



**Australian Government**

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**Department of the Environment and Heritage**

Assessment of the  
**Northern Prawn Fishery**

**December 2003**

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This document is an assessment carried out by the Department of Environment and Heritage of a commercial fishery against the Australian Government Guidelines for the Ecologically Sustainable Management of Fisheries. It forms part of the advice provided to the Minister for the Environment and Heritage on the fishery in relation to decisions under Parts 10, 13 and 13A of the Environment Protection and Biodiversity Conservation Act 1999. The views expressed do not necessarily reflect those of the Minister for the Environment and Heritage or the Australian Government.

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**Assessment of the ecological sustainability of management arrangements for the  
Northern Prawn Fishery**

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## EXECUTIVE SUMMARY

### Background

The Australian Fisheries Management Authority (AFMA) has submitted documents for assessment under Parts 10, 13 and 13A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

On 8 July 2001 the Minister for the Environment and Heritage (the Minister) signed an Agreement with AFMA to initiate the strategic assessment. Following public consultation, *Terms of Reference for the Environmental Assessment of the Northern Prawn Fishery* were adopted. The draft documents: *Northern Prawn Fishery Strategic Assessment* and *Northern Prawn Fishery By-catch Action Plan*; were received by the Australian Government Department of the Environment and Heritage (DEH) in September 2002. The documents were released for a thirty-day public comment period that expired on 28 November 2002. Seven public comments were received. AFMA provided a response to the issues raised and amended the documents where necessary. A final version of the *Northern Prawn Fishery Strategic Assessment* (the submission) and *Northern Prawn Fishery By-catch Action Plan* (the BAP) were submitted for assessment in February 2003.

The submission reports on the Northern Prawn Fishery (NPF) against the Terms of Reference, including the Commonwealth's *Guidelines for the ecologically sustainable management of fisheries*. The DEH assessment considers the submission and associated documents, public comments and AFMA's response to the comments.

**Table 1. Summary of the Northern Prawn Fishery**

<b>Area</b>	Northern Australia – Cape York in Queensland to Cape Londonderry in Western Australia (coastal waters out to 200 nautical miles)
<b>Fishery status</b>	Brown tiger prawns over-exploited, Grooved tiger prawns and Banana prawns fully fished. Endeavour prawns underfished. Remaining species of unknown status.
<b>Target Species</b>	80 % of catch is White Banana Prawns ( <i>Fenneropenaeus merguensis</i> ), Brown Tiger Prawns ( <i>Penaeus esculentus</i> ) and Grooved Tiger Prawns ( <i>P. semisulcatus</i> )  Endeavour Prawns ( <i>Metapenaeus endeavouri</i> and <i>M. ensis</i> ), Red-legged Banana Prawns ( <i>P. indicus</i> ), Giant Tiger Prawns ( <i>P. monodon</i> ), Western King Prawns ( <i>Melicertus latisulcatus</i> ) and Red spot King Prawns ( <i>M. longistylus</i> ) are also targeted.
<b>By-product Species</b>	Numerous Principal by-product species: squid, scampi, scallops and bugs. Numerous fish species retained. Size/catch limits or possession bans in place for a number of species.
<b>Gear</b>	Twin gear otter trawl. Vessels up to 29 m long
<b>Season</b>	Two seasons - April to May/early June and August to November. Closures coincide with spawning and recruitment phases of prawns.
<b>Commercial harvest 2001</b>	9282 tonnes of prawns; 9751 tonnes total harvest
<b>Value of commercial</b>	\$164 million – most valuable AFMA managed fishery

<b>harvest 2001</b>	
<b>Recreational harvest</b>	No significant recreational take of target species.
<b>Commercial licences issued</b>	Managed through Statutory Fishing Rights. 53,844 gear SFRs divided between 54 owners. 96 boats operated in 2002.
<b>Management arrangements</b>	Input controlled through: limited entry, boat and gear restrictions, and spatial and temporal closures. Some output controls eg by-product size and catch limits.
<b>Export</b>	Approximately 90% of catch exported annually. Major markets are Japan and mainland China, smaller quantities sold to Taiwan, Hong Kong, Europe, and the United States.
<b>Bycatch</b>	Various finfish, elasmobranch, and invertebrate species
<b>Interaction with Threatened Species</b>	Very high historical interaction with marine turtles. Interactions significantly declined through use of Turtle Excluder Devices. Sea snakes, syngnathids and some shark species also caught. Bycatch Reduction Devices reducing captures.

The fishery encompasses an area of 771,000 square kilometres off Australia's northern coast, stretching from Cape York in Queensland to Cape Londonderry in Western Australia. The fishery area extends from the low water mark to the outer edge of the Australian Fishing Zone, thus covering both State and Commonwealth waters. The fishery is subject to an arrangement under the Offshore Constitutional Settlement (OCS) between the Commonwealth Government and the Governments of the Northern Territory (NT), Queensland and Western Australia (WA). Under this arrangement, the Commonwealth Government, through AFMA, is responsible for the management of the entire fishery.

The NPF is a multi-species fishery targeting nine prawn species (see Table 1.) A number of other species are targeted opportunistically by fishers. These include scampi (*Metanephrops* species) and squid (mitre squid, north-west pink squid and northern calamari). These species are classified 'supplementary species' to distinguish them from other species deemed by-product. Species currently retained by the fishery as by-product include slipper lobster (*Thenus indicus* and *T. orientalis*), saucer or delicate scallop (*Amusium pleuronectes*) and some larger fish species. By-product limits are in place for a number of species. Possession bans have been implemented for some state targeted commercially valuable species such as barramundi, spotted grunter-bream, blue and threadfin salmon, black jewfish, jewelfish, queenfish, trepang, pearl shell, coral and trochus. An industry initiated possession ban is also in place for all elasmobranch species (sharks, skates/rays, sawfishes), and includes the prohibition of retention of any parts of these species.

All prawn species targeted, with the exception of brown tiger prawns, which are endemic to Australia, have a broad distribution. In Australia white banana prawns, giant tiger prawns, red-spot king prawns and endeavour prawns occur from Shark Bay in the west to New South Wales (NSW) in the east. Red-legged banana prawns are found from south of Broome in northern WA to the northeastern margin of the Gulf of Carpentaria (GoC). Western king prawns have been found from waters of South Australia around the coast to WA, NT, Queensland and as far south as northern NSW. Brown and grooved tiger prawns are found along the west, north and east coasts of Australia. Juveniles of all species inhabit the seagrass beds of inshore areas and move offshore into the fishery when mature. These species have an average life span of two years and are harvested throughout Australia in several trawl

fisheries. These prawn species are typically found in mud, silt and sand substrates in their adult phase. They are prey for a variety of species, especially during larval stages.

Extensive studies by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Marine Research have shown that the adults of the two tiger prawn species have different spatial distributions related to water depth and substrate. The two banana prawn species are also easily differentiated based on water depth. There is a high degree of genetic isolation between blue endeavour prawns (*M. endeavouri*) found in Exmouth Gulf in WA and those found in the GoC. Genetic differences have been identified between western king prawn populations and although no genetic differences were detected between brown tiger prawn populations, the majority of these operate as functionally independent stocks. Genetic differences have also been detected between giant tiger prawn populations throughout Australia.

The fishery was established in the late 1960s and expanded rapidly through the 1970's. Systematic reductions in effort through the late 1980s, 1990s and in more recent years have reduced the effort on target species considerably following confirmation that tiger prawn stocks were significantly over-fished. The fishery has two components: (a) the banana prawn fishery, which operates mainly in the eastern waters of the GoC, on isolated grounds along the Arnhemland coast and in Joseph Bonaparte Gulf; and (b) the tiger prawn fishery, which is concentrated near seagrass beds in the south and west of the GoC and along the Arnhemland coast. White banana prawns and tiger prawn catches account for approximately 80 per cent of the landed annual catch.

The NPF is the most valuable Commonwealth managed fishery and one of the most valuable fisheries in Australia. The gross value of production (GVP) for the 2001 season was over \$A164 million and varies annually between \$A105 and \$A165 million. The majority of product taken in the fishery is exported. In 2000, 90 % of product was exported, principally to Japan and China with smaller amounts exported to Hong Kong, Taiwan, Europe and the United States of America.

Effort in the fishery, as at April 2002, consists of 53,844 gear Statutory Fishing Rights (SFRs) divided among 54 trawler owners with 96 operational trawlers. Many owners have entitlements to operate multiple trawlers and the majority of trawlers are dual-endorsed allowing them to operate in other fisheries.

The fishery currently targets prawn species with twin otter trawl gear. Management arrangements are based on a limited-entry regime with seasonal, spatial and temporal closures, gear restrictions and bycatch restrictions. Bycatch reduction devices (BRDs) including turtle exclusion devices (TEDs) are now compulsory in all nets.

As in any trawl fishery, bycatch to target ratios are high with a large variety of species caught. Some bycatch species in this fishery are currently listed protected species under the EPBC Act. Protected species interactions in this fishery include the direct capture of syngnathids (seahorses and pipefish), sea snakes and marine turtles, and the provisioning and possible habituation of dolphins and seabirds. These interactions are assessed under Principle Two of this report.

Take of prawns by the indigenous and recreational sectors is insignificant, however some species caught as by-product and/or bycatch in this fishery are targeted by these users and in other commercial fisheries.

The fishery is managed under the *Northern Prawn Fishery Management Plan 1995*, (as amended) which obtains its authority from the *Fisheries Management Act 1991* and the *Fisheries Administration Act 1991*. The management plan sets out the range of management measures, objectives and performance criteria for the fishery. Under the management plan AFMA is required to develop, and industry implement, a Bycatch Action Plan for the fishery. The *Northern Prawn Fishery Bycatch Action Plan (BAP)* and the *Northern Prawn Fishery Bycatch Action Plan 2002 Background Paper* have been developed and contain clear objectives, strategies and actions to address ongoing bycatch issues. In addition, the Northern Prawn Fishery Management Advisory Committee (NORMAC) produces five-year Strategic Plans for consideration by the AFMA Board. The *Northern Prawn Fishery Strategic Plan 2001-2006* contains detailed objectives and strategies that AFMA and NORMAC intend to pursue over the period of the plan. Strategies and performance measures are reported against in NORMAC's annual report to AFMA, SFR holders and other stakeholders. NORMAC also produces a Five-Year Research Plan. Actions, performance measures and monitoring requirements contained in all of these documents have been considered during the DEH assessment.

### **Overall assessment**

The material submitted by the Australian Fisheries Management Authority (AFMA) indicates that the fishery operates in accordance with the Commonwealth *Guidelines for the ecologically sustainable management of fisheries*. DEH concurs that the Northern Prawn Fishery is a well managed fishery that is unlikely to have an unacceptable or unsustainable impact on the environment in the short to mid term. Recommendations have been developed to ensure that the risk of impact is minimised in the longer term. Overall, the sophisticated management regime of spatial and temporal closures, data collection systems and bycatch reduction strategies suggests that the fishery is being managed in an ecologically sustainable way.

