

**BENTHIC PROTECTED ZONE OF THE  
GREAT AUSTRALIAN BIGHT MARINE PARK:  
2. MONITORING SUSTAINABLE USE**



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December 2003**

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National Parks and Wildlife South Australia  
Commonwealth Department of the Environment and Heritage**



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Benthic Protected Zone of the Great Australian Bight Marine Park: 2. Monitoring Sustainable-use

Report to National Parks and Wildlife South Australia (NPWS) and the Department of Environment and Heritage (DEH)

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Mr Peter Graham (Commonwealth Department of Environment and Heritage) and Mr Simon Clark (South Australian Department of Environment and Heritage) commented on drafts of the report. The report was formally reviewed by Dr Stephen Mayfield and Dr Keith Jones (SARDI Aquatic Sciences) and approved for release by Professor Anthony Cheshire (Chief Scientist, SARDI Aquatic Sciences).

## EXECUTIVE SUMMARY

1. The Great Australian Bight (GAB) supports five Commonwealth fisheries managed by the Australian Fisheries Management Authority (AFMA) and six major (and several minor) fisheries managed by Primary Industries and Resources South Australia (PIRSA). The main Commonwealth fisheries that operate in or near the Great Australian Bight Marine Park (GABMP) are the GAB Trawl Fishery (GABTF), Southern Bluefin Tuna Fishery (SBTF) and the Gillnet, Hook and Trap Fishery (GHTF, formerly the Southern Shark Fishery). The main South Australian (SA) fisheries in or near the GABMP are the Northern Zone Rock Lobster Fishery (NZRLF), Western Zone Abalone Fishery (WZAF) and Marine Scalefish Fishery.
2. Until 1998, up to 14% of demersal trawling by GABTF vessels in the GAB was conducted in the BPZ. Trawling is now prohibited in the BPZ. However, logbook data suggest that ~2% of trawling in the GAB in 2002 took place in the BPZ. Gear used in the GABTF may directly affect the structure and species composition of benthic communities. Trawling near the BPZ may also affect benthic communities within the GABMP. GABTF vessels may also interact with protected species near the GABMP. Park managers should work with the AFMA to ensure that these potential interactions are measured, assessed and, if necessary, mitigated.
3. Between 1976 and 1995, up to 25% of fishing for tuna in the GAB was conducted in the area that is now the GABMP. Since 1996, <11% of SBTF operations have occurred inside the GABMP boundaries. Purse-seining activities are unlikely to have significant effects on benthic communities in the BPZ. However, operational interactions between the fishing gear and protected species, such as pinnipeds or cetaceans, may occur. Park managers should also address this issue by working with the AFMA to develop strategies and methods to measure, assess and, if necessary, mitigate these potential interactions.
4. Fishers in the GHTF using gillnets and demersal longlines to target shark accounted for >95% of effort in the GAB between 1997 and 2002. Since 1997, gillnet fishers in the GHTF spent <5% of total fishing effort in the GAB within the BPZ. Effects of gillnetting on benthic communities are likely to be minimal. Operational interactions with protected species could be significant. However, no data are currently available for the area west of Ceduna. Park managers should work with the AFMA to address these potential interactions.
5. In comparison to the Commonwealth fisheries, the SA fisheries have relatively few interactions with the BPZ. Prawn trawling and fishing operations for giant crab, Australian salmon, sand crab and sardine are confined almost entirely to the area east of 131°E. Snapper, abalone and rock lobster are taken in small quantities from areas in or near the BPZ. Fishing

activities by marine scalefish and abalone fishers have few obvious implications for the GABMP. Rock lobster fishing is also a relatively benign activity. However, pinnipeds are occasionally caught and drowned in rock lobster pots, and park managers should work with PIRSA Fisheries to ensure that these interactions are addressed.

6. Logbook data currently recorded by Commonwealth fishers operating in and near the BPZ are not collated or reported to managers of the GABMP on a routine basis. Data on extractive activities in and near the BPZ are needed to provide a context for future assessments of the effectiveness of the GABMP in protecting benthic communities of the GAB. Routine reporting of fishing activities would be simplified by establishing statistical areas for collecting and collating data on fishing activities conducted in and near the GABMP.
7. Similarly, the spatial units in which SA fisheries data are currently collected and collated do not coincide with the boundaries of the GABMP. The use of these data for monitoring sustainable-use would be enhanced by the collection of data on the location (latitude, longitude) of fishing activities. As is the case for the Commonwealth fisheries, statistical areas should be established to distinguish between fishing activities in and near the GABMP.
8. A review of logbooks is needed for the Commonwealth and SA fisheries that operate near the GABMP, and should involve Park managers. As noted above, one of the major needs is for better spatial information on fishing activities undertaken in and near the GABMP. More detailed information is also needed on the characteristics of the fishing gear and the level of interaction with the substrate. Additional information on bycatch and discards is also needed. Information on the quantities and nature of sessile epibenthos caught in trawls may provide useful insights into the potential effects of GABTF trawlers on benthic communities. Logbooks should also be used to record detailed information on interactions with protected species, especially marine mammals and seabirds. However, logbook data alone will not be sufficient to effectively quantify these interactions. Observer programs will also be required and should be developed and conducted in conjunction with AFMA and PIRSA Fisheries. The observer programs should address both general bycatch issues and potential interactions with protected species.
9. The main priorities for future monitoring of the sustainable use of the GABMP are (i) to establish effective collaborations with AFMA and PIRSA Fisheries and (ii) to establish mechanisms that ensure appropriate data on fishing activities in and near the GABMP are collected and reported to the GABMP administration on a routine basis.

## GLOSSARY

<b>AFMA</b>	Australian Fisheries Management Authority
<b>AFZ</b>	Australian Fishing Zone
<b>BPZ</b>	Benthic Protection Zone
<b>CCSBT</b>	Commission for Conservation of Southern Bluefin Tuna
<b>CDEH</b>	Commonwealth Department of the Environment and Heritage
<b>CPUE</b>	Catch Per Unit Effort
<b>GAB</b>	Great Australian Bight
<b>GABMP</b>	Great Australian Bight Marine Park
<b>GABTF</b>	Great Australian Bight Trawl Fishery
<b>GHTF</b>	Gillnet Hook and Trap Fishery
<b>ITQ</b>	Individual Transferable Quota
<b>IQF</b>	Individual Quick Frozen
<b>KGW</b>	King George Whiting
<b>MSF</b>	Marine Scale Fishery
<b>NSW</b>	New South Wales
<b>NPWS</b>	National Parks and Wildlife Service
<b>NRIFS</b>	National Recreational and Indigenous Fishing Survey
<b>NZRLF</b>	Northern Zone Rock Lobster Fishery
<b>PIRSA</b>	Primary Industries and Resources of South Australia
<b>Qld</b>	Queensland
<b>SA</b>	South Australia
<b>SADEH</b>	South Australian Department of Environment and Heritage
<b>SARDI</b>	South Australian Research and Development Institute
<b>SBT</b>	Southern Bluefin Tuna
<b>SBTF</b>	Southern Bluefin Tuna Fishery
<b>SPF</b>	Small Pelagic Fishery
<b>SSF</b>	Southern Shark Fishery
<b>SSJF</b>	Southern Squid Jig Fishery
<b>TAC</b>	Total Allowable Catch
<b>TL</b>	Total-length
<b>VMS</b>	Vessel Monitoring Systems
<b>WA</b>	Western Australia
<b>WCPF</b>	West Coast Prawn Fishery
<b>WZAF</b>	Western Zone Abalone Fishery

## 1. INTRODUCTION

### 1.1 Background

This is the second report in a three part series on the Great Australian Bight Marine Park (GABMP) by the South Australian Research and Development Institute (SARDI), Aquatic Sciences (Fig. 1.1). The report collates and synthesises information on fishing activities in the Great Australian Bight (GAB), especially those that operate in or near the Benthic Protected Zone (BPZ) of the GABMP, and suggests options for monitoring future sustainable-use of the GABMP.

The GAB supports five Commonwealth fisheries managed by the Australian Fisheries Management Authority (AFMA) and at least six SA fisheries managed by Primary Industries and Resources South Australia (PIRSA). Fishing activities in Commonwealth waters of the GABMP are managed in accordance with regulations of the *Environment Protection and Biodiversity Conservation Act 1999* and under the GABMP Management Plan. The current management plan generally allows commercial fishing in the Commonwealth waters of the GABMP, in accordance with a permit issued by the Director of National Parks and Wildlife South Australia and the relevant Commonwealth or South Australian fishing licences. However, the management plan prohibits demersal trawling in the GABMP and fishing in the Marine Mammal Protection Zone (MMPZ) from May to October (Table 1,1). There are other specific requirements for commercial fishing under the management plan, regulations and permits (Table 1.1, see McLeay *et al.* 2003).

AFMA manages the Great Australian Bight Trawl Fishery (GABTF), Gillnet, Hook and Trap Fishery (GHTF, formerly the Southern Shark Fishery), Southern Bluefin Tuna Fishery (SBTF), Small Pelagic Fishery (SPF, formerly the Jack Mackerel Fishery) and the Southern Squid Jig Fishery (SSJF). The GABTF, GHTF and SBTF are the main fisheries that operate near the GABMP.

South Australia's fisheries are managed under the Fisheries Act (1982), which is administered by PIRSA Fisheries (PIRSA website, 2003). South Australian (SA) fisheries that operate in the GAB include: the Northern Zone Rock Lobster Fishery (NZRLF); Giant Crab Fishery; Western Zone Abalone Fishery (WZAF); West Coast Prawn Fishery (WCPF) and Marine Scalefish Fishery (MSF). Marine scalefish fishers mostly operate in inshore coastal waters of the eastern GAB and target snapper (*Pagrus auratus*), King George whiting (*Sillaginodes punctata*), gummy shark (*Mustellus antarcticus*), school shark (*Galeorhinus galeus*), Australian salmon (*Arripis truttacea*) and ocean jacket (*Nelusetta ayraudi*).

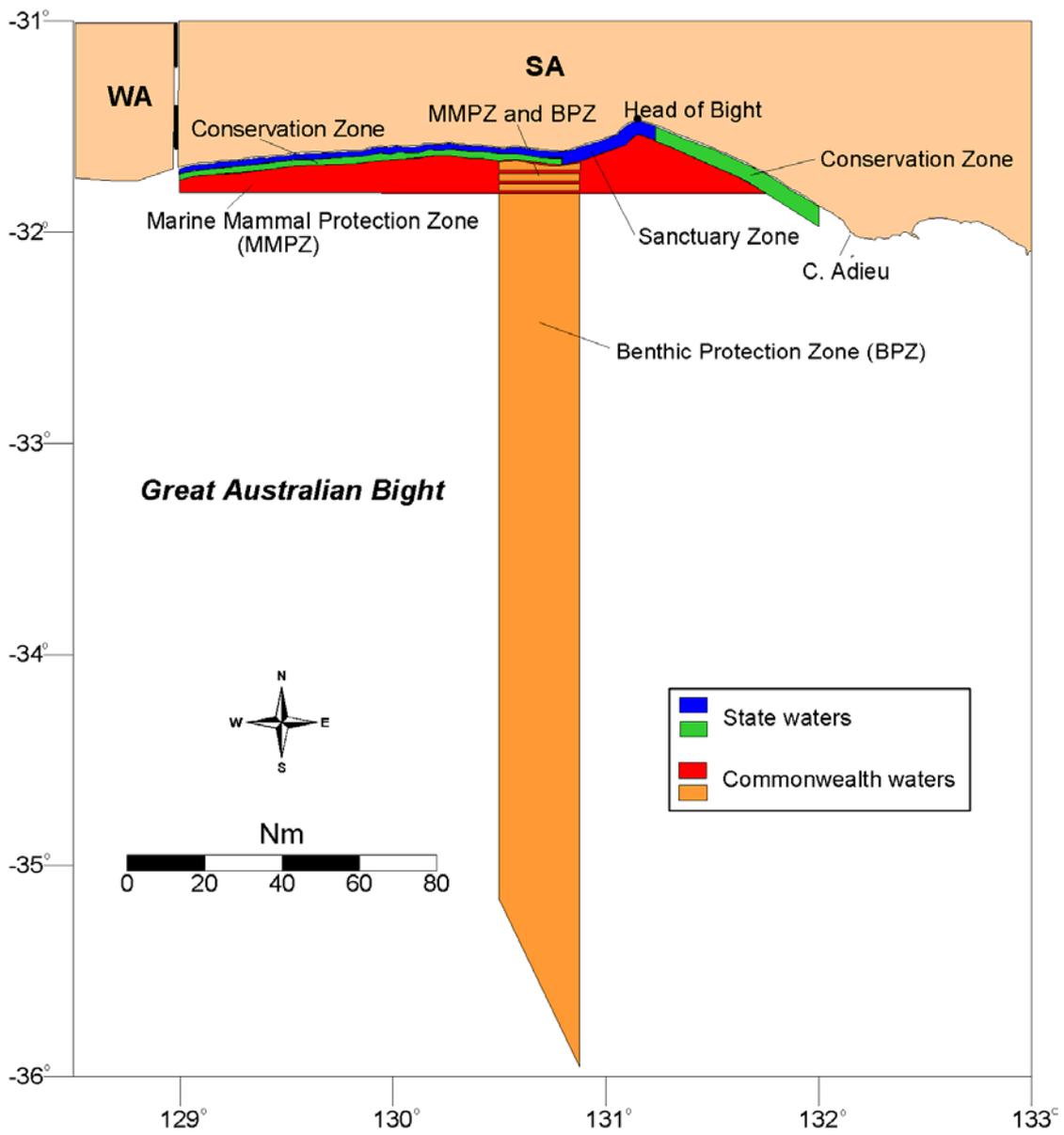
The eastern GAB also supports a significant recreational fishery and fishing-based tourism generates significant revenue for the region. Recreational anglers mostly target southern rock lobster (*Jasus edwardsii*), abalone (*Haliotis rubra* and *H. laevis*), snapper, King George whiting, Australian salmon, mulloway (*Argyrosomus hololepidotus*), several species of shark, and blue swimmer crab (*Portunus pelagicus*) in the GAB. Popular recreational fishing areas include the jetties and coastline along the eastern GAB and surf beaches from Almonta Beach on southern Eyre Peninsula to the GABMP Conservation Zone (west of Dog-Fence Beach) (Fig. 1.2). Several charter operators take fishing tours in the eastern and central GAB. Members of local aboriginal communities in the GAB fish from the shore, west of Ceduna. No region-specific catch and effort data are currently available for non-commercial sectors in the GAB.

## 1.2. Objectives

The objectives of this report are:

1. To describe the spatial and temporal patterns of fishing activities within the GAB.
2. To determine how existing fisheries data can be used to monitor the sustainable-use of the GABMP.
3. To identify additional data that are required to monitor fishing activities in the GABMP.
4. To assess the need for observer coverage of fishing activities within the GABMP.
5. To identify indicators for assessing the status of harvest, bycatch and discard species.
6. To recommend a program for monitoring sustainable-use of the GABMP.
7. To identify how the ongoing strategy for monitoring sustainable-use should be linked to performance assessment of the BPZ of the GABMP.

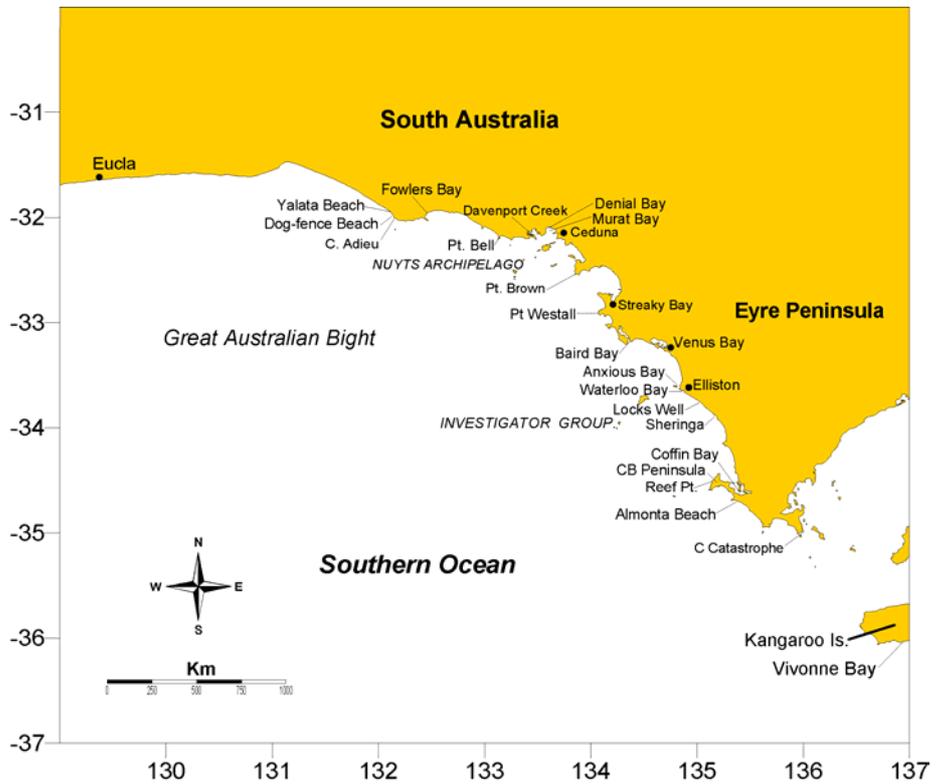
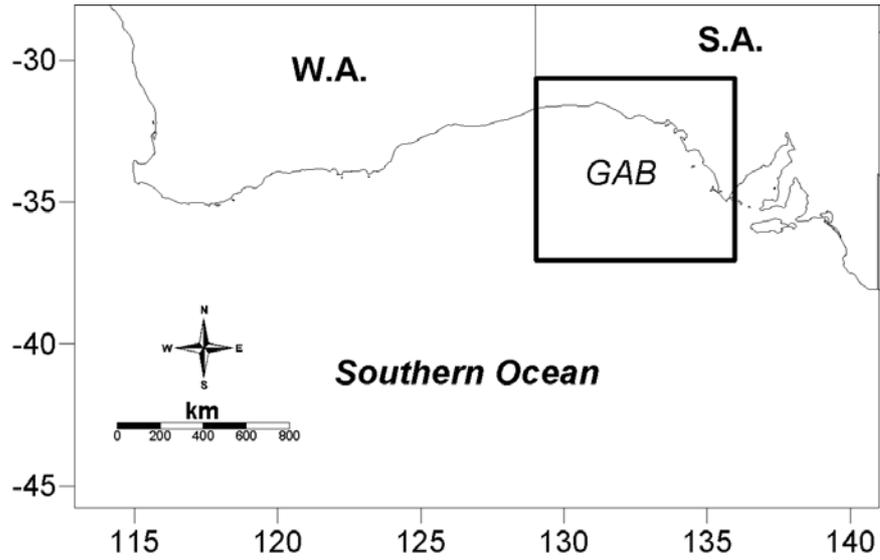
Catch, effort and catch-per-unit-effort (CPUE) data are presented for components of the Commonwealth and SA fisheries that are conducted in GAB waters between Cape Catastrophe and the South Australia/Western Australia border. It is important to note that the figures and tables presented in the report show the spatial and temporal patterns of fishing activities in the GAB, but do not provide a basis for inferring or assessing the status of stocks. Many factors other than stock abundance, including economic issues and gear technology, affect catches and CPUE. For example, recent increases in CPUE in the Commonwealth fishery for southern blue fin tuna (*Thunnus maccoyii*) reflect a change from line fishing to purse-seining rather than an increase in tuna abundance. The fishery descriptions include references for the most recent assessments reports for each stock.



**Figure 1.1.** Location and zonation of the GABMP in the Great Australian Bight (Sourced from SADEH website 2003).

Table 1.1 Regulations relevant to commercial and recreational fishing activities within each zone of the GABMP (Fig. 1.1, source SADEH website 2003).

	<b>Sanctuary Zone whales and sealions</b>	<b>Conservation Zones East and West</b>	<b>Marine Mammal Protection Zone</b>	<b>Benthic Protection Zone</b>
<b>Access to vessels</b>	Not permitted	Prohibited from May 1 to October 31	Prohibited from May 1 to October 31	Permitted except for overlapped area with MMPZ which is closed from May 1 to October 31
<b>Demersal trawling</b>	Not permitted	Prohibited from May 1 to October 31	Not permitted	Not permitted
<b>Commercial fishing (other)</b>	Not permitted	Prohibited from May 1 to October 31	Prohibited from May 1 to October 31.	Permitted except for overlapped area with MMPZ which is closed from May 1 to October 31
<b>Recreational fishing</b>	Shore based line fishing only	Shore based line fishing only	Subject to management plan	Subject to management plan



**Figure 1.2.** Location of the GAB in southern Australia (above). Locations important to commercial and recreational fisheries in the GAB (below).

## 2. COMMONWEALTH MANAGED FISHERIES

### 2.1 Great Australian Bight Trawl Fishery (GABTF)

#### 2.1.1 Overview

The GABTF is a multi-species fishery that operates from Kangaroo Island (138°08'E) in SA to Cape Leeuwin (115°08'E) in Western Australia, an area of approximately 812000 km<sup>2</sup>. This demersal trawl fishery is comprised of 10 vessels that operate on the continental shelf and slope at depths of 100 to 1000 m. The *FRV Endeavour* undertook the first demersal trawling in the GAB in 1912. However, until the 1980s commercial fishing in the GAB was restricted by the lack of suitable vessels and refrigeration facilities (Caton 2002; Maxwell 1981). Currently, vessels in the GABTF operate year-round in shelf waters and target deepwater flathead (*Neoplatycephalus conatus*) and Bight redfish (*Centroberyx gerrardi*). These species are targeted at depths of 120-160m. The slope fishery is seasonal and mainly targets orange roughy (*Hoplostethus atlanticus*) at depths between 200 and 1000 m. Fishing effort on the slope has decreased since the early 90s due to poor catches. The data presented on these fisheries was obtained from AFMA.

