

Commercial Fisheries

North Coast Bioregion

Regional Management Overview

Commercial fisheries in this bioregion are focused on the tropical and deep-water snappers in offshore waters and on barramundi, threadfin salmon and shark in more coastal areas. Most of the State's smaller prawn trawl fisheries are also based in this region.

The Pilbara Fish Trawl Interim Managed Fishery continued as the provider of the majority of the State's demersal finfish. Other important providers of demersal finfish operating in the area are the Northern Demersal Scalefish and the Pilbara Trap Managed Fisheries. A new management plan for the Northern Demersal Scalefish Fishery was introduced on 1 January 2001, moving the fishery from interim managed to fully managed status. All three fisheries operate under individual transferable effort management arrangements, monitored by the Vessel Monitoring System.

There were some significant changes to the management arrangements for the Onslow and Nickol Bay Prawn Managed Fisheries and the inter-relationships of the Nickol Bay Prawn Managed Fishery with the Pilbara Fish Trawl Interim Managed Fishery. Ministerial approval was received to amend the management plan for the fish trawl fishery to remove the link between it and the prawn fishery. Once this change is effected it will require the latent effort issue in the Nickol Bay Prawn Managed Fishery to be further considered. Ministerial approval was also received to provide for an amendment to the management plan for the Onslow Prawn Managed Fishery which will allow Onslow Area 3 licences to become fully transferable.

The Kimberley Prawn Managed Fishery formally adopted the Vessel Monitoring System for the commencement of the 2001 season, with the Nickol Bay Prawn Managed Fishery expected to come under the VMS later in the year. Ministerial approval was also received to bring the Onslow Prawn Managed Fishery under the VMS in 2002.

A resource management agreement (the 'Barramundi Accord') was developed for the barramundi resources of the Kimberley. Fisheries WA, together with Kimberley gillnet and barramundi licensees and representatives of other interested groups, developed and signed off on an agreement which will assist in sustainable management of the stock and reduce conflict between user groups. The 'Accord' now has to be approved by the Minister and given effect through a number of changes to management arrangements for the Kimberley Gillnet and Barramundi Managed Fishery and to recreational fishery controls.

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

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

Commercial fishing for Spanish mackerel (*Scomberomorus commerson*) operates mainly between May and October between Geraldton and the Northern Territory border. Limited catches are also made through summer by fishers operating in the Pilbara region. The main method for capturing Spanish mackerel is by trolling

baits and lures, with up to seven lines trolled at a time. Baits and lures drifted or cast from an anchored or drifting boat are also used to target mackerel, whilst incidental catches may occur when using handlines and droplines.

Owing to concerns from both industry and Government over increased catches and preliminary assessments which suggest that the species could be over-fished, an interim management plan is currently under discussion. Following extensive consultation during 2000/2001, and receipt of a large number of submissions on proposed options, it is anticipated that the fishery will move to interim managed status in 2002. In the interim, the minimum legal size for Spanish mackerel has recently been increased to 90 cm to correspond more closely to age at sexual maturity. Research data on Spanish mackerel fishing are reported on pp. 82-6.

There is also a take of fish throughout the region by beach seining and near-shore gillnetting using hand-hauled nets, which is not subject to any dedicated management plan. The exception to this is the Kimberley Gillnet and Barramundi Managed Fishery, reported on pp. 67-70.

The activities of the demersal line fishery, which takes demersal finfish, are reported in the Pilbara Demersal Finfish Fisheries Status Report on pp. 75-81.

Regional Compliance and Community Education Overview

The Pilbara Fish Trawl, Northern Demersal Scalefish and Kimberley Prawn Managed Fisheries were monitored through the use of VMS, which operates through client stations at the Karratha and Broome District Offices. In addition, Fisheries Officers from both of these locations carried out numerous land-based and sea patrols to inspect the catches of licensees in these and the region's other small prawn fisheries.

Compliance activities directed at the remaining fisheries were at a low level due to limited resources coupled with the extensive geographical area and small number of licensees involved. However, resource-sharing issues related mainly to barramundi fishing are leading to an increased demand for compliance activities, especially in the lower Ord River, Roebuck Bay and the Pilbara.

Regional Research Overview

In addition to the research projects and activities noted in the research summary for each individual fishery, there has been a major focus during 2000/2001 on assessing the general wetline catch in each bioregion. This assessment, undertaken utilising the CAES database, indicates that around a quarter (25%) of the State's wetline catch during 1999/2000 was reported from this bioregion, which includes waters off both the Kimberley and Pilbara coasts. The top ten species include Spanish mackerel (250 tonnes), threadfin (72 tonnes), other mackerel (25 tonnes), unspecified shark (20 tonnes), spangled emperor (17 tonnes), unspecified trevally (8 tonnes), blacktip shark (6 tonnes), cod (5 tonnes), red emperor (4 tonnes) and mullet (black jew) (4 tonnes). An interim management plan is currently being developed for the troll fishery for mackerel, details of which are reported on pp. 82-6. Most other species are taken by line fishing off the Pilbara coast.

Onslow Prawn Managed Fishery

MANAGEMENT SUMMARY

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

The 2001 fishing season commenced on 1 March and will end on 15 November. Within the main fishing period, a number of fishing area openings and closures allow access to tiger prawn and banana prawn stocks at appropriate times.

A significant number of boats have access to this fishery, as most Exmouth Gulf prawn vessels have access to Area 2 and most Nickol Bay prawn vessels have access to Area 3. Management controls include limited entry, gear restrictions and controls on replacement boat size. The Onslow Prawn Fishery Management Plan has recently been amended to increase the transferability of some licence categories.

Governing Legislation/Fishing Authority

Onslow Prawn Fishery Management Plan 1991
Onslow Prawn Managed Fishery Licence

Consultation Process

Agency–industry meeting

RESEARCH SUMMARY

Research for managing this small fishery involves stock monitoring and assessment utilising the CAES monthly return data provided by industry, as well as information from interviews with boat skippers. Annual meetings are held with boat operators to consider the status of the stocks and recommend changes to fishing operations.

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

Onslow Prawn Managed Fishery Status Report

Prepared by M. Kangas and E. Sporer

FISHERY DESCRIPTION

Boundaries and access

The boundaries of this fishery are 'all Western Australian waters of the Indian Ocean below high water mark lying west of 116°45' east longitude and east of a line commencing at the high water mark on the mainland due south of the southernmost extremity of Locker Island drawn due north to the high water mark at that extremity; thence northwesterly to the high water mark at the southernmost extremity of Serrurier Island; thence northerly along the high water mark of that island on its western shore to its northernmost point; thence due north' (Onslow/Nickol Bay Prawn Figure 1).

The fishery is then divided into three fishing zones with associated nursery areas as follows: Area 1, incorporating

Ashburton Nursery; Area 2, incorporating Coolgra Point Nursery; and Area 3, incorporating Fortescue Nursery.

During the 2000 season the areas were open during the following periods:

Area 1	2 April-11 November
Area 2	2 April-11 November
Area 3	1 March-15 November
Fortescue Nursery	1 May-11 November
Ashburton and Coolgra Point Nurseries	1 May-30 September

Different licence classes apply to this fishery allowing boats to trawl in specific zones. These classes are listed below (figures in brackets indicate 2000 endorsements):

Class A	Areas 1, 2 and 3 (4 boats)
Class B	Areas 2 and 3 (3 boats)
Class C	Area 2 (12 Exmouth Gulf boats)
Class D	Area 3 (12 Nickol Bay boats)

Main fishing method

Otter trawl.

RETAINED SPECIES

Commercial production (season 2000): 87 tonnes

Landings

The total landings of major penaeids for the 2000 season were 87 tonnes, including 12 tonnes of king prawns, 18 tonnes of tiger prawns, 6 tonnes of endeavour prawns and 51 tonnes of banana prawns (Onslow Prawn Figure 2). King prawn catches were 33% lower than the five-year average, which may have been due to effects of cyclonic activity and heavy rain during March 2000. This may have dispersed king prawns further offshore away from areas where they are normally caught, reducing the catchability for this season. Conversely, rainfall-dependent banana prawns provided a higher catch this season, up 144% on the five-year average.

Recorded landings of by-product species included 4 tonnes of coral prawns, 11 tonnes of bugs and less than one tonne each of black tiger prawns, squid, blue swimmer crabs, shark and mixed finfish species.

Fishing effort

Not assessed.

Catch rate

Not assessed.

Recreational component:

Nil

Stock assessment complete:

Not assessed

The catches during 2000 were below average for king prawns, middle of the range for tiger prawns, and in the low end of the range for endeavour prawns. Banana prawn catches were among the highest recorded since 1990. Further work is under way to assess the relationship between summer rainfall and catches from Area 1, which includes the Ashburton River estuary, a nursery area for this species.



Commercial Fisheries

Exploitation status: Not assessed

Breeding stock levels: Not assessed

NON-RETAINED SPECIES

Bycatch species impact: Low

Bycatch from the fishery is typical of tropical trawl fisheries (i.e. up to about 6:1 relative to the target species), but the effort levels and spatial coverage are too low to impact bycatch species.

Protected species interaction: Low

The Onslow prawn fishery can at times catch turtles and sea snakes, but the overall low effort level and targeted coverage of the fishery suggest that such interaction would not be significant.

ECOSYSTEM EFFECTS

Food chain effects: Low

Because of the limited spatial coverage of this fishery and its low levels of catch of the target species, it is unlikely to have any significant ecological consequences.

Habitat effects: Low

This fishery targets primarily king and tiger prawns in most years and, occasionally, schooling banana prawns in the infrequent high rainfall periods, as in 2000. Within the extensive licensed fishing zone, relatively few discrete areas offshore from nursery areas are fished (less than 5% of the overall fishery). Consistent effort occurs mostly between the Ashburton River and Onslow for banana and king prawns, and in the Mangrove Passage area for tiger prawns. Trawling occurs over a very small proportion (< 5%) of the king prawn habitat, as densities in most areas are too low for economically viable trawling. In contrast, fishing covers a high proportion (50%) of the discrete banana prawn habitats associated with river estuaries.

The fishery is restricted to clean sand and mud bottoms, where trawling has minimal physical impact.

SOCIAL EFFECTS

Estimated employment for the year 2000 was 12–15 skippers and crew, with up to 10 people involved in local processing.

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year 2000:
\$1.5 million

Ex-vessel prices for prawns vary depending on the type of product and the market forces operating at any one time. Generally, average prices received by vessels fishing along the northern coast in 2000 were as follows:

King prawns	\$17.30/kg
Tiger prawns	\$22.90/kg
Endeavour prawns	\$12.90/kg
Banana prawns	\$15.40/kg
Coral prawns	\$4.70/kg

FISHERY GOVERNANCE

Acceptable catch range: 60–130 tonnes

Under current effort levels and previous environmental conditions, the acceptable ranges of prawn catches, based on the catches of the 1990s, are as follows:

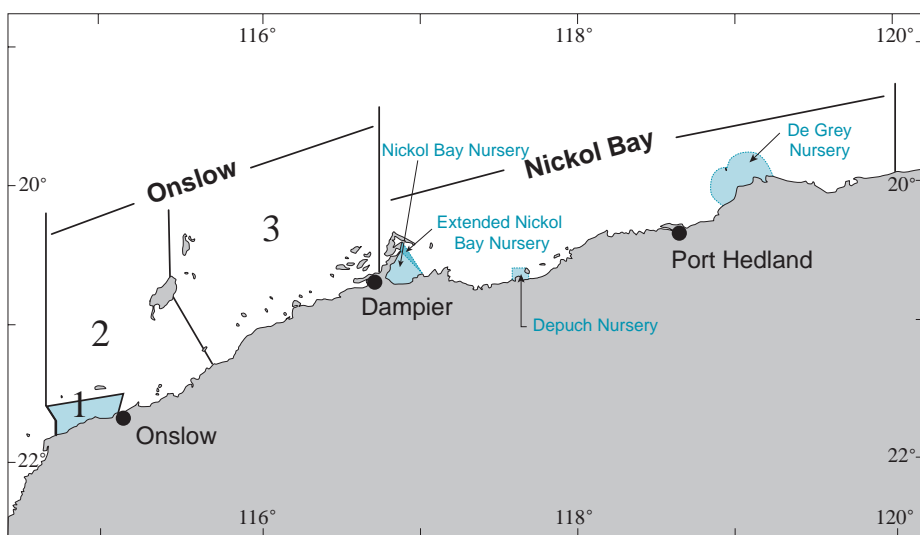
King prawns	10–55 tonnes
Tiger prawns	5–40 tonnes
Endeavour prawns	5–20 tonnes
Banana prawns	2–90 tonnes

Note the overall acceptable range for all species combined is different from the aggregate of the individual species ranges shown, as the environmental circumstances that benefit banana prawns generally result in decreased catches of the other species in the same year.

EXTERNAL FACTORS

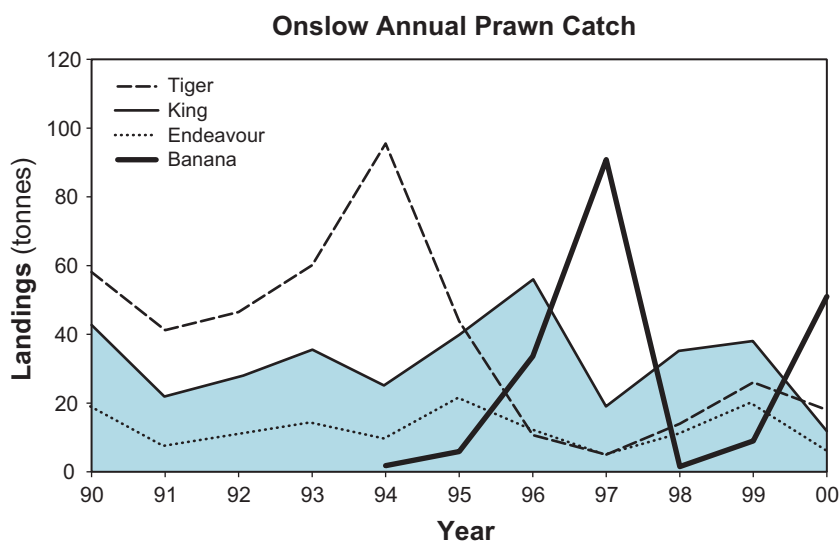
The catches taken are from a number of separate nursery areas and are highly variable from year to year. This is particularly the case for the rainfall-dependent banana prawn, which was the dominant species caught during 2000.

Catches of tiger prawns from this fishery are also quite variable. It is likely that severe cyclonic activity impacts negatively on tiger prawns in some years, and moreover, the effect varies depending on whether juvenile prawns are still in vulnerable, shallow nursery areas at the time. Severe cyclones can impact directly on endeavour prawns. The king prawn catch has remained stable, indicating that environmental effects such as cyclonic activity (producing heavy rainfall) have little effect on the abundance of the king prawn stock. However, fishers report that there can be an indirect, short-term impact on the distribution of king prawns when heavy rainfall inland and subsequent river flooding appear to disperse the stock, affecting overall catches. At times, debris from flooding is reported to restrict fishing activities and hence landings for the year.



ONSWLOW/NICKOL BAY PRAWN FIGURE 1

Boundaries of the Onslow and Nickol Bay Prawn Managed Fisheries.



ONSWLOW PRAWN FIGURE 2

Annual landings for the Onslow Prawn Managed Fishery, 1990–2000.



Commercial Fisheries

Nickol Bay Prawn Managed Fishery

MANAGEMENT SUMMARY

The Nickol Bay Prawn Managed Fishery (NBPMF) targets banana prawns (*Penaeus merguianus*), western king prawns (*Penaeus latissulcatus*), brown tiger prawns (*Penaeus esculentus*) and endeavour prawns (*Metapenaeus* spp.), with most prawn fishing activity occurring in inshore areas. Management controls for the NBPMF are based on limited entry, seasonal and area closures, gear controls and restrictions on boat size. A number of the Nickol Bay prawn trawlers also operate in the Pilbara Fish Trawl Interim Managed Fishery and the Onslow Prawn Managed Fishery. However, following industry consultation, Ministerial approval was received to amend the management plan for the fish trawl fishery to remove the link between it and the NBPMF. Once this change is effected it will require the latent effort issue in the NBPMF to be further considered.

