gulf Prawn and Shark Bay Snapper Managed Fisheries and the 'wetline' fishery, continued to require a high level of compliance monitoring/service delivery.

While compliance within the various 'wetline' fisheries continued to be generally good, complaints were received regarding a small number of fishers using unauthorised, recreational fishers as crew and/or incorporating the catches of recreational fishers in their consignments.

GASCOYNE COMMERCIAL COMPLIANCE TABLE 1

Summary of compliance and educative contacts and infringement types in commercial fisheries within the Gascoyne coast bioregion during the 2000/01 financial year.

CONTACT WITH THE COMMERCIAL FISHING COMMUNITY	NUMBER
Hours delivered in bioregion	6,051
Fisher field contacts by Fisheries Officers (6 months)*	103
District Office contacts by Fisheries Officers (6 months)*	124
Fishwatch reports **	85
OFFENCES DETECTED	NUMBER
Infringement warnings	3
Infringement notices	8
Prosecutions	7

* These figures represent regional activities conducted between 1 January and 30 June 2001, following the introduction of a new, more comprehensive system for collection of regional activity data. Since this represents an incomplete year of data, collected while Fisheries Officers were still undergoing training in the system, figures should be treated with caution.

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

2000/01 also saw greater numbers of offences being detected in the Shark Bay Snapper Managed Fishery, in line with the stricter and more comprehensive management arrangements introduced by major amendment in late 2000. These offences related mainly to non-compliance with quotas or failure to complete correct catch and disposal records.

Compliance with the regulations remained high in the Shark Bay Beach Seine and Mesh Net Managed Fishery.

Initiatives in 2001/02

During 2001/02, the Gascoyne bioregion’s management staff commenced a series of workshops and meetings with industry – in particular the Exmouth Gulf Prawn Managed Fishery participants – to work through issues associated with levels of compliance funding and servicing. At the time of reporting, these discussions were ongoing. However, it is expected that, by incorporating industry in the development of risk assessment processes, both the Department and industry will gain a better understanding of one another’s priorities, obligations and expectations, and that this increased awareness will facilitate the formulation and delivery of appropriate compliance projects.

With the Shark Bay prawn and scallop trawl fisheries having trialled the use of VMS as a compliance tool over the past two years, and the Exmouth Gulf prawn fishery coming ‘on line’ with VMS this year, the Department has been working to review the most appropriate strategy to deal with any

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 producing benefits for those handling these matters. In addition, the introduction of VMS into the Exmouth Gulf prawn fishery management arrangements necessitated extra training in VMS requirements for staff working at the Exmouth District Office.

During 2001/02, the Shark Bay Beach Seine and Mesh Net Managed Fishery has been undergoing review in relation to the identified need for more contemporary management arrangements. This is likely to include analysis of the current and ongoing compliance program for the fishery.

REGIONAL RESEARCH OVERVIEW OF WETLINE FISHING

The CAES database indicates that around 13% of the State’s wetline catch was reported from the Gascoyne coast bioregion during 2000/01. The top ten species comprised Spanish mackerel (*Scomberomorus commerson*) 63 tonnes, goldband snapper (*Pristipomoides multidens*) 26 tonnes, pink snapper (*Pagrus auratus*) caught outside of the Shark Bay Snapper Managed Fishery 25 tonnes, other mackerel 16 tonnes, red emperor (*Lutjanus sebae*) 15 tonnes, sea mullet (*Mugil cephalus*) 15 tonnes, nor-west snapper (Lethrinidae) 14 tonnes, spangled emperor (*Lethrinus nebulosus*) 11 tonnes, sweetlip emperor (*Lethrinus miniatus*) 10 tonnes and mulloway (*Argyrosomus hololepidotus*) 8 tonnes.

An interim management plan for the troll fishery for mackerel, details of which are reported under the north coast bioregion (pp. 86–91), is currently in review. 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. 57–59). The majority of the mullet and whiting 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 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 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 2002 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. Another exemption has also been granted to allow one licence holder to trial 'bison' otterboards (as opposed to standard flat wooden otterboards) in the 2002 season.

Bycatch reduction devices (specifically grids) were fully implemented in the 2002 season. Vessels operating in the fishery are required to fish with a grid in each net by way of a condition on the managed fishery licence. Trials of secondary bycatch reduction devices (for example, square mesh panels) are expected to occur later in the season.

The 2002 fishing season commenced on 6 March and is scheduled to close on 21 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 are soft-shelled and therefore less marketable. Permanent nursery area closures within the fishery prevent the fishing of small prawns while two spatio-temporal closures are to protect tiger prawn breeding stocks

The Shark Bay Prawn Management Advisory Committee (SBPMAC) provides advice to the Minister on the management of the fishery. The MAC 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. During 2002, the Minister approved an amalgamation of the SBPMAC with the Shark Bay Scallop and Exmouth Gulf Prawn MACs, which should see the amalgamated MAC better positioned to focus on broad issues while detailed fishery management matters will be dealt with directly between the Department and licensees.

An ecological sustainability report was prepared in consultation with the various stakeholders and submitted to Environment Australia for continued listing of the fishery products under the *Environment Protection and Biodiversity Conservation Act 1999*.

Governing Legislation/Fishing Authority
Shark Bay Prawn Management Plan 1993
Shark Bay Prawn Managed Fishery Licence

Consultation Process
Shark Bay Prawn 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 new project to determine biodiversity of bycatch in trawled and untrawled areas will commence in 2002.

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 2001 season, which opened on 14 March and closed on 28 October.