#### 2.1.2 Management

A management plan was developed for the GABTF in 1988 under the Commonwealth *Fisheries Act 1952*. In 1993, the GABTF became the first fishery to be managed under the Commonwealth *Fisheries Management Act 1991*. Access to the GABTF is currently limited to ten statutory fishing rights, and there are restrictions on vessel size (40 m) and cod-end mesh sizes. Trawl net designs vary between vessels in the GABTF, but most are cutaway wing trawls with headline lengths of 35-50 m, headline openings of 4.5-6.0 m and 10 cm mesh codends. Footrope lengths range between 18 and 58 m and warps used are typically 2000-2650 m in length (Newton and Klaer 1991). Nets are deployed from a large drum off the stern and trawl doors ranging in size between 3.6 and 4.3 m are used to spread the net during the trawl (Newton and Klaer 1991). Netsondes are deployed on the headline to monitor the vertical position of the net and duration of the trawl.

Under the *Environment Protection and Biodiversity Conservation Act 1999*, the management plan for Commonwealth waters of the GABMP prohibits demersal trawling within the GABMP and there are seasonal closures off the Marine Mammal Protection Zone (MMPZ) from May to October (Fig. 1.1).

#### 2.1.3 Interaction between the fishery and the GABMP

No trawling was conducted in inshore waters of the MMPZ between 1988 and 2002. In 1992, 14% of the trawling effort between Cape Catastrophe and the SA/WA border occurred in the area that has become the BPZ (Fig. 2.1). Since the BPZ was established, location data in logbooks (latitude,

longitude) suggest that trawling in the BPZ has decreased from 10.4% of effort in waters between Cape Catastrophe and the South Australia/Western Australia border in 1998 to 2% in 2002. However, no fishery independent measures of the level of trawling effort in the BPZ have been conducted.

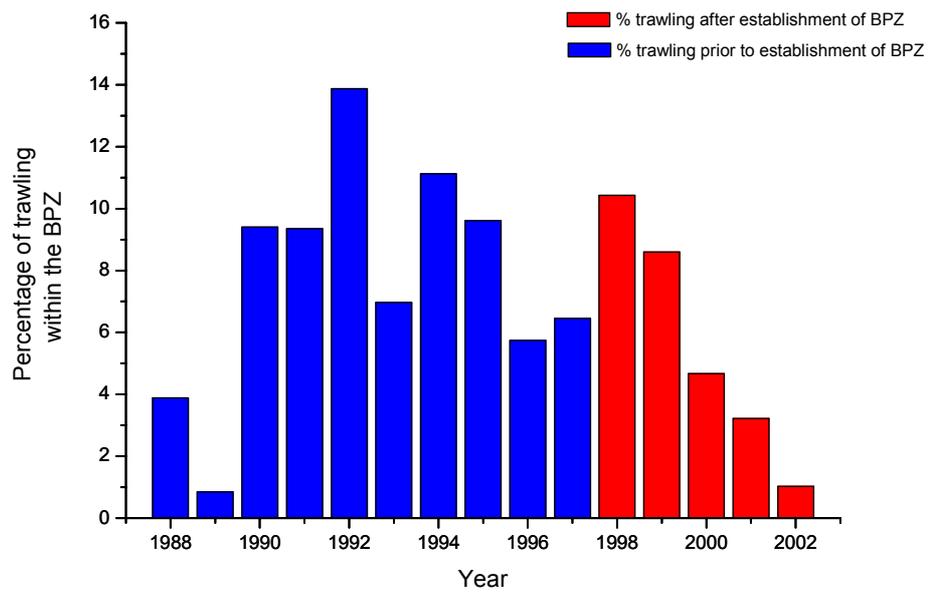
#### *2.1.4 Catch effort and CPUE by the GABTF in the GAB*

##### *2.1.4.1 Catch and effort within the GABTF*

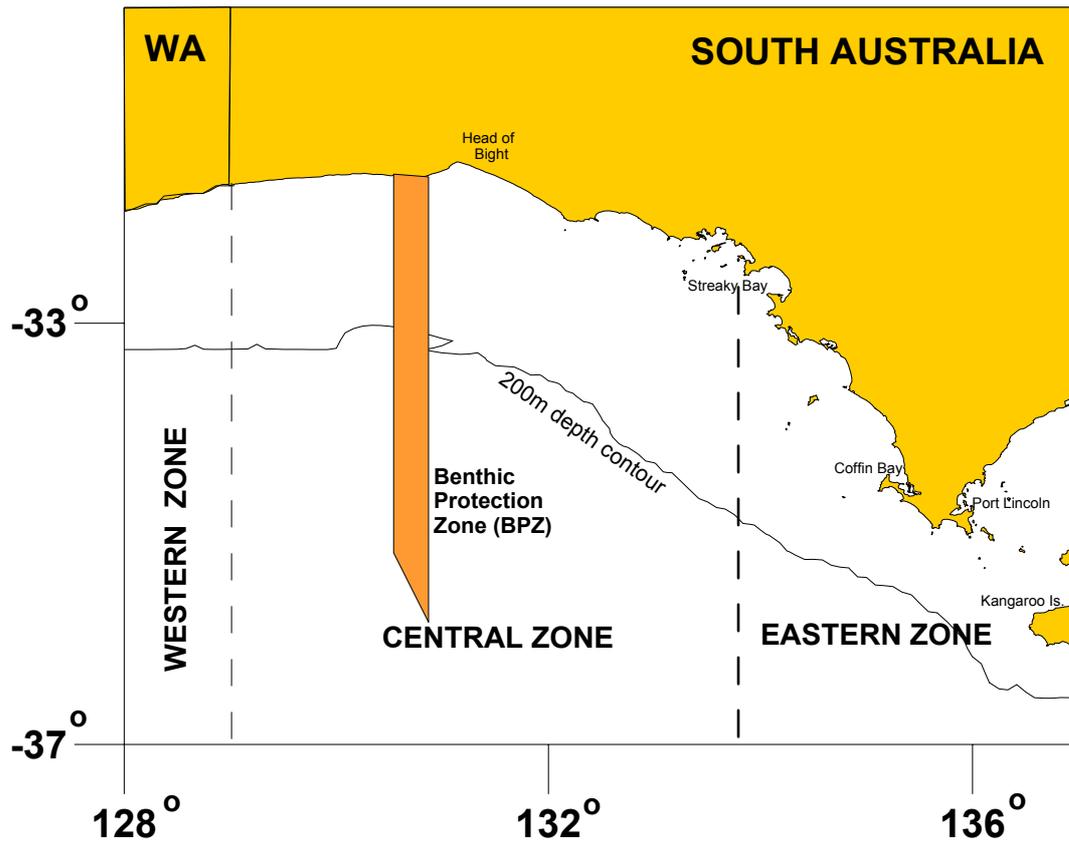
The total catch in the GABTF between 1988 and 2002 ranged from 13 tonnes in 1988 to 3913 tonnes in 1989. Over 100 species were landed between 1977 and 2002 (see Appendix 1). However, a small proportion of species comprised the majority of the catch, e.g. deepwater flathead and bight redfish comprised over 70% of the total catch (by weight) in 2002.

Most trawling occurs in the central zone (129-134°E) of the GABTF (Fig. 2.2 and 2.3). Between 1988 and 2002, >5500 trawl hours occurred annually in the central zone and <70 hours per year occurred in the eastern zone (Fig. 2.3). Trawl effort for orange roughy on the continental slope increased from 260 hours in 1988 to ~6000 hours in 1990 (Fig. 2.4). Since this period, GABTF operations have averaged >6000 hours per year. Operations are now confined mainly to shelf waters due to declining orange roughy catches on the slope. The number of vessels operating in the GABTF decreased from 31 in 1989 to 7 in 2002.

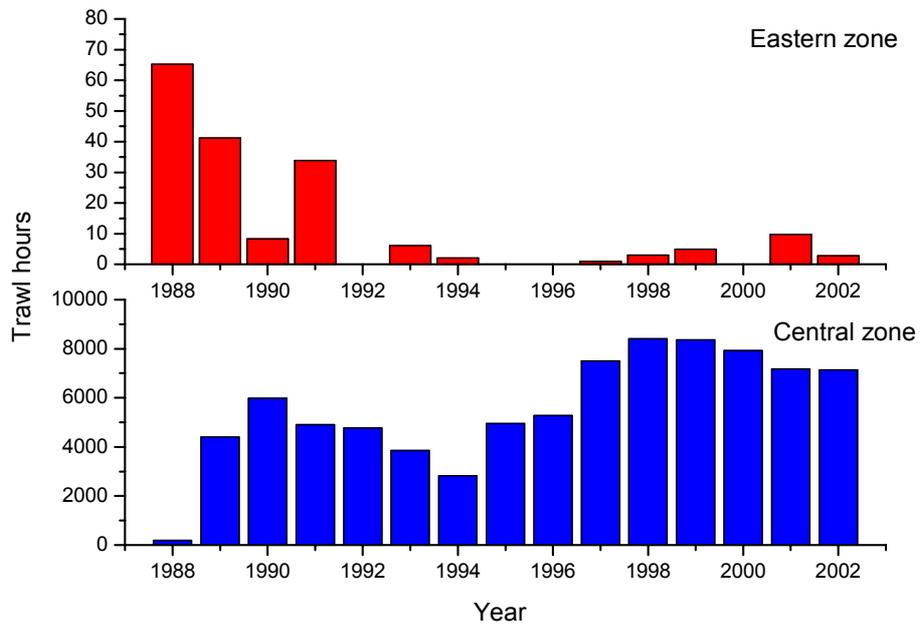
Catch effort and CPUE data for the main taxa taken by the GABTF between 1988 and 2002 are presented in Figs. 2.4-2.7. The composition of the retained catch is driven by market demand. Catches of low value species are often discarded and are therefore, likely to be under-reported.



**Figure 2.1.** Percentage of demersal trawling by GABTF vessels in the GAB conducted in the GABMP since 1988.



**Figure 2.2.** Zones of the GABTF as defined by Tilzey and Wise (1998). Note that the Western Zone is outside the region considered in this report.



**Figure 2.3.** Total annual fishing effort (trawl hours) in the eastern and central zones of the GABTF between 1988 and 2002.

#### 2.1.4.2 Catch and CPUE of orange roughy

The largest catches of orange roughy were taken in 1989/90 when aggregations were discovered on the continental slope of the eastern GAB. In 1989, catches and CPUE peaked at 3532 tonnes and ~800 kg trawl hr<sup>-1</sup>, respectively (Fig. 2.4). Since 1989, catches of orange roughy have decreased to <30 tonnes in 2000.

#### 2.1.4.3 Catch and CPUE of deepwater flathead

Catches of deepwater flathead in the GABTF increased steadily from 26 tonnes in 1989 to >590 tonnes in 1995 as operations shifted from the continental slope to shelf waters (Fig. 2.4). Catches steadily decreased to 320 tonnes in 2001, before increasing to >500 tonnes in 2002. CPUE peaked at 120 kg trawl hr<sup>-1</sup> in 1994 (Fig. 2.4). CPUE decreased from 119 to 45 kg trawl hr<sup>-1</sup> between 1995 and 2001, but increased to >70 kg trawl hr<sup>-1</sup> in 2002. CPUE in the late 1980s may be underestimated, as target effort was not recorded accurately.

#### 2.1.4.4 Catch and CPUE of bight redfish

Catches of bight redfish increased in the early 1990s due to spatial shifts in trawl operations. Catches peaked at >250 tonnes in 1991 and decreased to ~100 tonnes between 1992-1996 (Fig. 2.4). Catches increased to ~300 tonnes per annum from 1997 to 2001, but decreased to <170 tonnes in 2002. CPUE increased from <10 kg trawl hr<sup>-1</sup> in 1989 to >50 kg trawl hr<sup>-1</sup> in 1991 (Fig. 2.4). Since 1991, CPUE has remained relatively stable, ranging from 22 to 46 kg trawl hr<sup>-1</sup>.

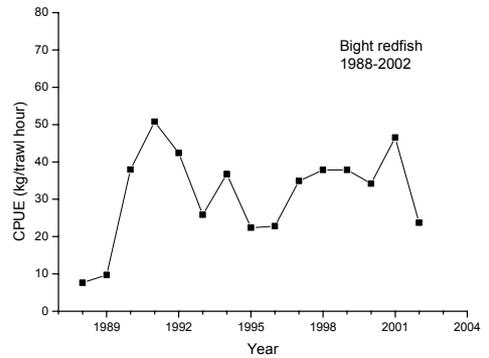
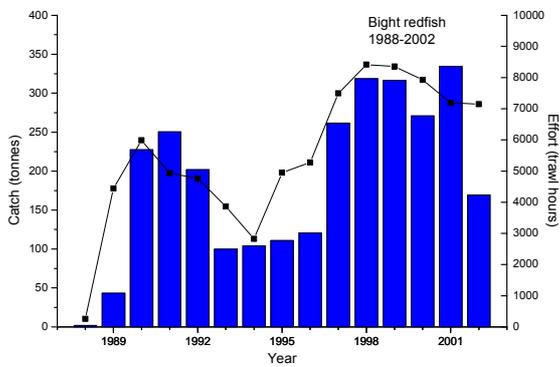
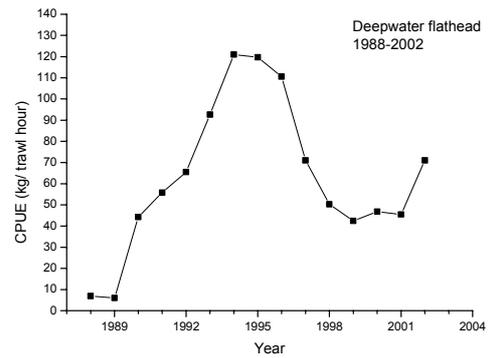
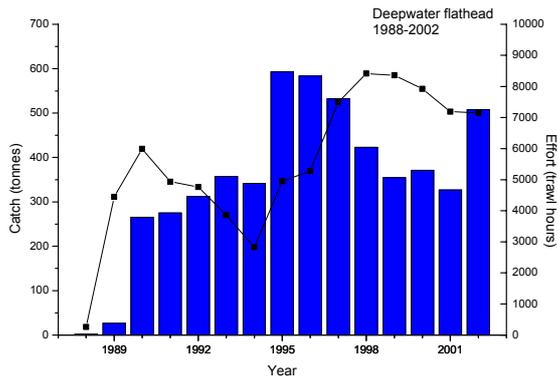
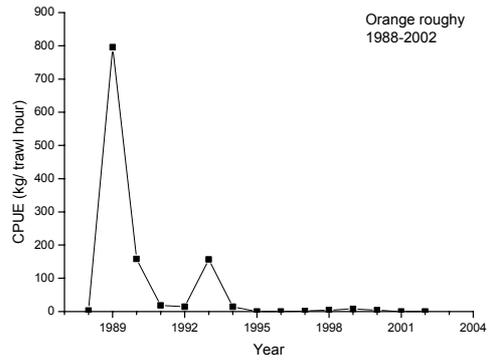
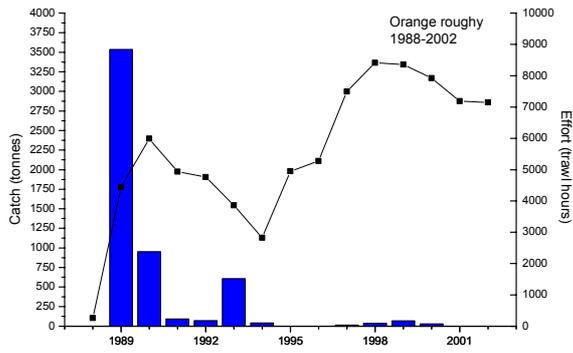
#### 2.1.4.5 Catch and CPUE of other species caught in the GABTF

Large quantities of angel shark (Family Squatinidae), ocean jacket (*Nelusetta ayraudi*), jackass morwong (*Nemadactylus macropterus*), squids (*Sepioteuthis australis* and *Nototodarus gouldi*), knifejaw (*Oplegnathus woodwardi*), latchet (*Pterygotrigla polyomata*), Queen snapper (*Nemadactylus valenciennesi*) and yellow spotted boarfish (*Paristiopterus galliparvo*) are taken in GAB shelf waters. Annual catches and CPUE of these species increased as effort on the shelf increased in the early 1990s and decreased between 1998 and 2002 (Figs 2.5-2.7). In 2002, “other” species comprised approximately 25% of the total catch (by weight) of all species taken in the GABTF. Catches of oreo and dory (Families Oreosomatidae and Zeidae) peaked in 1989 at >200 tonnes, as these species were common bycatch components while trawling for orange roughy (Fig. 2.6). CPUE for oreos and dory also peaked in 1989 at >200 kg trawl hr<sup>-1</sup>.

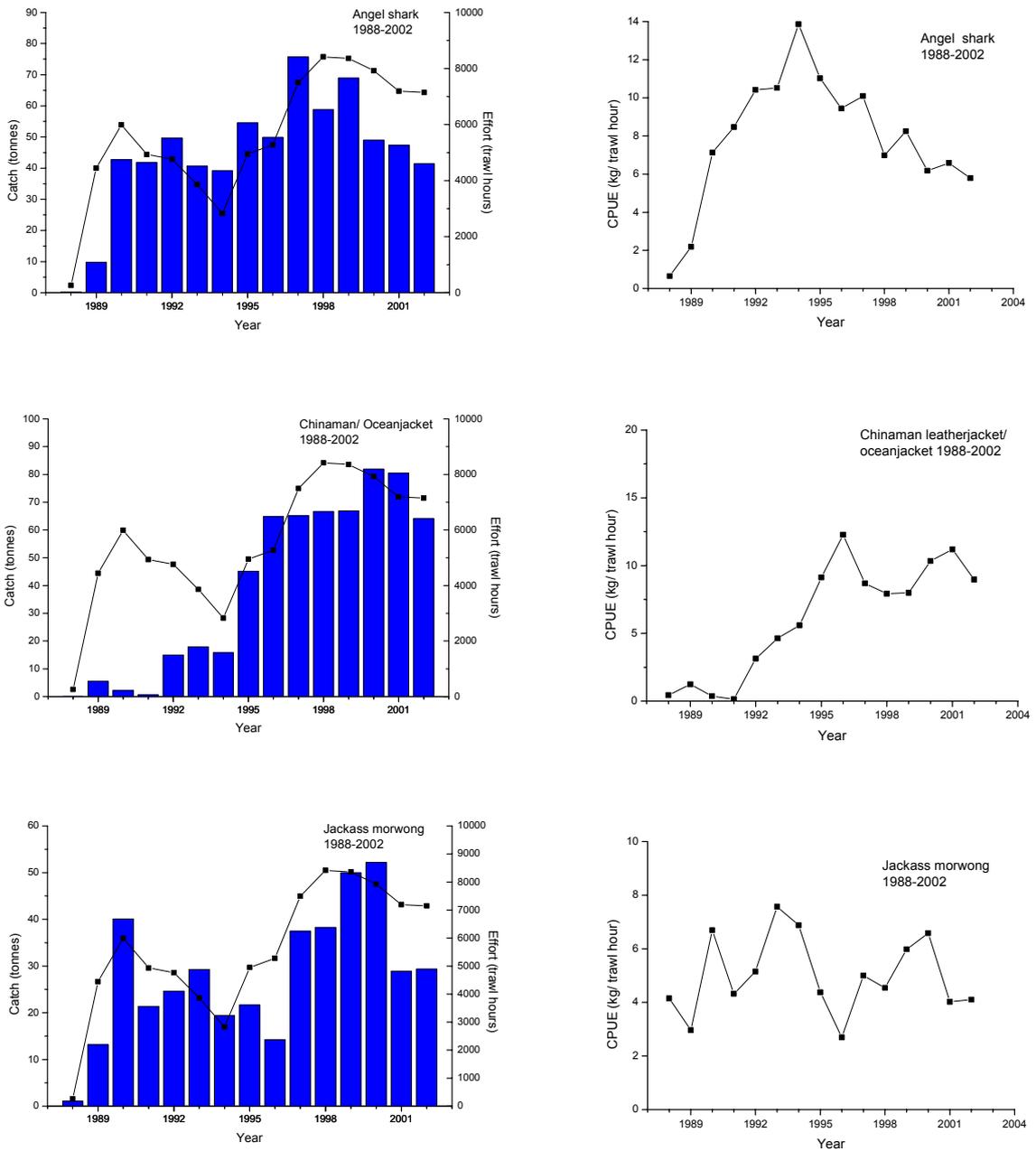
Catch of all “other” species (see species list Appendix 1) taken in the GABTF peaked in 1990 at over 163 tonnes (Fig. 2.8). However “other” species accounted for <5% of the total catch by weight in 2002.