While the NPF has a history of over-fishing tiger prawn stocks, causing high marine turtle mortality, and utilising a fishing method known to capture large quantities of bycatch and significantly damage benthic habitats, AFMA has a strong history of recognising these problems and working hard, together with industry, to address the issues. AFMA has systematically reduced effort in the fishery to alleviate pressure on tiger prawn stocks. DEH notes that as a result of the recent effort reductions and rebuilding strategy, Grooved tiger prawns' stock status has improved and they are now considered fully fished rather than overfished. Brown tiger prawn stocks remain overfished and the recovery strategy will continue to be applied and monitored. Management measures developed for tiger prawn stocks have been applied across the fishery, providing a more precautionary approach to management of other prawn species that are less impacted by continual harvest. Turtle mortality and bycatch quantities have been dramatically reduced through the use of TEDs and BRDs and work is ongoing to further minimise impacts on these species. AFMA have also used spatial management to minimise impacts on sensitive seagrass habitats and has committed to developing a spatial management system to protect representative areas of habitat types in the fishery.

In making its assessment, DEH is satisfied that the information collection system, risk assessments, management arrangements and objectives are sufficient to ensure the fishery is conducted in a manner that does not lead to over-fishing. DEH is further satisfied that, for the tiger prawn species currently over-fished; the fishery is conducted such that there is a high degree of probability the stocks will recover. Considering the research programs and management arrangements in place, DEH is satisfied that fishing operations are managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem. Management of this fishery has a history of reacting appropriately to threats to sustainability and DEH is confident that AFMA will continue to provide this high quality management.

Part 10 of the EPBC Act requires that Commonwealth managed fisheries undergo strategic assessment to determine whether actions taken in the fishery have a significant impact on the environment in Commonwealth Marine Areas. Under this Part, the Minister may accredit a management plan to exempt actions taken in accordance with the management plan from further impact assessment approval.

DEH is satisfied that there has been an adequate assessment of the impacts that activities taken in accordance with the management regime, have, will have or are likely to have, on the environment of a Commonwealth marine area. DEH also considers that actions taken in this fishery will not have an unacceptable or unsustainable impact on the environment in a Commonwealth marine area in the short to medium term.

DEH therefore recommends that the *Northern Prawn Fishery Management Plan 1995 (as amended)* be accredited under section 33 of the EPBC Act. If commitments made in the submission are not undertaken, or if further analysis shows there is an unsustainable impact in the long term, the Minister may revoke the declaration and accreditation of the plan under section 33 of the EPBC Act.

As the official fishery area encompasses Commonwealth as well as State waters, consideration under Part 13 of the EPBC Act is required regarding the impact of the fishery on listed threatened species, listed migratory species, cetaceans and listed marine species.

The fishery has in the past captured and killed significant numbers of marine turtles and other protected species. The mandatory use of TEDs and BRDs has substantially reduced the numbers of turtle interactions and mortalities to less than 5% of historical catches. While BRDs have been less successful they have substantially reduced the over all bycatch and are effective at minimizing capture of large animals, including sharks and dolphins, and show potential for the reduction of sea snake capture. Ongoing research and refinements of TEDs and BRDs design are expected to further reduce interaction with protected species.

DEH is satisfied that the monitoring of interactions, assessment of impacts, current management responses and commitments to ongoing research and future management are sufficient to ensure all persons engaged in fishing are required to take all reasonable steps to minimise impacts. A number of recommendations have been made to provide further confidence in the fishery's ability to minimise impacts on these species. DEH considers that the fishery is unlikely to have an unacceptable impact on the recovery or conservation status of protected species. DEH recommends that this fishery be accredited under Part 13 of the EPBC Act.

The assessment concludes that the fishery is managed in an ecologically sustainable way. DEH recommends that the export of species taken in the fishery should be exempt from the export permit requirements of Part 13A of the EPBC Act, with that exemption to be reviewed in five years.

To further strengthen the effectiveness of the management arrangements for the fishery, and to contain the environmental risks in the medium to long term, a series of recommendations have been developed. The implementation of these recommendations and other commitments made by AFMA in the submission will be monitored and reviewed as part of the next Commonwealth review of the fishery in five years time.

## **Recommendations**

The following recommendations will be implemented before the next review in 2008:

1. At the next review of the Management Plan detailed objectives, performance criteria, performance measures and regular review requirements will be formalised and directly linked to the Management Plan.
2. AFMA will continue to inform DEH of any significant changes to the Strategic Plan, Management Plan, Bycatch Action Plan, or managerial commitments in the strategic assessment submission.
3. At the next review of the Management Plan an amendment will be made to require the assessment of the effectiveness of the Management Plan, including the measures taken to achieve its objectives by reference to the performance criteria mentioned in recommendation (1), at least every five years.
4. AFMA will continue to cooperate with other relevant jurisdictions to pursue complementary management and research of shared stocks for all target and by-product species, which may be affected by cross-jurisdictional issues.
5. AFMA will develop and implement harvest strategies for all target prawn species, scampi, squid and slipper lobsters (bugs) within five years. Harvest strategies should include monitoring systems, suitable biological reference points and management responses with clear timeframes for implementation, to ensure that harvesting is conducted at an ecologically sustainable level. Harvest strategies should also be developed for other species as new market opportunities are detected.
6. AFMA, in cooperation with the Western Australia, Northern Territory and Queensland fisheries management agencies will, within five years, develop and implement a precautionary and biologically meaningful limit for squid harvest based on sound information about the species ability to withstand fishing pressure. Within 12 months, as an interim measure, AFMA will implement more precautionary management arrangements, based on the best available scientific advice, and taking into account historical catch, to limit the harvest of squid species in the NPF.
7. Within 3 years AFMA will identify and implement management responses to fishing impacts identified from the ecological risk assessment process.
8. An assessment of bycatch and biodiversity in prawn trawl fisheries<sup>1</sup> conducted prior to the introduction of Turtle Excluder Devices (TEDs) and Bycatch Reduction Devices (BRDs) identified Pristidae (sawfishes) and Dasyatidae (ray) species as least likely to be sustainable to trawling operations. Within three years, unless the introduction of TEDs

and BRDs have been found to significantly reduce the catch of these species to levels that do not place these species at conservation risk, or the ecological risk assessment has determined that these species are not likely to be significantly impacted by operations in the fishery, AFMA will ensure that these species receive ongoing monitoring and attention in future refinements of bycatch mitigation measures. Particular attention should be paid to the Green Sawfish (*Pristis zijsron*) and Narrow Sawfish (*Anoxypristis cuspidate*). Relevant information on species found to be at risk should be collected to inform the development of mechanisms to minimise the impacts of trawling on these species.

9. AFMA will continue to pursue reduction in the amount of bycatch taken in the Northern Prawn Fishery through the refinement of bycatch mitigation technology and will investigate methods for increasing the survivability of bycatch species. Any suitable methods identified should be implemented in a timely manner.
10. AFMA will ensure that ongoing monitoring of sea snake species taken in the fishery is undertaken to ensure that any future impacts on these protected species can be detected. Within three years, unless the introduction of TEDs and BRDs have been found to significantly reduce the catch of sea snakes to levels that do not place these species at conservation risk, or the ecological risk assessment has determined that these species are not likely to be significantly impacted by operations in the fishery, AFMA will ensure that sea snake bycatch is specifically considered in ongoing monitoring and refinement of bycatch mitigation measures. If necessary, the development of bycatch mitigation measures to significantly reduce the capture of sea snakes should be a priority. Research, monitoring and mitigation measure development should concentrate on *Hydrophis pacificus* (large headed sea snake) and *Disteria kingii* (spectacled sea snake) to ensure that impacts on these species are sustainable.
11. AFMA will develop and implement an education program for industry to increase awareness of the importance of sea snake protection, promote sensible handling techniques and improve species identification. AFMA will also ensure that observers are adequately trained in sea snake identification to species level to maximise the use of data collected in monitoring programs.
12. AFMA, in cooperation with the States, will develop and implement a spatial management system within the NPF that takes account of the impacts of fishing on:
  - species and populations identified by the ecological risk assessment process as high risk;
  - the recovery of overfished stocks;
  - important feeding/spawning/breeding/refuge grounds for key target, byproduct and protected species; and
  - benthic habitats

This spatial management system will be integrated with the regional marine planning process for Northern Australia that is already under way to establish a representative system of marine protected areas in the region and will ensure that the entire fishery area is taken into account.

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<sup>1</sup> Stobutzki, I., Blaber, S., Brewer, D., Fry, G., Heales, D., Miller, M., Milton, D., Salini, J., Van der Velde, T., Wassenberg, T. (2001) Ecological sustainability of bycatch and biodiversity in prawn trawl fisheries. FRDC Project 96/257.

## **PART I - MANAGEMENT ARRANGEMENTS**

The Northern Prawn Fishery (NPF) is managed by the Australian Fisheries Management Authority (AFMA).

The management regime is described in the following documents, all of which are publicly available:

- *The Northern Prawn Fishery Management Plan 1995* (as amended)
- *The Northern Prawn Fishery Bycatch Action Plan (BAP)*
- *The Northern Prawn Fishery Bycatch Action Plan Background Paper (BAP-BP)*
- *The Fisheries Management Act 1991*
- *The Fisheries Administration Act 1991*
- *The Northern Prawn Fishery Strategic Plan 2001-2006*
- *The Northern Prawn Fishery Five year Research Plan 2001-2006*
- *Fisheries Management Regulations*
- Directions and licence conditions made under the management plan

A number of other documents, including research reports, scientific literature and discussion papers, are integral to the management of the fishery.

Management of the NPF incorporates a sound range of consultative mechanisms and a clear commitment to effective consultation with a variety of stakeholders. DEH considers the level of consultation to be adequate and is confident that AFMA will continue to ensure interested parties are consulted appropriately.

DEH notes that an objective contained in the NPF Strategic Plan is to effectively communicate and consult with the fishing industry, other marine resource users and the broader community. One of the strategies identified to achieve this objective is to develop a communication strategy.

The primary consultative mechanism is the Northern Prawn Fishery Management Advisory Committee (NORMAC), which has been in operation since the 1970s. NORMAC meets regularly to discuss issues relating to the management of the fishery. The Committee provides advice to AFMA on a range of issues and was fundamental in the development of the NPF Bycatch Action Plan, Management Plan, Strategic Plan and Five-year Research Plan.

Membership on NORMAC includes an independent chair, an independent Executive Officer, 5 industry members, an environment/conservation member, a scientific member and the AFMA manager of the fishery. There is no representation by the recreational or indigenous sectors. AFMA has advised that this is due to the extremely low level of recreational and indigenous take of prawns, other consultative mechanisms available to these sectors and a restriction on numbers of members on MACs.