Recruitment surveys in March and April within the closed area south of the Carnarvon/Peron Line and extended nursery area (ENA) were used to determine the extent of the ENA to be opened. The ENA was partially opened (to 25°20'24" S) together with the Carnarvon/Peron Line on 16 April. Owing to small prawn size along the latitude 25°20'24" S, the ENA closure line was raised 1.6 nautical miles (to 25°18' S) on 20 April. The closed portion of the ENA opened on 15 May. The entire ENA closed to fishing on 1 August to protect juvenile king prawns.

Denham Sound opened on 14 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 (28 October).

Main fishing method

Otter trawl.

RETAINED SPECIES

Commercial production (season 2001): 1,696 tonnes

Landings

The total landings of major penaeids for the 2001 season were 1,696 tonnes, comprising 1,322 tonnes of king prawns, 371 tonnes of tiger prawns and 3 tonnes of endeavour prawns. There were also 165 tonnes of minor penaeids (coral prawns) landed.

King prawn landings for 2001 were 11% lower than the five-year average (Shark Bay Prawn Figure 2). Tiger prawn landings (371 tonnes) were 41% lower than the five-year

average and below the expected catch range (400–700 tonnes) for this species. It was noted that during the 2000 season both the Wooramel and the Gascoyne rivers flooded, which may have triggered early tiger prawn migration into the trawl grounds. This may have led to higher catches of tiger prawns earlier within the season. Because most of the tiger prawn catch was taken early during the 2000 season (31.5 kg/hr in March, compared to an average of 14.6 kg/hr in 1996–1999), it may have reduced the spawning biomass during that season, thus reducing the tiger prawn recruitment for the 2001 season. Two further factors restricted the tiger prawn catch in 2001. The southern tiger prawn spawning area was extended, and a threshold catch rate cut-off level of 10 kg/hr was implemented. These factors would have reduced the take of tiger prawns to maintain optimum spawning stock levels.

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 2001 totalled 78 tonnes whole weight. All Shark Bay Prawn Managed Fishery boats have Shark Bay Scallop Managed Fishery Class B licences.

By-product landings were 89 tonnes of blue swimmer crab (*Portunus pelagicus*), 26 tonnes of squid, 18 tonnes of cuttlefish, 10 tonnes of tuna (wetlining), 5 tonnes of mulloway (*Argyrosomus hololepidotus*) and a small quantity of other miscellaneous finfish species.

Fishing effort

Effort recorded in the 2001 daily logbooks for the fleet showed nominal effort as 50,422 hours, which was a reduction of 5,652 hours when compared with the last five years' average effort (56,074 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.

Catch rate

A catch rate of 26.2 kg/hr for king prawns was observed, which was similar to average catch rates seen in the fishery over the last five years and was relatively high compared to the catch rate of 24.7 kg/hr observed in the period of high catches from 1980 to 1988. The 2001 tiger prawn catch rate of 7.4 kg/hr was lower compared to that of the years 1991–2000 (mean 10.4 kg/hr). However, comparison with the catch rates for the period 1980–1989 (mean 4.2 kg/hr) indicates that the 2001 catch rate was better than during this period of low recruitment. The 2001 season catch rates have also been affected by extended full moon closures aimed at increasing economic efficiency and reducing 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 are being examined 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. 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 effects on recruitment, 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 now been employed to increase the survival of these spawning stocks. Because lower tiger prawn catch was anticipated for the 2001 season from pre-season surveys, the spatial extent and location of the tiger prawn spawning area (TPSA) was re-examined. Since the inception of the TPSA in 1996, the spawning area had been defined as one area and closed by an arbitrary date (generally mid-July). In 2001, it was divided into two parts, the southern and northern areas (Shark Bay Prawn Figure 1). 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. Standardised research surveys (to confirm commercial catch rates derived from logbook information) were carried out to obtain the catch rate of tiger prawns, which provided the basis for closure of the southern spawning area on 19 June. The southern boundary was also moved further south than previously to effectively close off areas where large female tiger prawns actively spawn. The northern spawning area, which is aligned with the northern portion of the original 1996 TPSA, was closed from 24 July for the remainder of the season. This survey and closure regime will continue for a minimum of three years to allow an analysis of its usefulness in protection of spawning stock.

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. However, 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 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 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 will 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 2001 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 (2001): \$25.2 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 lower than in 2000 and average ex-boat prices were as follows:

King prawns	\$14.05/kg
Tiger prawns	\$16.16/kg
Endeavour prawns	\$10.49/kg
Coral prawns	\$3.68/kg

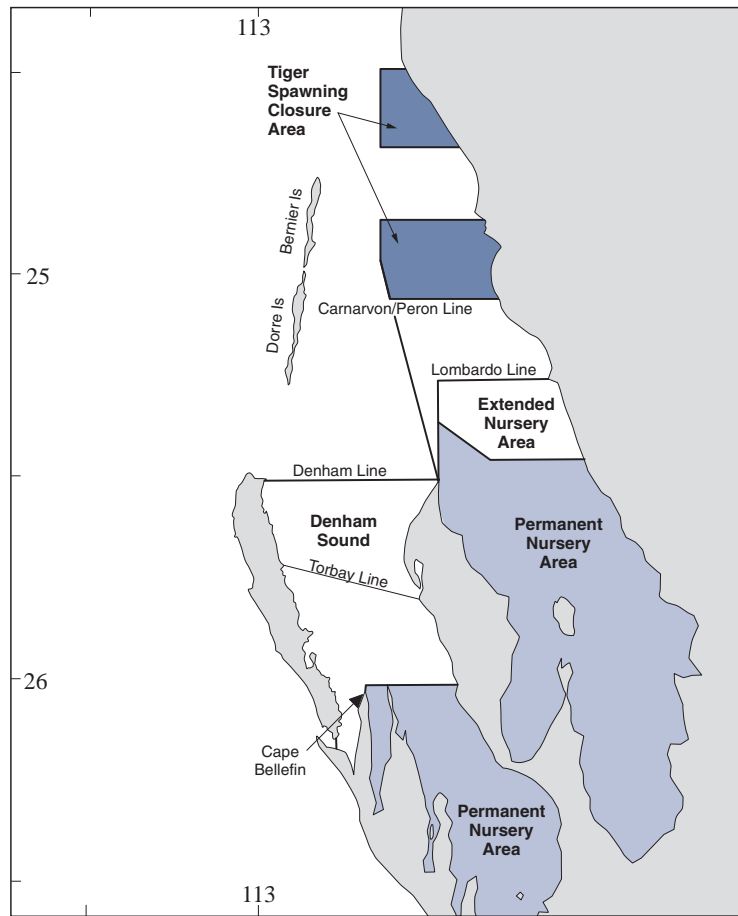
FISHERY GOVERNANCE**Acceptable catch range: 1,501–2,330 tonnes**