### *2.1.5 Bycatch and discard issues*

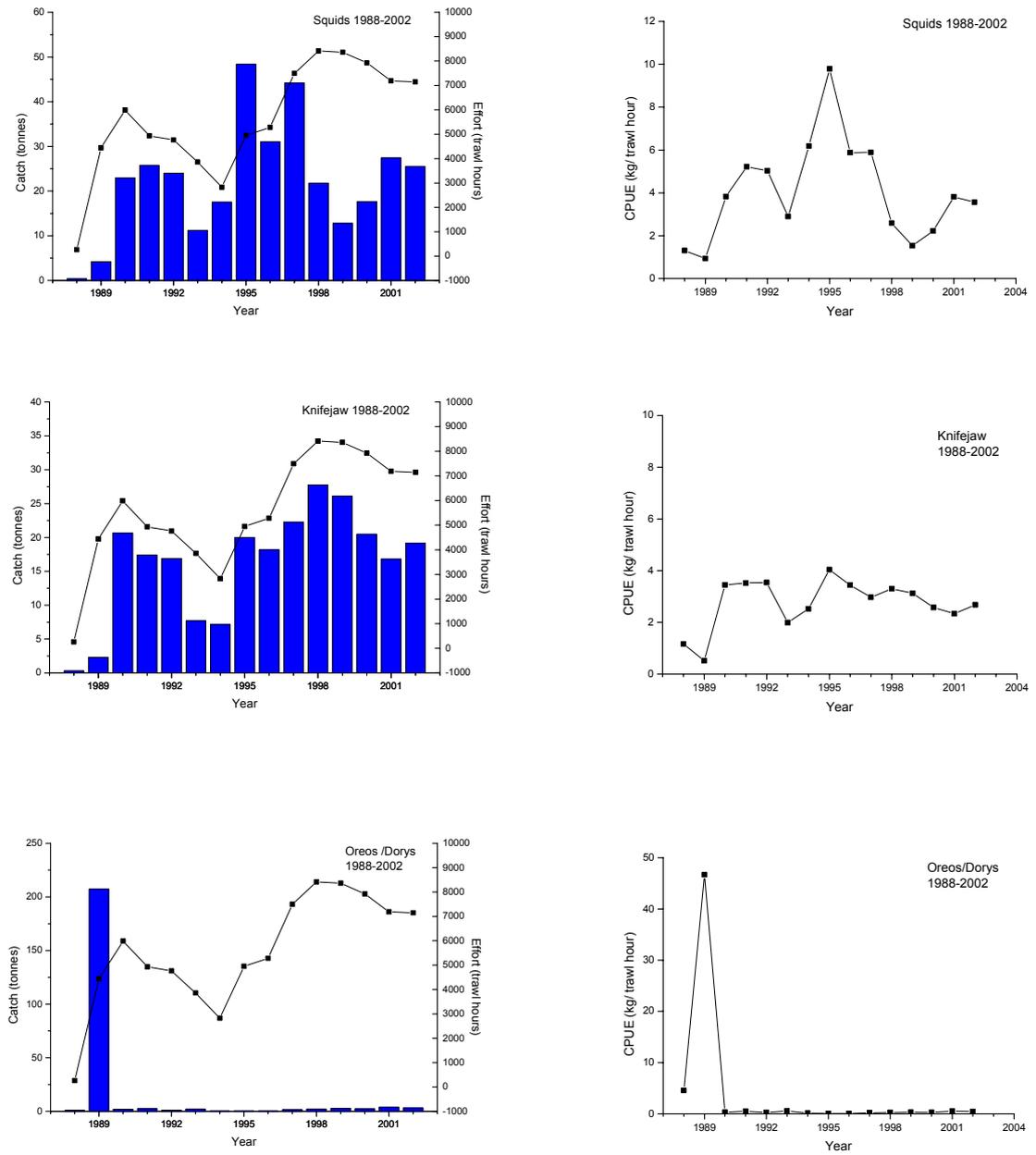
Information on the fate of non-target catch and discards in the GABTF is limited. Knuckey and Brown (2002) collected spatial and temporal information on the quantity and species composition of retained and discarded species. Over 160 species were identified. Species composition varied among areas. Up to 82 species were retained and 137 species were discarded. Current discarding practices by commercial operations are specific to particular vessels. Some data on discards are recorded in logbooks, but have not been verified by independent observers. Rates of capture of protected species in trawls by GABTF vessels are unknown.



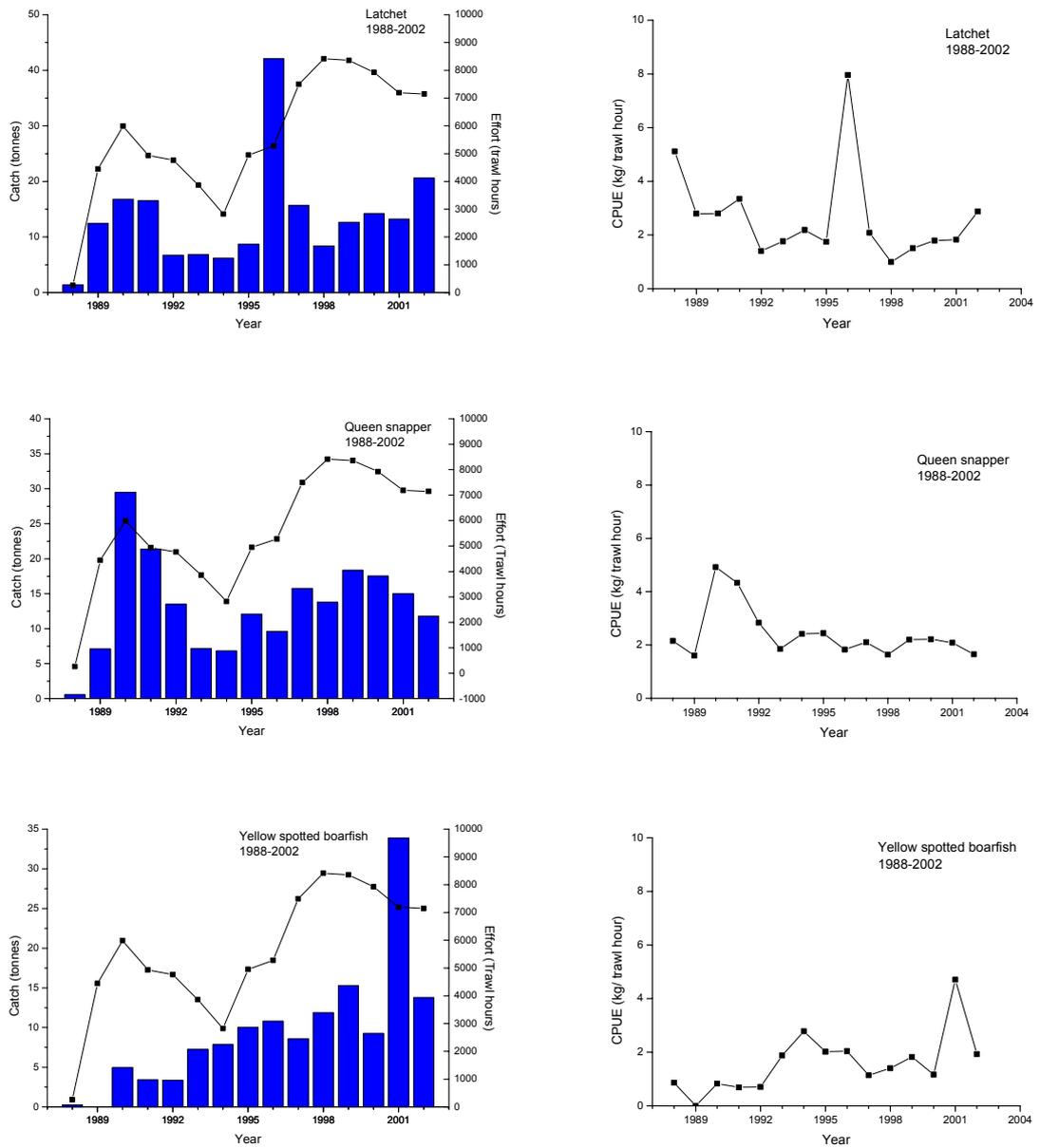
**Figure 2.4.** Catch, effort and CPUE for orange roughy, deepwater flathead and bight redfish in the GABTF from 1988-2002.



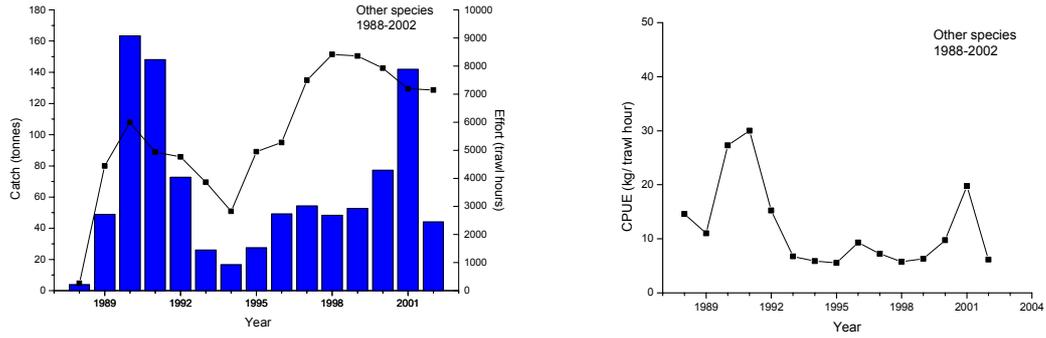
**Figure 2.5.** Catch, effort and CPUE for angelshark, oceanjacket and jackass morwong in the GABTF from 1988-2002.



**Figure 2.6.** Catch, effort and CPUE for squid, knifejaw and oreo/dory in the GABTF from 1988-2002.



**Figure 2.7.** Catch, effort and CPUE for latchet, queen snapper and yellow spotted boarfish in the GABTF from 1988-2002.



**Figure 2.8.** Catch, effort and CPUE for all ‘other species’ in the GABTF from 1988-2002.

## 2.2 Gillnet Hook and Trap Fishery (GHTF)

### 2.2.1 Overview

In early 2003, the South East Non-Trawl and Southern Shark Fisheries were merged to form the Gillnet Hook and Trap Fishery (GHTF). The GHTF operates from Sandy Cape in southern Qld to the SA/WA border. This fishery includes scalefish hook, shark hook, gillnet and trap sectors, which have access to different areas depending on gear endorsements and entitlements held by individual licencees. In the eastern GAB, fishers mainly use gillnets and demersal longlines to target shark. Small quantities of blue-eye trevalla (*Hyperoglyphe antarctica*), gemfish (*Rexea solandri*) and hapuku (*Polyprion oxygeneios*) are also taken in the eastern GAB by demersal longline and dropline operations.

Shark fishing operations are conducted as far south as the AFZ boundary (200 nm from coast) and as far west as the SA/WA border. Historically, shark fishers used longlines to target school shark. By the 1970s, gillnetting was the main fishing method and gummy shark was the main target species (Caton 2002). Most operations in the eastern GAB now target gummy, school and whiskery sharks. Other species taken include bronze whaler shark, saw shark spp., elephant fish (*Callorhinchus milii*), and dogfish (Families Daliitidae and Squalidae). Since the 1980s, the proportion of school shark in the catch has decreased dramatically. An assessment undertaken in 1991 indicated that school shark was severely overfished, with the total biomass reduced to 10-25% of the estimated virgin level (Caton 2002). In 2000, the total shark catch of the GHTF had an approximate value of \$A13.8M.

### 2.2.2 Management

The GHTF is managed by AFMA on behalf of the Commonwealth using entry restrictions, input controls on gear type, minimum legal lengths and TACs. In 2001, management arrangements were altered to include State waters within a 3 nm limit. The permanent transfer of shark quota is currently a controversial issue, and is subject to ongoing legal challenges (Galeano *et al.* 2003). In 2002, species-specific quotas were set for gummy (1700 t) and school (327 t) shark. Quotas also apply to bycatch of these species in the GABTF. Introduction of quotas and trigger levels is also being considered for other shark species taken in the GHTF (Caton 2002). Due to the Offshore Constitutional Settlement for school and gummy shark, some operators have access to these species in coastal waters (inside 3nm) of South Australia (AFMA Website 2003).

Commercial fishing is prohibited inside the Sanctuary Zone of the GABMP at all times and in the Conservation Zone and Marine Mammal Protection Zone (MMPZ) from May 1 until October 31 (Fig 1.1 and Table1.1). Fishing is permitted in the Benthic Protection Zone, except in the area that

overlaps the MMPZ, which is closed from May 1 to October 31. Exclusion of the GHTF fishery from these zones was intended to minimise interactions with cetaceans and pinnipeds. All netting is prohibited in State waters inside Murat Bay at Ceduna within following the geographic boundaries: from Point Brown (32° 32'35"S, 133° 50'50"E) to the southern point of the Franklin Island Group (32° 28'20"S, 133° 37'50"E) and then to Point Bell (32° 12'31"S and 133° 07'36"E).

Participants in the shark fishery may target sharks using the gear types specified on individual permits (AFMA website 2003). Gillnetting is the dominant fishing method in the GAB and permit holders are allowed up to 4200 m of monofilament gillnet in Commonwealth waters and 1,800 m in State waters (Caton 2002). Mesh sizes must be  $\geq 15$  cm and  $\leq 16.5$  cm. Nets are usually anchored to the bottom with weights and marked by flagged buoys while the vessel anchors or drifts nearby. Shark gillnetting is excluded from waters  $< 41^\circ\text{S}$  and at depths  $> 200$  m (AFMA website 2003).

Handlines and setlines, including demersal longlines, droplines and trotlines, can be used in the GHTF. Setlines are anchored to the seabed and marked by large floats with flags, while the vessel anchors or drifts nearby. Baited hooks on short (0.5-2m) steel or monofilament traces are fixed to the main lines (rope) by stainless steel clips. The length of time of each "set" varies, depending on the region and bottom type, target species and robustness of bait. No limits apply to the number of hooks that can be set outside the 3nm limit.

Five operators in the GHTF are permitted to use steel-framed fish traps. These traps are baited and lowered to the bottom attached to ropes and the position of each trap is marked using a buoy. Entitlement to this method was only granted to participants that had prior access to this gear type (AFMA website 2003). No further entitlements to fish traps will be issued to participants in the GHTF and no traps can be set at latitudes  $< 42^\circ 22'\text{S}$ .

### 2.2.3 Interaction between the fishery and the GABMP

Location data from logbooks (latitude, longitude) suggest that  $< 5\%$  of fishing effort by vessels the GHTF was conducted in the BPZ between 1997 and 2002 (Fig. 2.9). The spatial distribution of fishing effort cannot be reported in detail due to confidentiality issues.

### 2.2.4 *Catch, effort and CPUE by the GHTF in the GAB*

#### 2.2.4.1 Total effort within the GHTF

Gillnet operations targeting shark accounted for over 95 % of effort in the eastern GAB between 1997-2002. Gillnet effort reached a peak of 1712 boat days in 1998 but decreased to 735 days in 2000. Since 2000, effort has increased steadily reaching 854 days in 2002 (Figs. 2.10, 2.11 and 2.12).

#### 2.2.4.2 Catch and CPUE of school and gummy shark

Catches of school shark by gillnet operations in the eastern GAB decreased from 220 tonnes in 1997 to 59 tonnes in 2002 (Fig. 2.10). CPUE for school shark also decreased from 220 kg.day<sup>-1</sup> in 1997 to <70 kg.day<sup>-1</sup> in 2002. Conversely, gummy shark catches and CPUE have steadily increased since 1997, peaking at over 275 tonnes and 364 kg.day<sup>-1</sup> in 2001, respectively (Fig. 2.10). It should be noted that catches in 2002 were the lowest for five years and that CPUE decreased to approximately 235 kg.day<sup>-1</sup>.

#### 2.2.4.3 Catch and CPUE of whiskery and bronze whaler shark

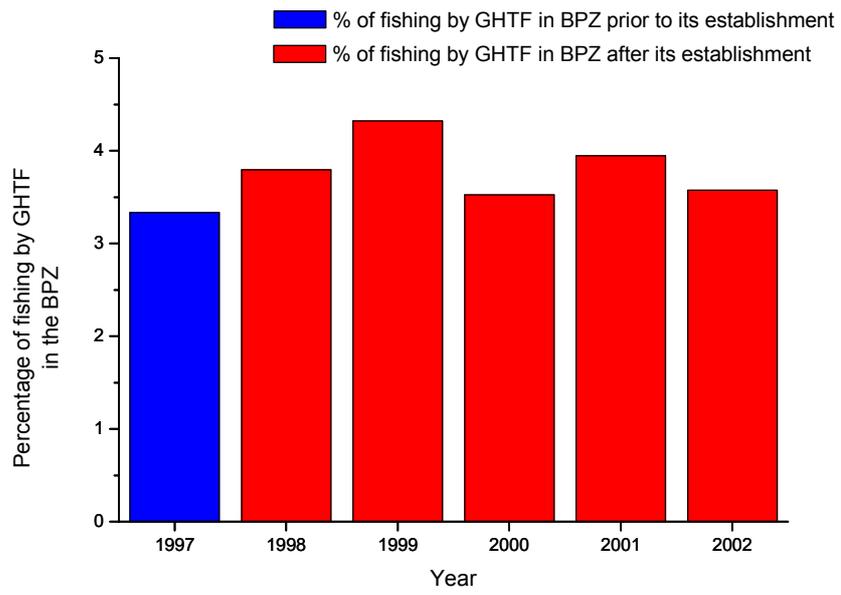
Catches of whiskery shark have been in steady decline since 1998 reaching ~34 tonnes in 2002 (Fig. 2.11). CPUE for whiskery shark decreased from >58 kg.day<sup>-1</sup> in 2000 to <40 kg.day<sup>-1</sup> in 2002. Catches of bronze whaler shark have fluctuated since 1997. Catches were lowest at approximately 13 tonnes in 1998 but reached 33 tonnes in 2001. CPUE for bronze whaler increased from 8 kg.day<sup>-1</sup> in 1998 to >40 kg in 2001. During 2002, CPUE decreased to 32 kg day<sup>-1</sup>.

#### 2.2.4.4 Catch and CPUE for “other species” in the GHTF

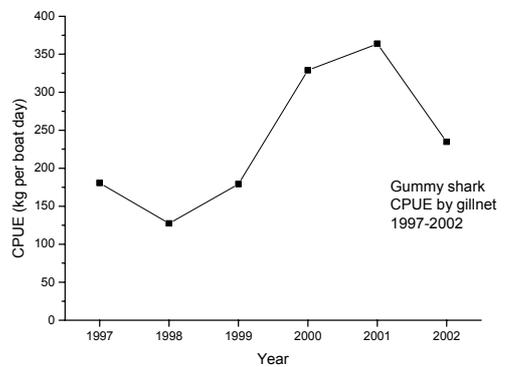
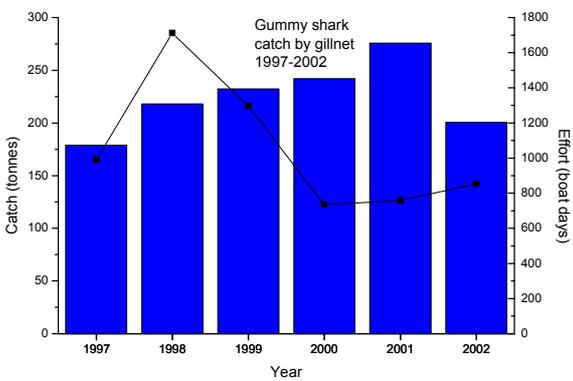
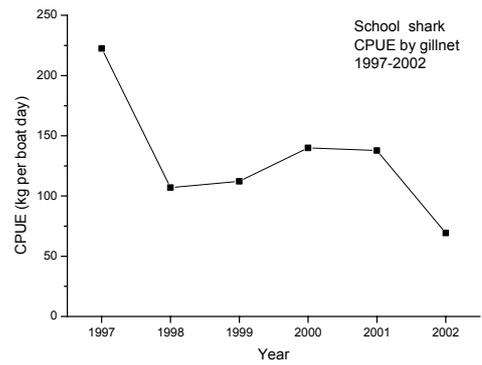
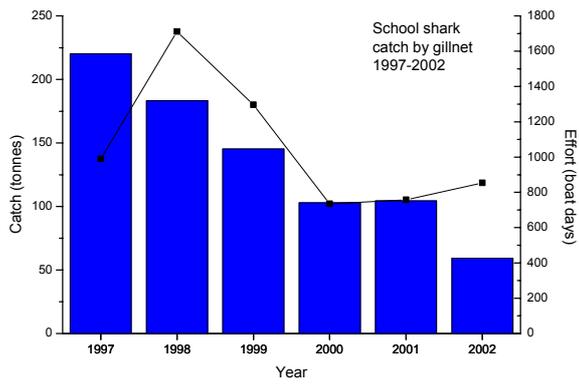
The main “other species” taken in the GHTF are saw shark, hammerhead shark (*Sphyrna* spp.), sevengill shark (*Notorynchus cepedianus*) and small quantities of redfish (*Centroberyx gerrardi*), Queen snapper (*Nemadactylus valenciennesi*) and elephantfish (*Callorhinchus milii*). Catches of “other species” by the GHTF increased from 28 tonnes in 1997 to >40 tonnes in 1999, and remained relatively consistent from 1999 to 2002 (Fig. 2.12). Similarly, CPUE reached >50 kg day<sup>-1</sup> in 2000 and has remained at this level ever since. Data on catch and CPUE of “other species” should be treated with caution as under-reporting of bycatch and discards may occur.

#### 2.2.4.5 Bycatch and discard issues

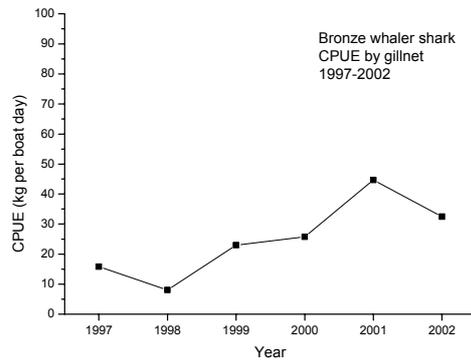
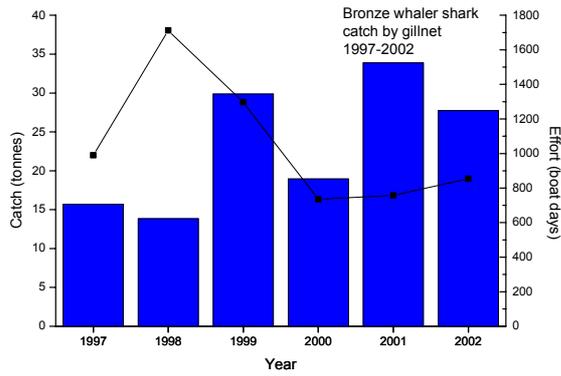
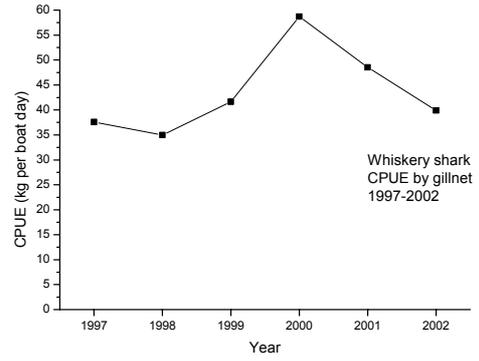
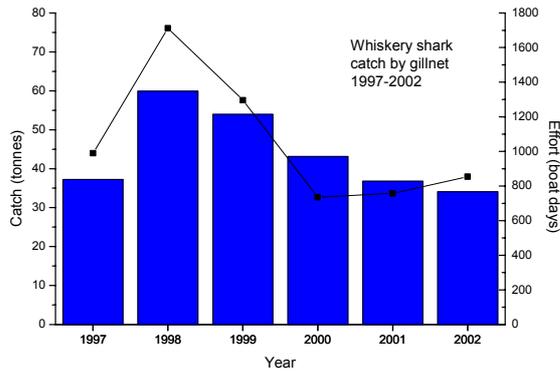
There is no information available on non-target catch in the eastern GAB, prior to 1997. Some logbook data are available on species retained as non-target catch since 1997, yet this information should be interpreted with caution, as retention and discard practices vary between vessels. The fate of the discarded catch is unknown. Shark species with no commercial value may be released (Harris and Ward 1999). A list of the taxa reported as retained bycatch in the GHTF is provided in Appendix 2. Anecdotal reports suggest that incidental catches of great white shark (*Carcharodon carcharias*), bottlenose dolphin (*Tursiops truncatus*), New Zealand fur seal (*Arctocephalus forsteri*) and Australian sea lion (*Neophoca cinerea*) may occur, but no data are available on catch rates.



