Estuary Prawn Trawl Fishery

Environmental Impact Statement

Public Consultation Document

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Details of the public consultation process and contact information are included on page A-19 in Chapter A (Volume 1)

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DECLARATION

For the purpose of section 115K(4) of the Environmental Planning and Assessment Act 1979, the Director, NSW Fisheries is the person engaged as responsible for the preparation of this Environmental Impact Statement (EIS). The Director, NSW Fisheries is Mr Steve Dunn, BSc Hons Fishery Science (Plymouth), Master of Management (Macquarie). A range of NSW Fisheries staff and stakeholders with expertise and qualifications in fisheries management, environmental science, fisheries science and fisheries compliance assisted in the preparation of the EIS. Where expertise was not available within NSW Fisheries, external experts were contracted.

The EIS has been prepared on behalf of the persons who are entitled to operate in the Estuary Prawn Trawl Fishery (the proponents). A list of the proponents is contained in Appendix A1 of the EIS.

The address for the Director, NSW Fisheries, and for the proponents is:

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The location of the proposed activity is described in Chapter C section 6(c). A description of the proposed activity and proposed controls is provided in Chapter C. An assessment of the environmental impact of the proposed activity as described in the draft Fishery Management Strategy is presented in the EIS in Chapters E through to I inclusive. The EIS contains all available information relevant to the environmental assessment of the activity to which the statement relates. The information provided in the EIS is neither knowingly false nor misleading.

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The members of the various advisory bodies who have received drafts of the fishery management strategy and EIS must be acknowledged. They have provided valuable and constructive feedback, often reading multiple draft documents. The Estuary Prawn Trawl Management Advisory Committee in particular has spent several meetings and much of the members' personal time reviewing and providing advice on the various drafts of the document. So too have the members of the following statutory Ministerial advisory councils, the membership of which is detailed on the following page:

Advisory Council on Commercial Fishing

Advisory Council on Recreational Fishing

Advisory Council on Fisheries Conservation

Fisheries Resource Conservation and Assessment Council

NSW Fisheries appreciates the timely and committed efforts of the consultants who reported on sections of the environmental assessment guidelines: Umwelt (Australia) Pty Ltd, Dominion Consulting Pty Ltd and SMEC Australia Pty Ltd. Thanks are also extended to the peer reviewers: Dr Ron West from the University of Wollongong, Dr Marcus Lincoln Smith from The Ecology Lab Pty Ltd, Dr Harry Campbell from the University of Queensland and Dr Heather Aslin from the Australian Bureau of Rural Sciences.

Staff from Environment Australia, Planning NSW, National Parks and Wildlife Service, Department of Aboriginal Affairs and the Department of Land and Water Conservation also provided assistance in developing the document.

MEMBERSHIP ON ADVISORY BOARDS

Estuary Prawn Trawl Management Advisory Committee

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William Baker	Darren Hale	Frank Ilacqua
Dennis Hyde	Malcolm Poole	(2 vacancies)

Advisory Council on Commercial Fishing

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Advisory Council on Fisheries Conservation

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Abbreviations

ACCF	Advisory Council on Commercial Fishing
ACFC	Advisory Council on Fisheries Conservation
ACoRF	Advisory Council on Recreational Fishing
ADT	Administrative Decisions Tribunal
AFMA	Australian Fisheries Management Authority
AQIS	Australian Quarantine and Inspection Service
BRD	Bycatch reduction device
CAMBA	Agreement between Australia and the People's Republic of China for Protection of Migratory Birds and their Environment
COE	Certificate of Exemption
CPUE	Catch per unit effort
DLWC	Department of Land and Water Conservation
DUAP	Department of Urban Affairs and Planning (now Planning NSW)
EG	Estuary General
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMPMP	Emergency Marine Pest Management Plan
EP&A Act	Environmental Planning and Assessment Act 1979
EPA	Environmental Protection Authority
EPBC Act	Environmental Protection and Biodiversity Act 1999
EPT	Estuary Prawn Trawl
ESD	Ecologically Sustainable Development
FAD	Fish aggregation device
FM Act	Fisheries Management Act 1994
FMS	Fishery Management Strategy
FP Act	Food Production (Safety) Act 1998
FRCAC	Fisheries Resources Conservation and Assessment Council
FRDC	Fisheries Research and Development Corporation
IMCRA	Interim Marine and Coastal Regionalisation for Australia
IPA	Intertidal protected area
JAMBA	Japan-Australia Agreement for the Protection of Migratory Birds, Birds in Danger of Extinction and their Environment
MAC	Management Advisory Committee
MPA	Marine Parks Authority
NCC	Nature Conservation Council
NPWS	National Parks and Wildlife Service
NRSMPA	National Representative System of Marine Protected Areas
NSW	New South Wales
NSWF	NSW Fisheries
Regulation	Fisheries Management (General) Regulation 1995
RFA	Recreational fishing area
RFO	Recognised Fishing Operation
RFG	Recognised fishing ground
RFR	Registered Fish Receiver
RRFR	Restricted Registered Fish Receiver
TAC	Total allowable catch
TCM	Total catchment management
TSC Act	Threatened Species Conservation Act 1995
WP Act	Wildlife Protection (Regulation of Exports and Imports) Act 1982

CHAPTER A. EXECUTIVE SUMMARY

Introduction

In December 2000, the NSW Government made changes to the way fisheries are managed in NSW. These changes place increased emphasis on ensuring that fishing activities are environmentally sustainable.

The changes require the development of fishery management strategies for each major commercial fishery, the recreational fishery, the recreational charter boat fishery, fish stocking programs and for the beach safety (shark) meshing program. They also require an assessment of the environmental impact of those fisheries. The draft fishery management strategy and environmental impact assessment for the Estuary Prawn Trawl Fishery are joined together in this document termed the Environmental Impact Statement (EIS) for the fishery. Its structure is based on guidelines produced by Planning NSW.

This overview constitutes the first chapter (Chapter A) in the EIS. Chapters B, C and D present an analysis of the current management rules operating in the fishery, a description of the proposed management arrangements for the fishery for at least the next five years (the draft strategy), and an outline of the alternative management approaches considered respectively. Together these chapters (Chapters A to D) comprise Volume 1 of the EIS.

Volume 2 comprises Chapters E to J, which contain an assessment of the biophysical, economic and social impacts of the management rules proposed for the fishery, and a justification for the chosen strategy.

Volumes 3 and 4 are appendices to the two main volumes.

This overview provides an introduction to the environmental assessment process. It briefly outlines the context within which the fishery operates, the management rules contained in the draft strategy, and the findings of the environmental impact assessment for the Estuary Prawn Trawl Fishery.

The public release of this EIS provides an opportunity for the community as a whole to review the environmental performance of the Estuary Prawn Trawl Fishery, and to have input into its future management.

The Estuary Prawn Trawl Fishery

Estuarine prawn trawling began in Port Jackson in 1926 and today occurs in just five of the 130 estuaries in NSW; namely, Clarence River, Hunter River, Hawkesbury River, Port Jackson and Botany Bay. By the end of 2002 the fishery will operate in only four estuaries because Botany Bay has been designated a recreational fishing haven, and prawn trawling will cease

In November 2001 there were a total of 289 fishing businesses entitled to operate in the Estuary Prawn Trawl Fishery. In 1999/2000 the value of the 527 tonnes of shellfish and finfish landed was approximately $3.9 million at first point of sale[1].

[1] Based on Sydney Fish Market average monthly prices, and does not account for higher prices paid for exports or in other markets.

The fishery uses a single method (the otter trawl net) to target two species of prawn and squid, although in the process many species of fish and crustacean are incidentally caught. Over 80 species have at some time been captured in the Estuary Prawn Trawl Fishery. The non-target species captured can be divided into a small number of species that have always significantly contributed to the marketed catch of the fishery (byproduct species), and the discarded portion of the catch (the bycatch).