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), 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. While total prawn catches during 2001 were within the overall range set, the low tiger prawn catch fell outside the acceptable range for that species. This low tiger prawn catch had the effect of triggering the collaborative initiative with industry to strengthen the TPSA closure system.

EXTERNAL FACTORS

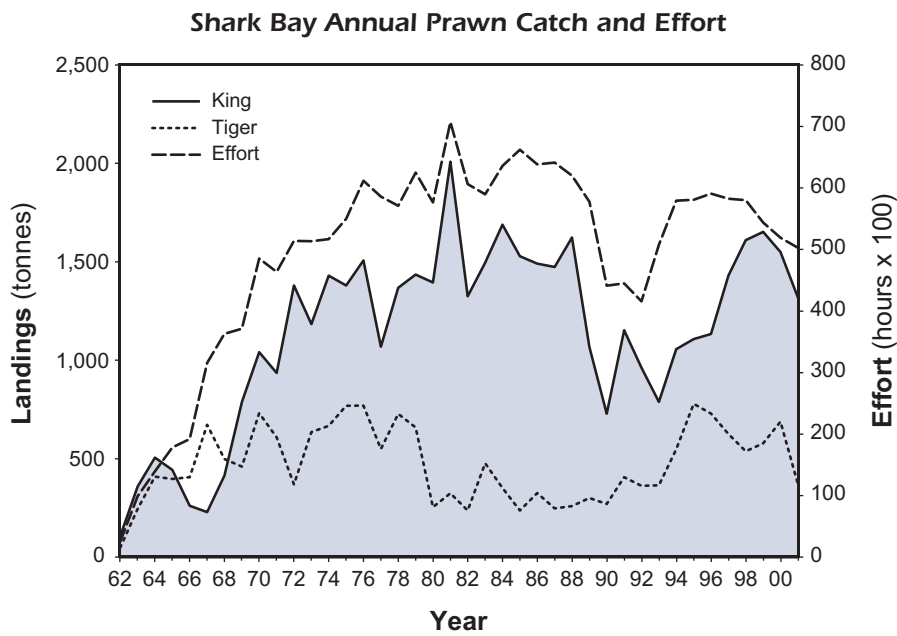
The catches of prawns in Shark Bay are particularly stable compared with other penaeid fisheries. The major environmental factor influencing these stocks appears to be the flow of the Leeuwin Current along the outside of the embayment. A relationship between current strength (as measured by Fremantle sea level) and king prawn catches has been identified and may be used to indicate catch trends. An ENSO (El Niño/Southern Oscillation) event is developing in 2002 that may result in a weaker Leeuwin Current and cause king prawn catches to be at the lower end of the range for the 2002 season.

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, 1962–2001.

EXMOUTH GULF PRAWN MANAGED FISHERY

Management Summary

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

The 2002 fishing season commenced on 6 April and is scheduled to close on 20 November. More flexible fishing arrangements are being trialled in the 2002 season in order to provide industry with the flexibility to maximise tiger prawn size (and hence market value) while maintaining the existing monitoring and tiger prawn breeding stock catch threshold protocols. A Memorandum of Understanding (MOU) between industry and the Department has been developed to ensure accountability over the trial period. The MOU provides a maximum of 199 fishing nights between the legislated opening and closing dates, with industry declaring closures based on prawn size/marketability and nominating non-fished nights as a replacement for legislated moon closures.

Management controls also include limited entry and gear restrictions as well as controls on vessel size and power. Licensees in the 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 in the fishery).

The Vessel Monitoring System was formally introduced to the fishery in the 2002 season by way of an amendment to the Exmouth Gulf Prawn Management Plan 1989. The VMS is being used to monitor both the legislated and MOU-based temporal and spatial closures.

Bycatch reduction devices (specifically grids) were also formally introduced to the fishery at the start of the 2002 season by way of a condition on the managed fishery licence. Vessels are required to tow a grid in half the number of nets being used (that is, one grid for two standard nets and two grids if using quad gear). Full implementation of grids is expected to occur in 2003. Similarly, it is expected that secondary bycatch reduction devices (for example, square mesh panels) will be trialled in the 2003 season.

The Exmouth Gulf Prawn Management Advisory Committee (EGPMAC) provides advice to the Minister on the management of the fishery. The MAC 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. During 2002, the Minister approved an amalgamation of the EGPMAC with the two Shark Bay trawl MACs, which should see the amalgamated MAC better positioned to focus on broad issues while detailed fishery management matters will be dealt with directly between the Department and licensees.