In 2001, the main fishing grounds opened on 1 May and will close on 15 November. Within the main fishing period, fishing area openings and closures allow access to tiger and banana prawn stocks at appropriate times.

Governing Legislation/Fishing Authority

Nickol Bay Prawn Fishery Management Plan 1991
Nickol Bay Prawn Managed Fishery Licence

Consultation Process

Agency–industry meeting

RESEARCH SUMMARY

Research for the management of this small fishery involves stock monitoring and assessment utilising monthly return data provided by industry, information from boat skippers, and rainfall records. Stock assessment of the banana prawn stocks involves updating the catch–rainfall relationship.

Research outcomes are reviewed at annual industry meetings which consider the status of the stocks and recommend changes to fishing operations.

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

Nickol Bay Prawn Managed Fishery Status Report

Prepared by M. Kangas and E. Sporer

FISHERY DESCRIPTION

Boundaries and access

The boundaries of this fishery are 'all the waters of the Indian Ocean and Nickol Bay between 116°45' east longitude and 120° east longitude on the landward side of the 200 m isobath' (Onslow/Nickol Bay Prawn Figure 1).

During the 2000 season the major fishing areas were open during the following periods:

Nickol Bay Nursery	1 May-1 August
Extended Nickol Bay Nursery	1 May-15 November
Depuch Nursery	1 May-1 August
De Grey Nursery	1 May-15 November
Onslow Area 3	1 March-11 November

There were 14 boats licensed to trawl for prawns in Nickol Bay during 2000.

Main fishing method

Otter trawl.

RETAINED SPECIES

Commercial production (season 2000): 512 tonnes

Landings

The banana prawn landings of 467 tonnes for the 2000 season (Nickol Bay Prawn Figure 1) fell within the range of 300–500 tonnes projected on the basis of the high rainfall in the 1999/2000 summer period.

Other prawn landings for the 2000 season totalled 45 tonnes, comprising 31 tonnes of king prawns, 13 tonnes of tiger prawns and 1 tonne of endeavour prawns (Nickol Bay Prawn Figure 1).

Recorded by-product species for 2000 were 1 tonne of black tiger prawns, 3 tonnes of coral prawns, 4 tonnes of bugs, 2 tonnes of blue swimmer crabs, 1.5 tonnes of shark and less than one tonne each of squid and mixed finfish species.

Fishing effort

Not assessed.

Catch rate

Not assessed.

Recreational component: Nil

Stock assessment complete: Not assessed

A relationship exists between the summer rainfall (December–March) and the catch of banana prawns in the same year. This relationship is assessed annually (Nickol Bay Prawn Figure 2). Other prawn stocks are insufficient to carry out a formal stock assessment.

Exploitation status: Not assessed

Breeding stock levels: Not assessed

**Projected catch next season (2001):
Banana prawns 80–190 tonnes**

Adjusting the forecast of banana prawns for the 183 mm of rain during the 2000/2001 summer period provides a catch projection of between 80 and 190 tonnes.

NON-RETAINED SPECIES

Bycatch species impact: Low

The Nickol Bay prawn fishery operates predominantly by specifically targeting schools of banana prawns. This results in relatively low effort and minimal bycatch compared with other trawl fisheries.

Protected species interaction: Low

The Nickol Bay prawn fishery can at times catch turtles and sea snakes, but the overall low effort level and targeted coverage of the fishery suggest that such interaction would not be significant.

ECOSYSTEM EFFECTS

Food chain effects: Low

In view of the highly variable nature of banana prawn recruitment, positively related to cyclonic rainfall, any food chain impacts from fishing are likely to be minimal despite the relatively high annual exploitation rate.

Habitat effects: Low

The small fleet fishes on a limited number of discrete fishing grounds, making up less than 5% of the coastal habitat within the fishery. Habitat types on the trawl areas associated with banana and king prawns are mud and sand respectively, and not impacted significantly by trawl gear.

SOCIAL EFFECTS

Estimated employment for year 2000 was 40–50 skippers and crew, with up to 20 people involved in onshore processing in the region.

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year 2000: \$8 million

Ex-vessel prices for prawns vary depending on the grade of the product and the market forces operating at any one time. Generally, average prices received by vessels fishing along the northern coast in 2000 were as follows:

Banana prawns	\$15.40/kg
King prawns	\$17.30/kg
Tiger prawns	\$22.90/kg
Endeavour prawns	\$12.90/kg
Coral prawns	\$4.70/kg

FISHERY GOVERNANCE

Acceptable catch range: 90–300 tonnes

Under current effort levels and previous environmental conditions, the acceptable ranges of prawn catches, based on the catches of the 1990s, are as follows:

Banana prawns	40–220 tonnes
King prawns	20–70 tonnes
Tiger prawns	2–40 tonnes
Endeavour prawns	1–10 tonnes

Note the overall acceptable range for all species combined is different from the aggregate of the individual species ranges shown, as the environmental circumstances that benefit banana prawns generally result in decreased catches of the other species in the same year.

It should also be noted that the banana prawn catch has exceeded 400 tonnes following extreme cyclonic rainfall on three occasions over the past 30 years.

EXTERNAL FACTORS

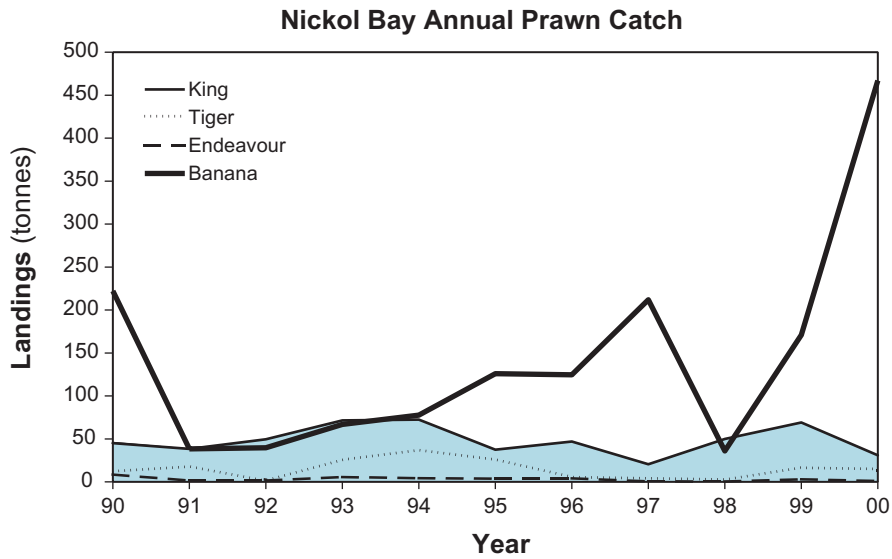
Minimum catch monitoring is completed for minor fisheries such as the Nickol Bay Prawn Managed Fishery.

The majority of boats in the prawn fleet of Nickol Bay are also licensed to fish finfish stocks offshore (the Pilbara Fish Trawl Fishery). Some also fish for prawns in the Kimberley Prawn Managed Fishery. As such, the fishing effort in the Nickol Bay Prawn Managed Fishery is dependent on management measures in place elsewhere, and on the catch rates available in these other fisheries. Fishing for finfish has encouraged the construction of larger boats with greater fishing power than would otherwise have been supported by fishing prawns alone. In recent years, however, concern about over-exploitation in the Pilbara Fish Trawl Fishery has led to time quotas and other restrictions. The impacts of these restrictions and of falling finfish catches have forced some of the fishing effort back into the Nickol Bay Prawn Managed Fishery.

Banana prawns usually dominate the catch from Nickol Bay. The catch of this species is positively correlated with rainfall in the months December to March. The record catches of banana prawns in 2000 were anticipated because of high rainfall (572 mm) during this critical period. With only 183 mm of rainfall recorded for this same period during 2000/2001 lower landings (80–190 tonnes) of banana prawns are forecast for 2001. The king prawn catches were below the five-year average but within the acceptable range for this species. The distribution of the king prawn stock appears to have been affected by freshwater inflow from cyclonic activity during the summer period (December to March). The high rainfall during the 2000 season would have dispersed the king prawns further offshore, away from where they would normally be caught, thus reducing their catchability for this season. It is anticipated that the king prawn catches should return to acceptable catch range in 2001 provided environmental conditions are favourable (less rainfall).

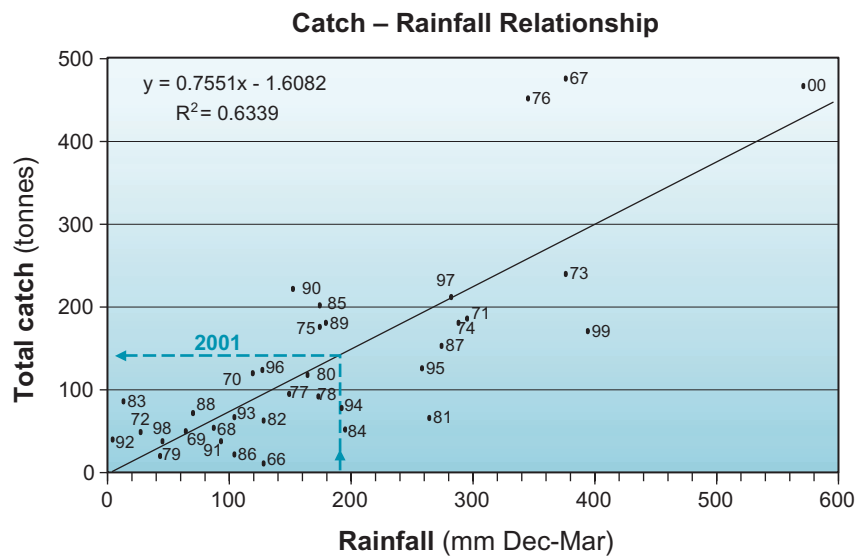


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NICKOL BAY PRAWN FIGURE 1

Annual landings for the Nickol Bay Prawn Managed Fishery, 1990–2000.



NICKOL BAY PRAWN FIGURE 2

Relationship between banana prawn landings and rainfall between December and March for the years 1966–2000.

Broome Prawn Managed Fishery

MANAGEMENT SUMMARY

The Broome Prawn Managed Fishery is a small fishery which operates in July–August in a designated trawl zone off Broome and generally coincides with the seasonal closures for the Northern and Kimberley prawn fisheries. The dominant species caught are western king prawns (*Penaeus latisulcatus*) and coral prawns (a combined category of small penaeid species). The management plan, which came into effect in 1999, includes a provision for licensees to be directed to instal bycatch reduction devices if required.

Governing Legislation/Fishing Authority

Broome Prawn Fishery Management Plan 1999
Broome Prawn Managed Fishery Licence

Consultation Process

Agency–industry meeting

RESEARCH SUMMARY

Research data for managing this small seasonal fishery is provided by detailed research logbooks completed by all boats. This data is used for stock assessment and monitoring which is discussed with industry at annual review meetings. The relationship between catch and moon phase was investigated during 1997/98, which has resulted in some ongoing modifications to the management arrangements.

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

Broome Prawn Managed Fishery Status Report

Prepared by M. Kangas and E. Sporer

FISHERY DESCRIPTION

Boundaries and access

The boundaries of this fishery are *'all waters of the Indian Ocean off the north-west coast of Western Australia east of 120° east longitude and west of 123°45' east longitude on the landward side of the 200 m isobath'*.

Within this schedule, the permitted fishing area is *'all Western Australian waters bounded by a line commencing at the intersection of 17°20' south latitude and 121°50' east longitude; thence east to the intersection of 17°50' south latitude and 121°55' east longitude; thence north-east to the intersection of 17°40' south latitude and 122° east longitude; thence north to the intersection of 17°30' south latitude and 122° east longitude; thence north-west to the intersection of 17°20' south latitude and 122°55' east longitude; thence west to the commencement point'*.

The permitted fishing area was opened for the 2000 fishing season on 1 June and closed on 7 August.

Five Western Australian-based Northern Prawn Fishery (Gulf of Carpentaria) boats are licensed to operate in this fishery.

Main fishing method

Otter trawl.

RETAINED SPECIES

Commercial production (season 2000): 159 tonnes

Landings

The total landings for the 2000 season were 159 tonnes, including 76 tonnes of king prawns and 83 tonnes of coral prawns (Broome Prawn Figure 1) for 54 days fished. King prawn landings for 2000 were 8% lower than the five-year average (83 tonnes) whereas the catch of coral prawns was the highest total catch recorded to date.

Fishing effort

Nominal effort recorded in the daily research logbooks for the fleet was 2,957 hours.

Catch rate

A catch rate of 25.8 kg/hr for king prawns and 28 kg/hr for coral prawns was recorded. The catch rates of king prawns for June (28.9 kg/hr) were similar to those seen in 1999, but rates were lower in July (21.8 kg/hr) compared to the corresponding period in 1999.

Recreational component: Nil

Stock assessment complete: Yes

A more sophisticated Delury depletion analysis incorporating lunar effects was carried out on the 2000 logbook data to quantify the standing stock of king prawns in the Broome fishery. From this analysis, a standing stock of approximately 190 tonnes was estimated. This indicates that approximately 40% of the stock was taken by fishing, utilising the 2,957 hours of fishing recorded in this fishery. The approach of using a depletion analysis has potential to examine variation in recruitment strength from year to year because the standing stock estimate for each year will reflect this. When sufficient years of data have been assembled, it will be possible to relate the proportion of the king prawn stock unfished at the end of each fishing season (a measure of residual spawning stock) and the recruitment of king prawns in the subsequent year.

The depletion method applied has provided a good insight into stock levels. It has the advantage of being a very direct assessment method, with the potential to carefully control exploitation rates. It is intended to continue its use as the primary assessment method for this fishery.

Exploitation status: Under-exploited

Breeding stock levels: Adequate

Depletion analysis indicated that approximately 60% of the king prawn stock was left when fishing stopped. This stock could continue to breed. In addition, some females may have spawned prior to capture. These data indicate that the king prawn stock is well above the level of 20% of virgin biomass generally considered to be sufficient to sustain a fishery.



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NON-RETAINED SPECIES

Bycatch species impact: **Low**

Owing to the very short duration of this fishery and the small number of boats involved, the impact on bycatch species is minimal.

Protected species interaction: **Low**

The fishery operates in relatively deep water, and this fact, combined with the short season and the small number of boats involved, means that interaction with protected species is minimal.

ECOSYSTEM EFFECTS

Food chain effects: **Low**

The short duration and limited spatial coverage of this fishery, and the small number of boats involved, indicate that food chain effects will be insignificant.

Habitat effects: **Low**

The fishery targets non-schooling king prawns with a secondary catch of coral prawns (common name due to colour, not habitat association) in relatively deep water. The fishery is permitted to operate only in a discrete area offshore, north-west of Roebuck Bay which is the nursery area for this king prawn stock. The gazetted fishing area was surveyed by the Fisheries Research Division and industry divers prior to establishment of the management plan to ensure minimal impact on the adjacent pearl fishery habitat. The sea floor in the trawl area was mud or sand which is unlikely to be adversely impacted by trawling.

SOCIAL EFFECTS

Estimated employment for the year 2000 was 20 skippers and crew.

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year 2000: **\$1.7 million**

Ex-vessel prices for prawns vary depending on the type of product and the market forces operating at any one time. Generally, prices received by boats for 2000 were as follows:

King prawns	\$17.30/kg
Coral prawns	\$4.70/kg

FISHERY GOVERNANCE

Acceptable catch range: King prawns 35–170 tonnes

Under current effort levels and previous environmental conditions, the acceptable range for the king prawn catch, based on the catches of the 1990s, is 35–170 tonnes.