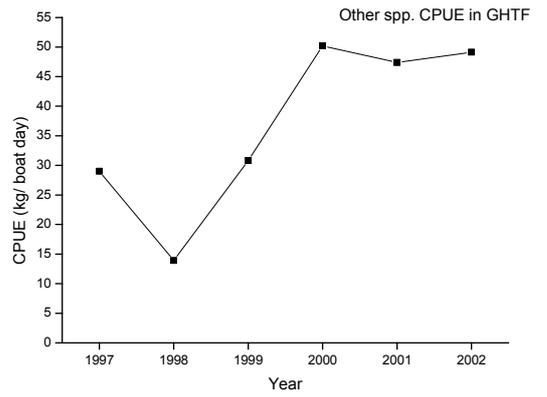
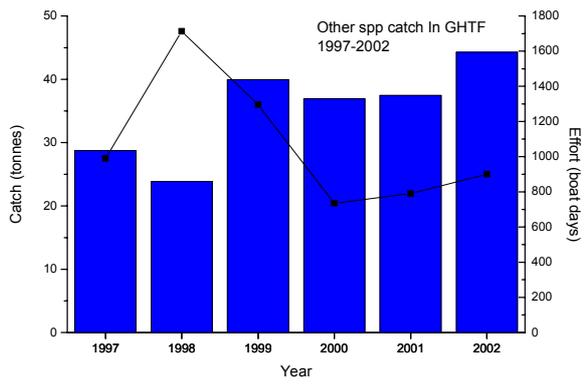
**Figure 2.9** Percentage of fishing carried out by the GHTF in the BPZ since 1997.



**Figure 2.10.** Catch, effort and CPUE for school and gummy shark caught by Commonwealth gillnet operations in the eastern GAB between 1997 and 2002.



**Figure 2.11.** Catch, effort and CPUE for whiskery and bronze whaler shark caught by Commonwealth gillnet operations in the eastern GAB between 1997 and 2002.



**Figure 2.12.** Catch, effort and CPUE for other species caught by Commonwealth GHTF operations in the eastern GAB between 1997 and 2002.

## 2.3 Southern Bluefin Tuna Fishery (SBTF)

### 2.3.1 Overview

The SBTF began as a pole-and-line fishery in NSW, SA and WA in the 1950s. Purse-seining was developed in the mid 1970s and was the dominant fishing method by the early 1980s. The NSW fishery collapsed in the early 1980s, when the occurrence of surface schools of SBT declined dramatically. Poling ceased in WA in 1983, when quotas were introduced. Japanese longliners operated in the Australian Fishing Zone until 1997. Some domestic pelagic longliners still operate in the eastern GAB, however purse-seiners in SA now take ~95% of the Australian TAC (5265 tonnes in 2000) (Caton 2002).

In SA, tuna taken in the eastern and central GAB are transferred to pens in Port Lincoln where they are held and conditioned for approximately six months. In 1999-2000, over 5000 tonnes of SBT were transferred to farms. The total value of exports from tuna farms in 1999/2000 was ~\$A280 million (Caton 2002).

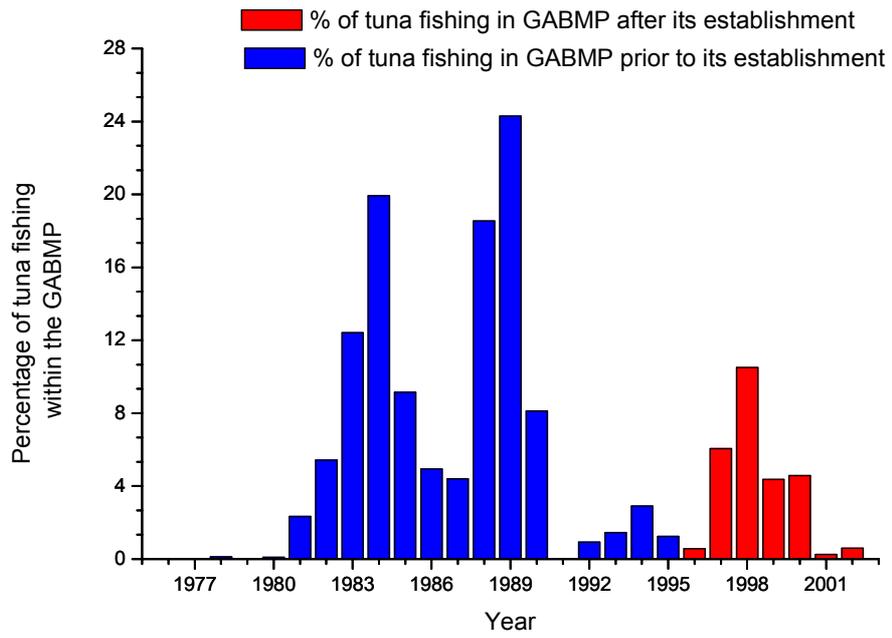
Pelagic longline vessels in the GAB take small quantities of broadbill swordfish (*Xiphias gladius*), bigeye (*Thunnus obesus*) and albacore tuna (*Thunnus alalunga*). Purse-seiners are reported to periodically take schools of skipjack tuna (*Katsuwonus pelamis*).

### 2.3.2 Management

The SBTF is managed by the Commission for the Conservation of Southern Bluefin Tuna (CCSBT). The commission was established in 1994 and receives advice from a scientific committee of member-country scientists and independent international scientists (Caton 2002). From 1989 to 1997, the CCSBT set catch limits in Australia, Japan and New Zealand. Since 1997, no agreement on catch limits has been reached and in the late 1990s approximately half of the global catch of SBT was not controlled by the CCSBT. The CCSBT has been urging non-member countries to join the Commission or to cooperate with international management measures. Member countries are considering trade restriction measures against countries that ignore CCSBT directives (Caton 2002). The TAC in Australia is set at 5265 tonnes and has not changed since 1989-90.

### 2.3.3 Interaction between the fishery and the GABMP

Few fishing operations target tuna within the GABMP. Between 1976 and 1995, up to 25% of annual purse-seine, pelagic longline and pole fishing for SBT occurred within the area that is now the GABMP (Fig. 2.13). Since 1996, <11% of all tuna fishing operations were carried out within the boundaries of the GABMP. Purse-seining and pelagic longlining and are now the major fishing methods used by the SBTF.



**Figure 2.13** Percentage of tuna fishing carried out since 1976 within the area that is now the GABMP.

### 2.3.4 Catch effort and CPUE by the SBTF in the GAB

#### 2.3.4.1 Catch effort and CPUE of SBT

Due to confidentiality issues, catch and effort data for this fishery was pooled by gear type.

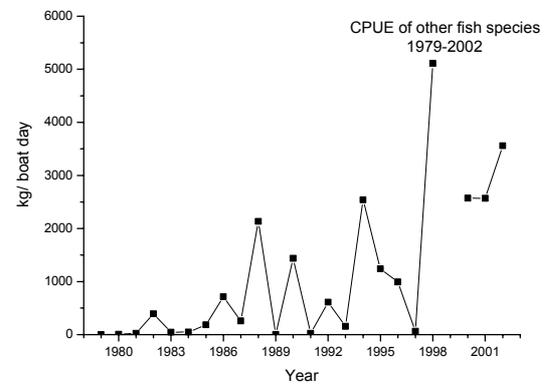
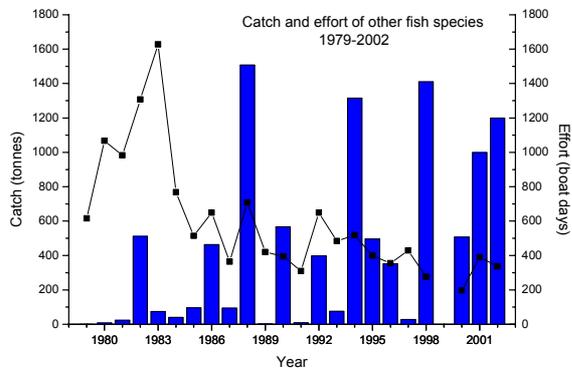
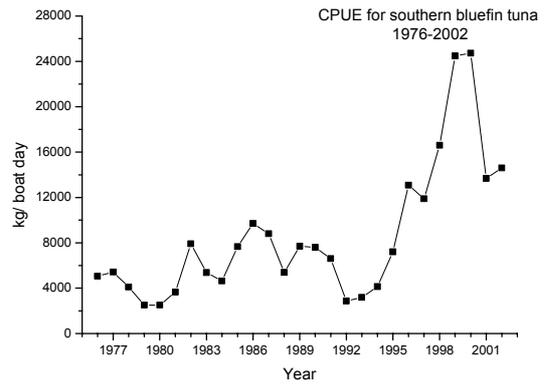
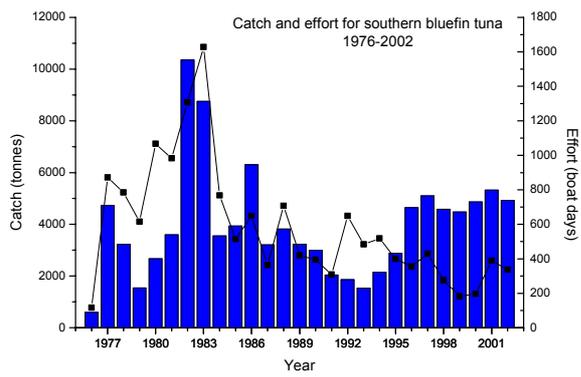
Between 1976 and 2002, catches of SBT by pelagic longline, pole and purse-seine vessels peaked at over 10,000 tonnes in 1982 (Fig. 2.14). Catches declined thereafter, reaching a low of ~1500 tonnes in 1993. Since 1993, catches have increased to over 4000 tonnes per year. The combined effort of all tuna fishing operations within the GAB declined substantially after the 1980s. Effort reached a peak of 1628 boat days in 1983 but has declined ever since. Effort in 1999 was 183 boat days, the lowest level since 1976. CPUE remained relatively stable between 1976 and 1992 ranging from 2497 kg day<sup>-1</sup> in 1979 to 9714 kg day<sup>-1</sup> in 1986. Since 1992, CPUE has increased dramatically to reach a peak of 24721 kg day<sup>-1</sup> in 2000, reflecting the change to purse-seining as the main fishing method.

#### 2.3.4.2 Catch and CPUE of other fish caught in the SBTF

Other fish species targeted and taken as bycatch by pelagic longline, pole and purse-seine fishing operations, include bigeye tuna (*Thunnus obesus*), albacore tuna (*Thunnus alalunga*), broadbill swordfish (*Xiphias gladius*) and several shark species. Skipjack tuna (*Katsuwonus pelamis*) are also taken periodically during purse-seine operations. Catches of “other” fish species taken by pelagic longline, pole and purse-seine fishing operations varied greatly between 1979 and 2002 (Fig. 2.14). Catches peaked at over 1500 tonnes in 1988 but decreased to <30 tonnes in 1997 before increasing to nearly 1200 tonnes in 2002. CPUE also varied from <0.5 kg day<sup>-1</sup> in 1979 to >5000 kg.day<sup>-1</sup> in 1998. A complete list of species reported as retained catch by the SBTF is given in Appendix 3.

### 2.3.5 Bycatch and discard issues

Some logbook data are available on retained bycatch, however discard levels remain largely unknown and logbook data is unverified (Harris and Ward 1999). There are some data on the size and composition of catches of non-target species by pelagic longliners east of 140° E. However there is no information on non-retained bycatch in the eastern GAB. Bronze whaler and white shark are occasionally caught during SBT purse-seine operations. However, bycatch and discard issues are more significant in pelagic longline operations. Seabirds such as short-tailed shearwaters (*Puffinis tenuirostris*) and albatross species that are attracted to vessels by bait, offal and discarded catch can become entangled or hooked and drowned. Longlining has been identified as a major threat to albatross populations in southern oceans (Brothers 1991). Changes in fishing practices to reduce seabird mortality have been implemented since the early 1990s. Current mortality rates in the SBTF are unknown (Harris and Ward 1999). Longlining may also pose a threat to great white shark (*Carcharodon carcharias*). Harris and Ward (1999) estimated the pelagic longline catch of great white shark at approximately seven per year.



**Figure 2.14** Catch, effort and CPUE for southern bluefin tuna and all other fish species caught by pelagic longline, pole and purse-seine fishing operations in the GAB between 1976 and 2002.

## **2.4 Southern Squid Jig Fishery (SSJF)**

### *2.4.1 Overview*

The Southern Squid Jig Fishery (SSJF) targets arrow or Gould's squid (*Nototodarus gouldi*). This species is taken using lights and hydraulic machines that deploy and retrieve small plastic jigs vertically through the water column. The fishery mostly operates off south-eastern Australia between Queenscliff and Portland (Victoria), but also extends into the eastern GAB (AFMA Website 2003). There is minimal information available for this fishery in the GAB.

### *2.4.2 Management*

The SSJF is a limited entry fishery and there are currently 84 Commonwealth licences. Of these licences 64 permits are linked to vessels and 20 permits are not (AFMA website 2003). There are currently no management arrangements restricting the size of the catch by the trawl fishery operating in the GAB (GABTF). Fishers taking arrow squid by bottom trawling must have authorisation to take this non-quota species. The AFMA management group (SquidMAC) has several new management proposals for this fishery, which include precautionary catch and effort trigger limits (SSJF Discussion Paper 2002: AFMA website 2003).

### *2.4.3 Interaction between the fishery and the GABMP*

Arrow squid is taken as bycatch in the GABTF which has operated in and near the GABMP (Section 2.1). However, there is no evidence of any interaction between the SSJF fishery and the GABMP. The SSJF has potential for expansion in the GAB and the interaction with the GABMP could increase over time.

### *2.4.4 Catch effort and CPUE*

The annual catch for the entire SSJF ranges from 200 to 300 tonnes.year<sup>-1</sup> (AFMA website 2003). Currently, the catch taken in the GAB is minimal.

## **2.5. Small Pelagic Fishery**

### *2.5.1 Overview*

The Small Pelagic Fishery (SPF) is a purse-seine and midwater trawl fishery that targets small schooling pelagic fishes, including jack mackerel (*Trachurus symmetricus*), cowan young (*Trachurus declivis*), yellowtail horse mackerel (*Trachurus novaezelandiae*), blue mackerel (*Scomber australasicus*) and redbait (*Emmelichthys nitidus*). The SPF mostly operates off the Tasmanian coast but occasionally extends into the eastern GAB (waters >3 nm from the coast) (Caton 2002). This fishery was formerly known as the Jack Mackerel Fishery (JMF). Small quantities of small pelagic fish are also taken by the SETF and GABTF. The catch is mostly used for fishmeal and bait with limited amounts processed for human consumption (AFMA website 2003).

### *2.5.2 Management*

The SPF is managed via limited entry, geographic zoning and mesh size restrictions for the midwater trawl sector. There are between 7 and 13 midwater trawl licences in each of the four management zones (Caton 2002). The GAB (Zone B) has an annual TAC of 5000 tonnes for all species. Precautionary trigger TAC's of 1000 and 2500 tonnes apply to the midwater trawl and purse-seine sectors, respectively (AFMA website 2003). Catch and effort data are reported in purse-seine and midwater trawl logbooks.

### *2.5.3 Interaction between the fishery and the GABMP.*

There is no evidence of interaction between this fishery and the GABMP, with the exception of <1 tonne year<sup>-1</sup> bycatch of small pelagic fish taken in the GABTF (Caton 2002). The GABTF has potential for expansion in the GAB and the interaction with the GABMP could increase over time.

### *2.5.4 Catch effort and CPUE*

Few data were available for this fishery in the GAB.

### 3. STATE MANAGED FISHERIES

#### 3.1 Northern Zone Rock Lobster Fishery

##### 3.1.1 Overview

The Northern Zone Rock Lobster Fishery (NZRLF) targets southern rock lobster (*Jasus edwardsii*) in the central and eastern GAB. The fishery mostly operates around inshore islands and reefs in the eastern the GAB. Vessels operating in the NZRL fishery are typically 15 to 18m long and of aluminium construction. Lobsters are taken in steel-framed, mesh-covered pots with plastic “necks” (entrance points). Lobster pots are baited with Australian salmon, carp or reef fish and retrieved daily using a mechanical hauler. Over 90% of the commercial catch is now exported live, mainly to China (Ward *et al.* 2002). The value of the catch in the GAB during 2001 was estimated at A\$13.2M (based on the assumed price of A\$40 per kg).

There is a significant recreational rock lobster fishery in the eastern GAB. Lobsters are taken by recreational fishers using registered pots, diving and snorkelling, and by drop/hoop nets. Pots can be set either from a vessel or from the shore.

##### 3.1.2 Management

The NZRLF operates between November 1 and May 31. There are currently 69 licence holders. Management arrangements for the fishery in the GAB are documented in the NZRLF management plan (Zacharin 1997). Historically, the fishery has been managed through input or effort controls that restrict the number of pots used by each licence holder and the number of days fished. Vessel size is restricted to 18 m and engine power is limited to 1,200 BHP (Zacharin 1997). A quota system was introduced for the 2003/04 season.

The minimum carapace size for rock lobster taken in the GAB is 10.5 cm and the taking of berried females is prohibited. Commercial fishers supply catch and effort information through daily logbooks that are returned to SARDI Aquatic Sciences monthly. Licence holders are permitted to take other species including giant crab (*Pseudocarcinus gigas*), octopus (*Octopus* spp.) and some scalefish species, including snapper (*Pagrus auratus*).

Registrations for recreational rock lobster pots can be obtained on application from Primary Industries and Resources, South Australia (PIRSA). Fishers may set up to 2 registered pots per person per day. Up to 4 rock lobsters can be taken per person per day and there is a daily boat limit of 8 rock lobsters. As in the commercial sector, recreational fishers are prohibited from taking rock lobster in the NZRLF between May 31 and November 1.

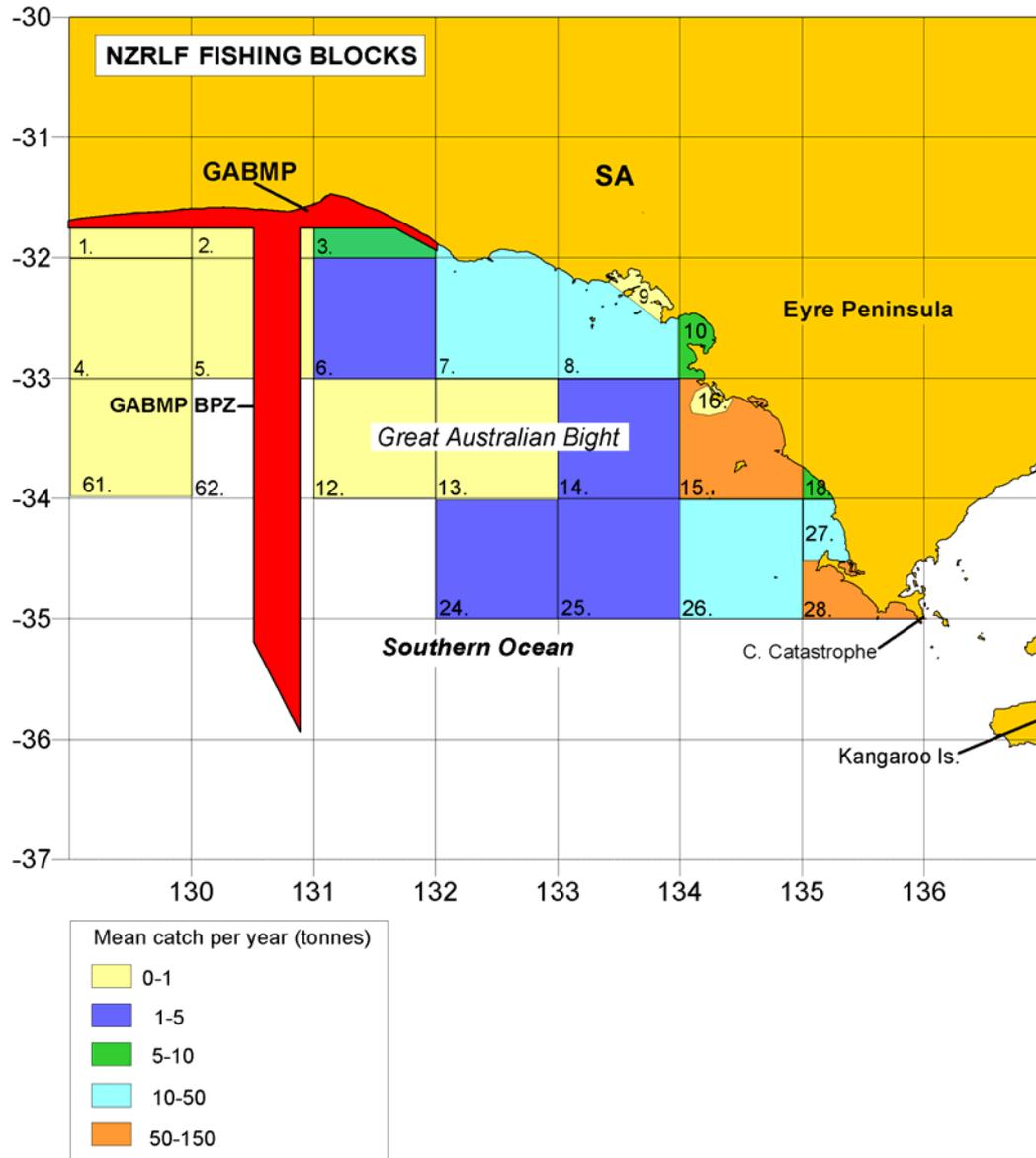
### *3.1.3 Interaction between the fishery and the GABMP*

The majority of the NZRLF catch is taken from two areas of the eastern GAB; Elliston to Streaky Bay and Cape Catastrophe to Reef Head on the Coffin Bay Peninsula (Fig. 1.2). The mean annual catch is relatively low ( $\leq 10$  tonnes.year<sup>-1</sup>) in areas near the GABMP (1-4) compared to the eastern GAB, where 10-150 tonnes.year<sup>-1</sup> was taken in six areas fished (Fig. 3.1). Similarly between 1970 and 2001,  $< 5,000$  potlifts.year<sup>-1</sup> were made in areas near the GABMP, whereas  $> 10,000$  potlifts.year<sup>-1</sup> were made in six areas in the eastern GAB (Fig. 3.2).