The primary target species in this fishery are the eastern king and school prawns, though squid are also targeted in the Hawkesbury River. In recent years fishers have reduced the volume of unwanted species in their nets by using bycatch reduction devices.

NSW Fisheries have records of reported landings of prawns (catches sent to market) since the turn of the century. Annual reported landings from the Estuary Prawn Trawl Fishery have only been separated from landings in the Estuary General Fishery and Ocean Prawn Trawl Fishery, however, since 1984/85. Total annual reported landings of eastern king and school prawns fell in most years between 1984/85 and 1993/94, but since then landings of eastern king prawn landings have remained stable and school prawn landings have risen. Patterns in landings and catch per unit effort for school prawns and eastern king prawns vary between estuaries in the Estuary Prawn Trawl Fishery.

Total annual reported landings of squid in all NSW waters have declined in most years since 1992/93, but catches of squid in the Hawkesbury River, where the majority of squid landed are caught in the Estuary Prawn Trawl Fishery, show an upward trend from 1984/85 to 1997/98, and then a fall over the past two years.

Fishing effort in the Estuary Prawn Trawl Fishery on the Clarence River has increased since 1984/85 whilst fishing effort in other estuaries has either declined or remained stable. These estimates of fishing effort should be treated with caution, however, because these do not allow for increases in effort associated with improved technology, including the introduction of planing hulled vessels, electronic fish finding equipment, motorised winches and synthetic net materials. The associated risks are dealt with in the environmental impact assessment.

Management of the fishery

Input and output controls are the two broad types of management tools that can be used to manage fisheries. Input controls limit the amount of effort that can be applied to take shellfish and finfish in the fishery, thereby indirectly controlling the catch, whereas output controls aim to directly limit the catch.

The Estuary Prawn Trawl Fishery has historically been managed mainly through a series of input controls because of fluctuations in stock levels and the compliance issues associated with controlling unreported sales of prawns under an output control regime. The input controls used have included limits on the number and size of vessels, the size of gear used and time and area closures. Some output controls have also been used, however; for example finfish such as estuary cod, blue grouper, estuary perch and Australian bass that occur in estuaries have been completely protected from commercial fishing, and fish with a minimum size limit have been protected from prawn trawling in some instances.

Bycatch reduction devices to reduce incidental catches have been mandatory in the Estuary Prawn Trawl Fishery, except for the lower Hawkesbury River where squid is the primary target species, since December 2000.

Environmental Risks Associated with the Fishery

A preliminary environmental assessment of the current operations of the Estuary Prawn Trawl Fishery identified the following risks.

(i) Protection of key habitat and areas of environmental sensitivity

Saltmarsh, seagrass and mangroves are vital habitats for the long-term survival of many shellfish and finfish species, including most of the species landed in the Estuary Prawn Trawl Fishery. Areas of saltmarsh and seagrass habitats, in particular, have declined greatly in recent decades, mostly as a result of land use and water management practices, but fishing gear such as prawn trawl nets, can also affect habitat. There is insufficient information about the distribution of these key habitats in each of the estuaries fished by the Estuary Prawn Trawl Fishery or about the impact of trawling on the various habitat types.

(ii) Sustainability of the target species

The stock assessments available, which are based on information that has only low levels of precision, suggest that the eastern king and school prawns stocks may be growth-overfished. This means that individual prawns are being harvested at too small a size to take advantage of the growth potential of the species.

There is no stock assessment available for the squid stocks harvested in the Estuary Prawn Trawl Fishery. While there is little need for concern over catch levels in the Hawkesbury River, there is concern about the long term decline in total annual reported landings of squid in NSW.

(iii) Incidental catches

The amount of incidental catch in the prawn trawl net can have an impact on the ecosystem and the sustainability of the resource, especially considering that some bycatch species are targeted by other commercial and recreational fisheries. NSW Fisheries and industry have worked together in recent years to reduce this impact by introducing bycatch reduction devices into nets. However, little is known about the rates of survival of individuals that escape capture through these devices, or about whether all designs have been successful under commercial conditions at reducing incidental catch.

There are no stock assessments available for any of the species that comprise the byproduct of the Fishery or exploitation status except for one of the species involved.

(iv) The multi-species character of the fishery in some estuaries

Overall, byproduct species contribute around 14% to the total annual reported landings of the Estuary Prawn Trawl Fishery. However, the high proportion of the catch in Botany Bay, Port Jackson and the Hawkesbury River made up of byproduct species such as octopus, trumpeter whiting and crabs suggests the fishery in these estuaries could be seen as multi-species in character, and that these species are being actively targeted. The impact of targeting these species on associated ecosystems is unknown.

(v) Activation of latent effort

Approximately 50% of the entitlements in the Estuary Prawn Trawl Fishery contribute little or no active effort to the fishery and could be considered as latent (i.e. unused) effort. If these dormant entitlements become more active, there is a potential high risk to the sustainability of the resources and to the environment. There are currently no controls preventing the increased use of entitlements and

while it is highly unlikely that this effort would all be activated at once, there is the potential for effort to increase significantly if economic circumstances change.

(vi) Effects of trawling

Little is known about the impact trawling has on biodiversity in the estuaries fished by the Estuary Prawn Trawl Fishery. Most information about the impact of trawling comes from studies done in the oceanic environment and these have implicated otter trawling in changing the ecosystem. However, relating these conclusions to trawling in estuaries is not straight forward because the estuarine environment is far less stable and is impacted on by variation in natural elements. A study is currently underway in the Clarence River to assess the effects of trawling.

(vii) Allocation of shellfish and finfish resources between fisheries

The species taken in the Estuary Prawn Trawl Fishery are also the target species of other commercial and recreational fisheries that operate in the same or adjacent waters. All sectors want access to these resources, so the challenge is how to share them in a way that is equitable but will not impact on the sustainability of the resources.

(viii) Conservation of threatened and protected species, populations and ecological communities

Little is known about catches of threatened species in the Estuary Prawn Trawl Fishery, but it is thought that the impact of the fishery on threatened species populations and ecological communities is small. State and Commonwealth legislation require any such impacts to be mitigated by modifying or phasing out the activity causing the impact. It is important therefore to quantify and monitor any threatened species interactions, and to have a management framework that is adaptive, and allows any impacts identified to be managed.

(ix) Conflict with other resource users and the community

The demands on our estuarine resources by commercial, recreational and passive users have never been greater. Commercial estuary prawn trawl fishers operate alongside commercial fishers working in other fisheries, recreational anglers, Indigenous fishers and a variety of other waterway users. While there has been a tendency, in the past, for each fishery to blame the actions of others for perceived declines in shellfish and finfish stocks, the reality is that all fisheries can have impacts and these impacts need to be managed.

Perceptions can also be important. Some members of the community dislike trawl fishing in estuaries and readily draw conclusions about the sustainability of such practices. Some commercial fishers on the other hand argue that the long history of stable catches means that these fishing practices are sustainable. A plan to achieve appropriate sharing of the waterways and seafood resources is needed.

(x) Information needs and research

Considering the general lack of information available - for use in stock assessments, about the impacts of trawling, about key habitats and/or environmental sensitivity, about catches of threatened or protected species and about trophic interactions - the draft strategy will need to take a precautionary approach to future harvesting arrangements and will need to place increased emphasis on performance assessment, monitoring and research programs.

Response of the Draft Strategy to the Environmental Risks

The draft strategy contains a series of measures that tackle the issues raised in the previous section. It proposes to make the Estuary Prawn Trawl Fishery as self regulating as possible, with penalties to apply if breaches occur. The draft strategy is a holistic resource management regime based on a combination of controls on gear, fishing effort, and catch.