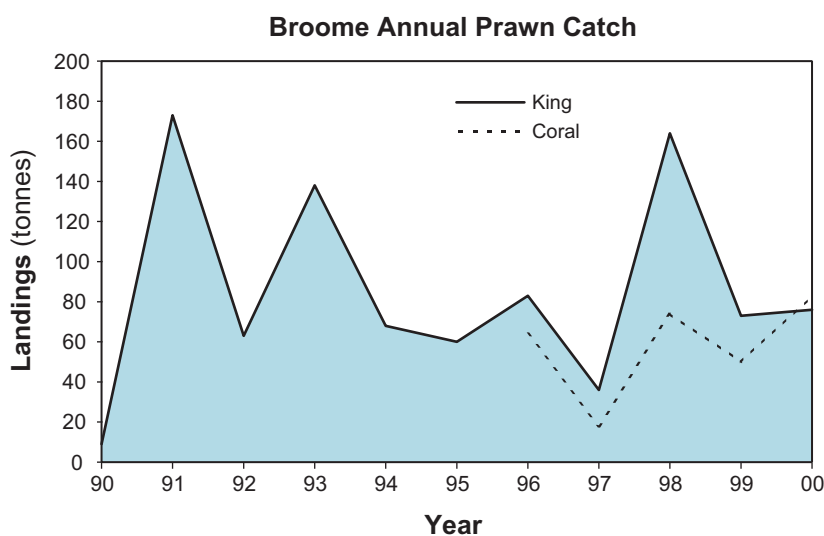
EXTERNAL FACTORS

Catches of king prawns in the Broome Prawn Managed Fishery have fluctuated between 36 and 173 tonnes since 1991. Before that time this fishing area was used on a casual basis by boats transiting to the Northern Prawn Fishery (NPF) in the Gulf of Carpentaria. The success of this fishery depends on how the limited fishing season (approximately eight weeks) coincides with the king prawn recruitment and catchability, which is influenced

by the lunar period. Historically, the timing of this fishery has been set by calendar to coincide with the NPF mid-season closure (six weeks) rather than the appropriate lunar period. Consequently, the timing of the fishing period has not always been optimal for exploiting the king prawn stock.

This fishery has benefited from advice from Fisheries WA relating to the timing of the fishing season. The catch of king prawns is affected by the lunar phase, with lower catches occurring around the full moon. By bringing the timing of the season in line with lunar period, fishing efficiency has been maximised. This achieves the best catch rates available during the fishing period while keeping the season generally in line with the NPF mid-season closure.

This fishery is valuable, despite its short season, because it allows approximately eight to nine weeks of fishing by five boats in a way that complements their fishing activity in the NPF, and in other fisheries in Western Australia.



BROOME PRAWN FIGURE 1

Annual landings for the Broome Prawn Managed Fishery, 1990–2000.

Kimberley Prawn Managed Fishery

MANAGEMENT SUMMARY

The Kimberley Prawn Managed Fishery operates off the north of the State adjacent to the Commonwealth-managed Northern Prawn Fishery. A significant number of vessels hold authorisations to operate in both fisheries, and opening and closing dates are aligned to prevent large shifts of fishing effort into the Kimberley fishery.

The management controls for the Kimberley Prawn Managed Fishery are based on limited entry, seasonal closures, gear controls and restrictions on boat replacements. VMS was also introduced into the fishery during 2001.

Governing Legislation/Fishing Authority

Kimberley Prawn Fishery Management Plan 1993
Kimberley Prawn Fishery Managed Fishery Licence

Consultation Process

Agency–industry meeting

RESEARCH SUMMARY

Research data for monitoring this fishery are provided by Western Australian fishers' monthly returns, and by research logbooks collected by the Australian Fisheries Management Authority (AFMA) for NPF boats licensed to operate in the Kimberley fishery.

Research assessments are provided to annual meetings of boat operators and provide the basis for recommending changes to management arrangements each year.

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

Kimberley Prawn Managed Fishery Status Report

Prepared by M. Kangas and E. Sporer

FISHERY DESCRIPTION

Boundaries and access

The boundaries of this fishery are 'all Western Australian waters of the Indian Ocean lying east of 123°45' east longitude and west of 126°58' east longitude'.

Seasonal dates for the Kimberley Prawn Managed Fishery are aligned with those of the adjacent Northern Prawn Fishery. Consequently, the 2000 season opened on 1 April and closed for the mid-season closure on 27 May. The fishery re-opened on 4 August and ran until the final season closure on 8 November.

Although a total of 134 boats had access to the Kimberley Prawn Managed Fishery under various licensing arrangements, only 25 boats operated in the fishery during the 2000 season.

Main fishing method

Otter trawl.

RETAINED SPECIES

Commercial production (season 2000): 236 tonnes

Commercial Fisheries

Landings

The total landings for the 2000 season were 236 tonnes, including 201 tonnes of banana prawns, 23 tonnes of tiger prawns, and 7 tonnes of endeavour prawns (Kimberley Prawn Figure 1).

The banana prawn catch was below the range expected (275–525 tonnes) using the preliminary relationship between summer rainfall (December to March) and catches. The estimate has a wide range because of highly variable catches due to environmental conditions (summer rainfall), the extensive coastline, the topography of the coastline, and large tidal fluctuations. The tiger prawn catch was within the expected range for these species (15–40 tonnes) whilst endeavour prawns were just below the expected range (11–80 tonnes).

Recorded by-products were 2 tonnes of bugs and less than one tonne of squid.

Fishing effort

Not assessed.

Catch rate

Not assessed.

Recreational component: Nil

Stock assessment complete: Not assessed

Although there has been no formal stock assessment based on catches and fishing effort for the Kimberley prawn stocks, nevertheless the relationship recognised from other fisheries between rainfall and catches of banana prawns (the dominant species taken in this area) may provide a degree of forecasting.

Further investigations have shown a more promising relationship between early season rainfall (January and February) and the subsequent catch of banana prawns. Rainfall during the period January–February 2001 was 348 mm at Derby and 571 mm at Kalumburu, which indicates that banana prawn catches for 2001 should be in the range of 200–350 tonnes. Investigations on refining rainfall–catch relationships are continuing.

Exploitation status: Not assessed

Breeding stock levels: Not assessed

Projected catch next season (2001):
Banana prawns 200–350 tonnes

The projected catch for 2001 based on the rainfall–catch relationship is 200–350 tonnes for banana prawns.

NON-RETAINED SPECIES

Bycatch species impact: Low

The majority of the catch in this fishery comprises banana prawns which form schools that are specifically targeted, meaning that bycatch is minimal. In the Kimberley, however, banana prawns may also be generally trawled when they are dispersed due to local tidal conditions. Overall, the fishery is likely to have a low impact on bycatch species.

Protected species interaction: Low

Turtle exclusion devices are used by the NPF boats. Only one turtle was recorded (AFMA records) as being captured in the Kimberley fishery during 2000, and this was returned to the sea alive.

ECOSYSTEM EFFECTS

Food chain effects: Low

As the fishery targets banana prawns, which are highly variable in recruitment due to cyclonic rainfall, any food chain impacts from fishing are likely to be negligible.

Habitat effects: Low

The Kimberley prawn trawl fishery operates over a very limited sector, estimated to be less than 5% of the licensed area. Owing to the unusual nature of the environment, characterised by extreme (10 m) tidal ranges, heavy mud substrates and high turbidity, the fishing is judged to have minimal impact on the habitat.

SOCIAL EFFECTS

Estimated employment for the year 2000 was 100 skippers and crew.

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year 2000:
\$3.7 million

Ex-vessel prices for prawns vary depending on the type of product and the market forces operating at any one time. Generally, average prices received by boats fishing along the northern coast in 2000 were as follows:

Banana prawns	\$15.40/kg
Tiger prawns	\$22.90/kg
Endeavour prawns	\$12.90/kg

FISHERY GOVERNANCE

Acceptable catch range: 240–500 tonnes

Under current effort levels and previous environmental conditions, the acceptable ranges of prawn catches, based on the catches of the 1990s, are as follows:

Banana prawns	200–450 tonnes
Tiger prawns	15–60 tonnes
Endeavour prawns	7–80 tonnes

Note the overall acceptable range for all species combined is different from the aggregate of the individual species ranges shown, as the environmental circumstances that benefit banana prawns generally result in decreased catches of the other species in the same year.

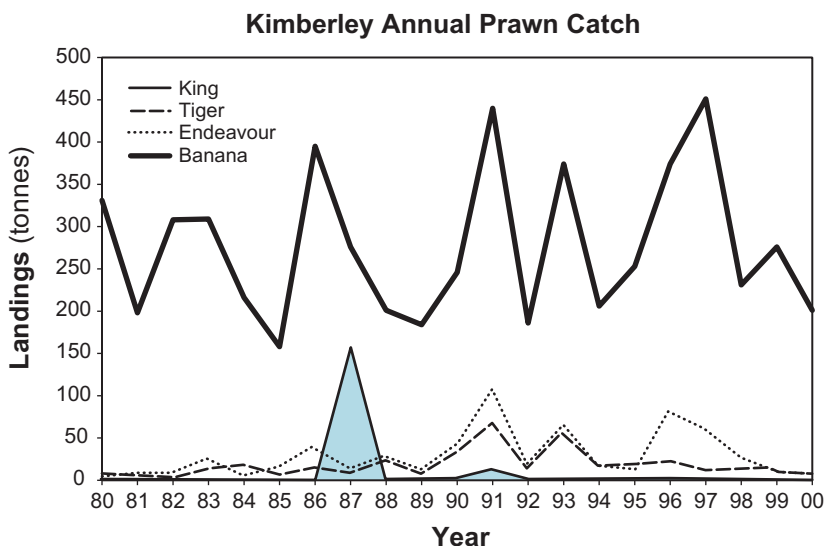
EXTERNAL FACTORS

The relationship between summer rainfall and the catch of banana prawns is being investigated further. As banana prawns usually comprise the majority of the prawn catch from this fishery, this correlation will assist fishers and managers to make the best use of the fishery.

This fishery is used by relatively few stand-alone, Kimberley-only boats for the complete fishing season. Boats from Nickol Bay and elsewhere in Western Australia use it at certain times of the year to complement

catches in their local fisheries. Boats fishing in the Northern Prawn Fishery in the Gulf of Carpentaria also use this fishery for periods each year, and in fact the Kimberley fishing season is set to mirror dates used in the

NPF, to prevent the small Kimberley fishery from attracting too much fishing effort from its large neighbour. However, it must be noted that the level of latent effort in this fishery is high.



KIMBERLEY PRAWN FIGURE 1

Annual landings for the Kimberley Prawn Managed Fishery, 1980–2000.

Kimberley Gillnet and Barramundi Managed Fishery

MANAGEMENT SUMMARY

The Kimberley Gillnet and Barramundi Managed Fishery extends from the WA/NT border to the top of Eighty Mile Beach, south of Broome (latitude 19° S). It encompasses the taking of fish by means of gillnet and the taking of barramundi by any means.

The species taken are predominantly barramundi (*Lates calcarifer*) and threadfin salmon (*Eleutheronema tetradactylum*). The main areas of the fishery are the river systems of the northern Kimberley, the Fitzroy River, Roebuck Bay and Eighty Mile Beach.

There are currently seven licences in the fishery, reduced from a historical level of 10 through a Voluntary Fisheries Adjustment Scheme in 1999.

In March 2000, a working group consisting of commercial, recreational and charter boat representatives as well as Fisheries WA research and management officers was formed to consider future management arrangements for the barramundi resource. A number of recommendations were developed for both the commercial and recreational exploitation of barramundi.

These recommendations included extensive areas closed to commercial fishing around major town sites and recreationally important fishing locations, and a total netting ban north of Beadon Creek near Onslow.

Amendments to existing bag and size limits have also been recommended. The main elements of this 'Barramundi Accord' have been supported by the Minister for Fisheries, and legislation is being drafted to implement the new arrangements.

Governing Legislation/Fishing Authority

Kimberley Gillnet and Barramundi Fishery Management Plan 1989
Kimberley Gillnet and Barramundi Managed Fishery Licence

Consultation Process

Agency–industry meeting

RESEARCH SUMMARY

The data used to assess the status of the series of barramundi stocks taken by this fishery are provided from the CAES database. The following status report is compiled annually and provided to industry and regional management.



Commercial Fisheries

Kimberley Gillnet and Barramundi Managed Fishery Status Report

Prepared by S. Ayyazian and G. Nowara

FISHERY DESCRIPTION

Boundaries and access

The boundaries of this limited entry fishery are 'all Western Australian waters lying north of 19° south latitude and west of 129° east longitude and within three nautical miles seawards of the low water mark of the mainland of Western Australia and the waters of King Sound of 16°21'38" south latitude'. Access to the fishery was by seven vessels during 1999/2000. (Note: The distribution of barramundi catches in Western Australia extends further south to the Ashburton River near Onslow. These catches are outside of the boundaries of the managed fishery and are not included in this status report).

Main fishing method

Gillnet.

RETAINED SPECIES

Commercial production (season 1999–2000):

All species 147 tonnes
Barramundi 44.5 tonnes

Landings

Each of five principal fishing areas is considered separately because of differing histories of development, effort application, recreational interest and unit stock considerations: Cambridge Gulf/Ord River, Kimberley coast (six river systems), King Sound/Fitzroy River, Broome coast, and Pilbara coast to the Ashburton River, the last of which is south of the prescribed restricted entry fishery (below latitude 19° S). Landings from the Pilbara coast are not included in the total catch figure. Total landings of barramundi for all four prescribed fishing areas within the fishery were 44.5 tonnes for 1999/2000 (Kimberley Gillnet Figure 1). This catch of barramundi was greater than those of the previous three years, reflecting an increase in abundance, noting that effort has been in an overall downward trend over recent years.

The 1999/2000 landings of threadfin salmon, at 90.8 tonnes, were once again far higher than those of barramundi. These two main species comprised 92% of the total catch. There were reported landings of 18 other species, including 3 tonnes each of elasmobranchs (sharks and rays) and cod.

Fishing effort

The fishing effort in this gillnet fishery is calculated as the total annual number of fishing days by all boats multiplied by the average daily total of 100 m lengths of gillnet used per boat. During 1999/2000, the total effort across the four prescribed fishing areas was 1,355 units. This total effort is slightly higher than last year, but lower than in the previous 10 years (Kimberley Gillnet Figure 1).

Catch rate

The catch and effort for barramundi peaked in the late 1980s and since then total catch and effort have fallen,

with an accompanying increase in catch per unit of effort. The current CPUE is down from last year, which was the highest in the past 12 years (Kimberley Gillnet Figure 1).

Recreational component: **Not assessed**

At this time there are no available figures on recreational catch and effort in this area.

Stock assessment completed: **Yes**

A boot-strapped biomass dynamics model was used to estimate biomass for the barramundi assemblage for each of the four principal fishing areas. The information for each of the four models uses commercial catch and effort data and an estimated recreational catch and participation level (=effort) based on a percentage of the 1999 commercial catch for the fishing area, and a rate of annual increase in recreational participation that is similar to the statewide increase. There remains a high degree of uncertainty around the results because the data to verify a number of assumptions inherent in the models, are not available.

The Cambridge Gulf fishery model and the Kimberley coast fishery model predict that at current commercial effort levels, the catch will be sustainable for the next 10 years in these areas. The estimated biomass remains above 50% of the virgin biomass and the stocks appear to be under-exploited, noting however that Cambridge Gulf has been at much lower levels over the past 20 years and has only just started to recover to acceptable levels. For both the Broome coast and King Sound sectors, the predicted future biomass falls between 20% and 50% of the estimated virgin biomass. In the Broome region the prediction is that the biomass will continue to decline. Management changes are being introduced to address this issue. For the King Sound fishery, large confidence intervals around the annual estimates indicate greater uncertainty. However, reference to historical catch and effort trends and our understanding of how the fishery operates indicate that fishing at current levels in this area is sustainable.

Exploitation status: **Fully exploited**

Barramundi on average are fully exploited.

Breeding stock levels: **Adequate**

Assessment of the barramundi stocks indicates that breeding stocks in most areas are adequate, with some local depletion approaching the critical level of 20% of virgin biomass in the Broome region.