An ecological sustainability report was prepared in consultation with the various stakeholders and submitted to Environment Australia for continued listing of the fishery

products under the *Environment Protection and Biodiversity Conservation Act 1999*.

Governing Legislation/Fishing Authority

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

Consultation Process

Exmouth Gulf Prawn Management Advisory Committee
Department–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. A pre-season survey of some of the king prawn stocks was also undertaken in collaboration with industry to assist with harvesting strategies.

During the past year, collaborative research has continued 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 and monitoring of juvenile tiger prawn habitats.

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 2001 season. All boats towed 4.5 fathom quad gear (four nets).

The fleet commenced fishing on 10 April in Area A (predominantly king prawn grounds), but moved to Area B (predominantly tiger prawn grounds) on 15 April due to the small size of the king prawns. Areas B and C were then fished until 1 August. However, there were a series of industry surveys carried out in these areas in collaboration

with the Department of Fisheries' Research Division to determine specific areas where small-sized tiger prawns were located and these areas were avoided through voluntary closures. Area D opened on 28 May and remained open until the closure of the season. Fishing ceased in all areas on 17 November. The season officially closed at 8.00 a.m. on 23 November.

Main fishing method

Otter trawl.

RETAINED SPECIES

Commercial production (season 2001): 670 tonnes

Landings

The total prawn landings from Exmouth Gulf for the 2001 season were 670 tonnes, an increase on last year's combined landings of 565 tonnes. Lower than average catches were achieved for all major prawn species, with 330 tonnes of king prawns, 208 tonnes of tiger prawns and 131 tonnes of endeavour prawns landed (Exmouth Gulf Prawn Figure 2). One tonne of banana prawns was also taken. Although the king and tiger prawn catches were still low (below the acceptable range), there was an increase in the catch of both species compared to 2000 when catches were negatively affected by the impact of Cyclone Vance on the prawn habitat. The improvement in tiger prawn catch is considered to reflect the improvement in nursery seagrass habitat (discussed later).

Recorded landings of by-product were 43 tonnes of coral prawns, 10 tonnes of blue swimmer crab, 7 tonnes of squid, 6 tonnes of cuttlefish, 3 tonnes of shark, 2 tonnes of bugs and octopus and less than one tonne of mixed finfish species.

Fishing effort

Total nominal effort for the 2001 season was 27,043 hours. Two boats were removed from the fishery in 2000 to compensate for the full introduction of quad gear (4 x 4.5 fathom nets), with 6 fathoms less of overall headrope towed in the fishery during 2000 and 2001 compared to the period when 16 boats fished using twin gear (2 x 7.5 fathom nets). The comparable effort in twin-gear terms was 33,284 hours, which was slightly lower than in 2000 (33,741 hours).

Catch rate

The catch rates in twin-gear terms, after adjusting for changes in configuration from twin to quad gear, were 9.9 kg/hr for king prawns, 6.3 kg/hr for tiger prawns and 3.9 kg/hr for endeavour prawns. These catch rates were above those in 2000 but still below average.

Recreational component: Nil

Stock assessment complete: Yes

The king and tiger prawn stocks are 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 variably exploited depending on the abundance of the more valuable tiger prawns.

The king prawn catch in 2001 was just below the normal range for the second year, apparently due to flow-on negative effects from the severe Cyclone Vance in March 1999.

The tiger prawn stock during 2001 was also below the normal range, but is recovering from the cyclone-induced low of 2000. The damaging impacts of Cyclone Vance on nursery seagrass habitats severely affected recruitment in 2000, but some of the structured habitats inshore have since recovered, resulting in improved recruitment in 2001. Length-frequency distributions have also returned to a normal pattern, showing a higher proportion of recruits than residual prawns. The catch in 2001 was achieved while maintaining a significant biomass of spawning stock (approximately 100 tonnes) during the spring period (August to October).

The endeavour prawn stock was lightly fished in 2001, as much of its distribution overlaps that of the tiger prawns, on which the fishing effort for the season was low.

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 spawner biomass above the historically determined biological reference point, utilises a cut-off threshold catch rate of 16 kg/hr (standard twin gear). During 2001, tiger prawn catch rates were closely monitored from May to July 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 23 kg/hr, i.e. well above the threshold level. After consultation with industry, the tiger prawn area was reopened for three nights fishing (24–26 October) to allow excess breeding stock to be harvested.

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 breeding stock each year. Endeavour prawns are also considered to be resilient to fishing pressure due to their smaller size and similar low catchability to king prawns.

Projected catch next season (2002): 330–430 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 to November of the same year). For 2002, the projected tiger prawn catch is 330–430 tonnes.

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 continued in 2001 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 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 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 2001 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 2001:
\$9.5 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	\$14.05/kg
Tiger prawns	\$16.16/kg
Endeavour prawns	\$10.49/kg
Coral prawns	\$2.12/kg