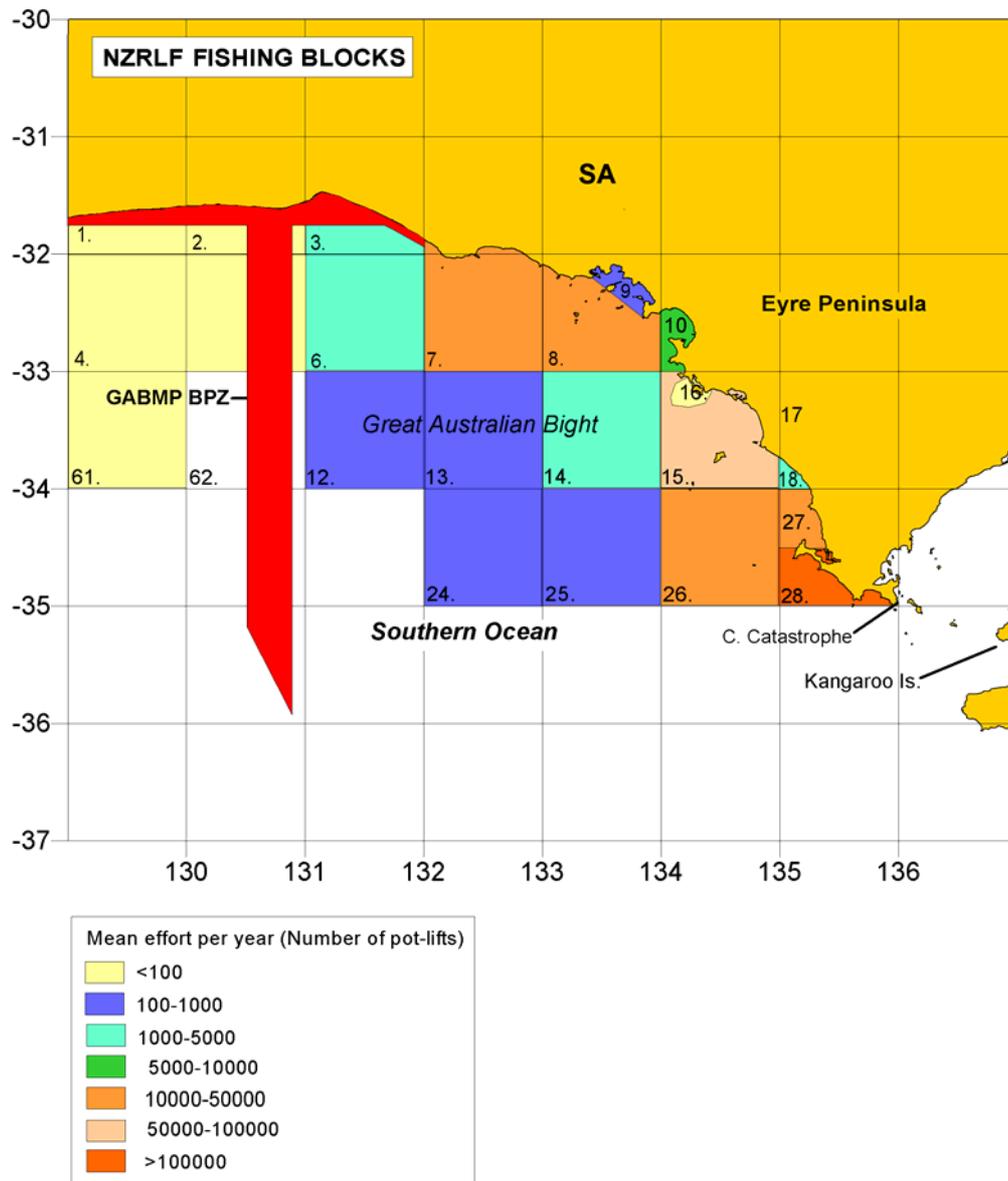
It is important to note that no information is available regarding the spatial patterns of catch and effort within each fishing area. Data from within blocks 1-3 are not necessarily from within the boundaries of the GABMP.

### *3.1.4 Catch, effort and CPUE*

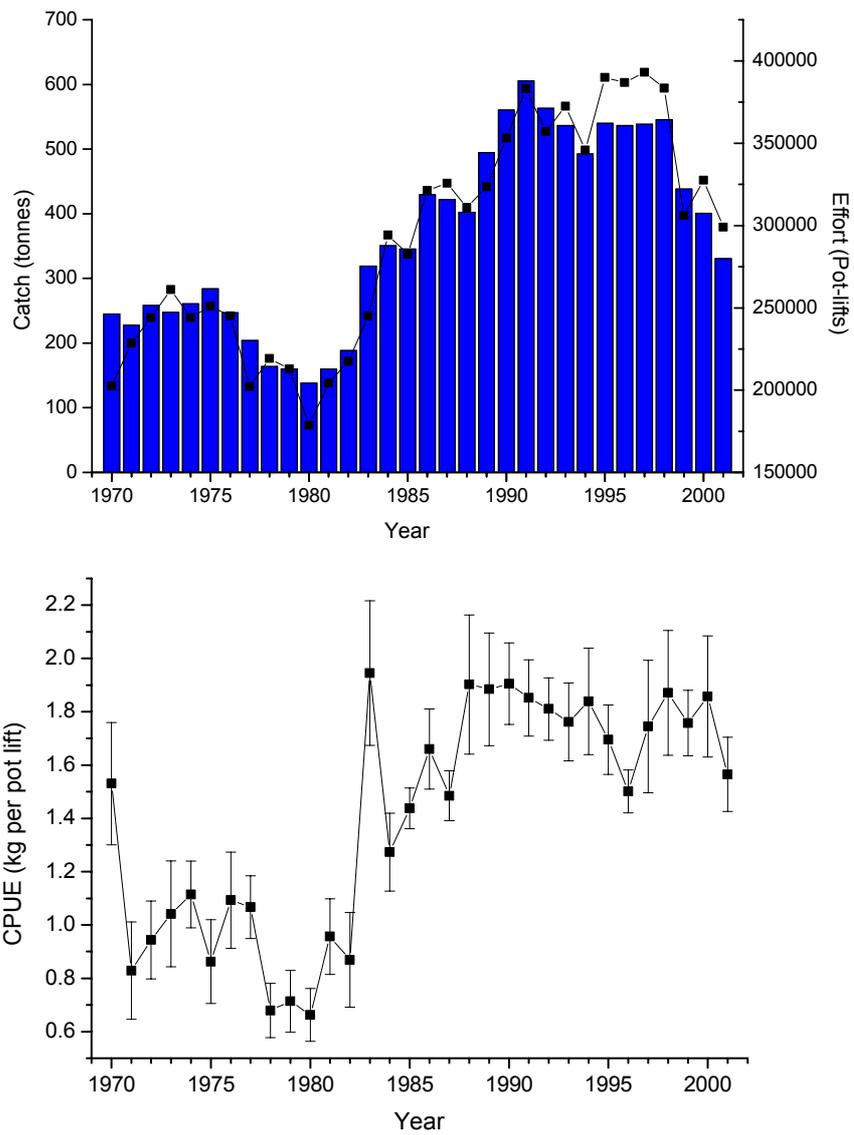
Rock lobster catches in the GAB portion of the NZRLF peaked at 606 tonnes in 1991 (Fig. 3.3). Between 1970 and 2001 annual catches ranged between 138 and 606 tonnes.year<sup>-1</sup>. The mean catch between 1970 and 2001 was 364 tonnes.year<sup>-1</sup>. Total effort ranged from 178,585 to 393,044 potlifts.year<sup>-1</sup> between 1970 and 2001. The peak in effort occurred in 1997. Mean annual effort was 291,009 potlifts.year<sup>-1</sup> between 1970 and 2001. Mean CPUE ranged between 0.66 kg.potlift<sup>-1</sup> and 1.94 kg.potlift<sup>-1</sup> between 1970 and 2001.



**Figure 3.1** Spatial distribution of catch in the NZRLF between 1970 and 2001 in the GAB.



**Figure 3.2** Spatial distribution of effort in the NZRLF between 1970 and 2001 in the GAB.



**Figure 3.3** Catch, effort and mean annual CPUE for the NZRLF between 1970 and 2001 (west of Cape Catastrophe). Error bars  $\pm 1$ SE.

### 3.1.5. Bycatch and discard issues

The main species taken as bycatch by the NZRLF are leatherjacket species, blue-throat wrasse (*Notolabrus tetricus*), octopus spp. and velvet crab (*Portunus puber*). Small quantities of snapper (*Pagrus auratus*) and bight redfish (*Centroberyx gerrardi*) are also taken. Most of the bycatch of the NZRLF is retained and used as bait. Fishers can retain up to five giant crab (*Pseudocarcinus gigas*) per trip.

The level of interaction of New Zealand fur seals (*Arctocephalus forsteri*) and Australian sealions (*Neophoca cinerea*) with lobster pots in the GAB is unknown. However, Australian fur seals (*Arctocephalus pusillus doriferus*) are captured in lobster pots in Bass Strait (Warneke 1975).

### 3.1.6. Recreational, charter and indigenous fisheries

An important recreational rock lobster fishery exists in the eastern GAB. Most of the catch is taken near Port Lincoln, Coffin Bay, Elliston, Venus Bay, Streaky Bay and Ceduna. McGlennon (1999) estimated the annual recreational catch for the NZRLF to be approximately 27 tonnes. During 2001/02, a telephone-diary survey based on the methods of McGlennon (1999) was undertaken by Venema *et al.* (2003). This survey reported the fishing patterns of 1,700 recreational rock lobster fishers. Recreational fishers in the NZRLF took approximately 19,262 rock lobsters during 2001/02. The total catch weighed approximately 23 tonnes. Recreational effort in the GAB represented only 15.9% of the total recreational effort in the NZRLF. No recreational rock lobster fishing was recorded in the vicinity of the GABMP (Venema *et al.* 2003).

The NRIFS showed that South Australian fishers caught 113,679 rock lobster, with a total weight of 9,590 kg in 2000/2001 (Henry and Lyle 2003). The proportion of the catch taken from the GAB is unknown.

There is no information available on the catch of rock lobster by indigenous or charter fisheries in the GAB.

## 3.2. Giant Crab Fishery

### 3.2.1. Overview

The giant crab (*Pseudocarcinus gigas*) is endemic to southern Australia. It has been taken as bycatch by the NZRLF for more than 80 years (Ward and Loiterton 2000). In more recent years, it has been targeted by two dedicated fishers and a small proportion of rock lobster fishers (Ward and Loiterton 2000). Significant quantities have been sold on export markets in recent years and the total value of the South Australian fishery in 1998/99 was ~A\$1M (Ward and Loiterton 2000).

### 3.2.2. Management

The giant crab fishery was controlled by the Commonwealth Government prior to 1992. Management was transferred to State Governments in 1997. The fishery is managed by input and output controls including a TAC.

The export of giant crab is controlled by under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Export permits can only be issued with approval of the Commonwealth Minister of the Environment and Heritage, by declaration or under an exceptional circumstances authority.

There are currently no recreational bag or boat limits for this species and berried females must be returned to the water (South Australian Recreational Fishing Guide 2001)

### 3.2.3. Interaction between the fishery and the GABMP

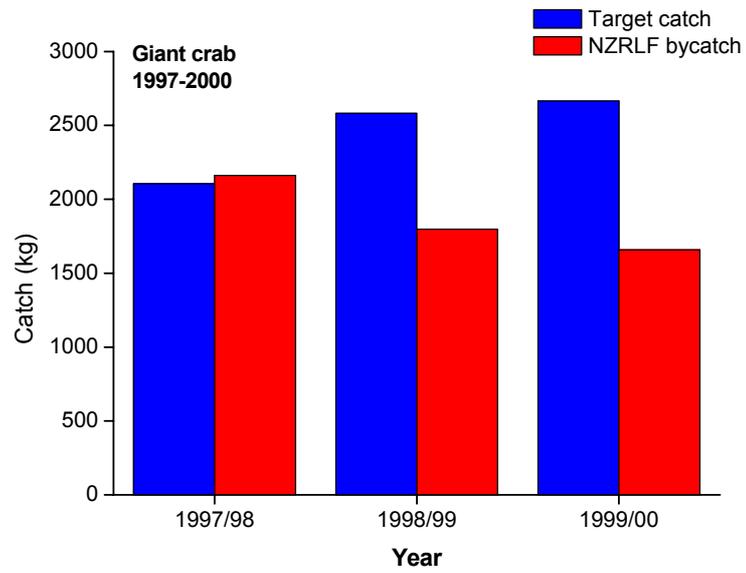
No information is available on the possible interaction of the giant crab fishery with the GABMP. However, most fishing is conducted at the shelf break off south-western Kangaroo Island and southern Eyre Peninsula and minimal fishing has been conducted in the central GAB (Ward and Loiterton 2000).

### 3.2.4. Catch and CPUE

Giant crab catches in the GAB peaked in 1999/2000 at 2665 kg (Figure 3.4). Between 1997 and 2000 catches ranged between 2,105 and 2,665 kg.year<sup>-1</sup>. The mean catch was 2,451 kg.year<sup>-1</sup>. Approximately 1800 kg has been taken as bycatch each year by the NZRLF since 1997. CPUE ranged between 1.5 and 3.0 kg.potlift<sup>-1</sup> (Ward and Loiterton 2000).

### 3.2.5. Recreational, charter and indigenous fisheries

Recreational, charter and indigenous fisheries do not usually take giant crab.



**Figure 3.4** Target catch and NZRLF bycatch for the giant crab fishery from 1997 to 2000 in the GAB (Ward and Loiterton 2000).

### 3.3 Western Zone Abalone Fishery

#### 3.3.1 Overview

The South Australian Western Zone Abalone Fishery (WZAF) targets greenlip (*Haliotis laevis*) and blacklip (*Haliotis rubra*) abalone. The western zone includes all coastal waters between the border of Western Australia (129° E) and Arno Bay (136° 33'E) (Fig. 3.5, Mayfield *et al.* 2002). Abalone is taken by diving and protective shark cages are commonly used. In 2001/02, the WZAF had a value of ~A\$35 million (Knight *et al.* 2003).

#### 3.3.2 Management

Licence holders are allocated an annual Individual Transferable Quota (ITQ) that is an equal share of the Total Allowable Catch (TAC). A total of 23 licence holders operate in the eastern GAB (Mayfield *et al.* 2002). Taking of abalone is prohibited in Waterloo Bay (Elliston). Minimum size limits for the commercial and recreational sectors are 14.5 cm for greenlip and 13 cm for blacklip abalone. Catch and disposal records (CDR) and catch and effort logbooks are completed daily by commercial fishers.

The Western Zone is divided into two regions (Fig.3.5). In region A (Arno Bay to Streaky Bay) the commercial catch quota for 2002 was 293 tonnes and 207 tonnes for blacklip and greenlip abalone respectively. In Region B (north and west of Streaky Bay) each of the 23 fishers may harvest 1.8 tonnes of either greenlip or blacklip abalone (Mayfield *et al.* 2002).

Abalone is also targeted in the eastern GAB by recreational fishers. Bag-limits of 5 per person per day or 10 per boat per day are in place.

#### 3.3.3 Interaction between the fishery and the GABMP

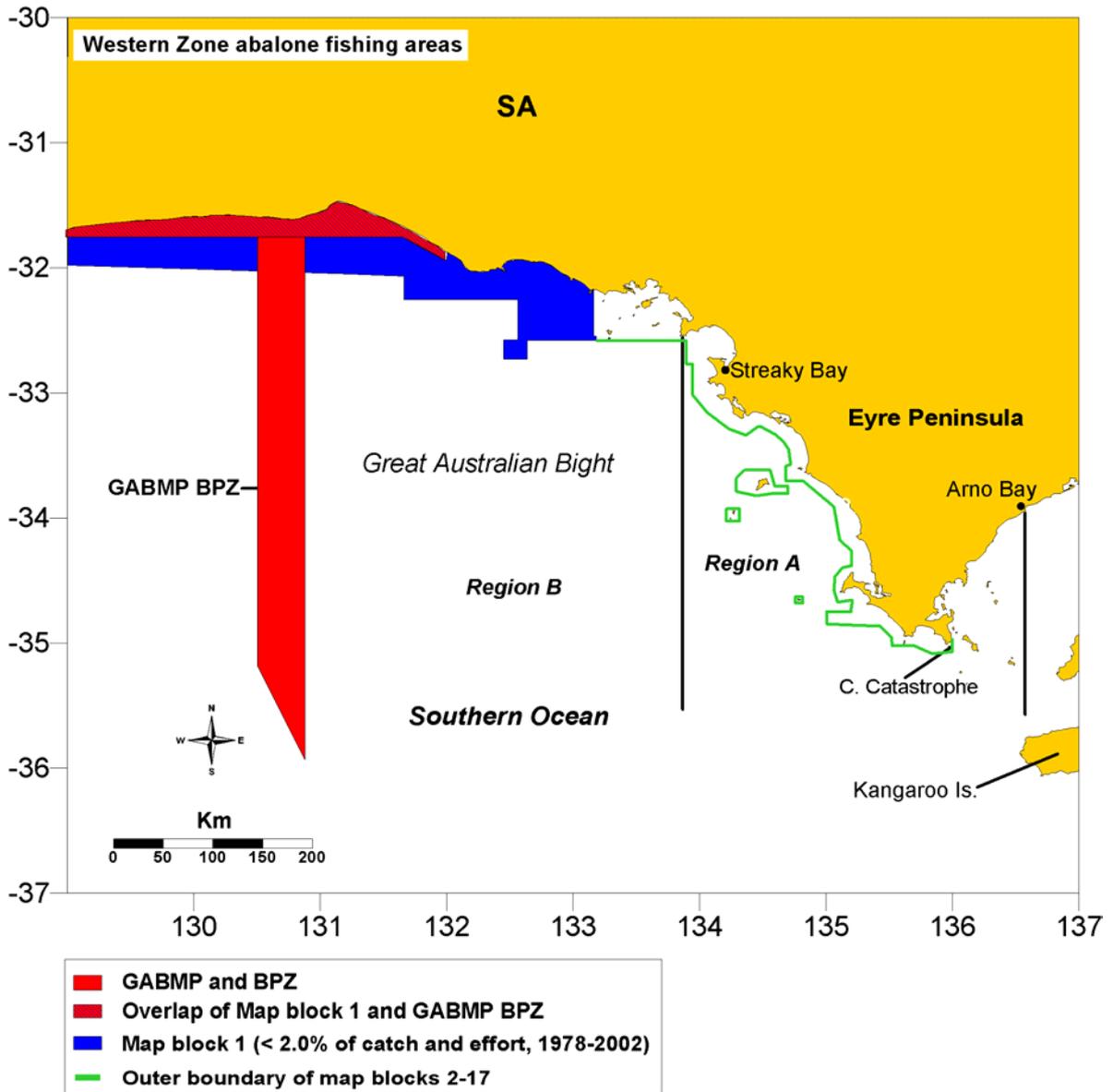
This fishery had minimal effect on the GABMP between 1978 and 2002. The single fishing area (1) in the vicinity of the GABMP contributed to only 1.7% of the total catch and 1.6% of total effort (hours) between 1978 and 2002 (Fig. 3.5). The remainder of the catch and effort was recorded in blocks 2-17, in the eastern GAB.

#### 3.3.4 Catch, effort and CPUE

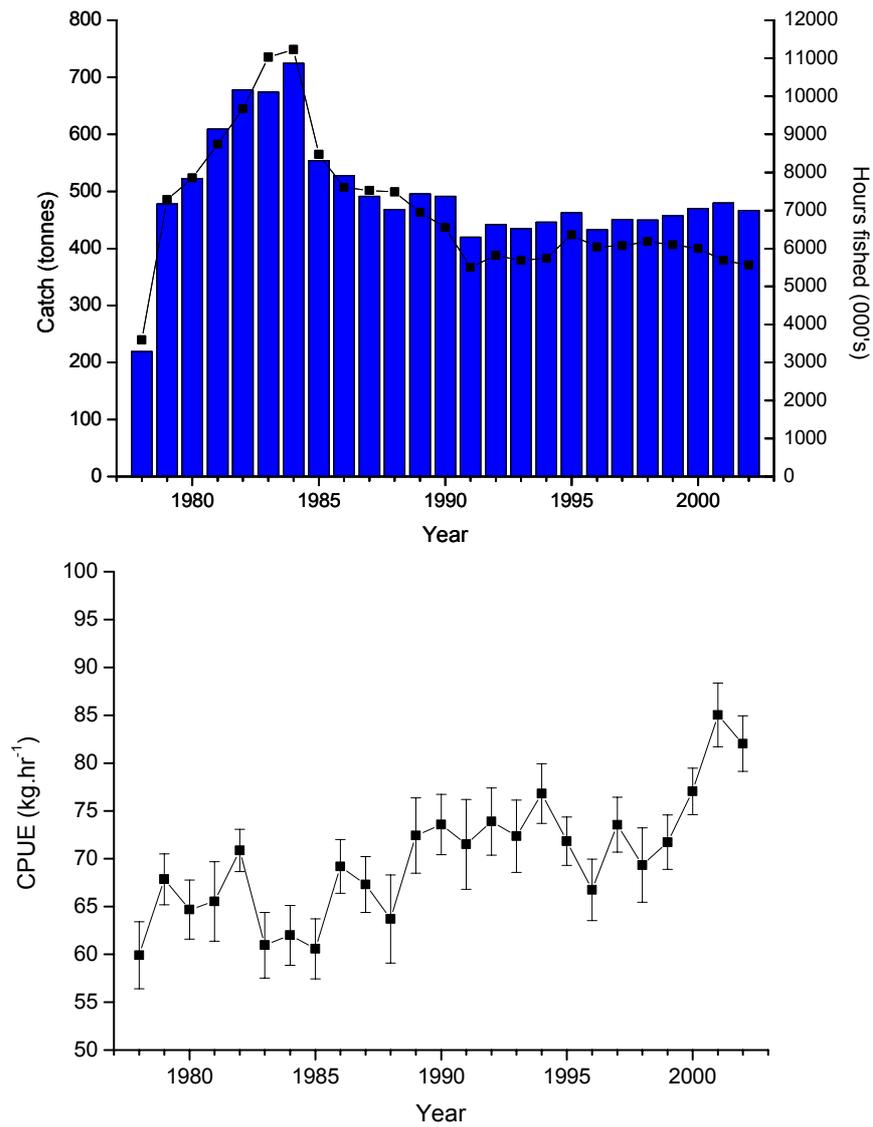
Abalone catches between Cape Catastrophe and the WA border peaked at 724 tonnes in 1984 (Fig. 3.6). Between 1984 and 2002 catches ranged between 419 and 554 tonnes.year<sup>-1</sup>, with a mean catch of 493 tonnes.year<sup>-1</sup>. Total effort ranged between 3,600 and 11,227. hours.year<sup>-1</sup> between 1978 and 2002 and peaked in 1984. Mean effort was 6,988 hours.year<sup>-1</sup>. Between 1978 and 2002 catch per unit effort (CPUE) gradually increased and ranged between 60 kg.hour<sup>-1</sup> and 85 kg.hour<sup>-1</sup>.