NON-RETAINED SPECIES

Bycatch species impact: **Low**

The fishery operates at a relatively low intensity over a wide area of the Kimberley, specifically targeting barramundi and threadfin salmon. The fishing gear, with large mesh sizes, does not generate a significant bycatch of species important to other sectors, but does take some saw sharks and rays. Because of the low effort levels, these impacts are unlikely to be significant to the stocks involved. Overall, this fishery is likely to have little effect on the Kimberley ecosystem as a whole.

Protected species interaction: Low

The fishing gear used for this fishery does take some crocodiles. Because of the low effort levels, these impacts are unlikely to be significant.

ECOSYSTEM EFFECTS

Food chain effects: Not assessed

Habitat effects: Not assessed

SOCIAL EFFECTS

The Kimberley Gillnet and Barramundi Managed Fishery involved an average of about 23 fishers in 1999/2000. There was additional employment through local processors and distribution networks.

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year (1999–2000):
 All species \$861,000
 Barramundi \$424,000

FISHERY GOVERNANCE

Acceptable catch range: Barramundi 25–40 tonnes

This projection is derived by double exponential smoothed forecasting of the annual catches up to 1998/99 and the variation of observations around the predictions. The confidence intervals are set at 80%. The future annual catch values which fall outside of this range will be investigated. Where consecutive values occur outside of the range, management changes may need to be considered.

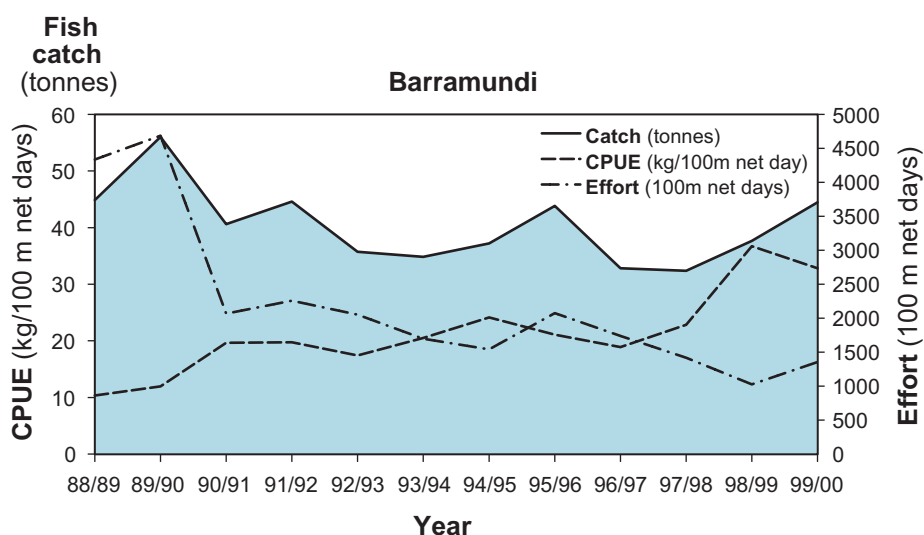
EXTERNAL FACTORS

The barramundi stocks utilising the large, productive Kimberley river systems as nursery areas are expected to be reasonably resilient to fishing pressure. However, the smaller, isolated stocks along the Pilbara desert coastline are likely to suffer more variable recruitment. These stocks are subject to relatively uncontrolled fishing under general wetline licence arrangements, as well as from recreational fishers, and are likely to need specific management arrangements in the future.

Resource sharing between commercial and recreational fishers on the Ord River is a current issue. However, recent and anticipated levels of commercial fishing by existing operators pose no threat to the viability of the resource. At current levels of fishing it is unlikely that the abundance of fish is being significantly impacted by the commercial sector.

The stock assessment models developed for the barramundi fisheries cannot be improved without the allocation of more resources to the gathering of the data necessary to test the model assumptions and to evaluate the effects of proposed management changes.

Since 1995/96 the catch of threadfin salmon has been considerable, making it the major focus of this fishery in recent years (Kimberley Gillnet Figure 2). As such, priority needs to be given to basic research on these stocks.

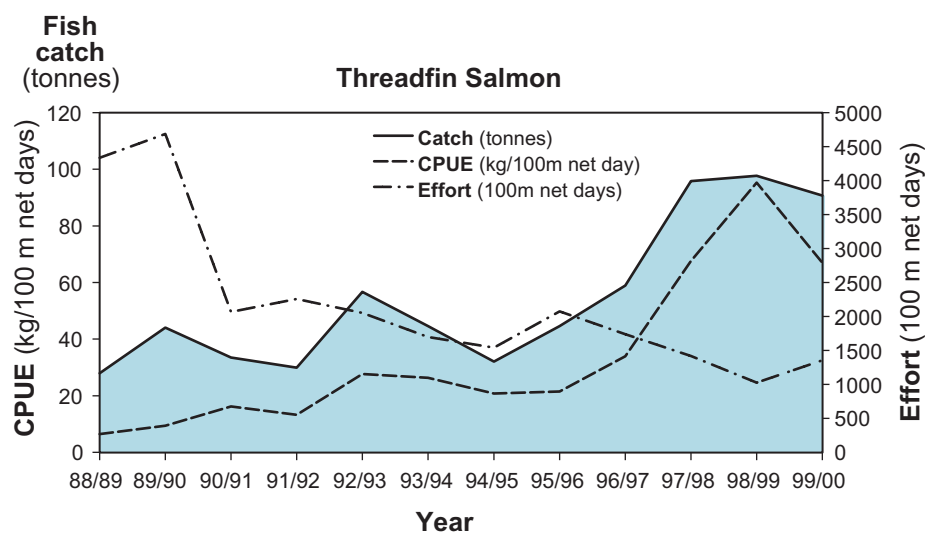


KIMBERLEY GILLNET FIGURE 1

The annual catch, effort and catch per unit effort (CPUE, kg/100 m net day) for barramundi from the Kimberley Gillnet and Barramundi Managed Fishery over the period 1988/89 to 1999/2000.



Commercial Fisheries



KIMBERLEY GILLNET FIGURE 2

The annual catch, effort and catch per unit effort (CPUE, kg/100 m net day) for threadfin salmon from the Kimberley Gillnet and Barramundi Managed Fishery over the period 1988/89 to 1999/2000.

Northern Demersal Scalefish Managed Fishery

MANAGEMENT SUMMARY

The Northern Demersal Scalefish Managed Fishery (NDSMF) operates off the north-west coast of Australia in the waters east of 120° E longitude. Commercial catches are dominated by tropical snappers (which include red emperor), the emperors or nor-west snappers (which include goldband snapper), and the cods or gropers.

The Northern Demersal Scalefish Fishery Management Plan 2000 was developed and legislated during 2000 and commenced on 1 January 2001. This plan superseded the Northern Demersal Scalefish Fishery Interim Management Plan 1997 and converted the NDSMF to managed fishery status. The Northern Demersal Scalefish Management Advisory Committee, NDSMF licensees and Fisheries WA have worked co-operatively to ensure that the new management arrangements are simple, enforceable, flexible and cost-effective.

The fishery is managed by way of a series of input controls including individual transferable effort allocations, gear restrictions and area closures. In addition, a nominal total sustainable catch (TSC) is allocated on an annual basis. In 2000, the TSC was 800 tonnes of demersal scalefish.

With the exception of one case, all the objection tribunals pertinent to the NDSMF have been resolved. There are presently three licensees authorised to fish in Area 1 of the fishery and 11 licensees authorised to fish in Area 2.

Governing Legislation/Fishing Authority

Northern Demersal Scalefish Fishery Management Plan 2000
Northern Demersal Scalefish Managed Fishery Licence

Consultation Process

Northern Demersal Scalefish Management Advisory Committee

RESEARCH SUMMARY

A major three-year research project to assess the status of the major fish stocks which contribute to this fishery was completed in 2000. The information gathered is now being analysed to reassess the sustainable yield. Ongoing monitoring of this fishery is being undertaken using both CAES data and VMS records.

The following status report provides a synthesis of the current data from the fishery.

Northern Demersal Scalefish Fishery Status Report

Prepared by S. Newman

FISHERY DESCRIPTION

Boundaries and access

The waters of the NDSMF are defined as all Western Australian waters off the north coast of Western Australia east of longitude 120° E. These waters extend out to the edge of the Australian Fishing Zone (200 nautical mile) limit under the Offshore Constitutional Settlement arrangements (Northern Demersal Scalefish Figure 1).

The fishery is further divided into two fishing zones, an inshore zone (Area 1) and an offshore zone (Area 2) (see Northern Demersal Scalefish Figure 1). The demersal scalefish resources of the deeper waters of the offshore zone (greater than 200 m depth) remain to be adequately investigated; these waters are shown on Northern Demersal Scalefish Figure 1 as a research fishing area.

The inshore waters in the vicinity of Broome are closed to commercial fishing. The closed area extends from Cape Bossut to Cape Coulomb, inside a line which approximates as closely as possible the 30 m bathymetric contour.

Access to the NDSMF is currently limited to 11 licences under an individual transferable effort quota system. This allows the effort quota to be operated by a lesser number of vessels. For example, during 2000, seven vessels collectively held and operated the effort individually assigned to the 11 licences.

Main fishing method

Principally fish traps, and to a lesser extent line fishing methods such as handline and/or dropline.

RETAINED SPECIES

Commercial production (season 2000): 470 tonnes

Landings

The reported catch in the NDSMF rose steadily in the period from 1992 to 1996 (Northern Demersal Scalefish Table 1 and Figure 2). However, catches have declined from 1997 through to 2000. In the three years since the implementation of management controls, the reported catch has ranged between 470 and 580 tonnes. The 2000 catch of demersal scalefish in the NDSMF is the lowest catch return of the last nine years. In particular, the trap catch in 2000 was down considerably on 1999 and on historical levels (Northern Demersal Scalefish Table 1, Northern Demersal Scalefish Figure 2). The trap and line fishery in the NDSMF principally targets red emperor (*Lutjanus sebae*) and goldband snapper (*Pristipomoides multidens*) with many species of snappers (*Lutjanidae*), emperors (*Lethrinidae*) and cods (*Serranidae*) comprising a large component of the landed by-product. A breakdown of the landed catch in the NDSMF in 2000 is provided in Northern Demersal Scalefish Table 2. A number of operators within the NDSMF are also involved in other fishing activities in the region, such as trolling for Spanish mackerel. The catches of pelagic fishes such as the mackerels are not included in the demersal scalefish catch. The catch of Spanish mackerel and other mackerels is reported on pp. 82-6.

Fishing effort

The fish trap effort (in boat days fished) within the NDSMF has on average been declining since 1992. The fish trap effort in 2000 was down from that recorded in 1999, but was marginally higher than the 1998 level (Northern Demersal Scalefish Table 1). As has been the case in both 1998 and 1999, a large proportion of the effort allocated to both line and trap vessels in the fishery remained unutilised in 2000. The line effort recorded in 2000 was down on that recorded in 1999, but was higher than the 1998 line effort (Northern Demersal Scalefish

Table 1). Line vessels operating within the NDSMF in recent years have struggled to be economically viable and most have looked to convert to trap fishing methods. This limited viability is the reason for the heavily reduced line effort evident for the period 1998–2000 (Northern Demersal Scalefish Table 1).

Catch rate

Catch per unit effort for trap vessels in the NDSMF increased in 1998, reflecting increases in efficiency as fishers sought to maximise their catch return from each day fished as the fishery came under full management, with consequent limitation on the available fishing effort. Since 1998, CPUE for trap vessels has declined to average historic levels.

Recreational component: **Not assessed**

At present there is little recreational fishing effort directed towards the deeper-water fish species in Area 2, which are the key species targeted by commercial fishers in the NDSMF. Most of the recreational fishing effort targeting demersal finfish in the Kimberley region is thought to be expended in Area 1. However, the magnitude of this effort and the catch taken is still to be quantified.

Stock assessment completed: **Not assessed**

The introduction of formal management procedures has restricted the number of vessels permitted to fish in the waters of the NDSMF. A target TSC of 800 tonnes was adopted in order to constrain harvest rates until a stock assessment of the key target species could be completed. The control mechanism implemented to maintain a catch level of approximately 800 tonnes was a restriction on the number of trap or line days fished by each vessel exploiting the NDSMF resource. Trap and line effort units (fishing days) are allocated annually on the basis of historical catch rate trends and set to enable the target catch to be achieved within each year. Decision rules have been developed to manage variations in catch around the target TSC. The outcome from this effort determination process for the 2001 fishing season is noted in the 'Acceptable catch range' section below.

A major three-year FRDC-funded research project was completed in 2000. The primary objective of this research project was to undertake a formal assessment of the key demersal finfish species in the NDSMF, red emperor and goldband snapper. Goldband snapper live to at least 30 years. Growth parameters for the goldband snapper are $L_{\infty} = 598$ mm, $K = 0.187$ yr⁻¹, $t_0 = -0.173$ (r² = 0.76). The instantaneous rate of natural mortality (M) was estimated to be in the range 0.104–0.139. Total instantaneous mortality rate (Z) estimates generated from catch-at-age data for goldband snapper, taking into account fishing effort levels were 0.65 for 1995/96, 0.87 for 1996/97 and 0.76 for 1997/98. In 1999 fishers increasingly targeted goldband snapper and this is likely to have affected their catchability, and thus influenced the mortality estimates derived from catch-at-age information. This result is to be investigated further. The above mortality estimates were used to calculate exploitation rates. They ranged from 0.79 to 0.84 in the period from 1995/96 through to 1997/98. These rates of exploitation for the NDSMF population of goldband snapper are considered to be above the optimum.



Commercial Fisheries

Red emperor were found to live to at least 34 years. There was significant differential growth between sexes, with male fish reaching a larger size at age than female fish. Growth parameters for males were $L_{\infty} = 628$ mm, $K = 0.151$ yr⁻¹, $t_0 = -0.595$, and for females $L_{\infty} = 483$ mm, $K = 0.271$ yr⁻¹, $t_0 = 0.065$. Slow growth in length was evident for both sexes. The instantaneous rate of natural mortality (M) was estimated to be in the range 0.104–0.122. The instantaneous rate of total mortality (Z) estimated from catch-at-age data for red emperor was 0.32 for 1997/98 and 0.28 for 1998/99. These results yield exploitation rates for the NDSMF population of red emperor of 0.63 in 1997/98 and 0.57 in 1998/99, which may also be above the optimum.

These results indicate that the fishery is fully exploited and is likely to be operating above optimum levels for the key species. Furthermore, the TSC has not been achieved in recent years, which raises the question of whether the 800 tonne TSC is sustainable or achievable in the long term.

The results from the stock assessment work will be used to undertake a review of the appropriateness of the current target sustainable catch prior to the 2002 fishing year. Part of the review process will involve attempting to improve the spatial resolution of the targeted effort used for stock assessment. The present stock assessment approach has looked at the fishery in its entirety. The next step in this process is to look at areas within the fishery to determine whether greater spatial resolution of the targeted catch and effort data is possible.

Exploitation status: Fully exploited
Key species are exploited above optimum levels.

Breeding stock levels: Declining
The length at maturity for goldband snapper was estimated to be 473 mm fork length (552 mm total length) for females and 470 mm fork length (549 mm total length) for males, corresponding to an age at maturity of 8.2 years for females and 8 years for males. As it is impractical to return under-size fish (due to decompression injuries), there is currently no legal minimum size for goldband snapper within the fishery, and all fish landed are sent to market. The length frequency distribution of more than 4,500 goldband snapper of both sexes sampled over the last five years indicates that a large proportion of the harvested population consists of immature fish. For male goldband snapper, 23% of fish sampled were below the size at maturity, while for females 41% were below the size at maturity. Furthermore, there has been a significant decline in the mean length and weight of goldband snapper landed in the period from 1995 to 1999. These results indicate that the breeding stock level of goldband snapper in the NDSMF is declining.