Annual public meetings, workshops, discussion papers and information circulars are also used to promote discussion and understanding of the management of the NPF. NORMAC hold workshops on gear units, bycatch and strategic planning and have sub-committees overseeing progress on these issues.

AFMA and NORMAC are participating in the development of the Northern Regional Marine Plan through engagement with the National Oceans Office (NOO). NORMAC also

participates (or has participated) in various community based groups in the region including:

- the Northern Gulf Resource Management Group, which brings together community based groups, indigenous representatives, the various resource industries and shire councils to discuss issues in the region; and
- the Community Consultative Council that developed a multiple use strategic plan for the southern Gulf of Carpentaria. The Council included community based groups and indigenous representatives.

Consultation regarding the management of the fishery is also conducted outside of NORMAC. The *Fisheries Management Act 1991* requires that AFMA consult adequately when developing management plans and in the development of other fisheries policies. This consultation includes the establishment and maintenance of an interested persons register and the advertisement of material in newspapers and on the AFMA website.

The overall objectives of the *Fisheries Management Act 1991* form the basis for the management of all Commonwealth fisheries. Performance indicators, measures and actions to address issues when required are specified in the management plan and strategic plan. An assessment of the effectiveness of these measures is included in Part Two of this report. AFMA have advised that all objectives and strategies will be implemented in the fishery to ensure the fishery management regime remains strategic and capable of detecting and addressing unacceptable impacts of fishing activity. The management plan is supported by a range of instruments including regulations, conditions on Statutory Fishing Rights (SFRs) and management Directions.

The management plan contains objectives for the management of the fishery and identifies performance criteria by which the effectiveness of the management arrangements is measured. The objectives are brief and provide little direct indication of what management is seeking to achieve. AFMA advises that the objectives of the plan should be read in-conjunction with the objectives prescribed in the Fisheries Management Act. Similarly, the performance criteria contained in the management plan, against which measures taken are assessed, are poorly articulated. Benchmarks are not clear, nor what it is that demonstrates that fishery is operating in accordance with its objectives. AFMA further advises that the strategic plan contains very specific objectives and performance criteria and that this document is crucial to the management of the fishery. DEH considers the detailed objectives, strategies and performance measures contained in the strategic plan sufficient. However, these objectives, criteria and measures are not formalized and there is no formal link to the development, implementation and review of the Strategic Plan in the management plan.

**Recommendation 1:** *At the next review of the Management Plan detailed objectives, performance criteria, performance measures and regular review requirements will be formalised and directly linked to the Management Plan.*

The management objectives contained in the strategic plan provide for the sustainable harvest of target species, the protection of bycatch species and the broader marine environment, and adequately address the objectives of the Commonwealth's *Guidelines for the ecologically sustainable management of fisheries*.

DEH recognises that management arrangements need to be flexible to ensure timely and appropriate managerial decisions and adaptability to new information. Consequently, changes to management arrangements are expected to occur between now and the next review of the fishery. Because of the importance of the Strategic Plan, the Management Plan and the Bycatch Action Plan to DEH's assessment, an amendment to any of these may alter the outcomes of this assessment. Therefore, DEH believes it is important that AFMA notify DEH of any changes to management arrangements and commitments made in the key management documents. DEH notes that a number of mechanisms already exist to ensure that DEH are made aware of issues affecting most Commonwealth managed fisheries and considers these for an appropriate means of notifying DEH of any changes relating to the management of the NPF.

**Recommendation 2:** *AFMA will continue to inform DEH of any significant changes to the Strategic Plan, Management Plan, Bycatch Action Plan, or managerial commitments in the strategic assessment submission.*

The management arrangements for the fishery provide for the establishment and implementation of a range of measures aimed at achieving and maintaining ecological sustainability. The fishery is managed under a comprehensive system of input and output controls capable of controlling the level of take of the target species. These controls are discussed under Part II of this report.

Comments received during public consultation that identified a need to consider alternative harvest strategies in recognition of the adverse impacts of trawling on the seabed. AFMA advises that no viable alternative method of fishing has been developed although research into the use of target species attractants is being undertaken by the Australian Institute of Marine Science (AIMS). Research into alternative fishing methods has been identified as a high priority by NORMAC but to date no relevant research proposals have been received.

Compliance and enforcement tools implemented in the fishery include the mandatory installation and use of a Vessel Monitoring System (VMS) and random at sea and port inspections. AFMA also provide educational material and hold port meetings to ensure that operators are aware of the rules and regulations that apply in the fishery.

AFMA develops a Compliance Plan for each major Commonwealth fishery. Compliance Plans contain strategies to manage the potential risks for non-compliance and details of compliance activity, performance measures and proposed budgets. The NPF Compliance Plan identifies the risks to compliance and presents a program detailing the compliance tasks, agency responsibilities and related performance indicators.

All operators are required to carry and operate an integrated computer VMS, which is used to monitor compliance with closures and provides valuable information on spatial effort. The Compliance Plan requires that a minimum of 65% of vessels in the fleet be subject to regular and random at-sea inspections. This is combined with a program of aerial surveillance. At-sea inspections check net lengths, ensure compliance with TED and BRD regulations, check logbook and transshipment records and inspect catch to ensure compliance with size and catch limits. In-port measuring is conducted of all nets and involves the measuring and tagging of nets, making at-sea inspection easier.

In 2002, three at-sea compliance operations were undertaken, aerial surveillance flights were conducted during April, May, August and September and 610 nets were measured and tagged. Several breaches of closures were detected and are being investigated. Other breaches included minor logbook reporting breaches. Given the large number of operators in the fleet and high surveillance activity, compliance in this fishery appears to be reasonable. DEH is satisfied that these compliance measures contain the means of enforcing critical aspects of the management arrangements.

AFMA must report annually on the performance of the management plan, including an assessment of the effectiveness of the measures taken to implement the objectives of the plan. There appears to be no formal requirement that the management plan be reviewed periodically. DEH believes that regular review of the management plan, its objectives and performance measures, is important for ensuring that the plan contains current and best practice management objectives that take into account recent changes in fishery management and science. DEH considers a review period of five years is appropriate for this fishery. This timeframe is in line with recently developed management plans by AFMA. DEH is satisfied that a five year review of the entire fishery is suitable while critical aspects are reviewed annually. The annual reviews include assessments of target stocks and performance of the management plan.

**Recommendation 3:** *At the next review of the Management Plan an amendment will be made to require the assessment of the effectiveness of the Management Plan, including the measures taken to achieve its objectives by reference to the performance criteria mentioned in recommendation (1), at least every five years.*

A comprehensive fishery dependent and independent monitoring program that informs annual stock assessments has been established in the fishery. Discussion of the information collection systems and stock assessment is contained in Part II of this report.

An analysis of the fishery's capacity for assessing, monitoring and avoiding, remedying or mitigating any adverse impacts on the wider marine ecosystem, including bycatch and protected species is contained in Part II of this report.

The fishery is influenced by a range of domestic programs and policies, in addition to the formal management arrangements already discussed. Of particular significance is the draft *Recovery Plan for Marine Turtles in Australia*. The NPF region is important to the breeding and foraging of a number of marine turtles. In April 2001, bycatch of sea turtles during coastal otter trawling operations in Australian waters north of 28°S was listed as a Key Threatening Process under the *Environment Protection and Biodiversity Conservation Act 1999*. The recovery plan contains specific actions aimed at mitigating this threat. NORMAC and industry were involved in the development of the plan and the fishery is managed in accordance with the measures contained in the plan.

The *Commonwealth Policy on Fisheries Bycatch* requires the development of bycatch action strategies. Strategies to minimize bycatch in the NPF are well established. The management plan requires that AFMA develops and implements a Bycatch Action Plan (BAP). The first NPF BAP was developed in 1998. A second BAP has recently been prepared, and is assessed under Principle 2 of the Guidelines.

A range of international agreements also influence the management of the fishery. The management regime takes into account other agreements such as, the United Nations Fish Stocks Agreement, the Food and Agriculture Organization's (FAO) Code of Conduct for Responsible Fisheries and the Convention on the International Trade of Endangered Species.

As the fishery operates in Commonwealth waters, operators are required to comply with the International Convention on Marine Pollution (MARPOL). The submission outlines a range of MARPOL regulations relevant to the fishery, including oil pollution and the on-board management of waste. Compliance is considered high with these regulations.

DEH is satisfied that the current management arrangements comply with all relevant intentional and regional agreements, threat abatement plans, recovery plans, the National Policy on Fisheries Bycatch, and bycatch action strategies developed under that policy.

### **Conclusion**

Management arrangements in the NPF are highly developed and well implemented. DEH is satisfied that the NPF management regime is appropriately precautionary and provides for the fishery to be conducted in a manner that does not lead to over-fishing and for fishing operations to be managed to minimize their impact on the structure, productivity, function and biological diversity of the ecosystem. DEH is also satisfied that for the Brown tiger prawn stocks currently over fished, the fishery is conducted such that there is a high degree of probability the stocks would recover.

The management regime takes into account arrangements in other jurisdictions and adheres to arrangements established under Australian laws and international agreements. The regime is developed through a consultative process, is subject to rigorous scientific scrutiny and has a record of implementing research findings into management action. The management arrangements in place are adaptable, are underpinned by adequate objectives and performance criteria by which the effectiveness of the management arrangements are measured, have the ability to control the level of take from the fishery and are reviewable and enforceable. AFMA has a history of adopting and delivering on management arrangements to address impacts on target, bycatch and protected species in the NPF and DEH is confident that using the management plan, strategic plan and BAP as a guide, AFMA will continue to do so to acceptable levels of precaution in the next five years.

A more detailed analysis of the management regime is contained in Part II of this report.

## **PART II – GUIDELINES FOR THE ECOLOGICALLY SUSTAINABLE MANAGEMENT OF FISHERIES**

### **Stock Status and Recovery**

Principle 1: *‘A fishery must be conducted in a manner that does not lead to over-fishing, or for those stocks that are over-fished, the fishery must be conducted such that there is a high degree of probability the stock(s) will recover’*

### **Maintain ecologically viable stocks**

Objective 1: *‘The fishery shall be conducted at catch levels that maintain ecologically viable stock levels at an agreed point or range, with acceptable levels of probability’*

### **Information requirements**

A comprehensive information collection system is in place in the fishery that includes a sound mix of fishery dependent and independent information.

Fishery dependent information is collected through compulsory daily logbooks. Logbooks record information on daily and shot-by-shot target and by-product catch, equipment used, location (6 minute grid references) and duration of trawling, and detailed information on interactions with protected species. Compliance with logbooks is high. Every NPF trawler has submitted a logbook record for every day in the NPF since 1996. Penalties are in place for operators who fail to submit logbook records in accordance with the regulations.

Logbook data is verified by processor records obtained for landed catch and by transshipment documentation. Vessel gear details are also collected which aid assessments of effort creep and fishing power. At-sea logbook monitoring and enforcement is also conducted.