### *3.3.5 Recreational, charter and indigenous fisheries*

Recreational fishers mostly target greenlip and blacklip abalone by snorkelling or diving. The National Recreational and Indigenous Fishing Survey (NRIFS) showed South Australians took 17,780 abalone (8,588 kg) in 2000/2001 (Henry and Lyle 2003). The proportion of catch taken in the GAB is unknown. There is no information available on the abalone catch by indigenous or charter fisheries in the GAB.



**Figure 3.5** Shows the abalone fishing blocks in the Western Zone used to describe the spatial patterns of catch and effort and proximity to the GABMP.



**Figure 3.6** Catch effort and mean annual CPUE for the Abalone fishery (west of Cape Catastrophe) between 1978 and 2002. Error bars  $\pm 1SE$ .

### **3.4 West Coast Prawn Fishery**

#### *3.4.1 Overview*

The West Coast Prawn Fishery (WCPF) is an otter trawl fishery that targets western king prawn (*Melicertus latisulcatus*). This fishery operates in the eastern GAB in three main regions (Fig. 3.7): Point Bell to Point Westall, Venus Bay to Elliston, and Drummond Point to Coffin Bay (Svane 2003). The season runs from the last quarter of the moon through to the first quarter during all months except January, May and October (MacDonald 1998; Svane 2003). In 2001/02 the WCPF had an approximate value of A\$1.6M (Knight *et al.* 2003).

#### *3.4.2 Management*

Management of the WCPF is based on limited entry. There are also restrictions on vessel horsepower (365 continuous brake HP) and size (22m) (MacDonald 1998). The WCPF is currently limited to three licence holders. Vessels used in the WCPF fishery must be endorsed and registered (McDonald 1998). Commercial logbook systems are in place and regular research surveys collect biological information for management purposes. Licence holders are permitted to retain slipper lobster (*Ibacus* spp.), octopus (*Octopus* spp.), scallop (Family Pectinidae), southern calamary (*Sepioteuthis australis*) and arrow squid (*Notodarus gouldii*).

#### *3.4.3 Interaction between the fishery and the GABMP*

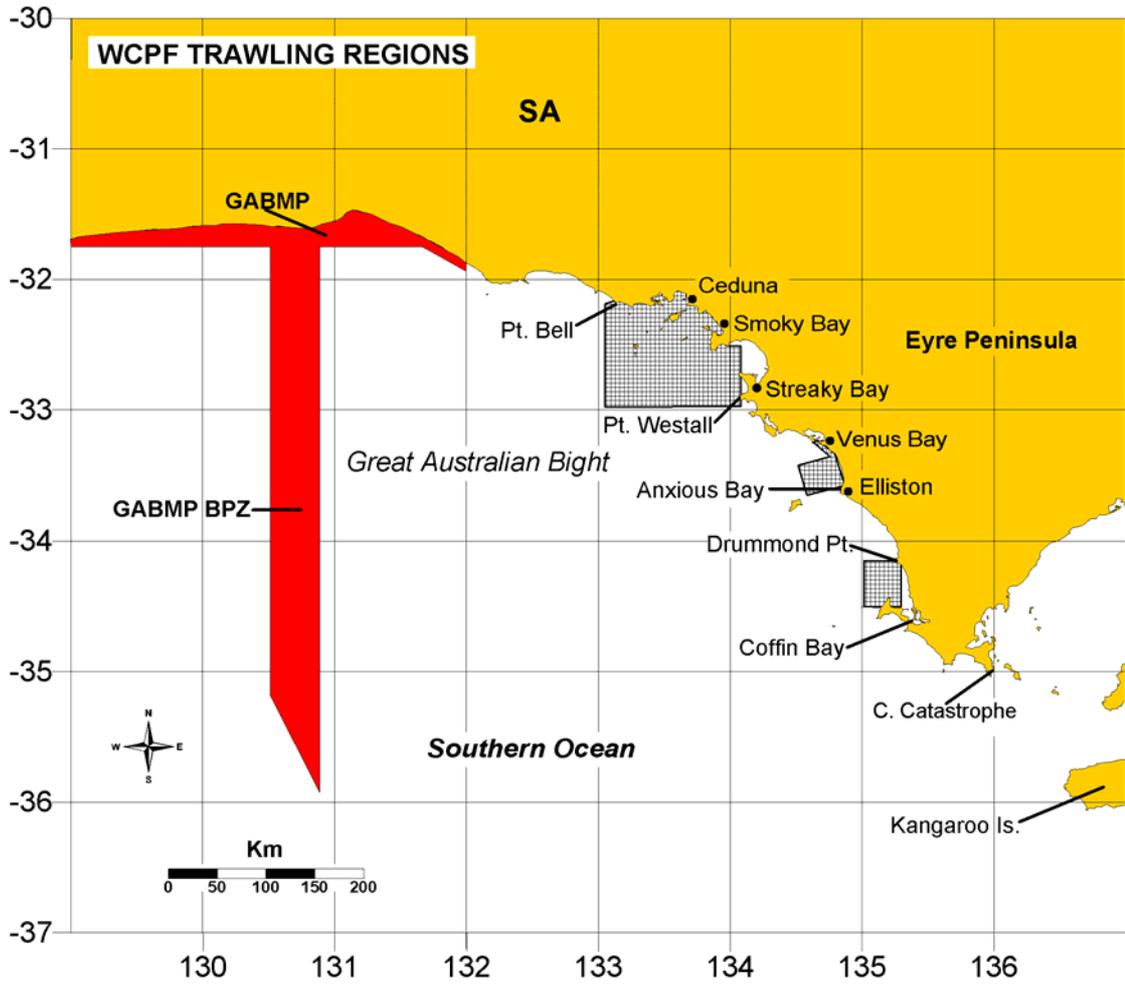
The WCPF includes waters between longitude 131 and 137°E only, and is separated from the GABMP (Fig.3.7).

#### *3.4.4 Catch, effort and CPUE*

The total catch for the WCPF for 2001/2002 was 104 tonnes. Total effort for the WCPF in 2001/2002 was 1,714 trawl hours. The majority of the catch (70 tonnes) was taken off Coffin Bay (Svane 2003).

#### *3.4.5 Bycatch and discard issues*

The WCPF is permitted to retain some bycatch species (see Section 1.4.2). However there are no published investigations of bycatch and discards in the WCPF.



**Figure 3.7** WCPF trawling regions in the eastern GAB and location of the GABMP.

### **3.5 Marine Scale-fish Fishery**

#### *3.5.1 Overview*

The Marine Scalefish Fishery (MSF) is a multi-gear fishery comprised of 412 commercial licence holders who are permitted to take finfish, crustaceans, molluscs, annelids, sharks and rays in South Australian waters. It is the oldest commercial fishing industry in South Australia with a total catch for all species (excluding sardine) in 2001/02 of over 4500 tonnes and a production value of over \$A18.5M. In the eastern and central GAB, commercial fishers mainly target snapper, King-George whiting, and Australian salmon in inshore waters and ocean jacket offshore.

#### *3.5.2 Management*

The MSF is managed under a complex system of arrangements pertinent to the *Fisheries Management Act 1982*. The MSF is a limited entry fishery managed by size limits, gear restrictions, and seasonal and area closures for specific fishing methods and/or species. Commercial fishers are permitted to take for sale the species specified in Schedule 1 of the *Scheme of Management (Marine Scale Fisheries) Regulations 1991*. Species taken by recreational fishers are managed through bag and size limits, and spatial and seasonal closures. Specific management arrangements for the main species targeted by commercial fishers in the GAB are outlined below.

#### *3.5.3 Snapper (Pagrus auratus)*

##### *3.5.3.1 Overview*

The commercial catch of snapper in the eastern GAB represents <5% of the total commercial harvest in SA (Fowler *et al.* 2003). Most of the catch in the GAB is taken using handlines and setlines. The handline catch in 2000/01 was the highest recorded since 1983. Small quantities of snapper are also taken as bycatch by shark and rock lobster fishers.

Snapper is highly prized by recreational fishers in the GAB. Snapper move into shallow embayments such as Coffin Bay, Streaky Bay, Ceduna and Fowlers Bay (Fig. 1.2) on a seasonal basis and are the target of annual recreational fishing competitions (eg the Streaky Bay snapper fishing competition). Charter operators target snapper on offshore reefs in the GAB and operate out of Ceduna, Coffin Bay, Venus Bay, Baird Bay and Fowlers Bay.

##### *3.5.3.2 Management*

The commercial snapper fishery is managed by input and output controls. There are minimum size limits and hook number restrictions for longlines. The use of gillnets, haulnets and sharknets to target snapper is prohibited. Two seasonal closures occurred for the commercial and recreational fishery between August 1 and August 20 and November 6 and November 26, in 2002. A total

prohibition on the taking of snapper is in place from the 1 November to 30 November in 2003, 2004 and 2005 (PIRSA website 2003). A 50 kg trip limit exists for snapper taken by the Commonwealth GABTF and GHTF (Fowler *et al.* 2003).

#### *3.5.3.3 Interaction between the fishery and the GABMP*

Interaction between the commercial snapper fishery and the GABMP and BPZ is limited. Between 1983 and 2002, <10% of catch and effort (all gear types) in the GAB occurred in areas 1-7 (Fig 3.8). There is no information available on the size of the recreational snapper catch in the GABMP.

#### *3.5.3.4 Catch, effort and CPUE*

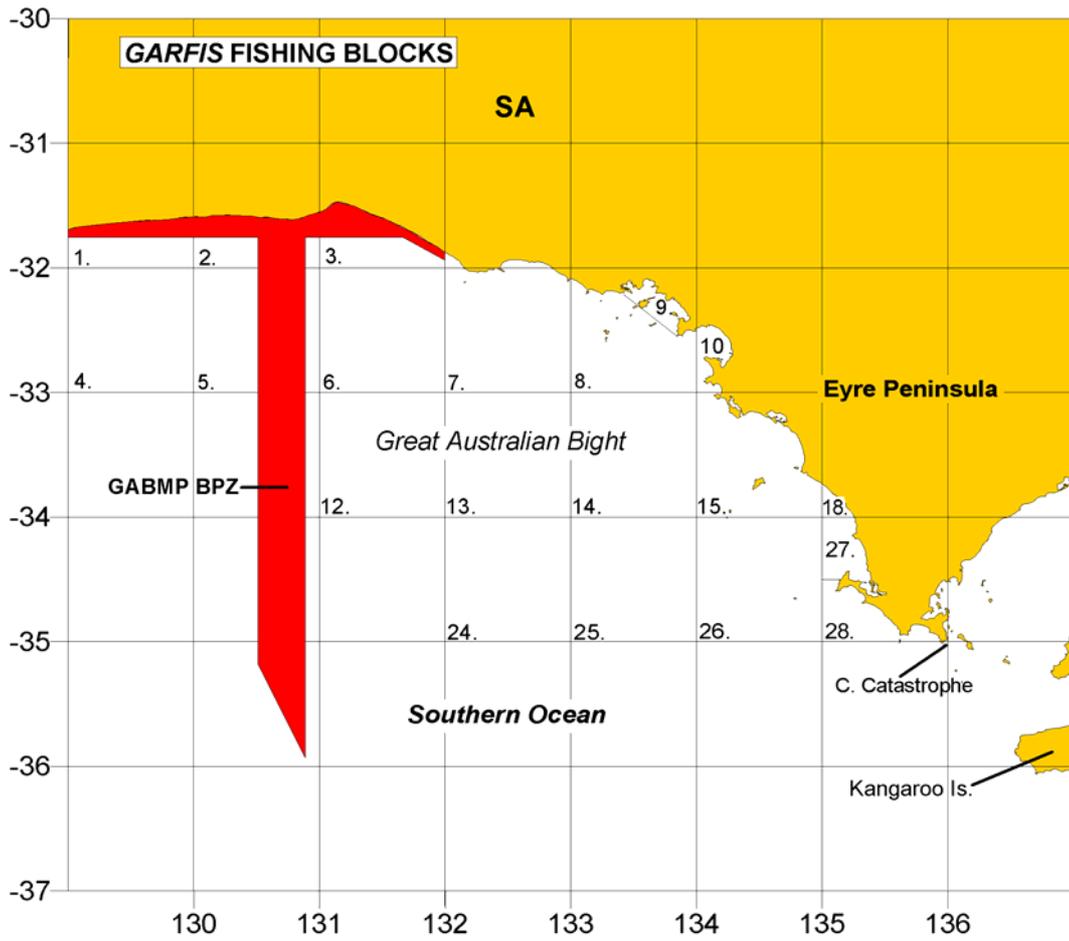
The annual snapper handline catch in the GAB ranged between 1.6 and 15.7 tonnes between 1983 and 2002 (Fig. 3.9). The peak in catch occurred during the 1986/87 season. The mean handline catch was 8.7 tonnes.year<sup>-1</sup>. Total handline effort ranged between 79 and 404 days.year<sup>-1</sup>. The peak in effort occurred during the 1983/84 season. Mean handline effort was 242 days.year<sup>-1</sup>. Mean handline CPUE ranged between 16 and 77 kg.boat day<sup>-1</sup>. The peak in mean CPUE occurred during the 2001/2002 season.

The snapper setline catch in the GAB ranged between 1.4 and 17.8 tonnes from 1983 to 2002. The peak in catch occurred during the 2001/2002 season. The mean setline catch for the same period was 9.6 tonnes.year<sup>-1</sup>. Annual setline effort ranged between 41 and 358 days.year<sup>-1</sup>. The peak in effort occurred during the 1988/89 season. Mean setline effort was 200 days.year<sup>-1</sup>. The mean setline CPUE ranged between 14 and 94 kg.boat day<sup>-1</sup>. The peak in setline CPUE occurred during 1986/87.

#### *3.5.3.5 Recreational, charter and indigenous fisheries*

The recent NRIFS indicated that the snapper catch in SA was approximately 115,798 individuals (~370,554 kg) in 2000/01 (Henry and Lyle 2003). The proportion of this catch taken in the GAB is unknown. The proportion of catch taken in the vicinity of the GABMP is likely to be small due to limited coastal access to small vessels.

There is no information available for snapper caught by indigenous or charter fisheries in the GAB.



**Figure 3.8** Shows the *GARFIS* (MFA) blocks used to describe the spatial patterns of catch and effort in the MSF fisheries and their proximity to the GABMP BPZ.

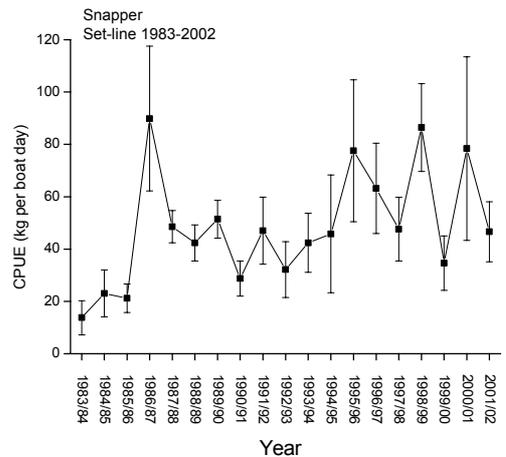
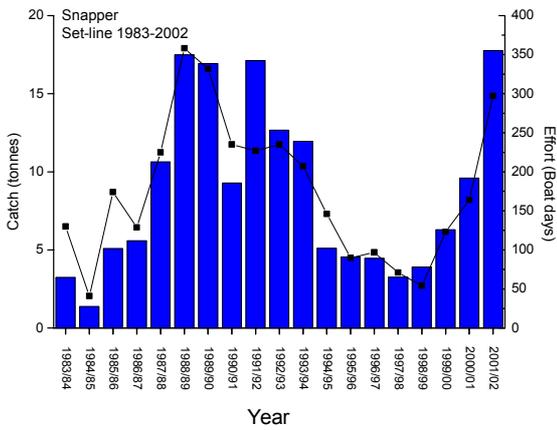
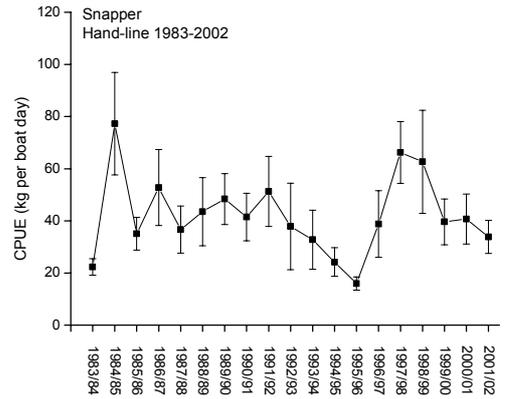
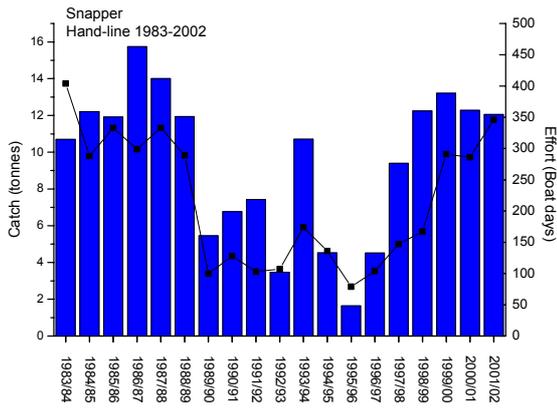


Figure 3.9 Catch, effort and CPUE for the snapper fishery in the GAB. Error bars  $\pm 1$ SE.

### 3.5.4 King George whiting (*Sillaginodes punctata*)

#### 3.5.4.1 Overview

King George whiting (KGW) is an important target species of the South Australian MSF in the GAB. It is fished in relatively shallow embayments (<40m), on offshore reefs and near islands, including those of the Nuyts Archipelago and Investigator Group (Fig. 1.2). KGW is taken by handline, gillnet and haulnet with the dominant fishing methods varying temporally and between regions. Historically, most of the KGW catch in the eastern GAB has been taken using handlines (Fowler and McGarvey 2000). The total catch in the GAB during the 2001/2002 season, had a conservative value of A\$1.6M (based on an assumed market price of \$A12 per kg).

#### 3.5.4.2 Management

The commercial KGW net fishery is limited to waters <5m deep. Commercial netting licences are non-transferable (Fowler 1997). Netting restrictions are in place in Murat Bay, Coffin Bay, Baird Bay, Venus Bay, Fowlers Bay, Streaky Bay and Waterloo Bay (Fig. 1.2). A minimum size limit of 30 cm TL applies to both the commercial and recreational fishing sectors. Bag and boat limits of 20 and 60 fish, respectively, apply for recreational fishers. Further information on management of the fishery is provided by Fowler and McGarvey (1997, 2000) and McGarvey *et al.* (2000, 2003).

#### 3.5.4.3 Interaction between the fishery and the GABMP

The majority of the KGW catch is taken in the eastern GAB from Denial Bay to Cape Catastrophe (Fowler and McGarvey 2000). There is no information available on the size of the recreational KGW catch in the GABMP.

#### 3.5.4.4 Catch, effort and CPUE

The KGW haulnet catch in the GAB ranged between 0.6 and 48 tonnes.year<sup>-1</sup> between 1983 and 2002 (Fig. 3.10). The peak in haulnet catch of 48 tonnes occurred during the 1991/92 season. The mean catch was 23 tonnes.year<sup>-1</sup>. Total haulnet effort ranged from 42 to 589 days.year<sup>-1</sup>. The peak in effort occurred during the 1987/88 season. Mean haulnet effort was 283 days.year<sup>-1</sup>. Mean haulnet CPUE ranged between 12 kg.boat day<sup>-1</sup> and 438 kg.boat day<sup>-1</sup>. The peak in mean CPUE occurred during the 1996/97 season.

The gillnet catch ranged between 3 and 26 tonnes.year<sup>-1</sup> between 1983 and 2002. The peak in catch occurred during the 1992/1993 season. The mean gillnet catch between 1983 and 2002 was 15 tonnes.year<sup>-1</sup>. Total gillnet effort ranged between 194 and 668 days.year<sup>-1</sup>. The peak in effort occurred during 1984/85. Mean gillnet effort was 431 days.year<sup>-1</sup>. Mean gillnet CPUE ranged between 8 and 56 kg.boat day<sup>-1</sup>. The peak in mean CPUE occurred during 1992/93.

The annual handline catch ranged from 135 to 209 tonnes between 1983 and 2002. Catches peaked during 1983/84. The mean handline catch was 172 tonnes.year<sup>-1</sup>. Annual handline effort ranged between 6,647 and 15707 days.year<sup>-1</sup> between 1983 and 2002. The peak in effort occurred during 1983/84. Mean handline effort was 11177 days.year<sup>-1</sup>. Mean CPUE for the handline sector ranged between 12 and 31kg.boat day<sup>-1</sup>. The peak in mean CPUE occurred during the 1999/2000 season.