FISHERY GOVERNANCE

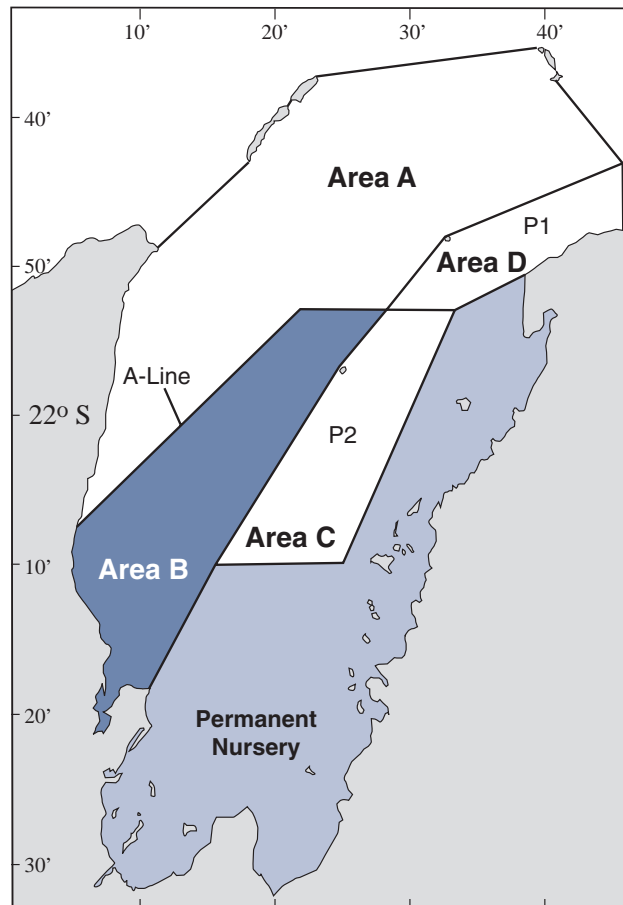
Acceptable catch range: **771–1,276 tonnes**

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

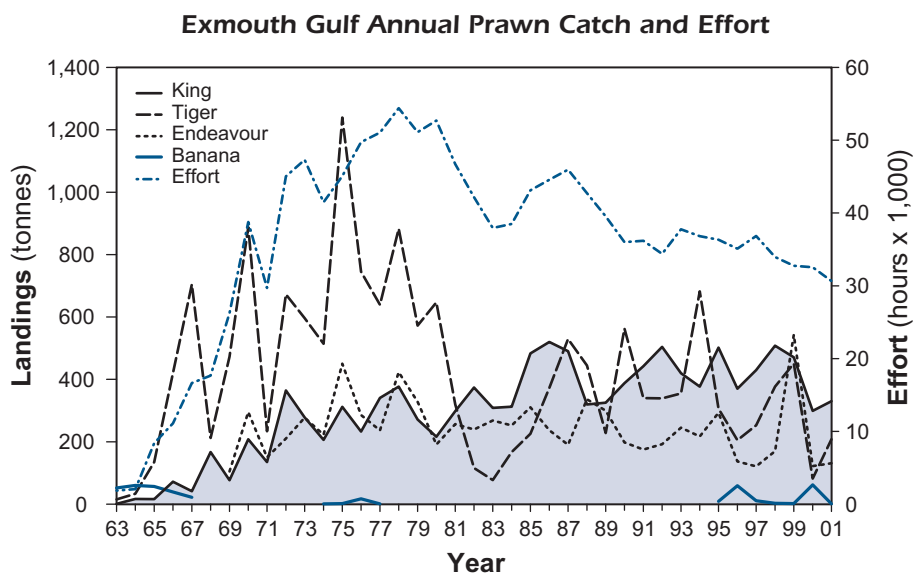
Changes to the nursery seagrass habitat in the eastern area of Exmouth Gulf following Cyclone Vance in 1999 appear to have had a significant effect on the productivity of the Gulf. Surveys of the juvenile tiger prawn habitat have been undertaken each spring since 1999 and are again planned for November/December 2002 to monitor the recovery of the habitat. The results of these CSIRO surveys between 1999 and 2001 indicate an increasing trend in seagrass biomass of 1.2% in 1999, 10.3% in 2000 and over 40% in 2001.

Thirteen boats continued to fish using quad trawl gear in 2001 under an exemption. This continues to be a 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, 1963–2001.

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 typically 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 2002 scallop fishing season commenced on 6 May and is scheduled to close on 21 October (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. Other management measures include limited entry, area closures, gear controls and crew limits.

Bycatch reduction devices (specifically grids) were formally introduced to the fishery at the start of the 2002 season by way of a condition on the managed fishery licence. Vessels are required to tow a grid in one of the two nets being used. Full implementation of grids is expected to occur in 2003.

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 (SBSMAC) provides advice to the Minister on the management of the fishery. The MAC 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. During 2002, the Minister approved an amalgamation of the SBSMAC with the Shark Bay Prawn and Exmouth Gulf Prawn MACs, which should see the amalgamated MAC better positioned to focus on broad issues while detailed fishery management matters will be dealt with directly between the Department and licensees.

An ecological sustainability report to Environment Australia was prepared in consultation with the various stakeholders for continued listing of the fishery products under the *Environment Protection and Biodiversity Conservation Act 1999*.

Governing Legislation/Fishing Authority

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

Consultation Process

Shark Bay Scallop 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 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 new project to determine biodiversity of bycatch in trawled and untrawled areas will commence in 2002.

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 2001 scallop season commenced on 28 April in Denham Sound, which was open for trawling for three days. Fishing for scallops then commenced on the main fishing grounds in Shark Bay on 1 May. Trawling for scallops by Class A boats had ceased by the end of June because of low catch rates. The Shark Bay scallop season officially closed on 28 October.

Main fishing method

Otter trawl.

RETAINED SPECIES

Commercial production (season 2001):
1,082 tonnes whole weight

Landings

The total scallop catch for this fishery was 1,082 tonnes whole weight, of which 60 tonnes were taken from Denham Sound during the three days of fishing in late April. This overall catch was lower than the acceptable range set but within the projected range based on the pre-season survey. The Class A fleet (all 14 boats fished in 2001) caught 694 tonnes whole weight or 64% of the total catch, with the Class B fleet taking 388 tonnes whole weight (Shark Bay Scallop Figure 1). Low quantities of by-product (4 tonnes of blue swimmer crabs and less than one tonne of bugs) were recorded for the Class A fleet during 2001.