Data summaries are produced biannually. Summaries contain catch and effort statistics by prawn species group, area, time and fishery. NPF has a long time series of data available for scientific analysis and data collected by the fishery is considered reliable.

It is compulsory for all vessels to be equipped with and use VMS technology. VMS has improved vessel monitoring and has significantly increased surveillance capability and improved management of closures.

The collection of fishery independent data is relatively recent in the fishery. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) designed a survey program to be conducted annually. The survey program commenced in August 2002. One survey conducted in January will provide a fishery independent recruitment index for the main target prawn species. A second survey conducted in September will provide information to examine spatial contraction of the fishery and attempt to quantify changes in fishing power.

One public comment received during public consultation suggested that the fishery should be managed through a system of preseason surveys to determine opening times of fishing seasons. AFMA advised in their response to public comments that pre-season surveys and additional collection of fishery independent data to improve the management of the fishery

are currently being investigated. They also advised that flexible opening times determined by such a survey would not necessarily improve the sustainability of the fishery.

Research is an integral part of the management decision-making in the NPF. The Northern Prawn Fishery Five Year Research Plan 2001-2006 (the Research Plan) has been developed by NORMAC. The Research Plan identifies research priorities for the fishery over the next five years, including the objectives of current research and the outcomes of recently completed projects.

Recent research includes investigations into the spatial distribution of stocks, population dynamics of prawn fisheries and indices of recruitment and effective spawning for tiger prawn stocks. In addition, there are many research projects are completed or underway dedicated to bycatch management issues.

DEH is satisfied that the information system is reliable, appropriate to the scale of the fishery and is based on an appropriate mix of fishery independent and dependent research and monitoring.

### **Assessment**

Assessments of the dynamics and status of NPF target species is undertaken by the Northern Prawn Fishery Assessment Group (NPFAG) on an ongoing basis. Logbook and research data are used in the assessments combined with extensive modelling work developed for the major prawn species. Results of each assessment are published annually and include an analysis of previous and current stock assessments, implications for management, economic status and environmental factors affecting prawn stocks.

Catch, effort and catch per unit effort (CPUE) trends for target prawn species are monitored and persistent downward trends over three or more years are investigated to determine if there is a biological problem with stocks. Research into improved stock assessment techniques is ongoing.

Extensive modelling is used, in particular for tiger prawns where there is a clear stock-recruitment relationship. These models are regularly peer reviewed. The stock assessment models have been independently reviewed by an international stock assessment expert, Dr Rick Deriso. He concluded that the assessment is probably the most comprehensive of any prawn populations in the world. While there were some concerns, the process is reliable enough to make sound management decisions. Recommendations made by Dr Deriso are being pursued by AFMA and most have been implemented. The submission provides a good description of the models in the Appendices.

Currently, stock assessment is only carried out for tiger, banana and endeavour prawns. While DEH recognises that the annual take of other species is low compared to these prawn species, all target and principal by-product species should ideally managed with a clear knowledge of their stock status. While formal stock assessment of all species may not be possible, the development of harvest strategies, including biological reference points linked to defined and timely management action, should be a priority for all target and by-product species, in particular squid, scampi and bugs. Further discussion of target species management and by-product species assessment and management is presented in the 'Management response' section of Principle 1, Objective 1.

The management objective for the tiger prawn fishery is to achieve the maximum sustainable yield (MSY) which is broken down into the levels of spawning stock which produce sustainable yields ( $S_{MSY}$ ) and the level of fishing effort which produces maximum yields ( $E_{MSY}$ ). Until 2001, the target reference point was  $S_{MSY}$ . In July 2001, following the release of the tiger prawn assessment results and the review by Dr Deriso,  $E_{MSY}$  was adopted as the limit reference point. A dynamic model that uses all data from 1970 to present to calculate a stock-recruitment relationship is the primary assessment tool for this species.

Banana prawn stock dynamics are strongly linked to environmental conditions, in particular annual rainfall. Consequently, a stock prediction style assessment model is used for assessing banana prawn stocks. Expected catches estimated on the basis of rainfall are compared to observed catches to give an assessment of the banana prawn fishery. A current project is testing the assessment process and may result in the development of a better predictive model. DEH understands that an age-structured model incorporating a stock-recruitment relationship as well environmental factors is being developed.

Due to the linear spawning stock recruitment relationship with endeavour prawns, a biological reference point  $F_{REP}$  is used in place of MSY to estimate stock status.  $F_{REP}$  is the fishing mortality associated with recruitment levels that would replace their parent stocks.

The distribution and spatial structure of the target prawn species have been established through research over the last 25 years. The submission summarises the spatial characteristics of the target species, including distribution in the NPF, spawning seasons and movement patterns, age and size at maturity and maximum weight.

Research has shown that the adults of the two commercial tiger prawn species have different spatial distributions. This information has been incorporated into management of these stocks with separate assessments now conducted on each species.

To date, prawn stock spatial information has not been directly incorporated into the stock assessment process. Previous work in developing a model to achieve this has had limited success. A new project has recently been funded to develop a fully spatial assessment model.

A number of species harvested in the NPF (e.g. target prawn species, squid, bugs, scampi) belong to the same stock as those commercially harvested in other jurisdictions. Ideally, management arrangements affecting a single stock should be under a single jurisdiction, or at least complementary across jurisdictions. DEH believes it would be beneficial, particularly for squid stocks and for AFMA governance, for AFMA to be involved in cross-jurisdictional actions to address shared stock concerns.

**Recommendation 4:** *AFMA will continue to cooperate with other relevant jurisdictions to pursue complementary management and research of shared stocks for all target and by-product species, which may be affected by cross-jurisdictional issues.*

There are reliable estimates of all removals from the fished stock. Recreational or indigenous take of the target species is insignificant. No other commercial prawn fishery operates in the NPF area. Commercial catch is known through analysis of the extensive catch data provided through the logbook program. Estimates are considered reliable due to the high validation requirements of logbook data and high compliance with logbook reporting.

Commercial catch data is factored into stock assessments and used to provide estimates of future catches of target species through stock models. Discards of prawns are also factored into stock assessment, although discarding is no longer as prevalent as it was before freezer boats were introduced to the fishery.

The stock assessment process, combined with a long catch and effort history and research data has ensured that reliable estimates of the potential productivity of the main prawn target species are undertaken.

Over-exploitation of tiger prawns in the 1980s, despite some remedial action in the 1990s, left the species over-fished and unable to sustain historic fishing effort. Both species are classified as over fished (Caton, 2002), however, recent stock assessment results indicate that Grooved tiger prawn stocks are no longer considered over exploited.

The MSY estimated for Brown tiger prawns for the period 1970-98 was 1800t a year. The 1999/2000 recruitment level of Brown tiger prawns was the lowest on record. The recent stock assessment indicates that Brown tiger prawns are still over exploited and below a level that produces MSY. Recovery may be expected in the next couple of years if current effort levels are maintained.

For the period 1970-98, the MSY estimated for Grooved tiger prawns was 1900t a year. Recruitment of Grooved tiger prawns, while slightly higher than previous years, was still well below the 10-year average. Recent stock assessment results indicate that the stock is not over exploited due to increased recruitment in recent years and is now classified as fully fished. The stock appears to have recovered to a biomass level that corresponds to that associated with MSY. This can be expected to continue if current effort levels are maintained.

The Banana prawn fishery is assessed as fully fished (Caton, 2002). The estimated annual yield from the fishery is around 4000 t (approx annual catch for last 10yrs) but is highly variable due to environmental influences. The estimated MSY is about 3500 t. There have been some concerns with the ability of the stock assessment model to predict catches. High variability has been experienced and work is underway to develop a more reliable model.

Little is known about the biology and status of the Endeavour prawn stocks. The estimate of  $F_{REP}$  (the fishing mortality associated with recruitment levels that would replace their parent stocks) was 4502 boat-days, assuming a 3% annual increase in fishing power. On this basis, endeavour prawn stocks are considered under fished.

### **Management response**

Target reference points have been established for some target prawn species and work is underway to develop limits for some other prawn species. Implementation of management action in response to triggers of reference points will be undertaken by AFMA. AFMA has a strong history in this fishery of implementing management measures to promote the protection and recovery of target species stocks. A recovery strategy has been implemented for tiger prawn stocks following assessments indicating levels beyond sustainable limits and is discussed under Principal 1 Objective 2.

The strategies developed to recover tiger prawn stocks have been adopted more generally for all prawn species in the NPF. As the remaining target species stocks are considered more

robust, employing more stringent management measures ensures a more precautionary approach to management of the fishery as a whole.

Management responses are implemented in response to stock assessments and understanding of the spatial distribution of stocks in the fishery. Spatial and seasonal closures are frequently used in response to threats identified through research and stock assessment.

The NPF is managed through a system of input and output controls designed to regulate the level of harvest from the fishery. These are:

- limited entry;
- gear restrictions (twin otter gear, use of bycatch mitigation devices);
- fixed season for the entire fishery and seasonal closures of prawn spawning areas;
- a ban on day trawling during spawning season;
- by-product size and catch limits;
- species possession bans;
- permanent spatial closures to protect seagrass habitats; and
- temporal spatial closures

Operators in the fishery must hold statutory fishing rights (SFRs) to engage in fishing. SFRs control fishing capacity by placing limits on the number of boats and the amount of gear permitted in the fishery. Each operator must hold a Class B SFR and the appropriate amount of gear SFRs for the length of net they wish to use. Each Class B SFR holder must have a minimum of 100 gear SFRs.

The most significant management measure implemented in the fishery has been large reductions in effort through changes to seasons and reductions in the value of gear units.

Spatial management is used in the fishery to limit the amount of target species that can be taken, to protect target species spawning grounds and times and to protect sensitive habitats. In total, only 14% of the fishery area is trawled due to the closures and large areas of untrawlable habitat.

This combination of management controls allows for the effort employed in the fishery to be restricted to minimise impacts on target stocks. Through implementing further closures, reducing gear units and limiting entry, AFMA has the ability to control the level of take in the fishery.

A number of species caught incidentally in the fishery are retained as by-product. Principal by-product species include slipper lobster (bugs), scallop, squid, scampi and some larger fish species. In 2001, 367,264 kg of squid, 3,800 kg of scampi, 27,755 kg of bugs and 2,083 kg of saucer scallops were taken. Smaller quantities of numerous finfish species were also taken.

All by-product is recorded in the logbooks, including the species taken and quantities. This data is verified as described earlier in this report. Some management measures in place to control the level of take of target species also apply to by-product species. In addition, the retaining of certain species is prohibited. There are also size and catch limits for some species.

Currently this fishery does not have a list of permitted by-product. This means that any species, with the exception of those under possession ban regulations, may be retained as by-product if the operators are able to find a market. The fishery is currently very focussed on the target prawn species but with enforced reductions in effort and contracted fishing seasons, there may be some risk that the fishery increasingly targets by-product species. In addition, there is some evidence of regular opportunistic targeting of some by-product species. Although AFMA has a demonstrated history of adaptive management, DEH believes that unacceptable levels of damage could be caused before management measures are developed if markets were to shift. Harvest strategies need to be developed for by-product species. AFMA also needs a means for monitoring catch and to develop performance measures and reference points to trigger management action.