#### *3.5.4.5 Recreational, charter and indigenous fisheries*

KGW is valued highly by recreational fishers. The NRIFS showed recreational fishers in SA caught approximately 2238071 individuals with a total weight of approximately 606,517 kg between May 2000 and April 2001 (Henry and Lyle 2003). The percentage of this catch taken in the GAB is unknown. The proportion of this catch taken in the vicinity of the GABMP is likely to be small due to the difficulties accessing these waters by recreational fishers.

There is no information available on the KGW catch by indigenous or charter fisheries in the GAB.

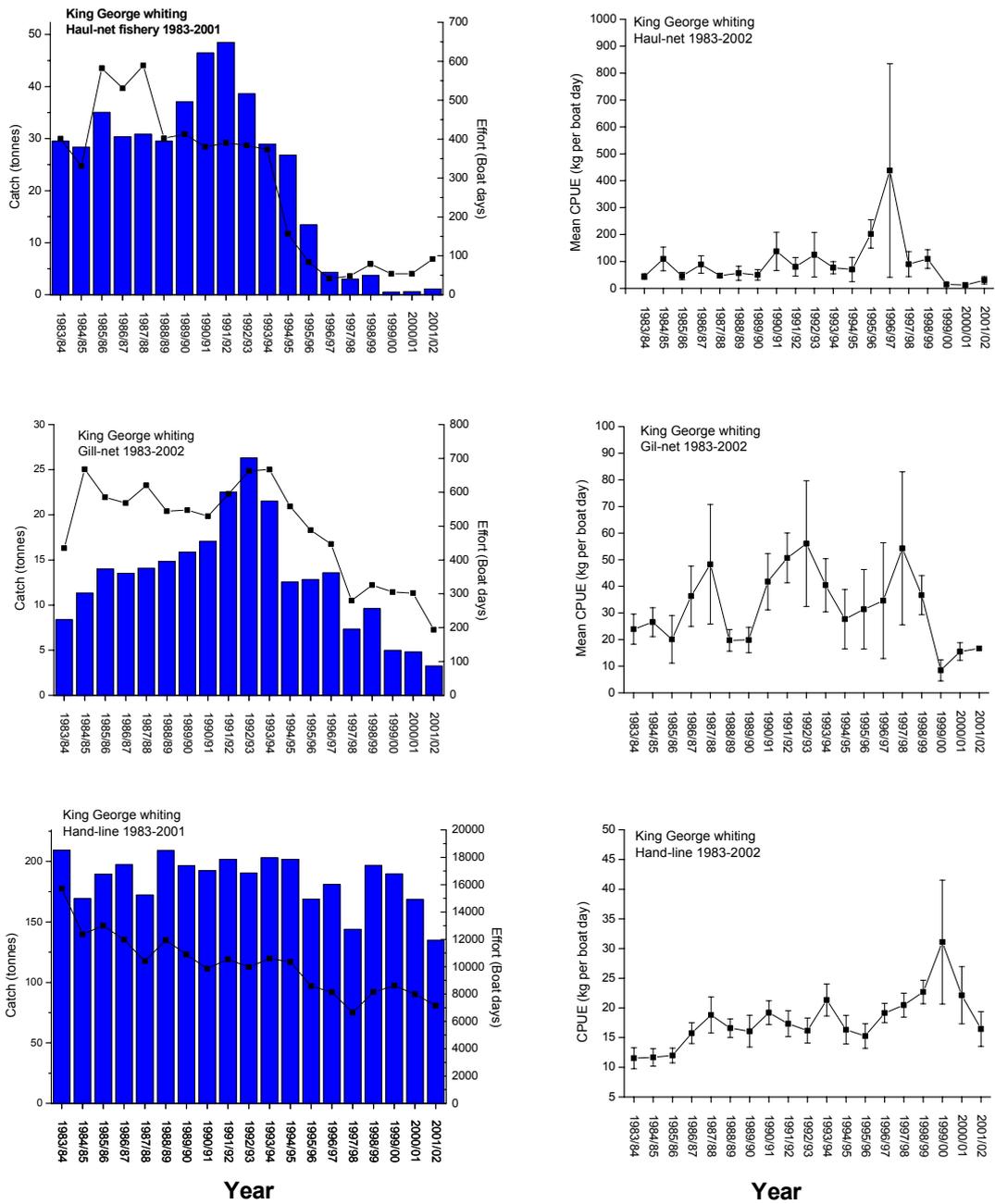


Figure 3.10 Catch, effort and CPUE for the KGW fishery in the GAB. Error bars  $\pm 1SE$ .

### *3.5.5 Ocean jacket fishery (Nelusetta ayraudi)*

#### *3.5.5.1 Overview*

This fishery targets ocean jacket using purpose built fish traps. The ocean jacket fishery operates from eastern Kangaroo Island to Nuyts Reef, west of Ceduna (Fig.1. 2). Ocean jacket is also the most common leatherjacket species taken by the Commonwealth managed GABTF. (see Section 2.1 of this report).

#### *3.5.5.2 Management*

There are 14 non-transferable licences in the ocean jacket fishery. Participants in the NZRLF and GABTF with trap endorsements are among the 14 licensees. The maximum number of traps that can be set by each fisher is 15. Trapping for ocean jacket is restricted to depths <60 m (Grove-Jones and Burnell 1991).

#### *3.5.5.3 Interaction between the fishery and the GABMP*

Confidentiality agreements prevent publication of catch and effort data for the eastern GAB.

#### *3.5.5.4 Catch, effort and CPUE*

Confidentiality agreements prevent publication of catch and effort data for the eastern GAB.

#### *3.5.5.5 Recreational, charter and indigenous fisheries*

Recreational fishers do not often target ocean jacket in the GAB. There was insufficient spatial resolution or species-level identification during the recent NRIFS to determine the catch of ocean jacket by recreational fishers in the GAB (Henry and Lyle 2003). There is no information available on catch of ocean jacket by indigenous or charter fisheries in the GAB.

### *3.5.6 Australian Salmon (*Arripis truttacea*)*

#### *3.5.6.1 Overview*

Australian salmon is mostly taken by MSF fishers in coastal waters of the GAB using purse-seine nets, gillnets and haulnets. The majority of the purse-seine catch is used for bait by the southern rock lobster fishery. Small quantities of Australian salmon are sold for human consumption on local markets. During 2001/2002, the total catch (all gear types) in the GAB had a market value of approximately \$A 160,000 (based on assumed market price of \$A1.30) (Jones and Westlake, 2003).

#### *3.5.6.2 Management*

The Australian salmon fishery is managed by a TAC of 1000 tonnes per financial year and quotas for individual haulnet and purse-seine fishers (Jones and Westlake 2003). This quota has sub-quotas of 600 and 200 tonnes allocated to two commercial fishers. The remainder of the TAC is separated between other MSF haulnet fishers. Commercial netting bans have been implemented near some popular recreational Australian salmon fishing beaches. However, this has not occurred in the GAB.

Australian salmon have a minimum size limit of 21 cm total length (TL), which applies to both recreational and commercial fishers. Individual daily bag limits vary depending on the size range of the catch. For Australian salmon between 21 and 35cm TL, the personal bag limit is 20 and the boat limit is 60. For fish over 35 cm TL, the personal bag limit is 10 and the boat limit is 30 (South Australian Recreational Fishing Guide 2001).

#### *3.5.6.3 Interaction between the fishery and the GABMP*

The fishery mostly operates in the eastern GAB between Streaky Bay and Cape Catastrophe. There is no information available on the size of the recreational Australian salmon catch in the GABMP.

#### *3.5.6.4 Catch, effort and CPUE in the GAB*

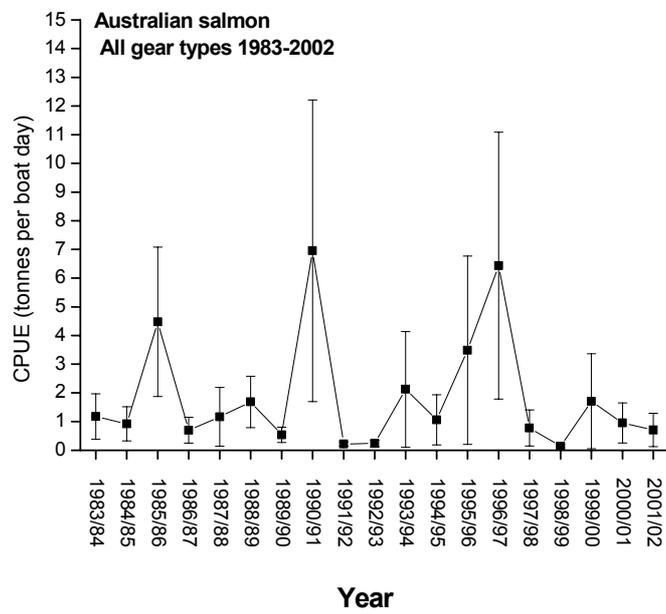
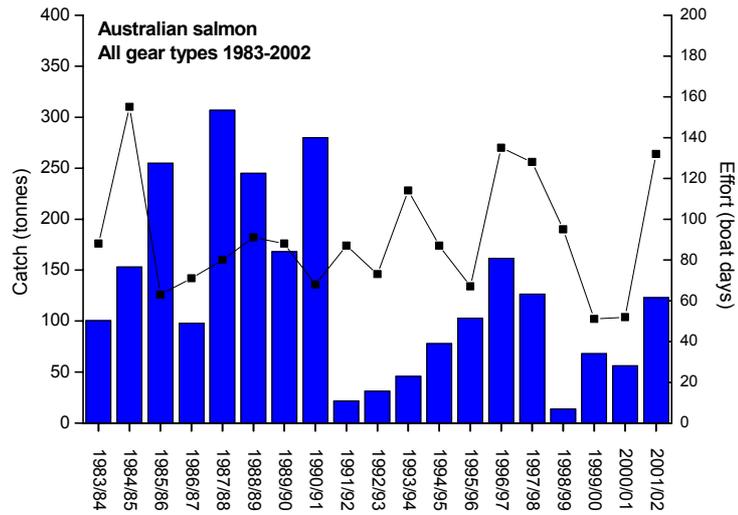
Between 1983 and 2002 the Australian salmon catch (all gear types) in the GAB ranged between 21.5 and 306.6 tonnes per year (Fig. 3.11). Catches peaked during 1987/88. The mean catch between 1983 and 2001 was 145 tonnes.year<sup>-1</sup>. Total effort ranged from 63 to 155 days.year<sup>-1</sup> between 1983 and 2002. The peak in effort occurred during the 1984/85 season. Mean effort during this period was 87 days.year<sup>-1</sup>. Between 1983 and 2002 the mean CPUE ranged between 0.2 and 7 tonnes.boat day<sup>-1</sup>. The peak in mean CPUE for this period occurred during the 1990/91season (Fig. 3.11).

#### *3.5.6.5 Recreational, charter and indigenous fisheries*

Australian salmon is highly sought after by recreational fishers in the GAB. Fishers targeting this species contribute significant tourism revenue to several coastal towns, including Elliston, Streaky Bay and Coffin Bay. Popular recreational fishing beaches for taking Australian salmon include Almonta, Sheringa, Locks well, Dog-fence and the beaches on Yalata Aboriginal Lands (see Fig. 1.2).

The recently completed NRIFS suggested the South Australian recreational fishers caught 715,768 Australian salmon between May 2000 and April 2001 with a total weight of approximately 372,199 kg. (Henry and Lyle 2003). The percentage of recreational Australian salmon catch taken in the GAB is unknown.

There is no information available on the Australian salmon catch by the indigenous or charter fisheries in the GAB.



**Figure 3.11** Catch, effort and CPUE for the Australian salmon fishery (all gear types) in the GAB between 1983 and 2001. Error bars  $\pm 1SE$ .

### **3.6 Sardine fishery (*Sardinops sagax*)**

#### *3.6.1 Overview*

The South Australian sardine fishery is Australia's largest by weight (TAC of 36,000 tonnes in 2003). Most of the catch is taken in southern Spencer Gulf. Large schools of sardine are observed throughout the GAB during annual research cruises on the *R/V Ngerin* but are rarely taken by commercial fishers. Fishers receive approximately A\$0.60 per kg as tuna fodder and A\$2.80 per kg for IQF sardine. In the past, small quantities of sardine were also taken as bait by the SBTF (Ward *et al.* 1999, 2000, 2001, 2003a).

#### *3.6.2 Management.*

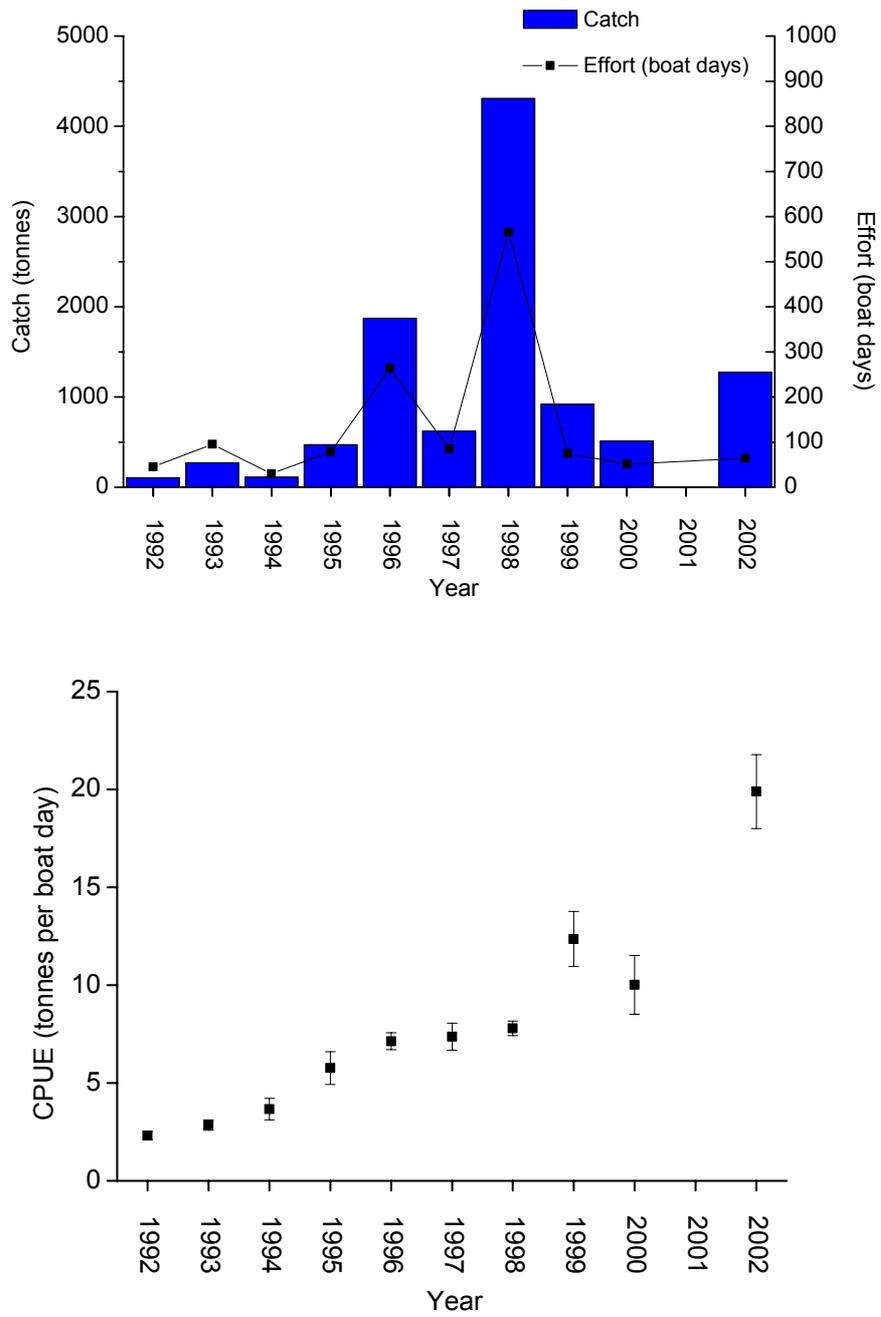
The South Australian sardine fishery currently comprises 14 licence holders and is managed by input and output controls including entry limitations, gear restrictions, an annual TAC and ITQs. Purse-seine nets cannot exceed 1000 metres in length or a depth of 200 metres, and mesh sizes can range from 14-22 mm. TACs for the fishery are established on the basis on spawning biomass estimates determined from annual research cruises undertaken by SARDI Aquatic Sciences.

#### *3.6.3 Interaction between the fishery and the GABMP*

Currently, the sardine fishery does not operate in or near the GABMP. Fishing in the eastern GAB, occurs off Coffin Bay Peninsula (Fig. 1.2). However, the fishery is based in southern Spencer Gulf.

#### *3.6.4 Catch Effort and CPUE*

Between 1992 and 2002, the sardine catch in the GAB ranged between 104.2 and 4307.4 tonnes (Fig. 3.12). The highest catch was taken in 1998, when fishing mostly occurred around the Coffin Bay Peninsula. Total effort ranged between 30 and 565 days.year<sup>-1</sup>, with a peak in 1998. Mean effort was 135 boat days.year<sup>-1</sup>. Mean annual CPUE gradually increased from 1992 ranging from 2.3 to 19.9 tonnes.boat day<sup>-1</sup> in 2002.



**Figure 3.12.** Catch, effort and CPUE for the sardine fishery in the GAB between 1992 and 2002. Error bars  $\pm 1SE$ .

## 4. GENERAL DISCUSSION

### 4.1 Spatial and temporal patterns of fishing activities within the GAB

#### 4.1.1 Commonwealth Fisheries

The GAB supports several economically important Commonwealth fisheries. Most operate in the eastern GAB and are unlikely to affect the communities and species of the GABMP directly. However, the Commonwealth GABTF, and to a lesser extent the SBTF and GHTF, have historically operated in the areas which are now zones of the GABMP and continue to undertake activities in areas that may impact on the BPZ.

##### 4.1.1.1 Great Australian Bight Trawl Fishery

Prior to the declaration of the BPZ in 1998, 14% of total trawling effort by GABTF vessels in the GAB was conducted in areas that are now within the GABMP. Logbook data suggest that demersal trawling effort in the GABMP declined to reach ~2% of effort in the GAB in 2002. Demersal trawling is permitted and conducted near the boundaries of the BPZ. The effects of trawling in and near the BPZ on the benthic communities are unknown. However, James *et al.* (2001) observed tracks from demersal trawls across the sediments of the GAB, suggesting that effects may be relatively prolonged. Studies from other areas suggest that trawl gear used in the GABTF is likely to affect the structure and species composition of benthic communities directly (see Ward *et al.* 2003b). Trawling near the BPZ could also affect benthic communities within the BPZ.

Data on bycatch can provide insights into the effects of trawling on benthic communities. Few data are available on the bycatch or discards in the GABTF. Knuckey and Brown (2002) identified over 160 species in trawls, and showed that species composition varied between areas and that discard rates were high and variable. Provisions of the *Commonwealth Environment and Biodiversity Conservation Act 1999*, require strategic assessment of fisheries against the principles of Ecologically Sustainable Development including monitoring, assessment and, if necessary, reduction of bycatch (see Fletcher *et al.* 2002). Hence, AFMA is responsible for ensuring that information on the size and composition of bycatch and discards in the GABTF are collected, and if necessary, for ensuring that bycatch reduction strategies are developed for the fishery. As bycatch levels and discarding practices in the GABTF *per se* are unlikely to impact on the capacity of the GABMP to achieve its primary goals, information on the size and composition of bycatch and discards of the fishery as whole is not needed to manage the GABMP effectively. However, information on bycatch levels, especially sessile epibenthos, in areas adjacent to the BPZ would provide a useful context for assessing the effectiveness of the BPZ in protecting the benthic communities of the GAB.

There are no data on the interactions of the GABTF with protected species, in the area surrounding the GABMP. Such interactions are likely to be rare events, but could include the occasional capture and mortality of pinnipeds or cetaceans. As the manager of the fishery, AFMA is also responsible, under provisions of the *Commonwealth Environment and Biodiversity Conservation Act 1999*, for ensuring that these potential interactions are measured, assessed and, if necessary, mitigated. However, these issues have potentially significant implications for the capacity of the Sanctuary, Conservation and Marine Mammal Protection Zones to achieve their primary goals and are thus directly relevant to the management of the GABMP. Park managers and the GABMP Consultative Committee should work closely with AFMA to ensure that these issues are addressed.

#### 4.1.1.2 Southern Bluefin Tuna Fishery

Between 1976 and 1995, up to 25% of annual purse-seine, pelagic longline and pole fishing operations for tuna in the eastern GAB tuna were conducted within the area that is now the GABMP. Since 1996, <11% of SBTF operations have occurred inside the boundaries of the GABMP. Some domestic pelagic longliners still operate in the eastern GAB. However, purse-seiners providing fish for the SA tuna mariculture industry now take 95% of the TAC for Australia (5265 tonnes in 2000). Purse-seining activities by the SBTF are unlikely to have a major impact on the benthic communities of the BPZ, as purse-seine nets have limited contact with the substrate. However, operational interactions between the fishing gear and protected species, such as pinnipeds or cetaceans, may occur and could have implications for management of the GABMP. Park managers should work with AFMA to address these issues.

#### 4.1.1.3 Gillnet Hook and Trap Fishery

The GHTF is comprised of scalefish hook, shark hook, gillnet and trap sectors, which each have access to different areas depending on the fishing method employed. Fishers in the GHTF using gillnets and demersal longlines to target sharks accounted for >95% of effort in the eastern GAB between 1997 and 2002. Small quantities of several scale-fish species are also taken in the eastern GAB using demersal longlines and droplines.

Since 1997, gillnet fishers in the GHTF spent <5% of total fishing effort in the BPZ. There are no data on the effects of gillnetting on benthic communities. However, these impacts are likely to be limited, given to the relatively minor contact of gillnets with the substrate. Operational interactions with protected species may more significant. However, no detailed studies of the bycatch gillnet sector of the GHTF have been published for the area west of Ceduna (Harris and Ward 1999). Park managers and the GABMP Consultative Committee should work closely with AFMA to ensure that these issues are addressed.