However, given the vulnerability of goldband snapper to swim bladder over-expansion injuries (meaning that goldband snapper caught below the size at maturity are already dead or moribund), the introduction of minimum size regulations is unlikely to have the desired effect of returning these immature fish to the breeding stock. Fishery managers and fishers will thus need to consider management measures other than those dealing with effort

reductions. Such measures may include spatial area closures designed to protect a portion of the spawning stock biomass from fishing.

The length at maturity for red emperor was estimated to be 429 mm fork length (461 mm total length) for females and 457 mm fork length (491 mm total length) for males, corresponding to an age at maturity of 8.2 years for females and 8 years for males. The current legal minimum size for red emperor is 410 mm total length. This is below the size at maturity for red emperor in waters of the NDSMF. In addition, there has been a significant decline in the mean length and weight of red emperor landed in the period from 1997 to 1999. The breeding stock level of red emperor in the NDSMF is considered to be declining even at the lower effort levels expended since the introduction of formal management.

Careful monitoring of the breeding stock level of red emperor and goldband snapper in the NDSMF is required on an ongoing basis.

NON-RETAINED SPECIES

Bycatch species impact: Low

As a result of the marketability of most species caught, there is a limited quantity of by-catch in this fishery. The most common by-catch species is the starry triggerfish, *Abalistes stellatus*, but the numbers taken are not considered to be significant.

Protected species interaction: Negligible

Trap fishing in deep water does not create any significant opportunities for the gear to interact with protected species.

ECOSYSTEM EFFECTS

Food chain effects: Not assessed

Habitat effects: Low

As a result of the gear design, the fishery has little impact on the habitat, although there may be some interaction with coral habitats. 'Ghost fishing' by traps is unlikely to be significant, as similar fish species have been observed on video to be able to exit traps if left undisturbed.

SOCIAL EFFECTS

Seven vessels fished in the 2000 fishing season with an average crew level of 3 people per vessel, indicating that 21 people were directly employed in the NDSMF.

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year (2000):
\$2.63 million

The NDSMF principally targets the higher-value species such as the goldband snapper and red emperor. The fishery landed a total of 470 tonnes of demersal scalefish in 2000, for a catch value of over \$2.63 million. This value is lower than that reported in 1999 owing to the lower catch. However, the average price received by fishers in 2000 was much improved on the prices achieved in 1999.

FISHERY GOVERNANCE

Acceptable catch (or effort) range: 600–1,000 tonnes

For the year 2001, the total allowable effort has been set at 1,320 fishing days distributed equally among the licences operating in the fishery. At this level of effort and at recent catch rates, the catch is expected to be in the range 600–1,000 tonnes.

However, a three-year research project to reassess the long-term sustainable catch level is expected to indicate that a reduction in the TSC is needed. This is in keeping with the inability of the fleet to achieve the 800-tonne TSC in the past four years.

EXTERNAL FACTORS

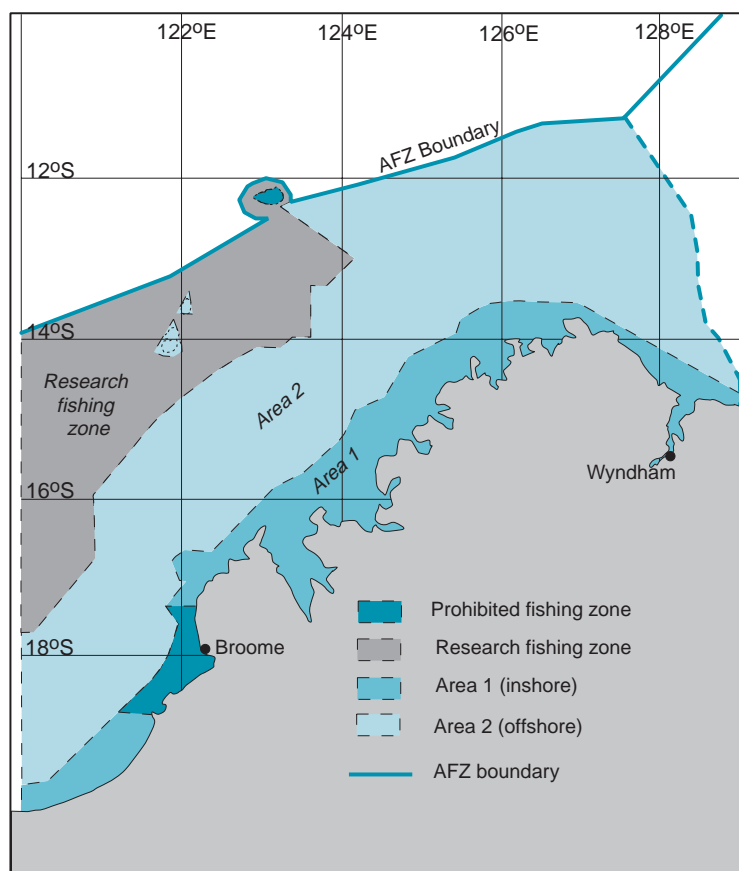
The current assessment of the status of the key species, in association with a declining catch rate in 2000, is likely to confirm that the current TSC needs to be revised downwards in future years.

There has also been reduced line effort in the period from 1998 to 2000, probably reflecting the reduced viability of line fishers presently in the NDSMF. Under the

management plan which took effect on 1 January 2001, licensees can now choose either fish traps or lines on a trip-by-trip basis. Hence, the low level of line fishing effort in the NDSMF is expected to continue.

Recreational fishing pressure in the Broome region is considered to be increasing, and potentially involves thousands of anglers per year. A recreational creel survey was undertaken between December 1999 and November 2000 to determine the magnitude and composition of the recreational fishing catch between Exmouth and Broome. Results from this survey should become available in 2002 to assess the degree of overlap between the two sectors.

The future catch from the NDSMF may also involve the stocks from waters greater than 200 m depth. This area of the fishery is available as a research fishing zone and fishers have the option to explore the deeper waters, though to date industry has shown little interest in doing so. However, the resources of this sub-region are unlikely to be substantial. Given the even lower production potential of deeper-slope reef fish, the sustainable catch from this zone is likely to be quite low.

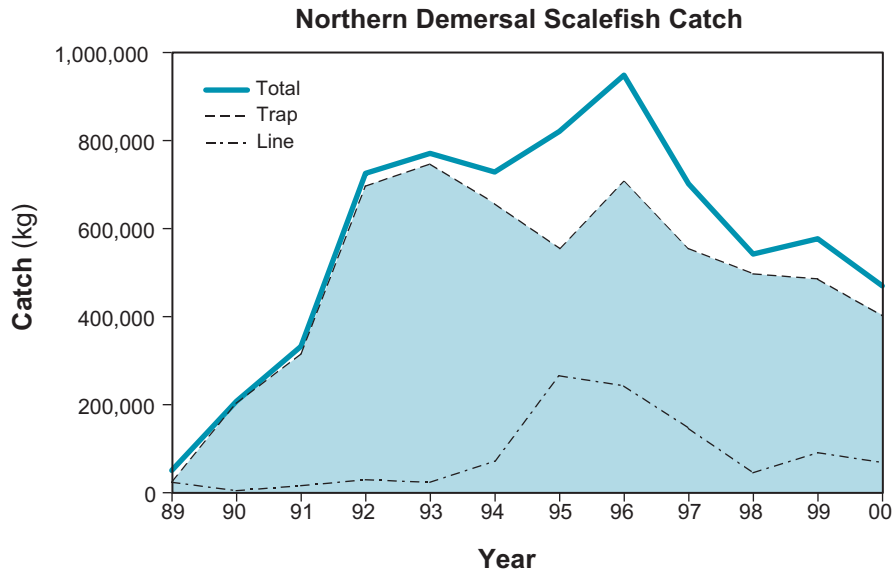


NORTHERN DEMERSAL SCALEFISH FIGURE 1

Boundaries and access areas of the Northern Demersal Scalefish Managed Fishery.



Commercial Fisheries



NORTHERN DEMERSAL SCALEFISH FIGURE 2

Catches of demersal finfish in the NDSMF by line and trap, 1989–2000.

NORTHERN DEMERSAL SCALEFISH TABLE 1

Catches of demersal finfish by line and trap in the NDSMF, 1989–2000. Note that the NDSMF came under full management in 1998 and effort levels have been limited in each year since.

Year	Total allowable effort (days)	Line		Fish trap		Total catch (kg)
		Catch (kg)	Effort* (block days)**	Catch (kg)	Effort (block days)**	
1989		23,979	267	26,649	81	50,628
1990		4,638	91	202,783	395	207,421
1991		16,031	255	316,228	750	332,259
1992		29,607	433	695,954	1,776	725,561
1993		23,507	283	747,215	1,713	770,722
1994		71,763	453	656,937	1,349	728,700
1995		265,798	1,204	555,162	1,200	820,960
1996		242,590	1,319	706,063	1,412	948,653
1997		146,548	788	555,172	1,293	701,720
1998	1,684	44,863	79	497,154	869#	542,017
1999	1,716	91,045	228	485,918	971#	576,963
2000	1,562	68,543	148	401,487	890#	470,080

* Line methods that have been selected for the calculation of effort include handline, dropline and longline only.

** Block days are defined as the number of days on which fishing occurred in a particular block by a particular vessel (that is, block boat days).

Trap fishing effort from 1998 onwards has been converted to standard trap fishing days for comparison with previous years.

NORTHERN DEMERSAL SCALEFISH TABLE 2

Demersal finfish catch in tonnes and the percentage composition of each of the major species taken by trap and line fishers in the NDSMF in 2000.

Species group	Line		Fish trap		Total catch Tonnes
	Tonnes	%	Tonnes	%	
Red emperor	3.1	0.7	85.7	18.2	88.8
Goldband snapper	48.2	10.3	136.8	29.1	185.0
Cod	4.4	0.9	70.3	15.0	74.7
Spangled emperor	-	-	11.4	2.4	11.4
Scarlet perch	6.0	1.3	16.8	3.6	22.8
Red snapper	2.2	0.5	5.2	1.1	7.4
Other species	4.7	1.0	75.3	16.0	80.0
All demersal finfish	68.6	14.6	401.5	85.4	470.1

Pilbara Demersal Finfish Fisheries

MANAGEMENT SUMMARY

The majority of demersal finfish produced from the North West Shelf are taken by fish trawling activities, with a smaller proportion taken by fish traps and line. Both the Pilbara Fish Trawl Interim Managed Fishery and the Pilbara Trap Managed Fishery operate under individual transferable effort (ITE) regimes monitored by the satellite-based Vessel Monitoring System.

The Pilbara Fish Trawl Interim Managed Fishery commenced in 1998 when a number of fishing boats with conditions authorising fish trawling were brought under a management plan. The fishery is controlled through a combination of area closures, gear restrictions, and total and area effort limitations. Since the fishery came into a formal management framework, effort has been reduced and redistributed to achieve the best yield from the fishery while keeping exploitation rates of key indicator species (red emperor and Rankin cod) at sustainable levels. Eleven licences currently exist to operate in the fishery, with a total of 29,568 trawl units allocated. Unit values for 2001 reflect values between 0.6 and 1.1 trawl hours per unit, dependent on the zones being fished.

The new ITE management arrangements introduced into the Pilbara Trap Managed Fishery in January 2000 dealt with the issue of latent effort in the fishery and proved effective at holding the fishery within its acceptable 300 tonne limit. However, the ability of the fishery to target red emperor may require species limits in the future.

Some demersal scalefish are also taken by 'wetline only' vessels which do not have access to specific managed fisheries.

Governing Legislation/Fishing Authority

Pilbara Fish Trawl Interim Managed Fishery Management Plan 1997

Pilbara Trap Management Plan 1992
Fishing Boat Licence (line fishing)

Consultation Process

Agency–industry meetings

RESEARCH SUMMARY

Baseline research for managing these important fish stocks was conducted in two FRDC-funded projects from 1993 to 1999, providing a basis for long-term research monitoring of the stocks.

In addition, research surveys of the deeper areas adjacent to the existing trawl grounds have been completed under a separate FRDC-funded project.

The following status report, which provides a synthesis of the data from the fishery, utilises the results of this earlier research and some ongoing monitoring.

Pilbara Demersal Finfish Fisheries Status Report

Prepared by P. Stephenson and J. King

FISHERY DESCRIPTION

Boundaries and access

The Pilbara Trap Managed Fishery (Pilbara Figure 1) lies north of latitude 21°44' S and between longitudes 114°9'36" E and 120° E on the landward side of a boundary approximating the 200 m isobath and seaward of a line generally following the 30 m isobath. This has been a managed fishery since 1992. In 2000, effort quota was introduced, with allocation of transferable trap units monitored by VMS.

The boundaries of the Pilbara Fish Trawl Interim Managed Fishery (Pilbara Figure 1) are the waters lying north of latitude 21°35' S and between longitudes

Commercial Fisheries

114°9'36" E and 120° E on the landward side of a boundary approximating the 200 m isobath and seaward of a line generally following the 50 m depth contour. The trawl fishery consists of two zones. Zone 1, in the west of the fishery, is currently not being trawled. In Zone 2, the interim management plan introduced in 1998 set down boundaries for six management sub-areas. There are 11 licence units with varying time allocations throughout Areas 1 to 6. The allocated effort quota is transferable and monitored by VMS.

In addition, some wetline fishing occurs in the areas of the trawl and trap fisheries. Planning for limiting access by the general wetline fleet began with the release of a discussion paper in November 1997.

Pilbara Figure 1 is a general diagram showing areas where specific fishing activities are permitted within this fishery. The exact latitudes and longitudes delineating the sectors of the Pilbara fishery are listed in the Pilbara Trap Management Plan 1992 and the Pilbara Fish Trawl Interim Managed Fishery Management Plan 1997.

Main fishing method

Trawling is the dominant fishing method, with line fishing and trapping being relatively minor components.

RETAINED SPECIES

Commercial production (season 2000):

Trawl 2,075 tonnes
Trap 257 tonnes
Line 59 tonnes

Landings

Catch of the major species for 2000 is shown in Pilbara Table 1. The catches by different fishing methods for the years 1985 to 2000 are shown in Pilbara Table 2 and illustrated in Pilbara Figure 2.

Demersal scalefish catch by trawl, trap and line was 1,995 tonnes, 257 tonnes, and 59 tonnes respectively.

The 2000 trawl fishery demersal scalefish catch had a similar species composition to that in 1999, with the catch of most of the major species decreasing and red snapper increasing. The major target species landed (with 1999 catch in brackets) were blue spot emperor 401 tonnes (445 tonnes), red snapper 252 tonnes (230 tonnes), red emperor 68 tonnes (78 tonnes), flagfish 166 tonnes (189 tonnes), threadfin bream 187 tonnes (217 tonnes), goldband snapper 75 tonnes (82 tonnes), scarlet perch 65 tonnes (72 tonnes) and Rankin cod 25 tonnes (34 tonnes). The main by-product species were shark 52 tonnes, bugs 5 tonnes, and cuttlefish 23 tonnes.

The trap fishery catch decreased from 351 tonnes in 1999 to 257 tonnes in 2000 due to the introduction of effort quota. Major species taken by trap fishing in 2000 (1999 figures in brackets) were red emperor 40 tonnes (55 tonnes), blue spot emperor 39 tonnes (27 tonnes), goldband snapper 30 tonnes (38 tonnes), Rankin cod 27 tonnes (52 tonnes), and red snapper 27 tonnes (22 tonnes). There is no by-product in this fishery.

Demersal scalefish catches by line fishing were slightly higher at 59 tonnes (50 tonnes in 1999), comprising mainly spangled emperor 18 tonnes (12 tonnes in 1999), Rankin cod 5 tonnes (5 tonnes) and red emperor 7 tonnes (6 tonnes). In addition, 187 tonnes of sharks and rays (which includes the North Coast Shark Fishery catch) and 103 tonnes of mackerel were caught in the Pilbara. The shark catch is reported in more detail in the North Coast Shark Fisheries Status Report (pp. 87-8), and the mackerel catch in the Spanish Mackerel Stocks Status Report (pp. 82-6).