**Recommendation 5:** *AFMA will develop and implement harvest strategies for all target prawn species, scampi, squid and slipper lobsters (bugs) within five years. Harvest strategies should include monitoring systems, suitable biological reference points and management responses with clear timeframes for implementation, to ensure that harvesting is conducted at an ecologically sustainable level. Harvest strategies should also be developed for other species as new market opportunities are detected.*

While stock assessment of the primary target species is well established, there is no assessment of by-product species. This issue was also raised during public consultation. In their response, AFMA advised that while assessments are required for these species there have been other priorities for assessment in the fishery. AFMA has also advised that NPFAG will focus on other species in the next two years but note that such a shift in focus will reduce the work undertaken on the tiger prawn assessments. AFMA also states that the nature of by-product catches means that formal assessment of these stocks may not be possible and that NPFAG will be investigating other assessment and management methods for these species.

The submission states that bugs are heavily exploited in areas where prawns are targeted. There is some evidence of over fishing through reduced catches and sizes of individuals. Size limits are now in place for the retention of bugs. Sizes are based on research into the biological parameters of the species and yield optimisation.

Scallops are retained by approximately 40% of trawlers. Opportunistic targeting of scallops is undertaken in times when meat yield and scallop condition can be optimised. The submission states that the catch of these species is considered sustainable due to the low numbers caught annually.

Scampi is targeted in the fishery when the prawn grounds are subject to seasonal closures. The submission states that due to very low catches of scampi and the small number of boats accessing the resource that catches are considered ecologically sustainable. Catches have dramatically declined from a high of 273 t to an average of 20 t in recent years. It is not clear if declines in catch are a sign of depleted stocks or lack of effort on the species. The submission is silent on this point. There is no limit reference point for scampi. DEH believes that further work on scampi is required to confirm that current levels of harvest are sustainable. DEH suggests that expansion of effort on scampi stocks be actively discouraged by AFMA until further work has been undertaken or an effective harvest strategy for the species has been developed.

Squid species are opportunistically targeted in the NPF. Although stocks may be considered under exploited, significant catches have been recorded in recent times and the species is harvested in other jurisdictions. The population structure of commercially harvested squid species is unknown and it is possible that stocks harvested in the NPF are shared with other jurisdictions. Consequently, harvesting the species in one fishery may impact on recruitment and stocks in other fisheries. Concerns were raised in the Northern Fisheries Managers meeting in Darwin in September 2002 that increasing fishing pressure and opportunistic targeting of squid in fisheries around the coast could significantly affect the status of this shared stock. A recommendation addressing this concern has previously been made (see **Recommendation 4**).

DEH notes that a limit has been implemented for squid harvested in the NPF, however, there are some concerns about the appropriateness of this limit. AFMA advises that the squid reference point was set by the Offshore Constitutional Settlement agreements between the Commonwealth and Queensland, the Northern Territory and Western Australia. The submission states that the take of squid is limited to the same amount of prawn take in the fishery and should the catch of squid exceed 70% of the prawn take, management action will be taken. DEH understands that this limit is not based on any information relating to the sustainability of squid take and was established as a precautionary measure.

Should the take of squid reach 70% of the prawn catch, based on recent catch data for prawns, the take of squid would exceed the highest ever take of squid combined for all jurisdictions. On these grounds, DEH believes that it is difficult to argue that a limit of 70% is precautionary. A biologically meaningful reference point for squid that takes into account the harvest of the species in other jurisdictions, should be developed.

**Recommendation 6:** *AFMA, in cooperation with the Western Australia, Northern Territory and Queensland fisheries management agencies will, within five years, develop and implement a precautionary and biologically meaningful limit for squid harvest based on sound information about the species ability to withstand fishing pressure. Within 12 months, as an interim measure, AFMA will implement more precautionary management arrangements, based on the best available scientific advice, and taking into account historical catch, to limit the harvest of squid species in the NPF.*

## **Conclusion**

DEH is satisfied that the information collection system and stock management arrangements are generally sufficient to maintain stocks at or recover them to ecologically viable levels within acceptable levels of probability. The regime is capable of controlling the level of take from the fishery. The combination of management arrangements and a history of adaptive management that address issues affecting sustainability provide high levels of confidence in AFMA's ability to manage the fishery sustainably.

## **Promote recovery to ecologically viable stock levels**

Objective 2: *‘Where the fished stock(s) are below a defined reference point, the fishery will be managed to promote recovery to ecologically viable stock levels within nominated timeframes’*

Tiger prawns were severely depleted in this fishery during the 1980s and actions taken during the 1990s did not promote recovery to ecologically viable stock levels. As described under Principle 1, Objective 1, assessments of the status of Brown tiger prawn concluded that the current biomass is well below abundance levels of the early 1970s and well below levels that support maximum sustainable yield. Recent assessment of Grooved tiger prawn stocks has indicated that stocks are no longer considered over exploited and should remain so under current effort levels.

AFMA, in conjunction with NORMAC, has developed a recovery strategy aimed at recovering stocks to  $S_{MSY}$  within 5 years. The strategy involves significant reductions in fishing time and gear. The recovery strategy has  $S_{MSY}$  as its reference point and a specific time period for recovery has been included.

The most recent effort reductions included a 25% reduction in gear and 13% reduction in the length of the fishing season. Changes to the fishing season also provided added protection to Brown tiger prawn stocks. The strategies in place were estimated to provide a reduction in effort of around 43% and 29% on Brown and Grooved tiger prawns, respectively. This assumed that 10 boats left the fishery following the gear reductions. Using the stock assessment model it was confirmed that the recovery strategy would have a greater than 70% chance of rebuilding tiger prawn stocks over the next five years.

DEH considers the recovery strategy in place for tiger prawns an adequate management response to promote recovery of stocks to ecologically viable levels. Industry, AFMA and NORMAC have adopted a responsible approach to rebuilding depleted stocks and have a history of timely management action and implementation of research and assessment outcomes. DEH is confident that AFMA will continue to implement appropriate management measures to ensure stocks are rebuilt within specified timeframes. However, it is important that the effectiveness of the strategy over time can be measured. DEH strongly suggests that AFMA develop a fishery independent mechanism to assess the effectiveness of the recovery strategy.

## **Ecosystem impacts**

Principle 2: *‘Fishing operations should be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem’*

### **Bycatch protection**

Objective 1: *‘The fishery is conducted in a manner that does not threaten bycatch species’*

### **Information requirements**

A comprehensive system is in place for the collection of information on bycatch caught in the NPF. Information is collected through the vessels’ bycatch logbooks and on-board research programs.

Operators are required to record information on bycatch in the compulsory logbooks. The logbooks require the total amount of bycatch, interaction with protected species and shark captures to be recorded. The logbook program has been modified over the years to increasingly require protected species reporting. In 1998, a specific page on TEDs and BRDs was included in logbooks during the trials of these devices. Since the introduction of TEDs and BRDs across the fishery, all operators must now complete this section. Detailed information about the capture of species, including species caught and condition when released, must be recorded. Information is also collected on the types of devices used, their dimensions and comment on their effectiveness at reducing bycatch and maintaining prawn catch.

The submission states that the number of species taken as incidental bycatch in the fishery makes recording all bycatch species in the logbook unfeasible. For this reason, logbooks focus on common species and other species of conservation concern. On-board research programs have been utilised to identify and quantify bycatch in the NPF.

Since its establishment, and in particular in more recent times, a significant amount of research has been dedicated to bycatch issues in the NPF.

A study conducted between 1996 and 1999 by CSIRO and the Queensland Department of Primary Industries (QDPI) - "Ecological sustainability of bycatch and biodiversity in prawn trawl fisheries", provided valuable information on bycatch in the fishery, prior to the introduction of TEDs and BRDs. The project also aimed to develop cost effective, accurate and feasible methods of describing and monitoring prawn trawl bycatch. Results suggested that it may not be feasible to monitor to detect a 50% change in catch rate for the very rare species but it may be feasible to monitor more common species in one or two regions. Three types of methods for monitoring bycatch in the NPF were investigated: crew member observers, trained observer collections and scientific survey. Each method has different costs and benefits and the monitoring strategy for the fishery incorporates a number of methods depending on the type of information required and focus species.

The submission states that to supplement existing bycatch data collected through logbooks and on-board research, a trained, crew-based, on-board observer program will be implemented for two years from April 2003. NORMAC is currently designing a two-year trial of a bycatch monitoring program for protected species and other species of conservation concern. The project - "*Design, trial and implementation of an integrated long-term bycatch monitoring program in the NPF*" is funded by the Fisheries Research and Development Corporation (FRDC) and CSIRO. The program will include training of crew in species identification and data requirements and information will be used to validate logbook and protected species reporting. This project will be complemented by another project commencing in 2003 - "*Designing and implementing an integrated monitoring program for the NPF optimising costs and benefits*".

DEH considers the development and implementation of an ongoing monitoring program a high priority for the future management of the fishery. It is also important that monitoring data be used to develop reference points for key species that are known to be susceptible to trawling. Comments raised during public consultation reinforced concerns about the lack of independence afforded by crew-based observers and a higher level of independent monitoring

is preferred. AFMA asserts that previous experience with crew-based observers has been excellent with validation showing that good data is collected. AFMA also explain that there is the added advantage of educating fishers on bycatch issues and the program includes a strong element of independent scientific monitoring to validate crew information.

Observers have been repeatedly used in the NPF to validate information collected in the logbooks and to aid development of TEDs and BRDs. A number of research projects have used trained crew for on-board monitoring. In 1989-90 CSIRO ran a project to estimate the capture and mortality of turtles in the fishery. A similar program commenced in 1998 following the significant effort reductions and changes to management arrangements in the early 1990s. Data was collected on turtle interaction as well as sawfish and sea snake information. The data collected during these research programs provided valuable information for the refinement of TEDs and BRDs.

Scientific and technical observers have also been used to assess the effectiveness of TEDs and BRDs and further work on improving TEDs and BRDs is currently underway. This project involves at-sea testing of the devices. Observers have also collected extensive information on turtles, sharks, rays, sea snakes, other small bycatch, prawn catches and quality and by-product. Information on environmental conditions further supplements the bycatch data.

The fishery dependent data collection program is considered robust. Validation of fishery dependent data is sound and the data collected is considered reliable. While some logbook breaches are detected through compliance activities, AFMA does not consider the level and nature of breaches to be significant. Management and industry have recognised the need for and value in collecting information on bycatch in the fishery. The BAP and strategic plan can be expected to progress bycatch data collection and refine reporting systems as work continues on methods to minimise bycatch in the fishery. The fishery has a strong history of using data and research findings to improve management when needed.