To address these and other issues, the draft strategy offers eight major long-term goals for the management of the fishery:

1. to manage the Estuary Prawn Trawl Fishery in a manner that promotes the conservation of biological diversity in the estuarine environment
2. to maintain target and byproduct species harvested by the Estuary Prawn Trawl Fishery at sustainable levels
3. to promote the conservation of threatened species, populations and ecological communities associated with the operation of the Estuary Prawn Trawl Fishery
4. to appropriately share the resource and carry out fishing in a manner that minimises social impacts
5. to promote a viable commercial fishery (consistent with ecological sustainability)
6. to ensure cost-effective and efficient management and compliance in the Estuary Prawn Trawl Fishery
7. to improve the knowledge of the community about the operations and management of the Estuary Prawn Trawl Fishery
8. to improve the knowledge about the Estuary Prawn Trawl Fishery and the resources on which the fishery relies.

These management goals are underpinned by 28 specific objectives and 84 proposed management responses, including immediate actions, development of future management and enforcement measures, and scientific research and monitoring programs.

The major changes to management of the fishery proposed in the draft strategy are:

- modifying nets (including the ongoing development of more efficient bycatch reduction devices) to minimise the impact of trawling on fish habitat, benthic communities and the incidental catches (byproduct and bycatch) in the fishery
- prohibiting trawling over all seagrass areas, and areas of key habitat or environmental sensitivity
- introducing incidental catch ratios to discourage trawling in areas where the abundance of incidental species is high
- introducing limits on the landings of byproduct species
- introducing prawn counts (as a type of size limit) to protect small prawns from capture
- investigating the need to introduce a legal minimum length for squid

- introducing a scientific observer program to collect data on species composition and abundance, and size composition of individuals in the catch of the prawn trawl net and any occurrences of threatened or protected species
- proposing to commence fishery-independent surveys to provide biological information for, estimates of relative abundance of, the fishery resources harvested by the estuarine prawn trawl fishery
- issuing 15 year tradeable shares to estuary prawn trawl fishers in accordance with the category 2 share management fishery provisions of the *Fisheries Management Act 1994*
- using either the Total Allowable Catch Setting and Review Committee to recommend a maximum number of fishing days for the fleet, or the share system and minimum shareholdings provisions to ensure that the number of active endorsements in the fishery do not exceed historical and sustainable levels
- removing the ability for the owners of fishing businesses to nominate third parties to operate the businesses
- promoting research into biodiversity in estuarine systems, ecosystem functioning and the effects of fishing practices
- modifying the fishery's operation to implement measures sought by related natural resource management programs, such as the marine park, aquatic biodiversity, marine pest, Indigenous Fisheries Strategy, and threatened species management programs
- developing a system for conducting formal stock assessments of the target species taken in the fishery, as well as ongoing monitoring of commercial landings of other retained species
- implementing an improved mandatory catch reporting system to improve the accuracy of commercial catch and effort data and to collect new data on interactions with threatened and protected species
- introducing greater deterrents for illegal activities, including the development of an endorsement suspension scheme and share forfeiture scheme based on a penalty point scale for serious offences and habitual offenders.

In addition to these proposed changes, the draft strategy incorporates a comprehensive performance monitoring system that will measure whether the stated management goals are being attained. The draft strategy identifies a series of indicators of management performance, and contains reference points that will trigger a review of the management rules if the fishery or fish stocks change beyond acceptable limits. All reviews of the management rules will be made public and completed within set timeframes.

Environmental Assessment of the Draft Strategy

This assessment uses the best available information to examine whether the proposed draft strategy adequately deals with the impacts of the Estuary Prawn Trawl Fishery on the shellfish and finfish resources, the biophysical environment and existing estuary prawn trawl fishers (economic and social consequences). The findings of this assessment are summarised in Table A1 and discussed below.

Table A1. A summary of the key issues of the environmental impact assessment, the programs proposed in the draft strategy and their ability to mitigate those impacts.

Issue	Component	Impact	Sources of Impact/Concern	Assessment of Level of Environmental Risk	Programs Proposed in the Draft FMS to Mitigate Impacts	FMS Likely to Reduce Risk?
Impact of the fishery on fish resources	Retained species	Potential for growth overfishing	Activation of latent effort Poor understanding of species Uncertainty of stock status Level of active effort Habitat destruction	High for 21 species, including target species - eastern king prawns, school prawns and squid; Medium for 1 species (yellowtail)	Controls on active fishing effort through total allowable fishing days or restructuring; stock assessments for target species; limits on gear; limits on landings and monitoring; time and area closures; investigate a winter closure for the Hawkesbury River	Yes - if there is high compliance, accurate catch returns and stock assessments are adequate
	Bycatch	Mortality of juvenile and undersized commercial and recreational species	Direct capture through non-selective method of fishing and discard mortality Contact without capture, damage from escape through trawl net, Lack of knowledge of bycatch species	High - capture of juveniles of commercial and recreational species; High - discard mortality	Use and ongoing development of bycatch reduction devices; time and area closures; handling methods; scientific observer programme to monitor effectiveness of bycatch reduction devices	Yes - for capture of juvenile species Inadequate - for discard mortality
		Mortality of other non-target species	Direct capture through non-selective method of fishing and discard mortality Contact without capture, damage from escaping through trawl net Lack of knowledge of bycatch species	High - direct capture and discard mortality	Closures in areas and times of high incidental catches; handling methods and gear modifications	Unknown
			Ghost fishing from torn netting	Nets rarely lost or torn - not applicable	Not required	-
	Bait	No bait used in fishery	Not applicable	Not applicable	Not applicable	Not applicable
Impact on the biophysical environment	Biodiversity	Change in ecosystem function or reduced diversity	Poor understanding of ecology of estuaries and non-target species Habitat destruction	High	Time and area closures; mapping of habitats within trawl area; prohibit trawling over seagrasses; impact study on biodiversity	Potentially - subject to appropriate action being taken following the results of impact studies and mapping
	Habitat damage	Destruction of estuarine habitat	Poor understanding of distribution of estuarine habitats and the impact of trawling on habitat	Low to high depending on key habitat type; e.g. medium for seagrass, high for unvegetated sediments	Time and area closures; mapping of habitats within trawl area; prohibit trawling over seagrassess; impact study on biodiversity; continue to prohibit wilful damage of marine vegetation; gear changes and restrictions	Yes
	Threatened and protected species	Mortality due to direct capture or disturbance	Poor understanding of threatened species interactions and the impact of trawling on threatened species	Low for most species; Low to medium for grey nurse shark, the little penguin population; Medium for estuary perch, Australian bass; Medium to high for green sawfish	Bycatch reduction strategies; area and time closures; observer survey; indentification of sightings and captures; inter-agency threatened species management; support for threatened species recovery plans; code of conduct	Yes, however more specific measures needed for green sawfish

Table A1 (cont).