Fishing effort

The fishing effort in the trap, line and trawl sectors of the commercial fishery is shown in Pilbara Table 3. The effort in days is from monthly catch and effort returns, however for the trawl fishery, the effort from 1991 to 2000 is also recorded as the net bottom time (hours) taken from skippers' logbook data.

In the trawl fleet there are the equivalent of seven full-time vessels. The number of hours allocated to the fleet in each area of the fishery (verified by a satellite monitoring system), the number of hours used, and the percentage of the allocation used from 1998 to 2000 are shown in Pilbara Table 4.

The management plan allows for some flexibility in the effort distribution between areas, which resulted in an effort over-run in 2000 of 17% in Area 2 and 10% in Area 4 (compared with 12% and 5% in 1999). There was no trawling in Area 6, the research zone, in 2000. The 2001 effort allocation will be redistributed in 2001 to reduce effort in Area 1, the most heavily exploited area.

Five trap boats using between 10 and 12 traps reported 518 days fishing in statutory monthly returns in 2000, compared with 842 days in 1999. 5,867 trap units (days multiplied by number of traps) were allocated in 2000 and 5,000 units were used. This equates to 505.6 days fished with an average of 11.6 traps per day.

In 2000, line fishers reported operating for 500 days, compared with 453 days in 1999. This effort does not include trolling, which is reported in the Spanish mackerel report (pp. 82-6). Line fishing in the Pilbara is still unrestricted and under review.

Catch rate

The catch rates (based on nominal effort) for red emperor have decreased in the recently developed Areas 4 and 5 of the trawl fishery. In Area 1 of the trawl fishery, the catch rate for red emperor is stabilising at a low level, while in Areas 2 and 3 it is increasing. Rankin cod and blue spot emperor catch rates increased in all areas of the trawl fishery. No decline in catch rates is evident for flagfish or rosy threadfin bream. However, the efficiency of the fish trawl fleet has probably continued to increase as skippers become more experienced and electronic equipment is used to target fish. This expected efficiency increase means that the observed catch rates are likely to be biased upwards in future years.

Catch rates for the trap fishery and line fishing (based on the reported number of days fished) were slightly higher

in 2000 than 1999, apparently due to the increasing skill of operators.

Recreational component: **Not assessed**

Stock assessment completed: **Yes**

Red emperor and blue spot emperor were used as indicators of long-lived and short-lived species.

Trawl fishery: The effort reduction introduced in 1999 appears have arrested the decline in the catch rates. An age-structured model (using biological information, age structure, catch from 1989 to 2000 and catch rates from 1993 to 2000) was used to assess the red emperor and blue spot emperor stocks in Areas 1 to 5. The assessment criterion was that 'the spawning biomass should not decrease below 25% of the estimated virgin level in the fishing area'.

The virgin biomass, with upper and lower confidence values, was determined using trawl, trap, line, and charter catches and the effort levels adopted in 2001 (Pilbara Table 4) were projected into the future. The assessment indicated that the lower estimate of the spawning biomass of red emperor in Area 1 declined to 17% of the virgin level in 1998 and would stabilise at a low level of 16% after 2001. In Area 2, the lower estimated spawning biomass was 25% of the virgin level in 1998, and then increased, with an expected value of 30% in 2006. In Area 3, which is closed to fishing, the biomass fell to 30% of the virgin level in 1998 and is expected to rise to 58% of the virgin level by 2006. Overall, in the western half of the fishery (Areas 1, 2, and 3), the lower estimate of spawning stock reached a minimum of 25% of the virgin level and would be expected to rise to 35% by 2006.

Blue spot emperor spawning biomass would be expected to decline in Area 1 for the next few years, but then remain steady at a level above the assessment criteria. There was no indication of decline for this species in Areas 2 or 3. For both red emperor and blue spot emperor, there was insufficient information for an assessment to be made in Areas 4 or 5. On the basis of this modelling, the 2000 effort allocation was continued into 2001.

Trap fishery: The effort quota introduced in 2000 reduced catches to a level below the recommended cap of 300 tonnes. In the portion of the trap fishery west of 116° E the catch rates of red emperor are still decreasing, and although the data is very limited, there appears to be serious growth over-fishing in this area.

Line fishing: The line catch was low in 2000, but there is some concern that it consists mainly of a few species vulnerable to line fishing (e.g. Rankin cod, red emperor and spangled emperor).

Exploitation status: **Fully exploited**

Breeding stock levels: **Adequate**

Breeding stocks of the short-lived species have been assessed as adequate in the fishing area overall. The spawning biomass of red emperor was estimated to have

fallen below the reference point in Area 1 in the period 1997–2000. However, this represents a local depletion, as Area 1 consists of only one-eighth of the area where this species occurs in the Pilbara fishery. The overall recovery of the spawning stocks in Areas 1, 2, and 3 of the trawl fishery is expected following the 1999 effort reductions and the 2001 effort redistribution. Careful ongoing monitoring is required to ensure compliance with effort reductions in order to maintain satisfactory breeding stock levels of the long-lived species within the fishing zone.

NON-RETAINED SPECIES

Bycatch species impact: **Low**

Owing to the relatively large mesh size used by the fish trawl fishery, there is only a small bycatch of under-size and unmarketable finfish. For the trap and line fisheries, bycatch is minimal.

Protected species interaction: **Medium**

The trawl fishery involves the occasional capture of dolphins which are apparently attracted to the trawl while it is operating. The significance of these accidental captures, relative to the population size and natural mortality of the North West Shelf dolphin population, is not expected to be great, but needs to be assessed further. Sea snakes are occasionally captured in the fish trawl nets but are returned alive to the sea in most cases. There is no turtle catch in the trap, line or fish trawl fishery,

ECOSYSTEM EFFECTS

Food chain effects: **Medium**

The current fish trawl fishery operates with standard stern trawling gear (single net with extension sweeps) within an area previously trawled by a Taiwanese fleet. Historical research by CSIRO has suggested that the extensive Taiwanese pair trawl fishery caused a significant decrease in the biomass of finfish on the North West Shelf, and a change in species composition towards smaller species. The current Australian trawl fishery, which developed when the fish stocks had somewhat recovered, uses a much larger mesh size and much lighter ground rope, and operates at lower exploitation rates. At the now permitted levels of trawl and trap exploitation, a higher standing stock is maintained, although all sectors selectively harvest the larger individuals of many of the top-end predators. Overall the fishery is likely to have only a moderate impact on the food chain of the North West Shelf outside 50 m.

Habitat effects: **Medium**

Impacts to the habitat are restricted to those of the trawl fishery, which in turn is restricted to a relatively low proportion of the North West Shelf (Pilbara Figure 1). Area 3 and the waters inside 50 m are permanently closed to trawling, Zone 1 is currently closed to trawling, and Area 6 has had no trawl effort allocation in 2000.

Effective impact is further lessened by the concentration of effort in the west of the fishery where the habitat is already most disturbed, with low effort in the east where habitat is least disturbed.

Within the area open to trawling, research has indicated that approximately 10% of the sessile benthic fauna



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(e.g. sponges) is detached per year, with higher rates in Area 1 where the effort is concentrated. It is not known whether this exceeds the rate of regrowth.

SOCIAL EFFECTS

It is estimated that 18 fishers were employed during 2000 on Pilbara trawl fishing vessels, and 9 fishers in the trap fishery. The level of employment in line fishing is not assessed.

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year (2000):
\$8.5 million

This estimate is based on the landed weight and price of each species as supplied by fish processors.

There has been little overall increase in prices in the last 12 months. The trawl fish catch is dominated by lower-valued species such as blue spot emperor and threadfin bream, and the value is \$7 million. The trap and line catches are dominated by the valuable species such as red emperor and jobfish, and the values are approximately \$1.2 million and \$0.3 million respectively.

The catches from these fisheries dominate the Western Australian metropolitan markets and support the local fish processing sector.

FISHERY GOVERNANCE

Acceptable catch range: Trawl 1,900–2,200 tonnes
Trap 150–300 tonnes
Line 50–115 tonnes

In the trap and line fisheries, the catch range is based on the catch variation of the target species over the last seven years. In the trawl fishery, due to effort reduction, there have been decreases in catch over the last four years, and the acceptable catch range has been determined from the relationship between more recent catches and fishing effort. The effort allocation in the trawl and trap fisheries in 2001 indicates a catch range of 1,900–2,200 tonnes for trawl and 150–300 tonnes for trap.

EXTERNAL FACTORS

There was a slight increase in catch and effort for line fishing in 2000. Conversely, catch and effort decreased in the trap fishery due to effort quota introduction, and in the trawl fishery due to unused effort quota by some vessels.

In 1999 and 2000 there has been noticeable recovery of red emperor stocks, and it is anticipated that similar recovery will occur for other long-lived species. In Area 1 of the trawl fishery, the decline in the red emperor stock appears to have been arrested, albeit at a low level. The stocks of red emperor in the portion of the trap fishery west of the trawl fishery appear to be over-exploited, and the same may be true of other long-lived species in this area.

The smaller species such as flagfish and threadfin bream are probably under-exploited. Development of fishing methods which increase catches of these species without increasing catches of the large, long-lived species could increase the economic return from the fishery.

Research is needed to obtain more detailed information on habitat distribution, recovery times and the importance of habitat to recruitment in order to assist future decisions on redistribution of trawl effort.

In the deep-water zone (100–200 m depth), the fish species are concentrated between the depths of 100 m and 140 m and are likely to be highly vulnerable to over-fishing. Industry surveys monitored by the Research Division suggest that stocks in this zone are limited and if fishing is to be allowed in this area, it should be very limited.

The area available for fishers has decreased over recent years due to exclusion areas for gas pipeline and facilities. This is not expected to adversely affect fish catches.

PILBARA TABLE 1

Commercial catches in tonnes (to the nearest tonne) and the percentages (to the nearest 1%) of each major species taken by trawl, trap and line in the Pilbara in 2000.

	Fish trawl catch		Trap catch		Line catch		Total catch tonnes
	tonnes	%	tonnes	%	tonnes	%	
Red emperor	68	59%	40	35%	7	6%	115
Rankin cod	25	44%	27	47%	5	9%	57
Scarlet perch	65	76%	18	21%	2	3%	85
Red snapper	252	90%	27	10%	2	0%	281
Goldband snapper	75	67%	30	27%	6	6%	111
Spangled emperor	27	39%	25	42%	18	26%	70
Blue spot emperor	401	91%	39	9%	-	-	440
Flagfish	166	98%	3	2%	-	-	169
Threadfin bream	187	100%	0		-	-	187
Frypan snapper	45	98%	1	2%	-	-	46
Other demersal scalefish	684	91%	47	6%	2	3%	750
All demersal scalefish	1,995	86%	257	11%	59	3%	2,311
Shark and ray	52	22%	0		187	78%	239
Other by-product	28		0		0		28

PILBARA TABLE 2

Summary of reported commercial catches (tonnes) of demersal scalefish by line, trap and trawl in the Pilbara fishery as well as shark catch by all methods, scombrid catch by trolling and charter catch.

Year	Demersal scalefish				Troll	Shark	Charter
	Line	Trap	Trawl	Total			
1985	180	168	-	348	132	22	-
1986	65	113	-	178	97	25	-
1987	67	192	3	262	119	19	-
1988	136	243	3	382	79	24	-
1989	104	457	124	685	116	29	-
1990	157	407	421	985	209	57	-
1991	107	119	754	980	196	132	3
1992	63	148	1,413	1,624	125	273	7
1993	67	178	1,724	1,969	160	143	7
1994	79	207	2,506	2,792	144	144	12
1995	95	222	2,821	3,138	131	67	15
1996	136	302	3,201	3,639	119	123	33
1997	109	234	2,630	2,973	152	96	22
1998	78	250	2,512	2,840	121	333	36
1999	50	371	2,136	2,419	113	232	47
2000	59	257	1,995	2,314	130	244	27

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PILBARA TABLE 3

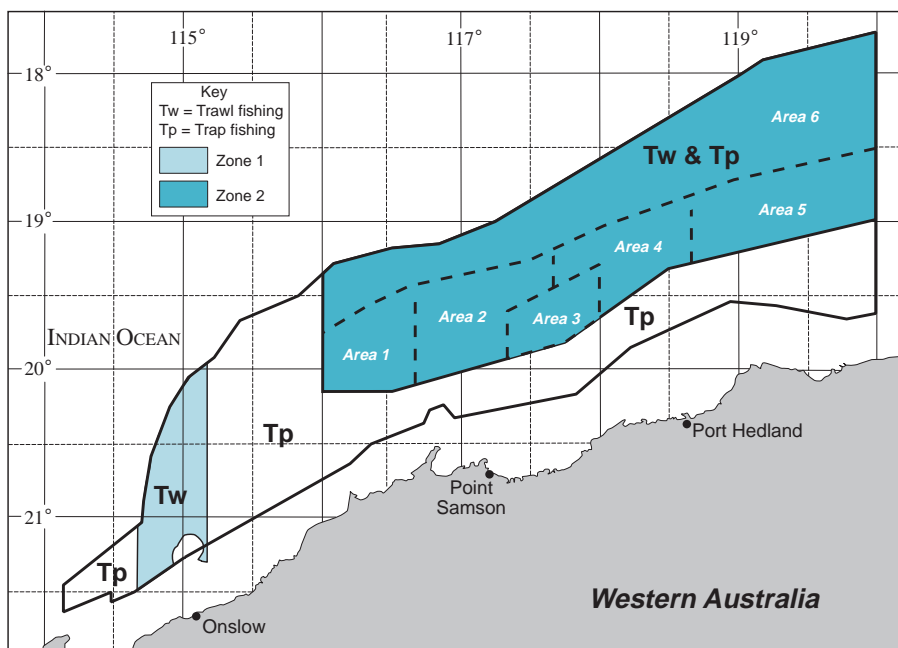
Summary of effort in the Pilbara fishery. The trap, line and trawl effort (days) is from monthly catch and effort returns. The trawl effort (hours) is nominal effort from operators' logbook data.

Year	Line (days)	Trap (days)	Trawl (days)	Trawl (hours)
1985	809	709	-	-
1986	655	548	19	-
1987	614	507	17	-
1988	985	804	32	-
1989	863	1,198	310	-
1990	1,332	1,321	698	-
1991	740	472	1,132	8,660
1992	514	681	983	10,030
1993	876	696	832	10,725
1994	732	545	1,484	22,087
1995	852	608	1,571	21,529
1996	814	513	1,550	25,246
1997	809	483	1,389	19,810
1998	692	503	1,291	20,555
1999	453	842	1,139	15,963
2000	500	518	957	14,084

PILBARA TABLE 4

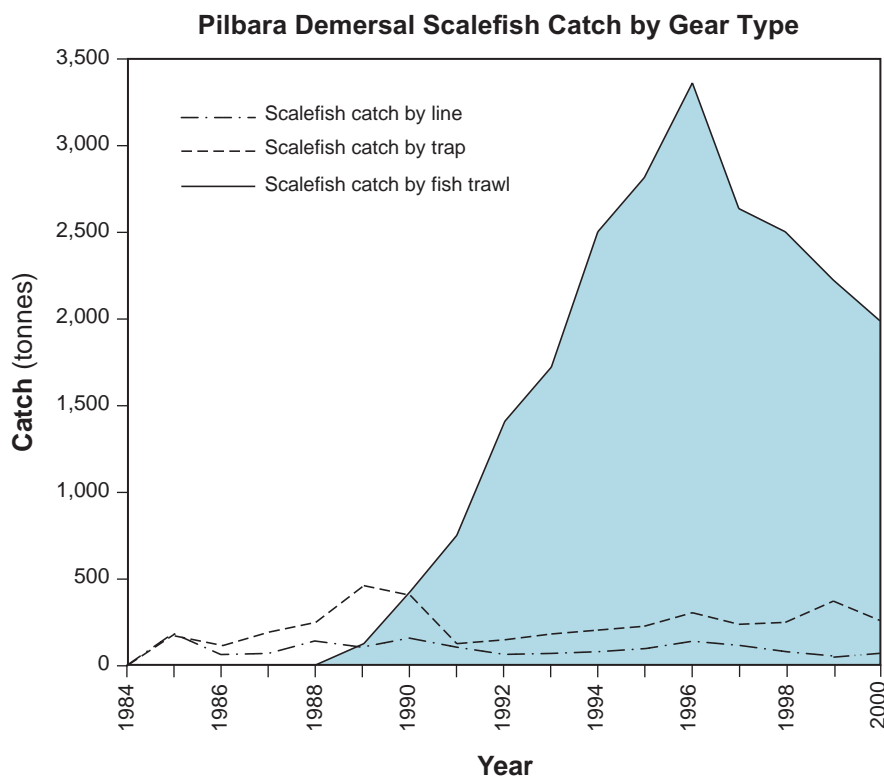
The number of hours allocated, the number of hours used and the percentage of the allocation used in each area of the Pilbara trawl fishery (and, for 2000, in the Pilbara trap fishery).