### **Assessment**

The bycatch of the NPF has been well described through a number of research projects. Bycatch has been shown to be highly diverse and consist of mostly rare species, making management of the sustainability of bycatch difficult. AFMA and NORMAC however, recognise that some bycatch species are clearly more susceptible to trawling and should be the focus of future bycatch management and research.

A range of species is taken as bycatch in the NPF and as with many other trawl fisheries, the ratio of bycatch to target species can be high. Prior to the introduction of TEDs and BRDs, the level of bycatch in the fishery ranged from 0-90% of the weight of any one shot. Bycatch in this fishery is predominately small fish and crustacean species of little or no monetary value and is generally discarded.

Stobutzki et al (2001) described the bycatch and specifically examined the impact of trawling on the sustainability of vertebrate bycatch in the NPF. The study assessed two main characteristics of species : the susceptibility to capture and mortality in a prawn trawl and the capacity for recovery of that species once depleted.

A number of species were identified as highly susceptible to the impacts of trawling; in particular, benthic or demersal species where their habitat is soft sediments and their diets includes prawns. Elasmobranchs were identified at risk from over fishing due to their life

history characteristics, with sawfishes and some stingrays most susceptible. Sea snakes were also found to be more susceptible to over fishing than bony fishes. Further discussion on sawfishes and sea snakes can be found later in this Part.

Stobutzki et al (2001) indicates that over 450 vertebrate species (fish, turtles, sea snakes, sharks, rays and sawfishes) and 230 invertebrate species (crabs, squid and scallops) may be incidentally taken in the fishery. It also estimates that the fishery captures up to 56 species of elasmobranchs (sharks rays and sawfishes) and suggests that sawfishes and some ray species should be a priority for research and management. The submission notes that more information is needed on the basic biology of these species as well as their distribution, movement patterns and stock structure.

Assessment of the performance of TEDs and BRDs is also undertaken and is ongoing. This research helps to identify those species still at risk from the impacts of trawling as the devices become more sophisticated and better at excluding certain species and not others.

The crew-based monitoring program due to commence in September 2003 will seek to validate the risk assessment of bycatch species which were identified as high risk in previous research and to provide a broader understanding of the impact of the fishery on general bycatch species.

AFMA is conducting Ecological Risk Assessments (ERAs) for all Commonwealth fisheries. The NPF ERA will be a crucial step in the future management of bycatch and fishing impacts in the fishery.

**Recommendation 7:** *Within 3 years AFMA will identify and implement management responses to fishing impacts identified from the ecological risk assessment process.*

### **Management response**

The NPF has developed its second *Northern Prawn Fishery Bycatch Action Plan* (BAP), following the development and successful implementation of the first BAP in 1998. The success of the previous BAP is demonstrated by the uptake and continual refinement of bycatch reduction measures by industry.

The revised BAP builds on the first plan and identifies the aims, strategies and actions that NORMAC intends to pursue and implement to reduce the impacts of fishing on non-target species and the marine environment. Combined with the revised *Northern Prawn Fishery Bycatch Action Plan Background Paper* (BAP-BP) the BAP provides a comprehensive description and assessment of the bycatch issues facing the fishery. It contains clear, deliverable actions and strategies with defined timeframes for implementation. DEH considers the BAP to be a useful tool in the management of the fishery and commends NORMAC and industry on its ongoing commitment to addressing the bycatch issues in the NPF.

The BAP is the primary management tool for bycatch in the fishery. It aims to eliminate to the greatest extent feasible the catch of large animals such as sharks, turtles and rays, other protected species and other species that may not be able to sustain impacts from the fishery. It also aims to reduce the overall amount of bycatch and provide protection for areas that are important for vulnerable species. Compliance with the BAP is formally required under the Management Plan and failure to comply is treated as a breach of the Management Plan.

Recognition of the bycatch issue in the fishery is also prominent in the NPF Strategic Plan 2002-2006 and NPF 5 Year Research Plan where the issue is identified as a high priority.

Substantial investment has been made in research and technical design to develop appropriate devices for use in the NPF to reduce the capture of turtles and other bycatch species.

The most significant bycatch management arrangement is the requirement for all operators to use TEDs and BRDs. This has been a requirement since April 2000. The objective of the compulsory introduction of TEDs is to reduce the number of turtles captured annually to approximately 5% of the 1989-90 estimated level. To date TEDs have been successful in achieving this objective. In general, the use of TEDs and BRDs has substantially reduced the amount of incidental bycatch in the fishery.

The BRDs in use are primarily designed to reduce the bycatch of finfish. A range of BRDs has been developed including fish-eyes, square mesh panels, square mesh codends, big eyes and radial escape devices. There is also a modified TED that has shown capacity to reduce fish bycatch. The effectiveness of these devices has been tested during observer surveys, on-board research projects and through industry based workshops. The requirements for these devices are well defined in management.

TEDs have been very successful in reducing turtle capture however, until April 2002, it appears that the use of BRDs in reducing other bycatch was less successful. Continued work is needed to improve BRDs. DEH notes that a research project evaluating the effectiveness of BRDs was due to be completed in January 2003 and a report is being prepared for consideration by NORMAC. Further work has been funded to assess the effectiveness of BRDs at reducing bycatch and permits may be granted to those operators who wish to trial alternative TED and BRD designs.

An industry initiated ban on all elasmobranchs and their products has also been a significant management tool in reducing the impact of trawling on certain bycatch species. This measure was implemented in response to increasing concerns about the conservation status of sharks, rays and sawfishes and in recognition of the potential impact of trawling in the NPF on these species populations. Since 1 February 2001, retention of any species or product of elasmobranch in the NPF has been prohibited. DEH notes that handling procedures to assist in the survival of smaller elasmobranchs once returned to the sea will be developed by industry in the near future. While a retention ban on these species does not reduce capture, the introduction of TEDs and BRDs has resulted in reduction in the overall capture of large animals, including elasmobranchs.

TEDs and BRDs have been shown to exclude some large animals, such as sharks and rays, from the trawl. Monitoring of the effectiveness of TEDs in 2000 indicated a reduction in elasmobranch catch of around 80%. While large animals may be excluded by TEDs, some smaller species may still be caught. There is some concern about the continued capture of sawfishes, in particular the green sawfish (*Pristis zijsron*) which has been nominated for listing as Endangered under the EPBC Act. Stobutzki et al (2001) suggests that sawfishes and some ray species should be a high priority for research and management as they are least likely to be able to sustain capture as bycatch. Information on these species is lacking. Information is needed on the basic biology, distribution, movement patterns and stock structure of these species. DEH recognises the significant steps already taken towards minimising impacts on elasmobranchs but considers it important that vulnerable species, such

as the green sawfish, receive ongoing monitoring and attention in the future refinements of BRDs and TEDs.

**Recommendation 8:** *An assessment of bycatch and biodiversity in prawn trawl fisheries<sup>1</sup> conducted prior to the introduction of Turtle Excluder Devices (TEDs) and Bycatch Reduction Devices (BRDs) identified Pristidae (sawfishes) and Dasyatidae (ray) species as least likely to be sustainable to trawling operations. Within three years, unless the introduction of TEDs and BRDs have been found to significantly reduce the catch of these species to levels that do not place these species at conservation risk, or the ecological risk assessment has determined that these species are not likely to be significantly impacted by operations in the fishery, AFMA will ensure that these species receive ongoing monitoring and attention in future refinements of bycatch mitigation measures. Particular attention should be paid to the Green Sawfish (*Pristis zijsron*) and Narrow Sawfish (*Anoxypristis cuspidate*). Relevant information on species found to be at risk should be collected to inform the development of mechanisms to minimise the impacts of trawling on these species.*

A range of other management arrangements are in place to reduce bycatch and impacts on non-target species. Possession bans have been introduced for a range of species and size and catch limits for certain by-product species are now in place. Banning daylight trawling can reduce the catch of many bycatch species that are far less active at night, while maximising the yield of target species that are more active at night, such as tiger prawns.

Fishing effort has systematically been reduced in the NPF and while these reductions were in response to declines in target species, they have also served to reduce the amount of bycatch taken in the fishery and the impact of fishing on benthos. Since 1990 the number of boat days in the fishery has reduced by approximately 46% and further measures to reduce effort by 40% on tiger prawns were introduced in 2002. This is further complemented by the use of spatial management to minimise impacts on bycatch species in the fishery. As discussed under Principle 1, significant areas of the fishery are closed (seasonally and permanently) to trawling, thereby reducing the available ground to trawling.

In addition to management measures, bycatch workshops have been held to improve the effectiveness of BRDs and international technical specialists have been engaged. Extension programs have also been used to raise awareness of the bycatch issue in the fishery. At-sea extension work has been complemented by the production of industry targeted educational material.

AFMA has also advised that the Research and Environment Committee (REC) is seeking to commission research, using currently available data, that will enable AFMA and NORMAC to assess the potential impacts and benefits in bycatch reduction, of modifying the closure times during 2004. This could, for example, show that by changing fishing times and using shorter shot times, bycatch can be reduced and survivability maximised. DEH looks forward to the outcomes of this work and strongly encourages the uptake of any relevant results into management action.

While no specific group of indicator species is being monitored, monitoring activities on bycatch will focus on protected species and those species identified in the risk assessment as least able to sustain the impacts of trawling. This monitoring should serve to validate the risk

assessment and should impacts be considered unsustainable, management action will be taken.

DEH recognises the ongoing research and refinement of bycatch mitigation measures in the NPF. While measures to date have been largely effective, DEH believes that work needs to continue to pursue bycatch reduction. In addition, the survival of bycatch species that escape through BRDs is still largely uncertain in most, if not all, trawl fisheries in Australia. Reducing the catch landed on the vessel of some species by an amount does not necessarily equate to an equivalent reduction in fishing mortality of that species. Current technology and competing priorities limit the extent to which researchers can assess these reductions in a single fishery. This is a significant issue in a number of fisheries in Australia and is an area that DEH considers should be a priority for research in the future.

**Recommendation 9:** *AFMA will continue to pursue reduction in the amount of bycatch taken in the Northern Prawn Fishery through the refinement of bycatch mitigation technology and will investigate methods for increasing the survivability of bycatch species. Any suitable methods identified should be implemented in a timely manner.*

## **Conclusion**

This fishery has adopted a proactive and commendable attitude to bycatch reduction and implemented a large range of management measures designed at minimising bycatch and the impact of trawling on non-target species. Investment in gear technology and research focussed on bycatch reduction in the fishery is ongoing. Through the ERA process and Strategic Plan, DEH expects that assessment of the risks to bycatch will continue to provide information on bycatch species to aid future management. The revised BAP provides a sound basis under which bycatch management and minimisation can take place. DEH is satisfied that measures are in place to avoid capture and mortality of bycatch species.

The compulsory use of TEDs and BRDs has resulted in significant reductions in bycatch across the fishery. The development and implementation of these measures has been underpinned by extensive research that continues to be undertaken to monitor whether the objectives of bycatch reduction are being achieved.