Issue	Component	Impact	Sources of Impact/Concern	Assessment of Level of Environmental Risk	Programs Proposed in the Draft FMS to Mitigate Impacts	FMS Likely to Reduce Risk?
Impact on the biophysical environment cont.	Trophic structure	Change in trophic structure and function	Poor understanding of trophic structure of estuaries and of the impacts of trawling on trophic structure	High	Contribute to research into ecological function Other proposed measures that may assist: mapping environmentally sensitive habitats; support for threatened species recovery plans; area and time closures; constrain fishing effort	Unknown, and not likely to be known until there is a better understanding of trophic structure in estuaries
	Translocation of organisms	Potential for spreading disease and introduce exotic and pest species	Movement of fishing vessels between fishing zones	Low for most estuaries because few vessels operate in more than one zone	Implementation of measures in accordance with Australian Emergency Marine Pest Plan or equivalent	Yes
	Fish health and disease	Increase risk of disease	Damage from escape through trawl nets Poor understanding of the impact of trawling on fish health	Medium	Adopting AQIS guidelines, when developed; specific research projects	Unknown
	Water quality	Potential affect on fish health	Sediment re-suspension Fuel discharged into water Non-toxic dumping of debris overboard Discharge of processing waste Release of heavy metals and anoxic conditions	Low to medium	Code of conduct; existing Waterways Authority and Environmental Protection Agency management and regulations	Yes
	Noise	Disturbance to fish, birds and wildlife	Operation of trawl gear	Low - due to limited time of year of operation in most estuaries	Time and area closures	Yes
	Light	Disturbance to fish, birds and wildlife	Boat operation at night	Low - due to limited time of year of operation in most estuaries	Time and area closures	Yes
	Air quality	No significant impact	Engine emmissions	Low - due to limited time of year of operation in most estuaries	Not required	-
	Energy & Greenhouse	No significant impact	Engine emmissions	Low	Not required	-
	External factors	Decrease area of trawl grounds Pollution of estuarine waters Destruction of habitats User conflicts	Land based development Water based activities Climate change	High	MAC and NSW Fisheries contribution and commitment to total catchment management	Yes - to the extent that the FMS can influence other Government policies

Table A1 (cont).

Issue	Component	Impact	Sources of Impact/Concern	Assessment of Level of Environmental Risk	Programs Proposed in the Draft FMS to Mitigate Impacts	FMS Likely to Reduce Risk?
Economic impacts of the draft FMS	Economic viability	Poor economic viability of fishing businesses	Structure of fishery	High	Restructure of the fishery is proposed through additional effort controls and/or minimum shareholdings	Yes
Social impacts of the draft FMS	Employment and community values	Reduction in number of fishers	Structure of fishery	High	The proposed industry funded restructure will allow fishers exiting the industry to reestablish themselves; effort controls will help to ensure greater employment security in the long term	Unknown
	Health and safety	Fishers' well being	Use of winches, machinery and boats	Low	Not required	-
		Provision of poor quality seafood	Handling and processing of fish	Low	Adopting Food Safety Programme guidelines, when developed	Yes
	European heritage	Loss or damage of heritage sites	Area of trawling	Low	Not required	-
	Indigenous heritage and issues	Loss or damage to cultural sites, resource allocation	Area of trawling and maintenance of boats	Low to medium	Appropriate policies developed in response to emerging issues	Yes

Impact on the fish resources

The draft strategy contains a series of measures that address the issue of sustainability of the shellfish and finfish harvested in the fishery. Overall, the measures aim to reduce management uncertainty by improving our knowledge of shellfish and finfish stocks, and the habitat and ecosystem on which they depend, by reducing the risk of overfishing retained and bycatch species , by appropriately sharing the fishery resources and by protecting key habitat areas.

Little is currently known about the stocks of shellfish and finfish retained by the Estuary Prawn Trawl Fishery. Of the target species, assessments of school and eastern king prawn stocks have commenced but there is no information on the targeted squid stocks. There is very little information on the stock status of byproduct species. Eastern king prawns and yellowtail stocks have been assessed as being fully fished using both fishery dependent indices of abundance, and ancillary information such as age structures or independent surveys, but the data is not yet incorporated into a formal model of the stocks. School prawn stocks have also been assessed as fully fished, however, this assessment has only been completed at an elementary level. Given that existing stock assessment information is incomplete considerable caution has been used when drawing conclusions from the data for retained species.

The likelihood of the Estuary Prawn Trawl Fishery overfishing the retained species was assessed through a risk analysis based on indices of species vulnerability and current fishing pressure. A precautionary approach was taken in this assessment, with the result that fishing pressure was automatically assessed as high for those species whose stocks had not been assessed. Current fishing effort was found to place nearly all (22 species) of the retained species at a high risk of being overfished, unless direct management responses are introduced. One species (yellowtail) was assessed as having a medium risk of being overfished by the fishery, requiring only indirect management action.

The draft strategy proposes the required direct management action to ensure the sustainability of retained species. The potential for overfishing will be reduced by measures that directly address the risks associated with the fishery, through a combination of fishing gear restrictions (including improved bycatch reduction devices), controls on fishing effort, harvesting limits on target and byproduct species and effective monitoring of these limits, time and area based restrictions and stock assessments for the target species. The draft strategy does not treat each species in isolation, nor does it treat each species from the point of view of the Estuary Prawn Trawl Fishery alone. Rather, it is based on a holistic assessment that also takes into account interactions between target species, the impacts of trawling on habitats, and the cumulative effects of other fisheries or fishing sectors (including recreational fisheries).

Prawn stocks targeted by the fishery may be considered to be growth-overfished. The draft strategy proposes a range of measures to ensure these stocks sustainably managed, and to investigate the decline in State commercial landings of squid. Through establishing limits on byproduct species that will be monitored and reviewed, the draft strategy will ensure that the focus of the fishery remains on its target species. On the basis of maintaining sustainable school prawn stocks and reducing bycatch and habitat disturbance, a winter closure of the fishery in the Hawkesbury River should be investigated, though it is not proposed in the draft strategy.

The major issue for bycatch in the fishery is the large quantity of juvenile commercial and recreational species that are caught and discarded. Such discarding could reduce adult stocks of these species and impact commercial, recreational and Indigenous fishing sector catches. The draft strategy

addresses this and other bycatch issues through a range of management responses that complement by the management arrangements in other fisheries and sectors. On the basis of the information provided, the proposed measures contained in the draft strategy are considered acceptable and should minimise adverse impacts of bycatch in the Estuary Prawn Trawl Fishery. However, unless research is done to develop ways of further minimising bycatch and the findings implemented, then a more precautionary approach may be required – for example larger area and time closures.

Based on the available data, the assessment of the proposed harvest strategies suggests an increase in the likelihood both of long-term stock sustainability and of bycatch reduction. While it is impossible to predict the effect of the draft strategy's implementation with any precision, given the uncertainty of stock size and the wide range of external environmental influences affecting the fishery, the draft strategy deals with this uncertainty by taking a conservative (precautionary) approach to future harvesting arrangements and by placing increased emphasis on performance monitoring, and scientific programs.

Impact on the environment

By the end of 2002, the fishery will operate only in specified areas of four estuaries. Little is known about their biodiversity or habitats or the exact location and frequency of trawling within the permitted zone. While considerable literature exists on the adverse impacts of trawling on the environment generically, little specific information exists on the impact of trawling in NSW estuaries. The draft strategy should reduce uncertainty in the management of habitat issues through a commitment to research the impact of trawling on biodiversity and to map the habitats and actual area trawled in each estuary. Until such programs are developed and implemented, there will be a high degree of uncertainty associated with any assessment of trawling impacts on the biodiversity and habitats of the trawled estuaries.

In the absence of reliable data about these effects, a precautionary approach has been adopted. In determining the potential effects of the fishery, this assessment compared the allowable area of operation, methods and timing of the fishery with the fauna and habitat that could be affected. The findings were based on extrapolations from studies mostly on much larger and heavier fishing equipment, often from overseas and in offshore environments.

The assessment found that, as a result of the measures proposed in the draft strategy, the Estuary Prawn Trawl Fishery is most likely to directly disturb the unvegetated sediments found within the area that can be trawled but to a lesser extent may also indirectly disturb the fauna found associated with estuarine shoreline habitats. Overall the management responses of the draft strategy will prevent the fishery from operating in previously untrawled areas and reduce the current impact of trawling on habitat condition and biodiversity, through measures such as effort controls, a ban on trawling over seagrasses and a the introduction of a code of conduct. If the research and management responses contained in the draft strategy are not implemented, a more precautionary approach to trawling in estuaries would be required, possibly involving greater area closures and a reduction in current fishing effort.