#### *4.1.2 State Fisheries*

In comparison to the Commonwealth fisheries, the SA fisheries have relatively few interactions with the GABMP. For example, trawling in the West Coast Prawn Fishery is confined entirely to the area east of 131°E, and fishing operations for giant crabs, Australian salmon, sand crabs and sardines are confined mainly to the area east of 132°E. However, some KGW are taken around the islands and reefs of the Nuyts Archipelago, and snapper are taken from fishing areas near the GABMP, including reefs off the Nullabor Cliffs. In addition, up to 2% of abalone fishing and 1% rock lobster fishing in the eastern GAB have been undertaken in areas in or near the GABMP. Fishing activities by marine scalefish and abalone fishers have few obvious implications for the GABMP. Rock lobster fishing is also a relatively benign activity (Casement and Svane 1999), however pinnipeds are known to be occasionally caught and drowned in rock lobster pots. Many fishers in the NZRLF utilise seal exclusion devices, but the effectiveness of these techniques has not been quantified. This issue is relevant to the management of the GABMP, and park managers and the GABMP Consultative Committee should work with PIRSA Fisheries to address this issue.

### **4.2 Use of fisheries data to monitor the sustainable-use of the GABMP**

#### *4.2.1 Commonwealth Fisheries*

Logbook data recorded by Commonwealth fishers generally include location (latitude, longitude) information that provides the opportunity for monitoring fishing activities in and near the GABMP. Although these data are available for most Commonwealth fisheries, currently they are not collated or reported to managers of the GABMP or the Consultative Committee on a routine basis. Hence, there is no effective program in place for monitoring and quantifying fishing activities in and near the GABMP. Data on extractive activities in and near the BPZ are needed to provide a context for future assessments of the effectiveness of the BPZ in protecting the benthic communities of the GAB. To understand changes in community structure that may occur in the GABMP, information is needed on activities, such as demersal trawling, that may affect habitats and communities. Experience gained by collating existing fisheries data for the preparation of this report suggest that routine reporting of the fisheries would be assisted by establishing statistical areas that distinguish between activities undertaken in and near the GABMP.

#### *4.1.2 State Fisheries*

It is difficult to use the SA fisheries data to monitor sustainable-use of the GABMP. This is because the spatial units in which fisheries data are collected and collated do not coincide with the boundaries of the GABMP. The latitude and longitude data that were used to quantify catch and effort by Commonwealth fishers in and near the park are generally not available for the SA fisheries. Use of SA fisheries data to monitor sustainable-use would be enhanced by the provision

of latitude and longitude data for fishing activities in and near the GABMP. However, as is the case for the Commonwealth fisheries, routine reporting of fishing activities in and near the GABMP would be made more efficient and effective, by establishing statistical areas that reflect the boundaries of the GABMP, and distinguish between activities undertaken in and near the GABMP.

There are no quantitative data on the catches of recreational and indigenous fishers in and near the GABMP. This issue needs to be addressed. Data on these activities were obtained in the recent NRIFS and should be collated and reported for the area in and near the GABMP. Ongoing mechanisms for monitoring and reporting recreational and indigenous fishing activities in and near the GABMP should be established.

Charter operators should also be required to provide daily catch and effort data that distinguish between activities taken in and near the GABMP. These data should be collated and reported to managers of the GABMP on a routine basis.

#### **4.3 Additional data required to monitor fishing activities in the GABMP**

There are significant limitations to the fisheries data currently collected through logbooks. A review of logbooks is needed for both the Commonwealth and SA fisheries that operate near the GABMP, and should involve managers of the GABMP and the Consultative Committee. As noted above, one of the major needs is for better spatial information in order to ensure that activities undertaken inside and outside the GABMP are clearly differentiated and reported regularly. More detailed information is also needed on the nature of the fishing operations, especially the characteristics of the fishing gear and the level of interaction with the substrate. Information on bycatch and discards are also needed, however the capacity of fishers to provide detailed data on the species composition of bycatch and discards may be limited. Information on the quantities and nature of sessile epibenthos caught in trawls by GABTF vessels would be particularly useful for that fishery.

Logbooks should also be used to record detailed information on the interactions of the fisheries with protected species, especially marine mammals and seabirds. However, independent quantification and verification of the nature and rates of these interactions will also be required. The main priority for effective monitoring of the sustainable-use of the GABMP is for managers of the GABMP to establish effective collaborations with AFMA to ensure that fishing activities near the GABMP are routinely reported to the Park manager and the GABMP Consultative Committee.

Despite the prohibition on demersal trawling associated with establishment of the BPZ, logbook data suggest that some fishing by GABTF vessels has been undertaken in this area since it was proclaimed. There are also anecdotal reports and confirmed instances of shark vessels operating in

the restricted zones of the GABMP. These compliance issues are difficult to address in an area as remote as the central GAB. One option for ensuring that vessels do not operate in restricted areas would be to expand the Vessel Monitoring Systems for fisheries that undertake activities that are prohibited in parts of the GABMP. Other options for ensuring compliance may also be available. Alternatives for ensuring compliance with management arrangements for the GABMP may also need to be considered for developing fisheries such as the SPF, SSJF and SA Sardine Fishery that could potentially expand their activities into parts of the central GAB adjacent to GABMP. Meetings between AFMA, PIRSA Fisheries and the Park manager are needed to ensure that effective mechanisms for ensuring compliance with management arrangements for the GABMP are established for current and potential fisheries in the region.

#### **4.4 Need for observer coverage of fishing activities within the GABMP**

Logbook data alone will not be sufficient to effectively quantify the bycatch and interactions with protected species of the fisheries that operate in and near the GABMP. The collection of information on the size and composition of bycatch and discards in these fisheries is the responsibility of fisheries managers and may not be a priority issue for the Park manager or the GABMP Consultative Committee. In contrast, interactions with protected species, especially pinnipeds and cetaceans, are directly relevant to the GABMP. Observer programs are costly, and programs for quantifying bycatch (which have been initiated by AFMA) and those for investigating interactions with protected species (that could be initiated by managers of the GABMP) should be conducted simultaneously, in order to minimise costs and maximise benefits to the community. This approach will require the establishment and maintenance of effective collaborations between fisheries managers (AFMA and PIRSA Fisheries) and managers of the GABMP.

The issues associated with the need for independent quantification and verification of bycatch and interactions with protected species have been addressed in fisheries such as the South East Trawl Fishery and the East Coast Pelagic Longline Fishery. Observer and monitoring systems that are developed for fisheries that interact with the GABMP should build on the expertise and insights developed in these fisheries. Programs need to be developed in conjunction with Consultative Committee to ensure that the needs and sensitivities of all stakeholders are addressed adequately.

#### **4.5 Indicators for assessing the status of harvest, bycatch and discard species**

Monitoring the status of harvest, bycatch and discard species for fisheries that operate in and near the GABMP is not an issue that is relevant to managers of the GABMP or the Consultative Committee. These roles are the responsibility of fisheries managers, namely AFMA and PIRSA Fisheries. Data required to identify indicators for assessing the status of harvest, bycatch and discard species are sparse. However, data from a survey of the GAB conducted by SARDI Aquatic

Sciences (Ward *et al.* 2003b) suggests that information on the quantities and nature of sessile epibenthos caught in trawls by GABTF vessels would be useful for monitoring the ecological effects of that fishery. Identifying indicator species or groups for the other fisheries is beyond the beyond the scope of this report and will require the collection and analysis of quantitative data on the bycatch and discards in these fisheries.

#### **4.6 Program for monitoring sustainable-use of the GABMP**

The first priority for establishing an effective program for monitoring the sustainable use of the GABMP is for managers of the GABMP to develop effective mechanisms for interacting and collaborating with AFMA and PIRSA Fisheries. GABMP managers will also need to participate actively in a review of current logbooks that will ensure that appropriate data are collected for relevant fisheries, including detailed information on the nature of the fishing gear used, bycatch levels and interactions with protected species. This review of logbooks should also involve the establishment of statistical areas for reporting on, and distinguishing between, fishing activities that are undertaken in and near the GABMP. A mechanism should be established to ensure that these data are collated and reported to the managers of GABMP on a routine basis.

The development of effective mechanisms for interacting and collaborating with the AFMA and PIRSA will also be critical to the establishment of a cost-effective observer program for quantifying bycatch and verifying data on the nature of interactions with protected species.

Effective mechanisms for communication should also be established and/or further developed with groups within AFMA and PIRSA that are responsible for monitoring compliance in fisheries that operate in or near the GABMP. The suitability of Vessel Monitoring Systems or other cost-effective mechanism for ensuring compliance with management arrangements for the GABMP should be assessed objectively and in consultation with stakeholders.

#### **4.7 Linking strategy for monitoring sustainable-use to performance assessment of the BPZ**

Data on spatial and temporal patterns of fishing activities in and near the GABMP will assist the design and satisfactory completion of future programs for assessing the performance of the BPZ in protecting biodiversity. For example, data on levels of trawling effort are needed to identify areas that should be used to assess the effects of demersal trawling on community structure. These data are also needed to determine areas within the BPZ where the effects of fishing activities conducted near the GABMP should be assessed. Hence, the success of future performance assessment of the BPZ will be determined, at least in part, by quality of the systems which are established for monitoring extractive activities in and near the GABMP.

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## APPENDICES

### Appendix 1. List of taxa reported for the GABTF from 1973-2003

Common name	Taxonomic classification	Common name	Taxonomic classification
Spiky oreo	<i>Neocyttus rhomboidalis</i>	King dory	<i>Cyttus traversi</i>
Triggerfishes	Family Balistidae	King George Whiting	<i>Sillaginodes punctata</i>
Blindsharks	Family Brachaeluridae	Knifejaw	<i>Oplegnathus woodwardi</i>
Oreos	Family Oreosomatidae	Latchet	<i>Pterygotrigla polyommata</i>
Saw sharks	Family Pristiophoridae	Ling	<i>Genypterus blacodes</i>
Angelsharks	Family Squatinidae	Lobsters	Lobsters
Arrow squid	<i>Nototodarus gouldi</i>	Long-finned boarfish	<i>Zanclistius elevatus</i>
Australian black shark	<i>Dalatias licha</i>	Mackerel	<i>Scomber scombrus</i>
Australian tuskfish	<i>Dannevigia tusca</i>	Manta ray	<i>Manta birostris</i>
Barracouta	<i>Thyrsites atun</i>	Mirror dory	<i>Zenopsis nebulosus</i>
Bearded rock cod	<i>Pseudophycis barbata</i>	Moonlighter	<i>Vinculum sexfasciatum</i>
Bight redfish	<i>Centroberyx gerrardi</i>	Skipjack tuna	<i>Katsuwonus pelamis</i>
Big-spined boarfish	<i>Pentaceros decacanthus</i>	Smooth dory oreo	<i>Pseudocyttus maculatus</i>
Black bream	<i>Acanthopagrus butcheri</i>	Smooth hammerhead	<i>Sphyrna zygaena</i>
Black shark/roughskin	<i>Centroscyminus</i> spp	Smooth oreo	<i>Pseudocyttus maculatus</i>
Blue eye trevalla	<i>Hyperoglyphe antarctica</i>	Snapper	<i>Chrysophrys auratus</i>
Blue grenadier	<i>Macruronus novaezelandiae</i>	Snapper	<i>Pagrus auratus</i>
Blue mackerel	<i>Scomber australasicus</i>	Southern calamary	<i>Sepioteuthis australis</i>
Blue warehou	<i>Seriolella brama</i>	Southern fiddler ray	<i>Trygonorrhina guaneri</i>
Boarfish	Family Pentacerotidae	Southern frostfish	<i>Lepidopus caudatus</i>
Brier shark	<i>Deania calcea</i>	Southern saw shark	<i>Pristiophorus nudipinnis</i>
Broadnose sevengill hark	<i>Notorynchus cepedianus</i>	Spiky oreo	<i>Neocyttus rhomboidalis</i>
Bronze whaler	<i>Carcharhinus brachyurus</i>	Spiny veilfin	<i>Velifer multiradiatus</i>
Bug	<i>Thenus orientalis</i>	Spotted trevalla	<i>Seriolella punctata</i>
Chinaman-leatherjacket	<i>Nelusetta ayraudi</i>	Spotted warehou	<i>Seriolella punctata</i>
Common slickhead	<i>Alepocephalus</i> Sp.	Spurdog	<i>Squalus megalops</i>
Crabs	Order decapoda	Squid	Teuthoids
Cuttlefish	<i>Sepia</i> spp	Squid (Calamari)	Teuthoids
Deepsea Trevalla	<i>Hyperoglyphe antarctica</i>	Stargazer	Family Uranoscopidae
Deepwater Flathead	<i>Neoplatycephalus conatus</i>	Striped trumpeter	<i>Latris lineata</i>
Dogfish	<i>Squalidae</i> Family	Swallowtail	<i>Centroberyx lineatus</i>
Dory - not specified	Family Zeidae	Thetis fish	<i>Neosebastes thetidis</i>
Dorymirror	<i>Zenopsis nebulosus</i>	Trevally	Family Carangidae
Eel	Family Congridae	Veilfin	<i>Metavelifer multiradiatus</i>
Elephant fish	<i>Callorhynchus milii</i>	Warehou	<i>Seriolella brama</i>
Flathead	<i>Neoplatycephalus richardsoni</i>	Warty Oreo	<i>Alloctytus verrucosus</i>
Gemfish	<i>Rexea solandri</i>	Western school whiting	<i>Sillago bassensis</i>
Giant crab	<i>Pseudocarcinus gigas</i>	Whiptail rattail	Family Macrouridae
Green-eyed dogfish	<i>Squalus mitsukurii</i>	Whiptail shark	Family Shimaeridae
Grey nurse shark	<i>Carcharias taurus</i>	Whiskery shark	<i>Furgaleus macki</i>
Gummy shark	<i>Mustelus antarcticus</i>	White trevalla	<i>Seriolella caerulea</i>
Hapuku	<i>Polyprion oxygeneios</i>	White-spotted dogfish	<i>Squalus acanthias</i>
Jack mackerel	<i>Trachurus declivis</i>	Wobbegong/carpet shark	<i>Orectolobus</i> spp
Jackass morwong	<i>Nemadactylus macropterus</i>	Yellow-spotted boarfish	<i>Paristiopterus galliparvo</i>
John dory	<i>Zeus faber</i>	Yellowtail kingfish	<i>Seriola lalandi</i>

Northwest ruby fish	<i>Etelis carbunculus</i>	Ribaldo	<i>Mora moro</i>
Ocean perch	<i>Helicolenus percoides</i>	Rosy dory	<i>Cyttopsis roseus</i>
Ogilbys ghost shark	<i>Hydrolagus gilbyi</i>	Rough gurnard perch	<i>Neosebastes pandus</i>
Oilfish	<i>Ruvettus pretiosus</i>	Royal red prawns	<i>Haliporoides sibogae</i>
Orange perch	<i>Lepidoperca pulchella</i>	Rubyfish	<i>Plagiogeneion</i> spp
Orange roughy	<i>Hoplostethus atlanticus</i>	Samsonfish	<i>Seriola hippos</i>
Ornate angel shark	<i>Squatina tergocellata</i>	Sandpaper fish	<i>Paratrachichthys</i> spp 1
Other	Mixed Species	Saw shark	<i>Pristiophorus</i> spp
Ox-eyed Oreo	<i>Oreosoma atlanticum</i>	Sawbellies	Family Trachichthyidae
Pilchard	<i>Sardinops sagax</i>	Scalloped hammerhead	<i>Sphyrna lewini</i>
Pink ling	<i>Genypterus blacodes</i>	School shark	<i>Galeorhinus galeus</i>
Puffer/toadfish	Family Tetraodontidae	School whiting	<i>Sillago flindersi</i>
Purple stargazer	<i>Pleuroscopus</i> sp. 1	Sea sweep	<i>Scorpius aequipinnis</i>
Queen snapper	<i>Nemadactylus valenciennesi</i>	Seal/black shark	Family Squalidae
Ray	Family Rajidae	Sergeant baker	<i>Aulopus purpurissatus</i>
Ray's bream	<i>Brama brama</i>	Shark "Other"	Shark "Other"
Red gurnard	<i>Chelidonichthys kumu</i>	Short boarfish	<i>Parazanclistius hutchinsi</i>
Red gurnard perch	<i>Helicolenus percoides</i>	Shortfin mako	<i>Isurus oxyrinchus</i>
Redbait	<i>Emmelichthys</i> spp	Silver dory	<i>Cyttus australis</i>
		Silver trevally	<i>Pseudocaranx dentex</i>

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## Appendix 2. List of taxa reported for the GHTF from 1997-2002.

Common name	Taxonomic classification	Common name	Taxonomic classification
Angel shark	<i>Squatina australis</i>	Ocean Perch	<i>Helicolenus percoides</i>
Australian salmon	<i>Arripis truttacea</i>	Octopus	<i>Octopus</i> spp.
Banjo shark	Family Rhinobatidae	Other	Mixed Species
Bight redfish	<i>Centroberyx gerrardi</i>	Pencil shark	<i>Hypogaleus hyugaensis</i>
Blue eye trevalla	<i>Hyperoglyphe antarctica</i>	Queen snapper	<i>Nemadactylus valenciennesi</i>
Blue shark	<i>Prionace glauca</i>	Redfish	Family Bercidae
Blue warehou	<i>Seriola lalandi</i>	Richardson's boarfish	<i>Pseudopentaceros richardsoni</i>
Boarfish	Family Pentacerotidae	Samsonfish	<i>Seriola hippos</i>
Broad billed swordfish	<i>Xiphias gladius</i>	Saw Shark	<i>Pristiophorus</i> spp.
Broadnose sevengill shark	<i>Notorynchus cepedianus</i>	Scalloped hammerhead	<i>Sphyrna lewini</i>
Bronze whaler	<i>Carcharhinus brachyurus</i>	School & gummy shark	Family Triakidae
Common saw shark	<i>Pristiophorus cirratus</i>	School shark	<i>Galeorhinus galeus</i>
CRABS	Order Decapoda	Shark "Other"	Shark "Other"
Crayfish	Order Decapoda	Shark fins -Other	Shark Fins Other
Dogfish	Family Squalidae	Shortfin mako	<i>Isurus oxyrinchus</i>
Dory-not specified	Family Zeidae	Silver trevally	<i>Pseudocaranx dentex</i>
Dusky morwong	<i>Dactylophora nigricans</i>	Smooth dory/ Oreo	<i>Pseudocyttus maculatus</i>
Eastern blue groper	<i>Achoerodus viridis</i>	Smooth hammerhead	<i>Sphyrna zygaena</i>
Elephantfish	<i>Callorhynchus milii</i>	Snapper	<i>Pagrus auratus</i>
Endeavour dogfish	<i>Centrophorus moluccnesis</i>	Southern eagle ray	<i>Myliobatis australis</i>
Flathead	Families Platycephalidae/ Hoplichthyidae	Southern frostfish	<i>Lepidopus caudatus</i>
Gemfish	<i>Rexea solandri</i>	Southern hake	<i>Merluccius australis</i>
Grouper and Cod	<i>Epinephelus</i> spp. and Family Serranidae	Southern rock cod	<i>Pseudophycis barbata</i>
Gummy shark	<i>Mustelus antarcticus</i>	Southern saw shark	<i>Pristiophorus nudipinnis</i>
Hapuku	<i>Polyprion oxygeneios</i>	Spotted warehou	<i>Seriola punctata</i>
Hapuku and bass groper-NSW	<i>Polyprion</i> spp.	Spurdog	<i>Squalus megalops</i>
Harlequin fish	<i>Othos dentex</i>	Squid	Teuthoids
Jackass morwong	<i>Nemadactylus macropterus</i>	Stingray	Family Dasyatididae
Jewfish	Family Glaucosomidae	Sweep	<i>Scorpius lineolatus</i>
John dory	<i>Zeus faber</i>	Thresher shark	<i>Alopias vulpinus</i>
Knifejaw	<i>Oplegnathus woodwardi</i>	Trevally	Family Carangidae
Latchet	<i>Pterygotrigla polyommata</i>	Whiskery shark	<i>Furgaleus macki</i>
Leatherjacket	Family Balistidae	White-spotted dogfish	<i>Squalus acanthias</i>
Ling	Family Ophidiidae	Wobbegong/carpet shark	<i>Orectolobus</i> spp.
Luderick	<i>Girella tricuspidata</i>	Yellowtail kingfish	<i>Seriola lalandi</i>

### Appendix 3. List of taxa reported for the SBTF from 1976-2002.

Common name	Taxonomic classification
Albacore tuna	<i>Thunnus alalunga</i>
Australian anchovy	<i>Engraulis australis</i>
Barracouta	<i>Thyrsites atun</i>
Bigeye tuna	<i>Thunnus obesus</i>
Black oilfish	<i>Lepidocybium flavobrunneum</i>
Black tip Shark	<i>Carcharhinus tilstoni</i>
Blue Mackerel	<i>Scomber australasicus</i>
Blue Shark	<i>Prionace glauca</i>
Broad billed swordfish	<i>Xiphias gladius</i>
Bronze whaler	<i>Carcharhinus brachyurus</i>
Butterfly mackerel	<i>Gasterochisma melampus</i>
Dolphinfish	<i>Coryphaena hippurus</i>
Gemfish	<i>Rexea solandri</i>
Hammer head shark	<i>Sphyrna lewini</i>
Lancet fish	<i>Alepisaurus sp.</i>
Longtail tuna	<i>Thunnus tonggol</i>
Manta ray	<i>Manta birostris</i>
Moonfish	Family Lampridae
Ocean sunfish	<i>Mola mola</i>
Oceanic whitetip shark	<i>Carcharhinus longimanus</i>
Oilfish	<i>Ruvettus pretiosus</i>
Pilchard	<i>Sardinops sagax</i>
Porbeagle shark	<i>Lamna Nasus</i>
Ray	Family Rajidae
Ray's bream	<i>Brama brama</i>
Rudderfish	<i>Centrolophus niger</i>
Scalloped hammerhead	<i>Sphyrna lewini</i>
Shark (Other)	Shark (Other)
Shortfin mako	<i>Isurus oxyrinchus</i>
Skipjack tuna	<i>Katsuwonus pelamis</i>
Sorrah shark	<i>Carcharhinus sorrah</i>
Southern bluefin tuna	<i>Thunnus maccoyii</i>
Southern frostfish	<i>Lepidopus caudatus</i>
Marlins	Family Istiophoridae
Thresher shark	<i>Alopias vulpinus</i>
Trevally	Family Carangidae
Whaler sharks	Family Caracharhinidae
Yellowfin tuna	<i>Thunnus albacares</i>
Yellowtail kingfish	<i>Seriola lalandi</i>
Yellowtail scad	<i>Trachurus novaezelandiae</i>