## **Protected species and threatened ecological community protection**

Objective 2: *'The fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species and avoids or minimises impacts on threatened ecological communities'*

### **Information requirements**

As discussed under Principle 2, Objective 1, logbooks, on-board research programs and crew-based monitoring provide for the collection of information on protected species. The previous discussion points and information about research projects are relevant here also.

Through the logbook program, operators are required to record all interactions with protected species. Since 1996, detailed information on turtle information, including the number of turtles caught and their condition when released has been recorded. A turtle handling and

identification guide is also included in all logbooks to aid the accurate recording of species and to increase survival of turtles capture.

Operators must record the number of sea snakes and syngnathids caught and their condition when released. Interactions with other protected species are also recorded on a separate detailed wildlife and protected species information sheet. As the fishery operates in Commonwealth waters, interactions with protected species must be reported as required under Part 13 of the EPBC Act. Work is underway between AFMA, NORMAC and DEH to refine the wildlife and protected species reporting form and to streamline the reporting process to ensure it complies with legislative requirements under the EPBC Act.

Ongoing monitoring of protected species interactions will be provided through the crew-based observer program due to commence in September 2003. One of the main purposes of the monitoring project is to ensure that the fishery is meeting its protected species reporting requirement and that the data is validated.

Fishery dependent data on protected species interactions is relatively robust. The industry has adopted a responsible attitude to the turtle bycatch issue and recognises the need for producing accurate records of interactions. Validation of fishery dependent data is sound and the data collected is considered reliable. Some logbook breaches are detected through compliance activities however AFMA does not consider the level and nature of breaches to be significant.

### **Assessment**

The submission identifies numerous protected species known to occur in the fishery area. The list includes marine turtles, sea snakes, syngnathids and solenostomids, dugongs, seabirds, great white sharks, grey nurse sharks and dolphins. Of these species, the fishery frequently interacts with turtles and sea snakes. Other species are sometimes incidentally caught, scavenge on discards or inhabit the environment in which the fishery operates.

Stobutzki et al (2001) undertook an assessment of the vulnerability of bycatch species to the impacts of trawling in the NPF. The sustainability of species was considered relative to their susceptibility to capture and mortality in prawn trawls and their capacity to recover once depleted.

Flatback Turtles (*Natator depressus*) are the most commonly caught turtle species in the fishery. Significant numbers of Olive Ridley's Turtles (*Lepidochelys olivacea*) are also taken followed by smaller numbers of Loggerhead Turtles (*Caretta caretta*), Green Turtles (*Chelonia mydas*) and Hawksbill Turtles (*Eretmochelys imbricata*).

Results of the 1989-90 survey indicated that over 5000 turtles were caught annually in the fishery with between 550 and 950 individuals killed. Capture and mortality at this level was not considered sustainable and following extensive research and trials, TEDs were developed to reduce turtle bycatch and introduced into the fishery. Turtle bycatch has been significantly reduced and is now less than 5% of 1989-90 levels.

At least 13 of the 30 sea snake species occurring in northern Australian waters are caught in the NPF. Predominantly mature females are captured with few juveniles encountered. Estimates of sea snake catch and biomass indicate fishing mortality of around 5-6% annually.

Stobutzki et al (2001) indicate that sea snake catches appear sustainable at current levels. Some doubt is expressed regarding two species - the large headed sea snake (*Hydrophis pacificus*) and the spectacled sea snake (*Disteira kingii*) as they appear susceptible to trawling. These species were identified as high priority for further study of trawl effects.

Research is underway into the effectiveness of BRDs at excluding sea snakes. The results of this project are not yet available. While DEH recognises that some work has been done regarding the exclusion of sea snakes through the use of BRDs, some concern remains about the long term impacts of continued capture and mortality of these species on populations. Little is known about many sea snake species and ongoing monitoring and assessment of the impacts on species taken in the fishery, coupled with the continual refinement of mitigation measures is needed.

**Recommendation 10:** *AFMA will ensure that ongoing monitoring of sea snake species taken in the fishery is undertaken to ensure that any future impacts on these protected species can be detected. Within three years, unless the introduction of TEDs and BRDs have been found to significantly reduce the catch of sea snakes to levels that do not place these species at conservation risk, or the ecological risk assessment has determined that these species are not likely to be significantly impacted by operations in the fishery, AFMA will ensure that sea snake bycatch is specifically considered in ongoing monitoring and refinement of bycatch mitigation measures. If necessary, the development of bycatch mitigation measures to significantly reduce the capture of sea snakes should be a priority. Research, monitoring and mitigation measure development should concentrate on *Hydrophis pacificus* (large headed sea snake) and *Disteria kingii* (spectacled sea snake) to ensure that impacts on these species are sustainable.*

Recording of interactions with sea snakes may be difficult to species level as most species are difficult to classify without close inspection. As sea snakes are often aggressive when landed, reliable identification may not be possible. DEH also understands that due to the aggressive nature of the animals, those individuals that survive the trawl process may be subsequently killed. Education programs aimed at increasing awareness and understanding about issues have proven to be useful tools in fisheries management, as demonstrated with the turtle bycatch issue. DEH believes that increasing industry awareness about sea snakes and the need to protect them may be a valuable management tool in the NPF

**Recommendation 11:** *AFMA will develop and implement an education program for industry to increase awareness of the importance of sea snake protection, promote sensible handling techniques and improve species identification. AFMA will also ensure that observers are adequately trained in sea snake identification to species level to maximise the use of data collected in monitoring programs.*

Dolphins and seabirds are known to actively feed on discards from the fishery. The impact of discards on species, including dolphins and seabirds, is discussed under Principle 2, Objective 3 of this report.

Dugongs, Great White Sharks and Grey Nurse Sharks occur within the fishery area but no captures of these species have been recorded in the fishery. Dugong habitat (seagrass communities) is permanently closed to trawling.

## **Management response**

The most significant management tool for avoiding the capture and mortality of protected species is the compulsory use of TEDs and BRDs. The same management arrangements used to minimise bycatch are in place to avoid capture and mortality of protected species. The use of TEDs and BRDs and other management measures is discussed in Principle 2, Objective 1 of this report.

Targeting methods employed in the fishery further assist in minimising the impact of trawling on turtle populations. These measures include night fishing, short shot duration in day fishing and permanent and seasonal closures to protect seagrass areas.

The objective of introducing TEDs into the fishery was to reduce annual turtle captures to 5% of the number estimated (5370) to have been captured in the fishery in 1989 and 1990. This translates to a maximum number of 268 turtles annually. Since the compulsory use of TEDs turtle captures have fallen to 120 individuals per year and mortalities have decreased from 40% to 22%. A contingency plan will be developed by AFMA and NORMAC to deal with the possibility that turtle captures may exceed the 5% trigger limit. The plan will identify management action to be taken should the trigger limit ever be reached. The plan will be developed by the commencement of the 2004 fishing season.

BRDs have demonstrated some capacity to minimise sea snake capture however additional work is required to further reduce captures and mortalities of these species.

No specific management arrangements are in place to minimise capture of syngnathids although BRDs may exclude some individuals. Syngnathids are not caught in significant numbers in this fishery. Protection of seagrass habitats ensures that dugongs are not captured during trawling operations.

Current management arrangements are consistent with all threat abatement plans, national plans of action and recovery plans.

The measures in place to avoid the capture and mortality of protected species are effective and well monitored. Ongoing refinement of TEDs and BRDs should continue to ensure that further reductions are made and that interactions with the fishery are sustainable in the mid to long term.

## **Conclusion**

There are no declared threatened ecological communities in the NPF area and therefore these provisions in the Guidelines are not applicable.

DEH is satisfied that the fishery is generally conducted in a manner that aims to minimise and avoid death or injuries to protected species. Considerable work has been undertaken and efforts are ongoing to address interactions with protected species, in particular marine turtles. Through the refinement of existing mitigation measures and other research, the risks to protected species are being addressed. DEH has made a number of recommendations to improve management and minimise the risks to protected species in the medium to long term.

## Minimising ecological impacts of fishing operations

Objective 3: *'The fishery is conducted, in a manner that minimises the impact of fishing operations on the ecosystem generally'*

### Information requirements

A range of data has been collected in the NPF since its establishment in the 1960s. Information collected includes catch and effort data, habitat and community distribution, sediment types and distributions, benthic dredge surveys, environmental information, acoustic data and diet information for some fish, shark and ray species. Considerable work has also been undertaken on the distribution of target species.

Historical catch and effort data provides significant information on the spatial and temporal distribution of fishing effort. Recent studies have estimated effort at very fine spatial scales.

A series of fine-scale maps of fishing and un-trawlable grounds in the NPF has been produced to provide a better understanding of the impacts of trawling and to assist in the development of strategies to maintain an ecologically sustainable fishery. Work has also been undertaken on comparing the impact of trawling in trawl and non-trawl (closed) areas.

AFMA anticipates that a large existing project – *'Surrogates I – Predictors, impacts, management and conservation of the benthic biodiversity of the Northern Prawn Fishery'* will yield significant information relevant to assessing the impacts of fishing on benthic communities.

Significant work has also been undertaken in the area of food chains, in particular, predation on commercial prawns in the NPF.

A number of large research projects have been funded and are scheduled to start in 2002-03 and will collect information on the environment of the NPF and the impacts of fishing. The two integrated long term monitoring projects described under Principle 2, Objective 1 will specifically look at fishery impacts and how best to monitor these impacts, both at the species level for those species of conservation concern and at the broader habitat level.

Another project commencing in 2002/03, - *'Effects of trawling on animals and plants living on and in soft sediment seabed'* (collaboration by CSIRO, FRDC and MIRF) is expected to investigate the benthic impacts of trawling in the NPF. The project will complement previous work undertaken by CSIRO on the impacts of trawling on seabed fauna where comparisons between trawled and un-trawled grounds were made.

DEH is satisfied that appropriate information is collected on the fisheries impact on the ecosystem and environment generally. The ongoing and new research programs should provide further valuable information to inform management with regard to ecosystem impacts of the fishery.

### Assessment

Considerable research has been undertaken into the effects of prawn trawling on the environment, both in the NPF and in other fisheries around the world. Assessment of the impacts of the NPF on ecosystem components has been undertaken through various research

projects. These projects were described in the preceding section. The submission provides an assessment of the existing and/or potential impacts of the fishery on the ecosystem.

The submission identifies disturbance and mortality of the benthic communities to be the main impact of the fishery due to the otterboards and groundchain contact with the seabed.

The impact of the NPF on benthic communities will be a function of the removal/mortality rate per trawl, the intensity of trawl effort, the ability of these communities to recover between trawls and the location of trawling in relation to vulnerable seabed communities. The impact will vary throughout the fishery depending on effort distribution. Analysis of logbook and VMS data has shown that trawl effort in the fishery is highly aggregated and in many cases only part of a 6 nautical mile grid (the scale of reporting) is fished. The consequence is that the area actually fished is smaller than that indicated by an analysis of the 6 nautical mile grids.