The Estuary Prawn Trawl Fishery has the potential to affect a range of species listed as threatened or protected under either the *Fisheries Management Act 1994*, *Threatened Species Conservation Act 1995* and the *Environment Protection and Biodiversity Conservation Act 1999*. At this stage the fishery has been observed to directly capture only two species that are protected from commercial harvesting, namely the Australian bass and estuary perch.

Trawling in estuaries directly disturbs unvegetated sediment habitat, however, and could impact on associated threatened and protected species, such as the endangered green sawfish, which was last sighted in the Clarence River around 30 years ago. Prawn trawling operations have been identified as one of the likely causes contributing to the decline of the green sawfish in NSW. Prawn trawling has also been identified as one of the fishing methods that could result in incidental captures of the grey nurse shark though none have been recorded. It could possibly also affect the little penguin population by depleting their food source.

The measures contained in the draft strategy should be effective in monitoring capture rates of threatened species and minimising their capture where they do occur. The proposed management measures are consistent with the recovery plans for the grey nurse shark and little penguin population and should reduce fishery-related impacts on this threatened species and population. A more precautionary approach is needed to minimise any possible indirect disturbance to threatened species caused by the fishery, as this appears to be the most likely form of impact on the majority of threatened species and species of international significance. The draft strategy should place greater emphasis on obtaining information about the effects on threatened species due to disturbance from trawling.

The environmental impact assessment has considered the eight factors listed under section 5A of the *Environmental Planning and Assessment Act 1979* in order to decide whether there is likely to be a significant effect on threatened species, populations or ecological communities or their habitats. The assessment was based on a review of biological information derived from the various agencies responsible for those species, from published literature and from personal communications. The assessment concluded that the Estuary Prawn Trawl Fishery could significantly impact on green sawfish, if it were found in trawled estuaries. If this occurred, the strategy would need to include such direct measures as the development of a code of conduct dealing with captures of the species, and targeted observer and research studies to assess and reduce any impacts on the species. Overall, however, the assessment concluded that the fishery alone would not have a significant effect on threatened species, populations or ecological communities or their habitats and, as such, a species impact statement was not required.

Due to the high level of uncertainty about trophic relationships in estuaries in NSW there is a high risk that trawling could substantially affect these relationships to the detriment of biodiversity. There are no management responses that specifically mitigate potential impacts of trawling on trophic structure in estuaries. However, research is proposed to investigate the effects of trawling on trophic relationships in specific habitats (e.g. unvegetated substrate) within estuaries of the fishery. The management responses that promote biodiversity are also likely to assist in mitigating the effects of trawling on trophic structure. The limited movement of fishers between the trawled estuaries in the Estuary Prawn Trawl Fishery limits the risk of spreading marine pests or diseases. Within an estuary the fishery could facilitate the spread of marine pests, such as the invasive marine alga *Caulerpa taxifolia.* To date, however, this species has not been found in any of the trawled estuaries, so further restrictions on the use and movement of fishing equipment are not required.

There are currently no proposals for the artificial enhancement of populations of fish and invertebrate species targeted by this fishery. Any such proposals would, at any rate, be subject to the provisions of the *Environmental Planning and Assessment Act 1979*.

The draft strategy contains a management response to develop a code of conduct that will include minimising the amount of oil and fuel in the bilge water of the trawlers. Only low levels of

water pollution are likely to be generated by the fishery, mostly from the discharge of bilge water and water used to cook prawns. Considering the seasonal nature of the fishery, such events are likely to be of low to moderate frequency. This pollution should not have a significant impact on water quality as the estuaries trawled by the fishery have largely developed catchments with many sources of pollution and their waterways are busy with a variety of other boating users of which the fishery represents only a small fraction. Also, the carrying capacity of these relatively large and deep estuaries with wide entrances should quickly assimilate any pollution events from the fishery. Given the existing controls administered by the Waterways Authority and the Environment Protection Authority the vessels used in the fishery do not require any specific management measures for water quality issues, although sediment resuspension as a result of trawling activity could increase turbidity and may require some investigation. The strategy is precautionary in proposing a code of conduct regarding water quality issues.

The fishery is considered to have minimal potential for significant adverse impacts due to light, noise, vehicle or boat emissions. Existing and proposed controls to limit the time and area fished should mitigate any potential impacts and monitoring of the level of complaints and the observer study will allow collection of data on their occurrence for use in future assessments.

There are some external factors (particularly land-based catchment uses, pollution, habitat degradation, climate and other estuarine users) that have the potential to significantly affect the estuarine habitats, the species harvested in the Estuary Prawn Trawl Fishery, and its operational area and capacity. These factors pose major challenges that go well beyond those contained within the parameters of the draft strategy. The draft strategy does propose useful options that will contribute to a more holistic management of estuaries and the fishery. Options in the draft strategy to help mitigate against external impacts include:

- the development of seafood safety protocols to reduce risks to consumers (this could result in temporary closures triggered by particular disease outbreaks or adverse environmental conditions)
- fishers reporting any detrimental impacts of external activities to NSW Fisheries
- contribution by fishers to habitat management policies and legislation
- increased fisher and fishery agency representation on boards and committees that regulate catchment activities and/or land uses liable to affect shellfish and finfish or their habitats
- ad hoc area closures.

Economic impacts

This is the first formal economic and social assessment of the Estuary Prawn Trawl Fishery of NSW. It has been compiled from a limited amount of existing information, and augmented by new economic and social surveys, and access to Australian Bureau of Statistics data .

The review of existing information shows that the Estuary Prawn Trawl Fishery is currently based in five estuaries located either in, or north of, Sydney. Estuary prawn trawl businesses have a diverse range of endorsements in other managed fisheries, particularly the Estuary General and Ocean Prawn Trawl Fisheries. The Estuary Prawn Trawl Fishery is seasonal, with a peak between November to May and comprises predominantly one person businesses, with some partnerships between fishers and limited corporate involvement.

Trends in licence values show no significant rise in the value of estuary prawn trawl endorsements in the last eight years, but this is a limited measure of economic performance due to restrictions on transfers of endorsements. The fishery is highly variable in capital investment levels, with some fishers having small boats, while others have significant investment in larger vessels, such as those also authorised in ocean-based fisheries.

Economic surplus exists in only 10% of all estuary prawn trawl businesses examined. Estuary prawn trawl businesses obtaining less than 20% of revenue from prawn fishing were more profitable than those obtaining more than 20% of revenue from prawn fishing. Those businesses currently operating below long term viability levels are effectively subsidised by forgoing returns on capital and labour, presumably to accommodate lifestyle. For these operators, increased management charges and any requirements to purchase shares will impact on their operational viability.

The assessment of management responses contained in the draft strategy are ranked on the basis of their potential larger scale economic impacts. The following issues are assessed:

- Under the draft strategy an annual reduction in the number of fishing businesses of 3% per annum is estimated due to the implementation of the category 2 share management regime, and minimum entry requirements at the fishing business level. Category 2 share management will give the remaining fishers improved fishing rights. The draft strategy will reduce 241 fishing businesses in 2002, to 205 in 2007. The most likely businesses to exit are those involving elderly fishers, latent effort holders and those businesses grossing below $10,000 per year. Shares will be more readily purchased by the 10% of businesses in economic surplus. It is essential to monitor latent effort and constrain active effort levels, as stated in the strategy. The economic flow-ons from exiting businesses will be limited, however, due to their low catch history.
- The draft strategy proposes to address concerns about effort levels either through the implementation of minimum shareholdings on endorsements in each estuary, or by a total allowable effort limit, possibly related to the past fishing effort of fishers. These policies will enable estuary capacity to be contained within sustainable limits. Estuary based effort limitations (through shares or total effort days) are estimated to reduce the number of endorsed fishers by 5% (approximately 12 persons) during the first five years.
- Medium level impacts may come from the implementation of optimal prawn harvesting practices, such as prawn counts. Changes in food safety practices are also envisaged.
- Low level impact parts of the draft strategy involve closures for species protection and for weekend and public holidays. Recovery plans and the implementation of an owner-operator policy may impact fishers also.