		Area 1	Area 2	Area 3	Area 4	Area 5	Total
1998	time allocation	17136	3,360	0	3,360	5,712	29,568
TRAWL	time used	15,076	3,842	0	3,736	4,955	27,609
	% of time used	88%	114%	-	111%	87%	93%
1999	time allocation	11,481	3,360	0	3,057	5,198	23,096
TRAWL	time used	10,237	3,767	0	3,213	4,973	22,190
	% of time used	89%	112%	-	105%	96%	96%
2000	time allocation	11481	3360	0	3057	5198	23096
TRAWL	time used	9438	3928	0	3358	4476	21199
	% of time used	82%	117%	-	110%	86%	92%
2000	time allocation			0			524
TRAP	time used			0			507
	% of time used			-			97%



PILBARA FIGURE 1

Demersal scalefish fisheries of the Pilbara region of Western Australia. Areas 1 to 6 refer to the management regions in Zone 2 of the trawl fishery.



PILBARA FIGURE 2

Catches of demersal scalefish (tonnes) in the Pilbara fishery by trap, line and trawl.



Commercial Fisheries

Spanish Mackerel Fishery

MANAGEMENT SUMMARY

Fishing for Spanish mackerel (*Scomberomorus commerson*), under the general wetline access available to all Western Australian licensed commercial fishing boats, was reported by 68 boats during 2000 (18% of the total wetline fleet for the year). Most of these catches were made opportunistically by boats operating within other fisheries, and at present there are only about 10 boats which specifically target mackerel. Owing to concerns over increased catches and anecdotal evidence to suggest that the species may be in danger of over-fishing, an interim management plan (IMP) is currently in preparation. This plan will restrict the mackerel fishery to boats which meet certain fishing history and catch criteria, with two separate options proposed for managing the fishery. The first of these is a low-cost, simple alternative with stricter criteria and fewer boats in the fishery. Subject to ongoing review of the fishery, these boats would have unlimited access to designated sectors of the fishery. Under the second option, the fishery would contain more boats with restrictions to fishing effort based on previous catch histories. This option would require the use of VMS technology. The IMP has involved significant consultation with industry and is unlikely to be instigated during the 2001 season. In addition to the IMP, the capture of Spanish mackerel by commercial and recreational fishers is subject to a minimum legal size of 90 cm total length. A recreational bag limit of four fish per angler per day is also in place.

Governing Legislation/Fishing Authority

Fish Resources Management Regulations 1995
Fishing Boat Licence

RESEARCH SUMMARY

In 1998, a joint WA/NT/Qld FRDC-funded research project to determine the stock structure of Spanish mackerel in these States commenced, using genetic markers, stable isotope ratios and parasitic fauna. This project is due for completion in 2001. In 1999 a second FRDC-funded project began, aimed at determining the status of Spanish mackerel stocks in Western Australian waters. The main focus of this research is the gathering of biological information on Spanish mackerel. A preliminary evaluation of the status of Spanish mackerel stocks has been undertaken using the CAES records provided by industry to Fisheries WA, and from interviews with industry. This information has been required for the IMP. Results from the stock assessment should be available at the conclusion of the current project in June 2002.

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

Spanish Mackerel Stock Status Report

Prepared by M. Mackie

FISHERY DESCRIPTION

Boundaries and access

Spanish mackerel are widespread throughout the Indo-West Pacific. In Western Australia, they are fished commercially from Geraldton north to the NT border. Most of the commercial catch is taken from May through to October, with minor catches made during summer in the Pilbara and Kimberley regions when weather conditions permit. On rare occasions (including 2001), fishers also report small catches as far south as Albany.

Spanish mackerel are usually captured at or near the surface in coastal areas around reefs, headlands and shoals. Anecdotal evidence suggests that many also spend time dispersed in deeper offshore waters, particularly during summer when the coastal fishery is generally not viable. It is also likely that Spanish mackerel migrate along the coast. The extent of these movements has important stock and management implications, and will be clarified at the end of the stock structure project.

Spanish mackerel fishing was previously reported under three sectors based on overall catches, fishing methods and likely boundaries of the IMP. However, as a result of ongoing consultation with industry over the IMP, the fishery is now reported in four sectors, with resultant changes to the boundaries between them.

Kimberley sector: The use of dories (5–6.5 m dinghies) is restricted to this sector, which extends east of longitude 121° E (previously 120° E) to the NT border. Dories troll two to three lines and work to a mother boat that is about 20 m in length. Fishing gear used in this sector is relatively heavy (8–10 mm rope with a 200+ kg mono line and wire trace), crews number between three and five, and fishing trips generally last between one and three weeks. Mackerel captured in this sector are usually filleted, boxed and frozen.

Pilbara sector: This sector extends from longitude 114° E to 121° E and north of 23° S. Vessels used in this area are between 9 and 15 m in length (no dories), with one to two crew using 180 kg mono line and wire trace. In recent years the main catches from this sector have come from the Port Hedland area. Fishing trips usually last less than a week, and the product is trunked, brined, and sold locally or sent to Perth markets.

Gascoyne sector: This sector extends from 27° S to 23° S. Vessels used in this area are between 7 and 15 m in length and are crewed by one to two persons for trips lasting one to five days. Gear used is rod and reel with 20–30 kg line and wire trace. Fish caught by Carnarvon- and Quobba-based fishers are usually kept whole in brine for export, while fish landed at other ports are usually trunked and sold locally or sent to Perth markets.

West coast sector: This sector extends south of 27° S. Fishing gear and methods are the same as those used in the Gascoyne sector, with most catches obtained from the

Geraldton and Abrolhos areas. Few commercial mackerel catches are made south of Geraldton, and this sector may remain within the general wetline fishery following implementation of the IMP.

Main fishing method

Trolling.

RETAINED SPECIES

Landings

Commercial production (season 2000): 304.7 tonnes

Spanish mackerel (*Scomberomorus commerson*) is the target species and may comprise 95% of the catch. Grey mackerel (*S. semifasciatus*) is the dominant by-product, particularly in the Gascoyne and west coast sectors where it is sometimes captured in large numbers. However, because fishing methods need to be modified in order to catch this species in quantity, it is essentially a separate fishery. Other by-products of Spanish mackerel fishing include school, spotted and shark mackerel, wahoo, cobia, blue- and yellowfin tuna, smaller sharks and the occasional reef fish such as spangled emperor and coral trout. Quantities of mullet, whiting and similar species are also netted by some fishers for use as bait in their mackerel fishing operations.

The total catch of 304.7 tonnes of Spanish mackerel in 2000 comprised 118.3 tonnes from the Kimberley sector, 103.4 tonnes from the Pilbara, 68.1 tonnes from the Gascoyne and 14.9 tonnes from the west coast. (It should be noted that the catch figures expressed here may differ from those given in previous reports owing to the changes in sector boundaries, the introduction of a new sector, and the use of an improved conversion factor for filleted to whole weight – previously 3, now 1.6.)

Annual catches in the Kimberley sector rose slowly between 1979 and 1990, before a significant increase in catches from 45.4 tonnes in 1990 to 160.7 tonnes in 1991 when two of the four main present-day operators entered the fishery (Spanish Mackerel Figure 1 and Table 1). Between 1991 and 1998 the trend in catches increased slightly in this sector, with a peak of 198.2 tonnes in 1997. However catches have dropped in subsequent years to 118.3 tonnes in 2000. Catches within the Pilbara sector have been steadily rising from a low in 1988 of 47.1 tonnes, following a period of high catches that peaked in 1984 at 136.9 tonnes. In 2000, 103.4 tonnes were caught in this sector. Catch trends in the Gascoyne sector are similar to those in the Pilbara, with a steady increase in recent years from a low of 8.7 tonnes in 1992. This low followed a period of high catches during the 1980s which peaked in 1987 at 110.6 tonnes. In 2000 the catches in this sector were 68.1 tonnes. Catches in the west coast sector are minor, averaging about 10 tonnes per year with 14.9 tonnes caught in 2000. Catches in this sector have ranged from 1.7 tonnes in 1981 to 20.4 tonnes in 1989.

The 2000 catch in the Kimberley sector gives cause for concern because it was below the acceptable catch range provided last year (150–200 tonnes), and continues the downward trend in catches since 1998 (Spanish Mackerel Figure 1). Continuation of this trend in 2001 would create

serious concern over the status of the stocks; however, this seems unlikely because catch rates in this sector still remain relatively high (Spanish Mackerel Figure 2), and the pattern of fish abundance during 2000 was considered unusual by fishers. Catches in the Pilbara sector during 2000 were slightly above the acceptable catch range for that year, again due in part to the unusual pattern of mackerel abundance along the coast. The 2000 Pilbara catches continue a rising trend that sees them approaching the peak catches of the mid-1980s, which are considered unsustainable (Spanish Mackerel Figure 1). Catches in the Gascoyne sector during 2000 were within the projected catch range (noting that the change in boundaries and the addition of the west coast sector makes comparisons less valid).

Annual catches of other species of mackerel, including the grey or broad-barred mackerel (*Scomberomorus semifasciatus*), school mackerel (*S. queenslandicus*), spotted mackerel (*S. munroi*) and shark mackerel (*Grammatorcynus bicarinatus*), are shown in Spanish Mackerel Table 1. Grey mackerel are sometimes captured in large numbers but are usually present in the fishery for only one or two months each year. This species, which makes up approximately 80% of the ‘other mackerel’ catch, is becoming more targeted in the Gascoyne sector and will be reported as a separate species in 2002. (Catches of grey, school and spotted mackerel are now recorded separately in the CAES database.) School and shark mackerel species make up approximately 7% each of the ‘other mackerel’ catch. Annual fluctuations in the catch of other mackerel are thus mainly due to variability in the capture of grey mackerel. Catches of other mackerel in the Kimberley and Pilbara show particular year-to-year variability. In 2000, the catches of 14.3 tonnes in the Kimberley sector were at their lowest level since 1989, coinciding with decreased catches of Spanish mackerel, whilst in the Pilbara sector catches improved from 7.9 tonnes in 1999 to 27.1 tonnes in 2000. Catches of other mackerel in the Gascoyne sector have generally been on the increase despite periods of low catches in the 1980s and early 1990s. In 2000, catches within this sector reached 29.2 tonnes. The increase in catches of other mackerel in the Gascoyne sector since 1992 mirrors increases in catches of Spanish mackerel. Catches of other mackerel peaked in the west coast sector in 1989 at 37.1 tonnes, but have since dropped and remained at a low level since 1993. Only 4 tonnes were captured in this sector in 2000. Note that landed weights of other mackerel species are converted to whole weights using the same conversion factors used for Spanish mackerel.

Fishing effort

The annual number of boats recording catches of Spanish mackerel has varied substantially since 1980, from 4 to 20 boats in the Kimberley sector (7 in 2000), 17 to 53 boats in the Pilbara sector (17 in 2000), 13 to 56 boats in the Gascoyne sector (26 in 2000), and 10 to 39 boats in the west coast sector (32 in 2000). Note that the number of boats within each sector differs from that given in 1999 because of changes to sector boundaries and the addition of the fourth sector.



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The unit of effort used in analysis of catch rate is the 'fishing day'. This is not considered the most accurate measure of effort given the variation in number of hooks trolled and number of hours fished per day by the mackerel fleet. It is nevertheless the most reliable measure of effort until a more appropriate means of determining fishing effort is put into use. Monthly patterns of fishing effort are similar to those for catches: 70.3% of the annual fishing effort (days per month in which Spanish mackerel were captured) by all vessels within the Kimberley sector for the period 1990-1999 (data pooled) was expended between June and October, with a peak of 16.2% in August. In the Pilbara sector for the same period, 68.9% of effort occurred from June to October (peak of 19.7% in August), whilst in the Gascoyne and west coast sectors 72.4% of effort occurred between April and August (peak of 17.7% in July).

Annual trends in effort and catch are also similar in the Kimberley sector, where total fishing days varied from 92 in 1982 to 921 in 1994. Between 1979 and 1990 the average was fairly steady at 262 days/year, with a jump in 1991 and a fairly steady average of 789 days/year between 1991 and 1997. Since 1997 total fishing days have declined to 367 days in 2000. In the Pilbara sector, fishing effort peaked in 1984 at 1,960 total fishing days before a downward trend to 1,443 days in 1997. Since 1997 the drop in fishing effort has been more dramatic, with a total of 552 fishing days for this sector in 2000. Effort in the Gascoyne sector reached peaks of 2,476 and 2,087 fishing days in 1985 and 1987 respectively, followed by a steep decline to 335 fishing days in 1991. Since 1991 total fishing days rose steadily to 1,265 in 1999 before dropping to 868 in 2000. The annual number of fishing days in the west coast sector reached a peak in 1988 of 1,148 before dropping and remaining between 330 and 746 from 1989 to 2000. In 2000 the total of fishing days in this sector was 545. It should be noted that the large differences in fishing days between sectors reflect the number of vessels recording mackerel catches in each sector rather than the intensity of fishing effort. For instance, the few mackerel fishing vessels in the Kimberley sector focus almost exclusively on mackerel but have a relatively low combined total of fishing days. In contrast, most of the Gascoyne fleet do not target mackerel and may only catch a small number of them per day; nevertheless, their combined tally of days on which mackerel were caught is relatively high.

Catch rate

Analysis of catch per unit effort is complicated by the fact that many fishers who catch Spanish mackerel do not normally target them, and thus the effort they expend in doing so is likely to be combined with the effort spent catching other species. The catch rate of vessels known to target Spanish mackerel is therefore used to estimate catch rates of all vessels in the fishery in the following analysis. Catch rates (kg/day) in the Kimberley sector since 1989 have fluctuated markedly but exhibit an increasing trend peaking in 1998 at 440 kg/day (Spanish Mackerel Figure 2). Catch rates in this sector have since dropped to 351 kg/day in 2000. In the Pilbara, catch rates remained fairly steady between 1990 and 1996 at about

155 kg/day, but have risen in consecutive years to a high of 294 kg/day in 2000. Catch rates in the Gascoyne sector reached a low of just 6 kg/day in 1992 during the period when catches for this sector were also at a low point, but have since increased to a high of 155 kg/day in 2000.

Catch and effort data for vessels known to target Spanish mackerel in the west coast sector is too limited to provide meaningful statistics for this sector.

Recreational component: 40–44% (approx.)

Recreational survey data are only available for the west coast in 1996/97 (Sumner and Williamson 1999) and the Gascoyne in 1998/99 (Sumner et al., in press). For the west coast in 1996/97, the recreational take was estimated to be about 44% of the total catch of Spanish mackerel and related species, while for the Gascoyne in 1998/99, the recreational share was estimated at 40%.

A recreational survey of the north coast in 2000/2001 will provide information on these more remote areas where the recreational catch share is expected to be lower than for the Gascoyne and west coast.

Stock assessment completed: Not assessed

Exploitation status: Not assessed

Breeding stock levels: Not assessed

NON-RETAINED SPECIES

Bycatch species impact: Low

Fishing for Spanish mackerel uses specialised troll lines to target the schooling fish and involves limited discarding. Species occasionally caught and generally discarded include sailfish, billfish, pike, barracuda, shark, mackerel tuna, queenfish and trevally.