Fishing effort

The total effort recorded by the Class A boats in 2001 was 8,645 hours, the lowest recorded since 1991.

Catch rate

A mean catch per unit effort of 80.5 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 was at the low end of the range, as measured using the data from the November 2000 scallop survey. This low recruitment, apparently due to environmental conditions, resulted in a 2001 catch that was slightly below the acceptable range set. This follows a strong Leeuwin Current in 1999 and 2000, a feature which has previously been correlated with low catch rates and is therefore not considered to reflect the impact of fishing. The survey design and analysis of the data are also being refined to provide separate catch forecasts for the Shark Bay and Denham Sound areas. This will allow separate opening dates to be determined for each area to optimise scallop catches each season. No fishing took place in Denham Sound between 1996 and 2000 due to low recruitment levels. More settlement of scallops was observed during the 2000 and 2001 surveys, hence the need for an assessment of scallop stocks in the entire Shark Bay scallop fishery.

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 2001 as a result of the low recruitment, it is considered adequate to provide recruitment in the normal range for 2002.

Projected catch next season (2002):
1,250–1,950 tonnes whole weight

The catch projection for the 2002 season is based on the November 2001 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 1,150–1,700 tonnes whole weight. Higher recruitment was observed in the Denham Sound area, giving a predicted catch range of 100–250 tonnes whole weight. The catch projection for the fishery as a whole is therefore in the range 1,250–1,950 tonnes whole weight.

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 2001, grid trials to minimise the capture of large animals were continued on Class A scallop boats, and full implementation is planned to take place in 2003.

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 2001 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 2001:
\$4.4 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 \$4.10/kg whole weight or \$20.50/kg meat weight. Meat weight is 20% of whole weight.

FISHERY GOVERNANCE

Acceptable catch range:

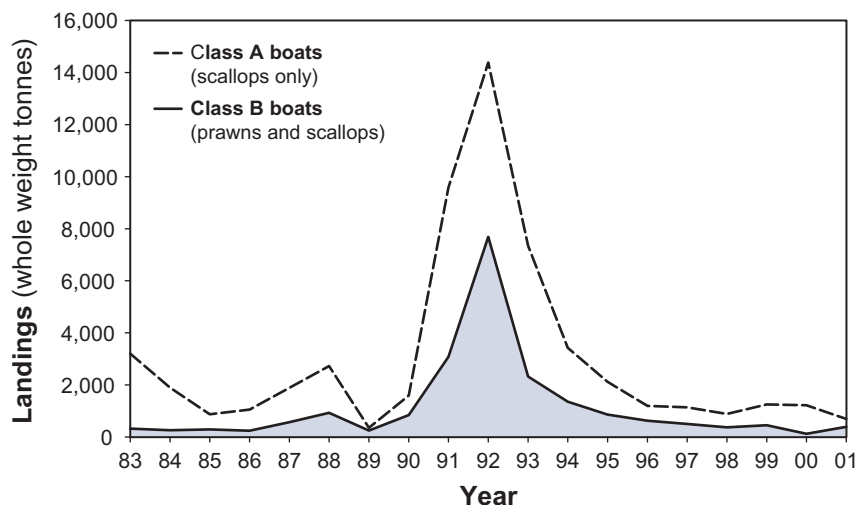
1,250–3,000 tonnes whole weight

The acceptable catch range is approximately 1,250–3,000 tonnes 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 lower end of this acceptable catch range. The 2001 catch of 1,082 tonnes was marginally below the acceptable range, but resulted from poor environmental conditions rather than the effects of fishing and is therefore not of concern to management.

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 1999–2001 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. An ENSO event is developing in 2002 that may result in a weaker Leeuwin Current and improved scallop catches in 2003.

Shark Bay Annual Scallop Catch



SHARK BAY SCALLOP FIGURE 1

Annual scallop landings by fleet for the Shark Bay Scallop Managed Fishery, 1983–2001.

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 currently takes a mixed catch of whiting (Sillaginidae), sea mullet (*Mugil cephalus*), tailor (*Pomatomus saltatrix*) and yellowfin bream (*Acanthopagrus latus*). Entry to the fishery is limited, with restricted, family-only transfers and gear/effort 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 local fish processing factory in Denham. Effort is primarily driven by market needs as opposed to fish availability, with catches

conforming to commercially acceptable size limits, which are frequently above the legal minimum size for species concerned.

Governing Legislation/Fishing Authority

Shark Bay Beach Seine and Mesh Net Management Plan 1992

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 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 -

- south of a line drawn from the northernmost point of Cape Inscription on Dirk Hartog Island due east to the mainland; and
- 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 2001, 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 2001):

All finfish 259 tonnes
Whiting 115.3 tonnes

Landings

Whiting is the main target species in Shark Bay, although the overall catch consists primarily of two species of whiting (*Sillago schomburgkii* and *S. analis*), 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 2001 were 115.3 tonnes of whiting. The 2001 total catch for the Shark Bay beach seine and haul net fishery of 259 tonnes has decreased from the 2000 reported catch (Shark Bay Beach Seine Figure 2). Among the landings of other species from this fishery, mullet (90.8 tonnes) ranked second to whiting, followed by tailor (26.1 tonnes) and bream (7.7 tonnes). There were 19 tonnes of fish of other species.

Fishing effort

During 2001, there was an average of seven boats fishing per month, expending a total of 1,241 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 2001.