A management cost appraisal of the draft strategy includes net economic revenues from fishing operations and all subsidies and management costs. The fishery commences in deficit and is significantly improved by the end of the draft strategy. The economic effectiveness of any restructuring needs to be monitored during the plan, as years of high prawn abundance would improve the viability of the fishery and its capacity for policy adjustments.

Social impacts

Existing social data on fishers and their communities was supplemented by obtaining access to ABS data[2] and through a telephone questionnaire of 171 estuary prawn trawl fishers. The regional and community location of fishers was identified from licensing data and compared with the ABS data for a range of social indices including the SEIFA[3] index of disadvantage for rural communities, at the postcode level.

Total employment in businesses with an estuary prawn trawl endorsement is estimated as between 257 and 474 persons (full-time and past-time), though employment directly associated with the Estuary Prawn Trawl Fishery would be less than this. A social profile of its fishers revealed fishers to be an aged, highly resident population, with substantial fishing experience and strong family involvement with fishing. Estuary prawn trawl fishers have a mean age of 47 years and 20% are in excess of 60 years of age

Approximately 83% of fishers were insistent about their identity as fishers and were unable, or unwilling, to consider re training. This "psychic income" from fishing and problems in mobility of fishers are analogous to the NSW dairy industry.

The social assessment followed the environmental assessment guidelines issued by Planning NSW and ranked impacts into high, medium and low categories. It prioritised socio-economic issues and issues where policy changes require social processes to function properly for management to be most effective. The most highly impacting issues include the use of minimum business shareholdings, total effort limits, closures for species and on weekends and public holidays. Each of these changes has the capacity to impact fishers, families and local communities.

The major social changes from the draft strategy, after the closure of the Botany Bay fishery, involve the displacement of between 36 and 48 fishers in the first five years of the draft strategy through the implementation of minimum business shareholdings and proposed effort controls. Adjustment will probably impact part-time and older fishers, as 20% of fishers are over 60 years old, and latent endorsement holders, or fishing businesses grossing less than $10,000 per year.

The estuary prawn trawl fishing communities in the Clarence and Hunter are most vulnerable to changes from any socio-economic impacts under the plan. An estimated 36-48 fishers, with between 21-105 dependents, will be impacted to differing extents in proportion to their age and income dependence on the Estuary Prawn Trawl Fishery.

The social impact will be noticeable in estuary prawn trawl fishing communities, given the lack of alternative employment for many older fishers, but should also enable elderly fishers to retire with a payment from the sale of shares. Further research should prioritise understanding of fishing communities to reduce the cumulative impacts from successive management strategies.

Health impacts

The Seafood Safety Scheme Regulation is based on the premise that some species and/or activities present a potentially higher food safety risk than others. An example of high-risk species is bivalve molluscs (shellfish), which are caught in the Estuary General Fishery, but are not to be retained for sale in the Estuary Prawn Trawl Fishery. The species retained in this fishery are considered to be a low food safety risk and thus do not require any special management arrangements.

[2] Thanks to staff of the Social Science Unit, Bureau of Rural Science, Canberra.
[3] (Socio-Economic Index For Areas)

Heritage impacts

The activities associated with the Estuary Prawn Trawl Fishery are limited to associated boating, foreshore access and the use of trawl nets. Commercial fishing operations are likely to have only a marginal interaction with the European heritage resources, both structural and transport, within estuaries. With regard to shipwrecks, it appears likely that commercial prawn trawling in estuaries will have no impact and residual material evidence, having regard to the likely nature, bulk and mass of any residual material and the potential for sub-surface material to be covered by silt/sand. Nonetheless, in the reverse situation, it is possible for residual wreckage to pose a hazard, as a potential snag for nets.

There is abundant ethnographic and archaeological evidence for past use of estuaries and beaches by Indigenous people, and of the importance of resources from these environments to Indigenous economies and lifestyles. In the cases of both Indigenous sites along the banks of estuaries, and Indigenous sites along the dunes of ocean beaches, however, the overall risk that activities authorised by the draft strategy will detrimentally impact on Indigenous cultural heritage is considered to be low, requiring no specific management measures.

Indigenous issues

There are several other concurrent policy development initiatives by the NSW Government that will affect the interaction of Aboriginal fishers with the Estuary Prawn Trawl Fishery. In particular, NSW Fisheries has been consulting with the Aboriginal community on an Indigenous Fisheries Strategy.

Ongoing review of the fishery management strategy will be essential to ensure that any changes in the policy approach to Indigenous fisheries are incorporated.

Justification for the Draft Strategy

The EIS highlighted the importance of the Estuary Prawn Trawl Fishery to the community in terms of employment, supply of seafood and economic benefits. There are approximately 500 people employed in association with the Estuary Prawn Trawl Fishery. The fishery contributes approximately 500 tonnes of fresh seafood annually for general consumption, and recent market surveys clearly indicate the increasing consumption of seafood products and demand for locally caught shellfish and finfish. The annual landed value of the fishery is approximately $4 million, with almost all the first sale value staying within local communities.

If the fishery were not to continue, then much of the production may be absorbed by other fisheries. The extent to which this would happen would vary between estuaries because some of the estuaries have other estuary based fisheries and/or are ports for large ocean going fleets of prawn trawlers. Both these catching sectors would be likely to take a share of any prawn catch foregone by not allowing trawling in estuaries. However, the production of squid in the Hawkesbury River might well be lost.

The main arguments for maintaining the Estuary Prawn Trawl Fishery are the employment it generates; its importance to regional economies; and its capacity to variously produce: a high quality squid product, to help satisfy an elastic demand for prawns and to provide live prawns for specialised seafood markets and small prawns for the bait market.

The EIS concluded that the management responses proposed by the draft strategy provide for an appropriate allocation of the resource, and incorporate those measures needed to address the various principles of ecologically sustainable development, including the precautionary principle.

How the Environmental Impact Statement was Developed

The EIS incorporates an assessment of the likely environmental impacts if the draft strategy was to be implemented. As well as satisfying the environmental assessment requirements of the *NSW Environmental Planning and Assessment Act 1979*, the EIS will also be submitted to the Commonwealth Government to meet assessment requirements for the *Environment Protection and Biodiversity Conservation Act 1999* and the *Wildlife Protection (Regulation of Exports and Imports) Act 1982*. This is the third time in NSW that the widely accepted environmental impact assessment process has been applied to fisheries assessments. This methodology has already been applied to the Estuary General and Ocean Hauling Fisheries.

Development of the draft strategy

The draft strategy for the Estuary Prawn Trawl Fishery was compiled with significant input from the Management Advisory Committee (MAC) for the fishery. The MAC includes elected representatives of the commercial estuary trawlers as well as representatives of recreational fishers and the Nature Conservation Council. Input into the draft strategy was also sought from all fishers endorsed in the Estuary Prawn Trawl Fishery, the Minister for Fisheries' advisory councils on conservation, recreational fishing and commercial fishing (which includes commercial fishers from other fisheries), and the Fisheries Resource Conservation and Assessment Council. Government agencies, such as Planning NSW and the Commonwealth's Environment Australia, have also been consulted during the drafting of the EIS, as have professionals in the fields of aquatic research and environmental impact assessment.

The draft strategy contains all the proposed rules for management of the fishery, but it is much more than a collection of rules. The draft strategy contains the objectives for the fishery, a detailed description of the way the fishery operates, and describes the management framework for at least the next five years. It also outlines a program for monitoring the environmental, social and economic performance of the fishery, establishes trigger points for the review of the draft strategy, and requires annual reporting on performance in order to ensure that the draft strategy meets its objectives.