Protected species interaction: Not assessed

ECOSYSTEM EFFECTS

Food chain effects: Not assessed

Habitat effects: Negligible

The fishing methods used in this fishery do not impact on the habitat.

SOCIAL EFFECTS

Approximately 72 people were employed in the Spanish mackerel fishery during the 2000 mackerel fishing season. This estimate is based on those boats recording significant catches of Spanish mackerel (> 500 kg in the Gascoyne, > 1000 kg in the Pilbara and Kimberley). The average number of crew on each boat (2 per boat in the Gascoyne and Pilbara, 4 per boat in the Kimberley) was then pooled to determine overall employment. This estimate does not consider employment of fishers in the west coast sector or of fishers catching minor amounts of mackerel in other sectors, as they are considered employees of other fisheries. For many of the fishers included as employees of the mackerel fishery, the duration of employment is only about six months each year.

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year (2000):
Spanish mackerel \$1.9 million
Other mackerel \$0.37 million

Overall ex-vessel prices for Spanish mackerel (\$6.27/kg) and other mackerel (approximately \$5/kg) were obtained from fish processors and represent an average price per kilogram of whole weight. Actual prices paid to fishers for their product may reach over \$10/kg for fillets and trunks, particularly during summer when few mackerel are captured.

FISHERY GOVERNANCE

Acceptable catch range: 249–358 tonnes

Acceptable catch ranges for the individual sectors are Kimberley 110–165 tonnes, Pilbara 80–110 tonnes, Gascoyne 50–70 tonnes and west coast 9–13 tonnes.

These acceptable catch ranges are broad due to incomplete knowledge of the status of mackerel stocks. They are based on historic catch trends and take into account previous fishing pressure. This is particularly relevant in the Kimberley, where accumulated stocks of larger, older fish are likely to have supported high initial catches during the 1990s.

EXTERNAL FACTORS

Spanish mackerel and associated species are important commercial and recreational species, and implementation of the interim management plan will provide timely regulation of the commercial fishery that is needed for the long-term conservation of these fish. This is agreed in principle by industry, although there is considerable debate about the type of management that is needed. As a consequence there have been delays to implementation of the IMP and it is unlikely to be operational during the 2001 season. Ongoing cooperation between Fisheries WA research staff and mackerel fishers will be essential under the IMP to ensure information needed to monitor the status of the fishery is obtained.

The recreational fishery for Spanish mackerel also requires assessment as this is a growing sector which takes a significant proportion of the mackerel catch. Such an assessment will need to examine the usefulness of current minimum size limits and bag limits, since research fishing and tagging experience suggests that the survival of released fish is low.

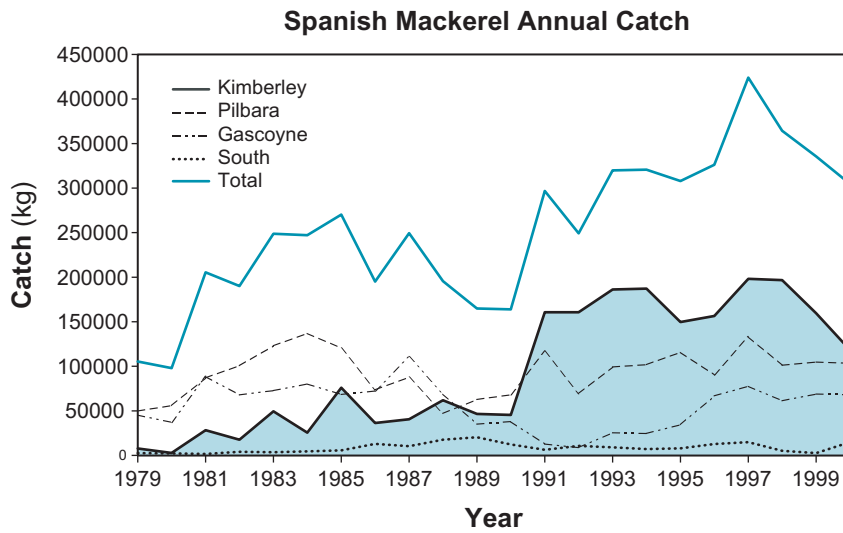
SPANISH MACKEREL TABLE 1

Catches of Spanish and other mackerel within each sector. The main species included under 'other mackerel' are grey mackerel (*Scomberomorus semifasciatus*), school mackerel (*S. queenslandicus*), spotted mackerel (*S. munroi*) and shark mackerel (*Grammatorcynus bicarinatus*).

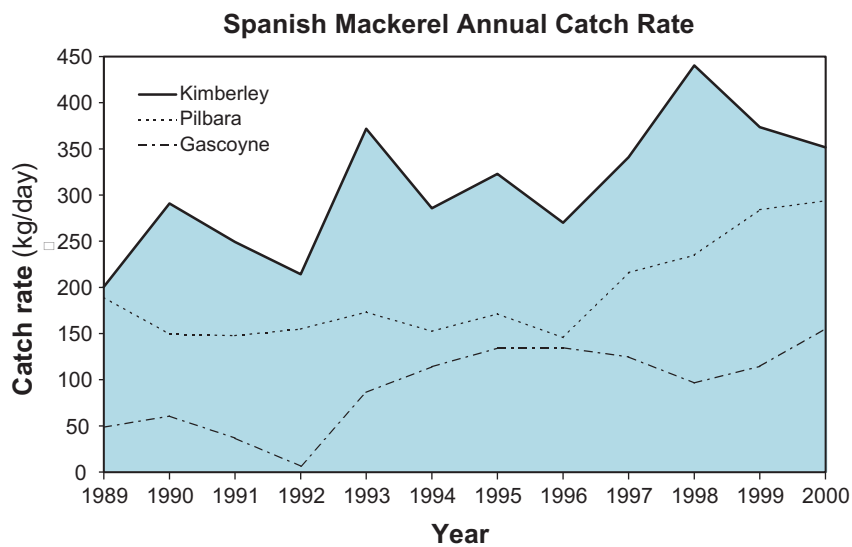
Year	Spanish mackerel (tonnes)					Other mackerel (tonnes)				
	Kimberley	Pilbara	Gascoyne	South	Total	Kimberley	Pilbara	Gascoyne	South	Total
1980	2.8	56.0	36.9	2.2	97.9	0.0	8.6	2.1	0.0	10.8
1981	28.3	68.7	88.5	1.7	187.2	1.9	0.4	0.1	0.1	2.5
1982	17.6	100.7	67.8	4.0	190.1	3.3	3.6	11.8	1.2	19.9
1983	49.5	123.0	72.8	3.5	248.7	0.0	2.2	0.9	0.6	3.6
1984	25.5	136.9	80.1	4.5	247.0	0.4	1.2	0.2	0.0	1.8
1985	75.9	120.4	68.3	5.7	270.3	11.7	5.7	2.0	0.1	19.4
1986	36.4	73.5	72.3	12.9	195.1	16.7	11.4	8.9	2.2	39.2
1987	40.6	87.8	110.6	10.3	249.3	12.2	2.3	8.6	0.7	23.9
1988	62.0	47.1	68.8	17.6	195.5	56.6	16.2	3.3	13.3	89.3
1989	46.6	62.7	35.1	20.4	164.8	13.4	35.8	18.2	37.1	104.5
1990	45.4	68.0	38.1	12.3	163.8	24.8	97.3	23.6	20.9	166.4
1991	160.7	116.8	12.8	6.3	296.7	50.5	44.3	12.1	8.9	115.8
1992	160.6	69.3	8.7	10.6	249.2	37.0	30.5	5.2	6.8	79.5
1993	186.1	99.3	25.4	9.1	319.9	28.0	36.4	8.1	2.4	75.0
1994	187.1	101.8	24.6	7.2	320.7	67.9	9.7	6.5	3.8	87.9
1995	149.7	115.8	34.5	7.9	307.9	27.6	15.6	9.7	2.8	55.8
1996	156.4	90.3	66.7	12.8	326.2	34.1	31.0	25.9	2.9	93.8
1997	198.2	133.2	77.6	14.9	423.9	64.7	31.8	20.6	3.5	120.6
1998	196.7	101.2	61.2	5.2	364.3	25.8	16.2	21.2	2.6	65.7
1999	159.5	104.7	68.8	2.6	335.6	26.9	7.9	32.7	5.2	72.7
2000	118.3	103.4	68.1	14.9	304.7	14.3	27.1	29.2	4.0	74.6



Commercial Fisheries



SPANISH MACKEREL FIGURE 1
Annual catch of Spanish mackerel in Western Australia.



SPANISH MACKEREL FIGURE 2
Estimated catch per unit effort (kg/day) for vessels catching Spanish mackerel. Effort data was based on those vessels known to target the species.

North Coast Shark Fisheries

MANAGEMENT SUMMARY

The taking of shark by longline and gillnet between 123°45' E and the WA/NT border is controlled by a Western Australian and Commonwealth Joint Authority. This sector is officially titled the Joint Authority Northern Shark Fishery (JANSF).

The Western Australian-controlled sector of the north coast shark fishery is managed by orders under section 43 of the *Fish Resources Management Act 1994*. The orders were first gazetted in May 1993 and cover the taking of shark in all waters off the north coast, from longitude 114°06' E to 123°45' E with longline, and from 114°06' E to the WA/NT border with dropline. This sector is referred to in this report as the WA North Coast Shark Fishery (WANCSF).

There is a lack of knowledge regarding the dynamics of the target species in these fisheries, largely as a result of low fishing activity. The paucity of knowledge on northern shark species is not a problem unique to Western Australia, and to address this concern Fisheries WA is part of a cooperative approach to shark research by a number of agencies across northern Australia that includes CSIRO and the Northern Territory and Queensland fisheries agencies.

Governing Legislation/Fishing Authority

- Fisheries Notice no. 476 (Section 43 order)
- Fisheries Notice no. 602 (Section 43 order)
- Fisheries Notice no. 601 (Section 43 order)
- Condition 127 on a Fishing Boat Licence

Consultation Process

Agency–industry meeting

RESEARCH SUMMARY

Research to monitor the status of the northern shark stocks has been undertaken as an extension of the south and west coast shark research project. A three-year research project partly funded by the FRDC began in July 2000 and will provide an improved understanding of these fisheries and of northern shark stocks generally. The following status report has been prepared based on CAES data from industry and a general knowledge of tropical shark stocks from the scientific literature.

North Coast Shark Fisheries Status Report

Prepared by R. McAuley and R. Lenanton

FISHERY DESCRIPTION

Boundaries and access

The management boundaries of the north coast shark fisheries depend upon the type of gear used. Western Australia manages dropline fishing for shark from longitude 114°06' E to the WA/NT border (129° E) and longline fishing for shark from longitude 114°06' E to 123°45' E (the WANCSF). Longline and gillnet fishing for

shark from longitude 123°45' E to the WA/NT border is managed by Joint Authority between Western Australia and the Commonwealth (the JANSF). Gillnet fishing is not permitted west of longitude 123°45' E or within 12 nautical miles of the coast east of longitude 123°45' E. A total of 13 fishers have licensed access to one or more of these zones.

Main fishing method

Shark dropline and shark longline.

RETAINED SPECIES

Commercial production (season 1999/2000):
103 tonnes

Landings

This total shark catch of 103 tonnes comprised 101 tonnes from the WANCSF and 2 tonnes from the JANSF. In 1999/2000, the WANCSF also retained 6 tonnes of finfish species.

Sharks are also caught by other user groups apart from the two dedicated fisheries. During 1999/2000, vessels licensed in other managed fisheries operating in the same overall area (i.e. between North West Cape and the WA/NT border) reported catches of shark and ray totalling 77 tonnes. A further 'wetline' catch of 22 tonnes of shark and ray was taken by vessels without access to managed fisheries.

Fishing effort

There are 13 vessels with specific licensed access to these stocks, eight of which were active in 1999/2000. Effort is not reported this year as the accuracy of CAES returns from the northern shark fisheries cannot be ascertained until research staff have had the opportunity to assess reporting procedures. However, there does appear to have been a reduction in effort during 1999/2000. Given the escalation of shark-fin prices and the subsequent introduction of additional full-time vessels in the northern shark fisheries, this is considered to be a temporary and artificially low level of effort.

Catch rate

See 'Fishing effort' above.

Recreational component:	Not assessed
Stock assessment completed:	Not assessed
Exploitation status:	Not assessed
Breeding stock levels:	Not assessed

NON-RETAINED SPECIES

Bycatch species impact: **Low**

The fisheries have some scalefish catch which is generally retained for sale. There is some discarded bycatch of unsaleable species of sharks, stingrays and scalefish.

Protected species interaction: **Negligible**

The WANCSF between North West Cape and Koolan Island is only permitted to utilise longlines and droplines,



Commercial Fisheries

which have negligible interaction with endangered species. The JANSF, when operating more than 12 nautical miles from the coast, is permitted to utilise gillnets, and therefore has the potential to interact with dolphins and turtles. However, little fishing is undertaken in this sector (2% of the catch), with the result that such interactions are insignificant.

ECOSYSTEM EFFECTS

Food chain effects: **Not assessed**

Habitat effects: **Negligible**

The physical impact of dropline and longline on the seabed is minimal.

SOCIAL EFFECTS

Estimated employment in the WANCSF during 2000 was 20 fishers. Employment levels in the JANSF are not known.

ECONOMIC EFFECTS

Estimated annual value (to fishers) for year (1999/2000): **\$0.4 million**

The value of the combined catch from the two managed sectors was approximately \$0.4 million (including estimated value of shark fins). During the 1999/2000

season, shark fins were worth between \$25 and \$120/kg, depending on fin size and species. As fishers do not specify the value of fins on their catch returns, fin weight was calculated at an average of 3% of sharks' whole weight and value was conservatively estimated using a price of \$60/kg (the high value reflecting the generally larger sharks caught in this fishery). Categories of shark which do not have saleable fins were excluded from fin valuation.

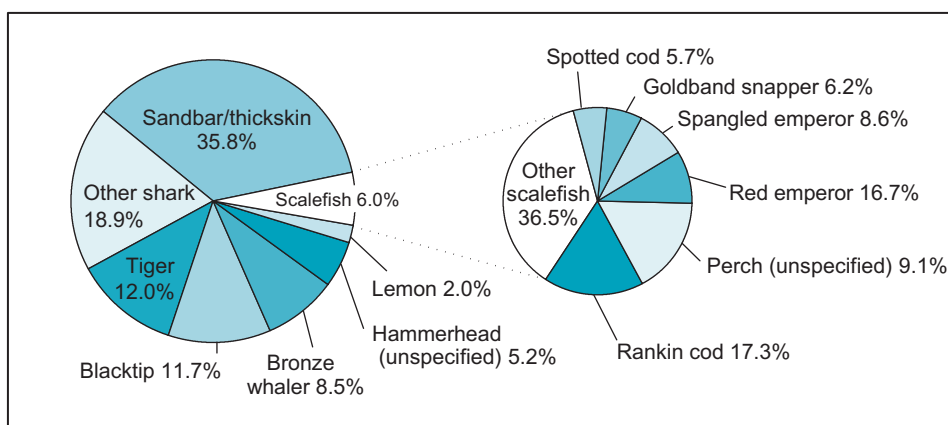
FISHERY GOVERNANCE

Acceptable catch range: **Not assessed**

EXTERNAL FACTORS

A large portion of the shark catch from the State's northern bioregion is taken by vessels fishing for other target species. This factor, in addition to the multi-species nature of the tropical shark fisheries, makes formal stock assessment processes particularly difficult. However, a new research project funded in part by the FRDC, aimed at conducting a stock assessment of the sandbar (thickskin) shark *Carcharhinus plumbeus*, will improve understanding of several northern shark stocks as well as providing a clearer picture of the shark catch by other fisheries.

North Coast Shark Catch Composition



NORTH COAST SHARK FIGURE 1

Combined WA North Coast Shark Fishery and Joint Authority Northern Shark Fishery catch species composition.