Catch rate

The CPUE (based on nominal effort) for the whiting fishery has shown a rising trend over the past decade, although the catch rate declined slightly in 2001, to 93 kg/boat day. The CPUE for the overall Shark Bay beach seine and haul net fishery increased steadily between 1989 and 1995. Following the 1995 peak there has been a slight downward trend in the CPUE values. The current season catch rate was 208.7 kg/boat day (all species) (Shark Bay Beach Seine Figure 2).

Recreational component: < 5%

An estimate of the recreational component of the beach seine fishery based on the 1998/99 survey (Sumner et al. 2002) was provided in the *State of the Fisheries Report 2000/01*. This survey indicated that at that time the recreational share of the catch was less than 5% of the total catch. As another recreational survey has recently been completed, an update will be provided in next year's report.

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). Ongoing monitoring of the whiting catches to 2001 shows a general increasing trend in CPUE resulting from the reduced effort levels during the early 1990s. This indicates that the stock is being fished within its productive capacity at the current levels of effort.

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 it 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 2001, the average number of fishers in the Shark Bay Beach Seine and Mesh Net Fishery was 17. Fishing and associated local processing is one of the major sources of employment for the Denham community.

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year (2001):
All finfish \$750,000
Whiting \$414,000

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 catches occur outside of the range, changes to the management arrangements may need to be considered.

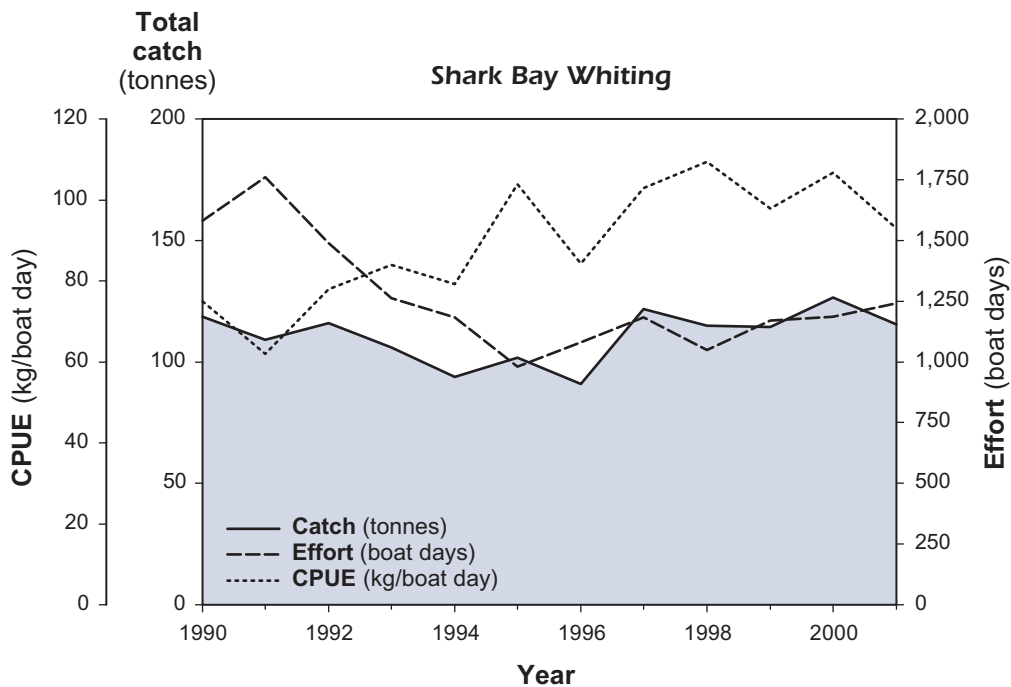
EXTERNAL FACTORS

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.

FISHERY GOVERNANCE

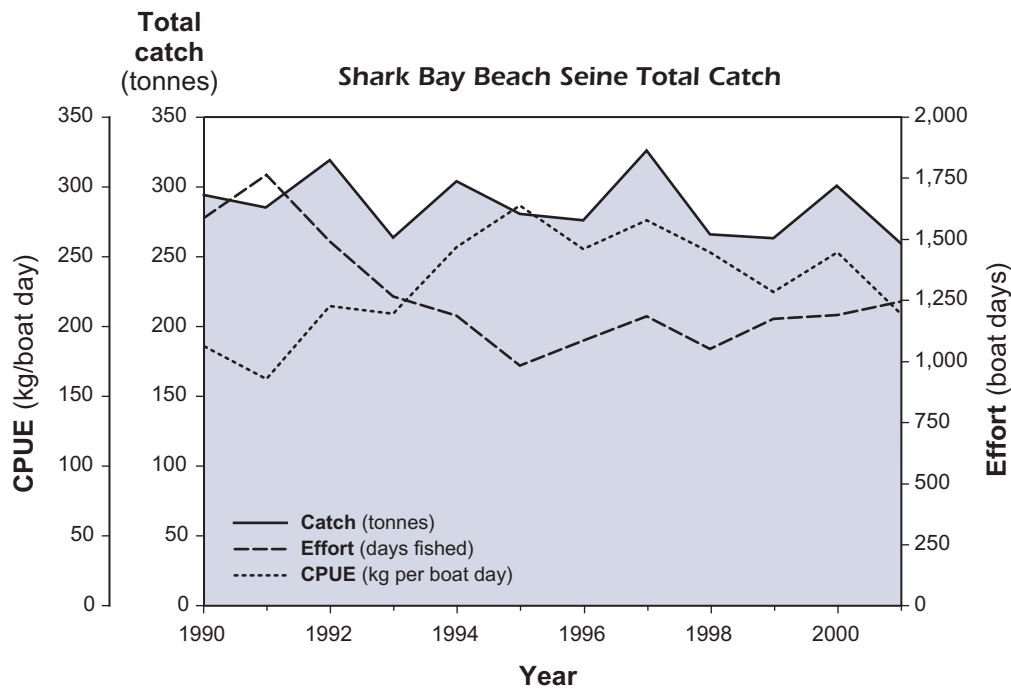
Acceptable catch range: **Whiting 95–140 tonnes**

The acceptable catch range under the current management regime is 95–140 tonnes of Shark Bay whiting. The



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 1990–2001.