Development of the Environmental Impact Assessment

It is important to understand that the environmental impact assessment and the draft strategy have been developed concurrently, in a series of steps. The draft strategy assessed here is in fact the third draft of the strategy. The process is designed to give early feedback to the MAC and allow a response to the predicted environmental impacts of the management proposals. Each draft of the strategy is then modified to ensure that the proposed management framework appropriately addresses the environmental impacts identified during the assessment process.

One difference between assessing the impacts of an existing fishing industry and assessing, for example, a new building development is that the fishing industry already exists. Consequently, any changes to fishing practices and levels of harvest will have direct social and economic impacts on these already-established fishing and related industries. It is important that when the impacts of proposed changes are assessed time is allowed, where appropriate, for industry to adjust to any changes required.

In comparison to our knowledge of terrestrial resources, less is known about aquatic ecosystems, and even less about estuarine ecosystems; this makes any assessment of fishery impacts more difficult than is the case with many other natural resources. The environmental assessment acknowledges such uncertainty and, where there is little information upon which to make a decision about an issue, the precautionary principle is applied. The precautionary principle, a key component of the principles of ecologically sustainable development, states that if there are threats of serious or irreversible damage to fish stocks, lack of full scientific certainty should not be used as a reason for postponing measures to prevent that damage.

Other Management Initiatives Relevant to the Estuary Prawn Trawl Fishery

Apart from the management responses contained in the draft strategy, there are a number of initiatives currently underway by the NSW Government that may affect existing allocation arrangements in estuaries, namely the recreational fishing area process, the establishment of marine protected areas and the development of an Indigenous Fisheries Strategy.

- *Recreational fishing havens.* A general recreational fishing fee was introduced in March 2001. Money raised by the fee is being used to improve the quality of recreational fishing. A major initiative funded by this fee has been, after extensive community consultation, the announcement that 29 areas are to be protected from commercial fishing. These fishing havens aim to resolve long standing resource-sharing issues in areas popular with large groups of anglers, and involve closing small and large areas to commercial fishing. Under this process, sufficient commercial fishing businesses will be bought out to ensure there is no net transfer of commercial fishing effort into other areas, and fair compensation will be offered to the owners of fishing businesses that are acquired. The new areas to be protected from commercial fishing include Botany Bay which directly relates to the Estuary Prawn Trawl Fishery. For a complete list of the new recreational fishing havens that have been announced, refer to the NSW Fisheries website: www.fisheries.nsw.gov.au.

- *Marine protected areas.* NSW is committed, under national and international agreements, to the conservation of marine biodiversity and to the ecologically sustainable use of marine resources. Nationally, all states and territories are working towards establishing a national representative system of marine protected areas. In NSW, the term 'marine protected areas' includes large multiple-use marine parks, small aquatic reserves, and the marine components of some national parks and nature reserves.

  Together with sustainable fisheries management and coastal protection, marine protected areas play a vital role in conserving marine ecosystems and in maintaining natural processes. At the time of writing, three marine parks had been created and consultation was occurring over the possible creation of an additional marine park.

- *Indigenous Fishing.* Changes to fisheries management policies, practices and laws have increasingly impacted on Indigenous fishing activities over the years. Commercial and recreational uses of fisheries resources can cause concerns for Aboriginal communities as these practices may interfere with cultural activities. Many Aboriginal people have also expressed an interest in expanding their involvement in the commercial use of fisheries resources, thereby contributing to their financial independence. Indigenous communities also want to participate more in the management of the resource. The Government has been

consulting about a NSW Indigenous Fisheries Strategy with Aboriginal people and fisheries stakeholder groups.

Aboriginal people agree that resource sustainability remains paramount and any strategy must take into account the impacts of such practices on biodiversity.

Consulting the Community

You are invited to comment on the Environmental Impact Statement for the Estuary Prawn Trawl Fishery, which is on public exhibition until 15 April 2002. The full EIS can be viewed at NSW Fisheries Offices, the head office and regional offices of Planning NSW, NSW Government Information Service, local coastal councils (including relevant Sydney councils) and the Sydney office of the Environment Centre (NSW) during normal business hours. A paper or CD copy can be purchased for $25 (includes GST). It is also available on the NSW Fisheries website at www.fisheries.nsw.gov.au.

Need more information?

For enquiries relating to the Estuary Prawn Trawl Fishery, please phone (02) 6645 1321.

For enquiries relating to the environmental impact statement, please phone (02) 9527 8524.

Or visit: www.fisheries.nsw.gov.au

Want to comment?

Write to: Environmental Impact Statement Submission

Estuary Prawn Trawl Fishery

PO Box 21

CRONULLA NSW 2230

Fax: (02) 9527 8576 (marked attention "Estuary Prawn Trawl EIS Submission")

Email: estuarytrawl.eis@fisheries.nsw.gov.au

If you wish your submission to remain confidential, it should be so marked.

Comments must be received by 15 April 2002

CHAPTER B. REVIEW OF THE EXISTING OPERATION OF THE FISHERY

1. Introduction

The prawn stocks of NSW are ranked first in value amongst the wild caught seafood resources managed solely by the State government. The Estuary Prawn Trawl Fishery is one of three major commercial fisheries in NSW that harvests prawns from the wild. Over the period 1995-96 to 1999-2000 the Estuary Prawn Trawl Fishery contributed on average around 28% by weight (430 tonnes) and 16% by value ($3 million) to the production from prawns. There is also a significant aquaculture industry and recreational fishery for prawns in NSW.

The Estuary Prawn Trawl Fishery operates in five of the 130 significant coastal estuaries within NSW; namely, the Clarence, Hunter, and Hawkesbury Rivers, and Port Jackson and Botany Bay. In August 2001, the NSW Government announced that Botany Bay would become a recreational fishing area, commencing from May 2002. From that time, prawn trawling will not be permitted in Botany Bay and fair compensation will be paid to commercial fishers in exchange for their fishing entitlements. The Estuary Prawn Trawl Fishery uses a single method, the otter trawl net, to target a single group of species, the prawns of the family Penaeidea. The exception to this is that prawn trawlers operating in the Hawkesbury River are permitted to also target squid. The fishery operates for defined seasons (with the exception of the Hawkesbury River) and within each estuary is confined to a specific area and specific times.

This chapter describes the Estuary Prawn Trawl Fishery as it exists now, looks at the species that are taken, the gear that is used and the current management arrangements that apply. It then outlines the issues that arise from the existing operation of the fishery, which are the issues that need to be addressed by the FMS.

Chapter C then specifies the changes to the operation of the fishery that are proposed by the FMS to deal with each of the issues, and outlines the proposed harvesting strategy to apply to the fishery over the next five or so years.

a) Jurisdictional arrangements

The Estuary Prawn Trawl Fishery is entirely managed under the *Fisheries Management Act 1994* (the FM Act). NSW Fisheries is the State Government agency responsible for the administration of the FM Act.

b) Background and history of the fishery

The practice of trawling for prawns in NSW began in 1926 in Port Jackson. A single net connected to a pair of otter boards to spread the net was towed behind a small boat. At the completion of a shot (i.e. setting, towing and retrieval of the net) the net was pulled back onto the boat by hand. Trawling spread to four other estuaries in the 1940s following the improvement of transport, development of markets and the advent of motorised vessels. The introduction of mechanical winches onto prawn trawling boats allowed the boats to trawl in deeper waters. Further developments in

technology brought the introduction of multiple trawling nets in the Clarence River, the use of polyethylene netting which reduced the shrinking of nets, the use of echo-sounders to trace the sea floor and bycatch reduction devices (BRD) to reduce the catch of unwanted species.