A large study conducted by CSIRO and the QDPI between 1991 and 1996 examined the impacts of trawling on seabed fauna by comparing assemblages in closed areas and trawl grounds. This study also examined the impact of single and multiple trawls over the same area. Research has shown that although depletion rates are low, repeated trawling over the same ground will result in significant depletion. Heavily trawled areas were also found to be unlikely to support the more 'trawl vulnerable' species and favour faster growing, more robust species, with a shift towards a habitat containing the latter the likely outcome. A more recent study by CSIRO and QDPI into the effects of prawn trawling on bycatch and biodiversity was inconclusive on the difference in biodiversity between areas open and closed to trawling in the GoC.

A trawl impacts model developed for the Queensland East Coast Trawl Fishery was used to estimate the impact of various management regimes on the seabed fauna in selected parts of the NPF. Reduction in effort was shown to result in gradual recovery of the seabed in areas previously exposed to high fishing effort. There is some concern about the ability of a community to recover between periods of heavy fishing and periods of closure. Closure times may not be sufficient to allow regeneration of communities with lengthy recovery rates. DEH understands that this issue is being considered in the current research project investigating the impacts of trawling.

A semi-quantitative evaluation of the sustainability of benthic invertebrates has been conducted. The project identified a number of species considered most sustainable and a range of other species is considered least sustainable. Less sustainable taxa include soft corals, bryozoans, octopods, olivids, lobster, pea crabs, sea pens, cephalopods, solemyids, solenoids and teuthoids.

The NPF may impact on food chains in a number of ways: through the removal of target prawn species and by-product species; through the capture of bycatch species; and through the reintroduction of discard species.

Given the large quantities of prawns harvested annually by the fishery, removal of these species from the food chain is considered a potentially significant impact. While prawn species do not constitute the sole source of food for any animals found in the NPF region,

they are significant prey items of some shark species and other fish predators. This group may be considered the most significant group of ecologically related species.

AFMA asserts that the productivity of the tropical systems, variability in prawn availability and the availability of alternative prey mean that it is unlikely that a reduction in prawns would have a measurable influence on predator populations. However, AFMA recognises that impact of prey removal in inshore estuary systems may be different. Juvenile prawns constitute a significant food source for certain species, such as juvenile and sub-adult barramundi and queenfish. There is no evidence to suggest that stocks of these species have declined as a result of removal of prey species.

The impact of removing bycatch species has not been assessed. The ERA will consider the broader ecological impacts of the fishery and identify any substantial risks for food chains. The majority of bycatch species caught in large quantities generally occupy lower trophic levels. AFMA considers the impact of the NPF on these species low risk as lower trophic levels are generally characterised by high biomass, redundancy, variability and turnover rates, combined with spatial and temporal refuges for species.

Discarded bycatch in the NPF is substantial and may also impact on food chains. Floating discards are scavenged by species including dolphins, sharks and seabirds. Some discards sink and are later scavenged by other species on the seafloor. An assessment of the possible impacts of discards on populations of seabirds, dolphins and sharks and small fish and invertebrates is described by Poiner et al (1998). The assessment found that discarding in even lightly fished areas may impact on seabird populations due to their propensity to travel long distances for food. Discarding in areas of regular trawling may impact on dolphin and shark populations as discards concentrate in smaller areas within the foraging range of the scavengers. Small fish and invertebrate populations may only be impacted in areas of regular trawling as the impact is very localised.

Provisioning of animals, including seabirds, is an issue of concern. The impacts of increasing populations of some species, beyond their natural capacity may have implications for the ecosystem as a whole. DEH suggests that an assessment of the impact of discards on key scavenging species should be considered a future area of research in the fishery.

The submission identifies changes to sediment or substrate due to trawling activities, and changes to water quality through the introduction of debris and biological wastes (discards), as the most likely impacts on the physical environment. While movement of sediment and turbidity is a natural feature of the fishery area, due to frequent cyclone and wet season river discharge, trawling artificially increases sediment mobility. AFMA does not consider changes to sediments or substrates caused by trawling to be a significant impact on the physical environment. DEH considers that given the high frequency and long duration of trawling in certain areas of the fishery, changes would be expected over time to the sediments and substrates subject to trawling. While the impacts of trawling on the physical environment may be considered sustainable, the combined impacts of trawling and natural disturbance should be considered.

Water quality may be impacted by activities in the fishery. Discarding of bycatch increases biological waste in the water and disposal of garbage from vessels, in particular plastics creates pollution. AFMA advises that pollution by vessels is not an issue of concern due to

regulations imposed on operators in the fishery. Risks posed by discarding have previously been discussed.

### **Management response**

AFMA has implemented a range of management measures that minimise the risk of significant impact of fishing on ecosystems and their components. Most management measures were established to protect target species and their habitats, although some actions are specifically designed to protect the broader environment. Further work to improve management of ecosystem impacts is also proposed. The BAP describes the strategies and actions in place and proposed to minimise ecosystem impacts.

As discussed under Principle 1 of this report, significant reductions in effort, both in number of boats and length of season, have been imposed in the fishery in recent years. These reductions, while imposed to protect tiger prawn stocks, have resulted in a reduction in the amount of bycatch and discards and reduction in the impact of fishing on benthic communities.

Benthic impacts are also monitored through the logbooks where the spatial distribution of effort is recorded. VMS is used to validate this data and the extent of trawling is then reported annually. Further work is proposed on benthic impacts through research projects investigating vulnerability of benthic species and communities.

Spatial management is well developed in the fishery. Research to identify seagrass beds has been conducted in the NPF, resulting in the permanent closure of all known seagrass beds to trawling. Other closures in the fishery, combined with unsuitable trawl grounds, have resulted in a low proportion of the fishery area (14%) being trawled. Closure arrangements are reviewed annually by the NORMAC Closures Committee, who also considers proposals to provide additional protection to sensitive areas.

While existing closed areas protect specific areas in the NPF, they do not appear to cover sensitive bioregions and provide an adequate representation of them. AFMA has advised that work is underway to address this issue. The Strategic Plan contains a commitment to achieve a comprehensive, adequate and representative system of Marine Protected Areas in the NPF. The submission states that these additional spatial management options will be developed through the northern regional marine plan being prepared through the National Oceans Office. This process should identify potential marine protected areas for inclusion in the regional plan and should draw on recent information collected through the ERA and other relevant projects. The importance of protecting representative areas from the impacts of prawn trawling in the region should not be underestimated.

**Recommendation 12:** *AFMA, in cooperation with the States, will develop and implement a spatial management system within the NPF that takes account of the impacts of fishing on:*

- *species and populations identified by the ecological risk assessment process as high risk;*
- *the recovery of overfished stocks;*
- *important feeding/spawning/breeding/refuge grounds for key target, byproduct and protected species; and*

- *benthic habitats*

*This spatial management system will be integrated with the regional marine planning process for Northern Australia that is already under way to establish a representative system of marine protected areas in the region and will ensure that the entire fishery area is taken into account.*

The compulsory use of TEDs and BRDs serves to minimise the impact of the fishery on food chain structure and productivity by reducing the amount of bycatch (and therefore biological material) taken out of the ecosystem. Ongoing work to refine these devices could be expected to further reduce this impact.

The BAP describes a number of actions that will help in the long term minimisation of ecosystem impacts. These are focused primarily on bycatch mitigation but will have flow-on effects to the broader marine ecosystem.

Impacts on water quality through the discharge of plastic wastes and pollution from vessels are controlled under MARPOL legislation. Operators are required to comply with the legislation and must retain any plastic waste and dispose of it only when the vessel returns to port.

Ghost fishing, where lost or discarded fishing gear continues to impact on species, has been an issue of concern for many of the world's fisheries. Following concerns raised by the Anindilyakawa people of Groote Eylandt about large amounts of lost fishing gear washing up on beaches, a survey was conducted to determine the levels and origins of the marine debris in the GoC. The results, described in the submission, indicate that the majority (84%) of debris is attributable to other fisheries (primarily Indonesian and Taiwanese) operating in the Arafura and Timor seas. Management of ghost fishing in the NPF is addressed through regulations. Regulations state that fishing vessels must make every effort to retrieve all lost or damaged gear and report the incidence and location of all lost gear. The likelihood of lost gear being traced back to the owner is considered high, as all nets used by operators in the NPF must be tagged with an identification code. DEH is satisfied that ghost fishing is not a significant issue of concern in the NPF and that management arrangements are in place to address the issue.

The NPF industry, NORMAC and AFMA have a history of addressing sustainability and impact issues in the fishery. Their record of incorporating research results into management is excellent. DEH is confident that the fishery will continue to be managed in a manner that aims to minimise ecosystem and broader environmental impacts.

## **Conclusion**

The fishery is conducted in a manner that minimises the impacts of fishing operations on the ecosystem. Significant amounts of information have been collected on the impacts of the fishery on ecosystem components and work in this area is ongoing. Information collected has been used to assess the extent of likely impacts and management measures are in place to minimise these risks. In cases where action is still required, further research is being conducted to develop mechanisms for managing these risks.

As in any trawl fishery, the potential to impact unacceptably and unsustainably on the environment generally is quite high. Research focussing on bycatch and the impacts of

trawling has allowed assessment of the risks of ecosystem impact. Industry, AFMA and NORMAC have a history of implementing management action to address areas of significant concern.

DEH is therefore satisfied that the fishery is conducted in a manner that minimises the impact of fishing on the ecosystem generally to the greatest extent practicable in the short to mid-term. DEH is satisfied that actions are in place to ensure that mid to long-term risks will be identified in the next five years and all significant issues will be pursued.

A recommendation has been made for further action to strengthen current management of this fishery and minimise environmental impacts in the longer term.

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## LIST OF ACRONYMS

AFMA	Australian Fisheries Management Authority
AIMS	Australian Institute of Marine Science
BAP	Northern Prawn Fishery Bycatch Action Plan
BAP-BG	Northern Prawn Fishery Bycatch Action Plan Background Paper
BRD	Bycatch Reduction Device
CPUE	Catch Per Unit Effort
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEH	Australian Government Department of Environment and Heritage
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ERA	Ecological Risk Assessment
FRDC	Fisheries Research and Development Corporation
GoC	Gulf of Carpentaria
MARPOL	International Convention on Marine Pollution
MSY	Maximum Sustainable Yield
NORMAC	Northern Prawn Fishery Management Advisory Committee
NPF	Northern Prawn Fishery
NPFAG	Northern Prawn Fishery Assessment Group
OCS	Offshore Constitutional Settlement
QDPI	Queensland Department of Primary Industries
REC	Research Environment Committee
TED	Turtle Exclusion Device
UNCLOS	United Nations Convention on the Law of the Sea
VMS	Vessel Monitoring System