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 1990–2001.

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 annual (1 September to 31 August) total allowable catch of pink snapper (*Pagrus auratus*) is currently set at 563,750 kg. There are 5,125 units in the fishery and the current value of each unit is 110 kg.

The amendment to the management plan simplified the complex management and administrative arrangements previously in place while providing more flexibility for both industry and the Department. However, a number of minor ‘teething problems’ with the new arrangements have occurred on both sides. In response, a working group comprising Departmental and industry personnel has been established to resolve the issues.

An ecological sustainability report was prepared in consultation with the various stakeholders for continued listing of the fishery products under the *Environment Protection and Biodiversity Conservation Act 1999*.

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 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 D. Gaughan

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 48 licences, but some boats have several managed fishery licences aggregated on one fishing boat licence. This total includes Shark Bay prawn and scallop trawlers, which are also permitted to catch up to one tonne of snapper per year. 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. Commencing in 2001, the whole year's catch is now subject to a single TAC and individually transferable quotas. The snapper quota for 2001 was set at 550 tonnes.

Main fishing method

Mechanised handline.

RETAINED SPECIES

Commercial production (season 2001):

Snapper 467 tonnes
Other species 105 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 2001 were slightly lower than the previous year, at 467 tonnes compared with 488 tonnes in 2000. The fact that the catch achieved was below the TAC was due to limited market capacity rather than availability of fish. The snapper fishery also took 105 tonnes of other finfish species in 2001, which is very similar to the catch 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 2001 was 894 standard May–August line boat days, compared with 851 days in 2000 and 712 days in 1999.

Catch rate

Catch per line boat day of the managed fishery licensed boats for the peak months (May–August) was 418 kg in 2001, approximately 30% lower than the average for the 1990s of 593 kg/boat day (Shark Bay Snapper Figure 1).

Recreational component: 4% (approx.)

The Gascoyne Recreational Fishing Survey, conducted between April 1998 and March 1999 (Sumner et al. 2002), 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 about 6 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. 147–150.

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 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.

SHARK BAY SNAPPER TABLE 1

Catches in the year 2001 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. 86–91).

SPECIES	TONNES
Spangled emperor <i>Lethrinus nebulosus</i>	20.4
Mulloway <i>Argyrosomus hololepidotus</i>	15.9
Sweetlip emperor <i>Lethrinus miniatus</i>	10.7
Red emperor <i>Lutjanus sebae</i>	9.1
Trevally, various	8.1
Cod, various	7.0
Goldband snapper <i>Pristipomoides multidens</i>	5.1
Rankin cod <i>Epinephelus multinotatus</i>	4.3
Dhufish <i>Glaucosoma hebraicum</i>	3.7
Pearl perch <i>Glaucosoma buergeri</i>	2.5
Cobia <i>Rachycentron canadum</i>	2.1
Tuna, various	1.8
Sea perch, various	1.5
Amberjack <i>Seriola dumeridae</i>	1.4
Flagfish <i>Lutjanus vitta</i>	1.4
Shark, various	0.6
Scalefish, other	9.4
Total	105.0

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 catch of non-retained 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 negligible 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

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 (2001):
\$2.6 million

The value of the pink snapper taken in the fishery was \$2.15 million, while other finfish species added a further \$450,000.

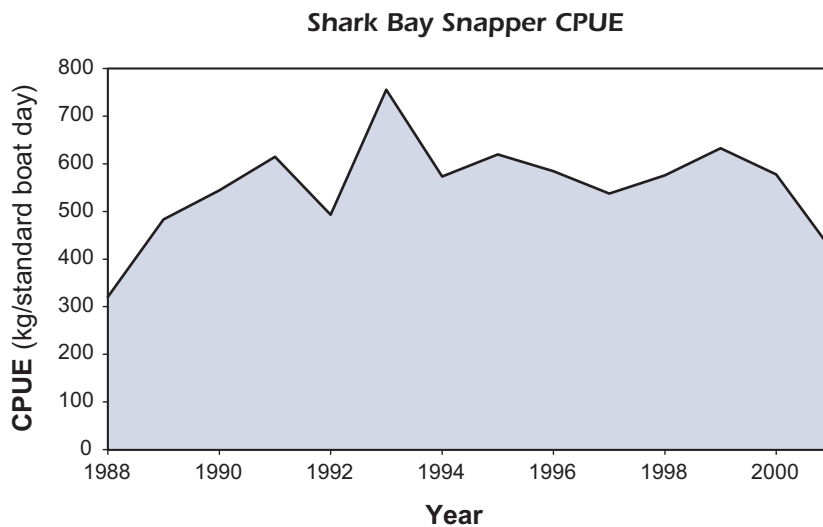
FISHERY GOVERNANCE

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 May–August line boat days. It is expected that the new management arrangements may encourage the Shark Bay prawn and scallop trawler fleet to utilise their share of the TAC (41 tonnes).

EXTERNAL FACTORS

Demand for snapper has been low in recent years and efforts are being made to develop overseas and Eastern States markets.



SHARK BAY SNAPPER FIGURE 1

Catch per unit effort by year from 1988 to 2001 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 from May to August, the CPUE for line fishing from May to August is used as the index of abundance.