Prior to the 1980s most people could get either a commercial fishing or boat licence provided they gave a commitment to earn the major part of their income from, and spend most of their time commercial fishing. This access changed in 1984 when a freeze on the issue of new boat licences was introduced. This restriction was tightened in 1987 by requiring commercial fishing licence applicants to demonstrate investment in the industry. In 1988 after the introduction of management plans for each of the five estuaries, the number of vessels operating in the Estuary Prawn Trawl Fishery was limited to 309 and vessels were in most cases restricted to one of the five estuaries in the state where trawling was permitted.

In June 1994 the process of catch validation was introduced. Each business was assessed and a validated record of historic catch was produced. The June 1994 Licensing Policy outlined the rules for the transferability of fishing businesses, which, for many fisheries involved some criteria relating to the validated catch history. This policy however did not heavily affect the transfer of estuary prawn trawl entitlements, which could be freely traded.

In March 1997 the Estuary Prawn Trawl Fishery, along with five other major commercial fisheries, was formally declared a restricted fishery[4] and the operators in the fishery were issued with 'endorsements' to replace their previous authorisations.

The FM Act was amended in December 2000 to create a new framework for commercial fisheries management called category 2 share management fisheries. The Estuary Prawn Trawl Fishery was declared a category 2 share management fishery in March 2001. The difference between the three possible commercial fishery management frameworks is summarised in Table B8.

While management arrangements have been in place in the Estuary Prawn Trawl Fishery ever since its inception in the 1920s, never before have fishers had a long term secure access entitlement. The category 2 share management framework will provide 15 year shares in the fishery that are subject to statutory compensation if the fishery is closed within that time and the shares are cancelled. This provides commercial fishers with a greater incentive to ensure the fishery is sustainable in order to maintain or improve the value of their entitlements.

c) Extent of the fishery

This fishery uses otter trawl nets to take shellfish and some finfish for sale in five estuaries in NSW, namely, the Clarence River, Hunter River, Hawkesbury River, Port Jackson and Botany Bay (see Figure B2). Management arrangements have generally varied on an estuary by estuary basis because each is based upon separate stocks of school prawns and the fishery has many issues peculiar to the estuary in which it operates. Also, most recently, trawling for squid has developed in the Hawkesbury River, being known as the Hawkesbury River squid component. Different management rules apply in each of these estuaries.

Estuarine waters are defined under the *Fisheries Management (General) Regulation 1995* as waters other than ocean waters that are ordinarily subject to tidal influence. Where an estuary meets ocean waters, estuarine waters are generally those that are west of, or upstream of, a line drawn across the entrance between the eastern most high water mark of the two banks.

[4] Under s.111 of the *Fisheries Management Act 1994*

Trawling is also permitted within Jervis Bay, which falls under the definition of estuary waters but is managed as part of the Ocean Prawn Trawl Fishery. With the exception of the Hawkesbury River, trawling is permitted in each of the five estuaries for around seven to eight months of the year. Trawling is carried out all year round in the Hawkesbury River.

It is important to note that the Estuary Prawn Trawl Fishery does not use any method other than trawling to take shellfish and finfish from estuarine waters. Methods other than trawling in estuaries, though they may target the same stock, are managed as a separate commercial fishery known as the Estuary General Fishery, and a separate fishery management strategy is being prepared to manage these activities.

2. Shellfish and Finfish Stocks

a) Species composition

The fishery catches a wide range of species (see Appendix B1) but lands relatively few (see Appendix B2 for the species which are landed), most are returned to the water. The target species in the Estuary Prawn Trawl Fishery are prawns (for a list of species see Table B1) and in the case of the Hawkesbury River, squid are also considered a target species. Overall, the school prawn *Metapenaeus macleayi* contributes by far the most to the catches of the Estuary Prawn Trawl Fishery (see Figure B1), but these proportions change depending upon the estuary because of amongst several reasons, changes in species diversity and abundance between estuaries. The species caught other than the target species are referred to as the incidental species.

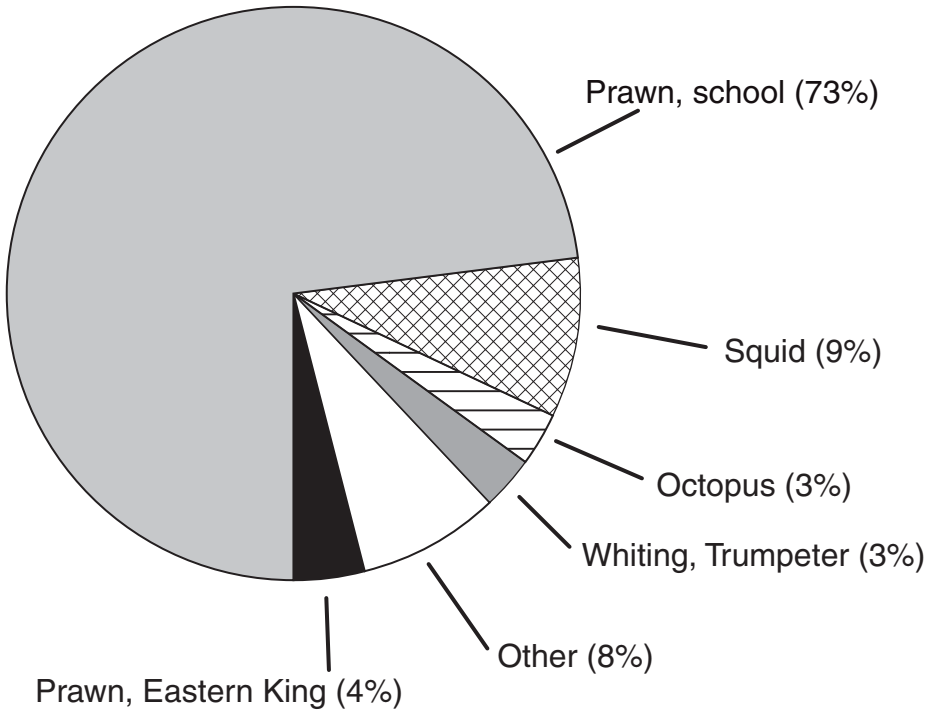

Figure B1. The mean proportion of the most abundant species in the annual reported landings for 1997-98 and 1998-99 of the Estuary Prawn Trawl Fishery.

The incidental species can be divided into the small number of non-target species that have always significantly contributed to the marketed catch of the fishery, referred to as byproduct species, and the discarded portion of the catch known as the bycatch.

Table B1. The target species caught in each estuary by the Estuary Prawn Trawl Fishery.

"Yes" signifies that the species is a target species in that estuary. "No" signifies that the species is not a target species in that estuary.

Common Name	Scientific Name	Estuary				
		Botany Bay	Port Jackson	Hawkesbury River	Hunter River	Clarence River
Eastern king prawn	*Penaeus plebejus*	Yes	Yes	Yes	Yes	No
School prawn	*Metapenaeus macleayi*	Yes	No	Yes	Yes	Yes
Broad squid	*Photololigo etheridgei*	No	No	Yes	No	No
Bottle squid	*Loliolus noctiluca*	No	No	Yes	No	No

3. Operations Common to All Estuaries

The review of the fishery is structured to first provide details of the operations of the fishery that are common to all estuaries in the fishery and then to provide the specific details for each estuary.

a) Existing area of operation

There are five estuaries in the fishery namely the Clarence River, Hunter River, Hawkesbury River, Port Jackson and Botany Bay (see Figure B2). The areas operated within each estuary are discussed in section 6 of this chapter.

Botany Bay has been gazetted as a recreational fishing area from 1 May 2002 and as such all commercial fishing in that estuary with the exception of that for rock lobsters and abalone will cease from that date.

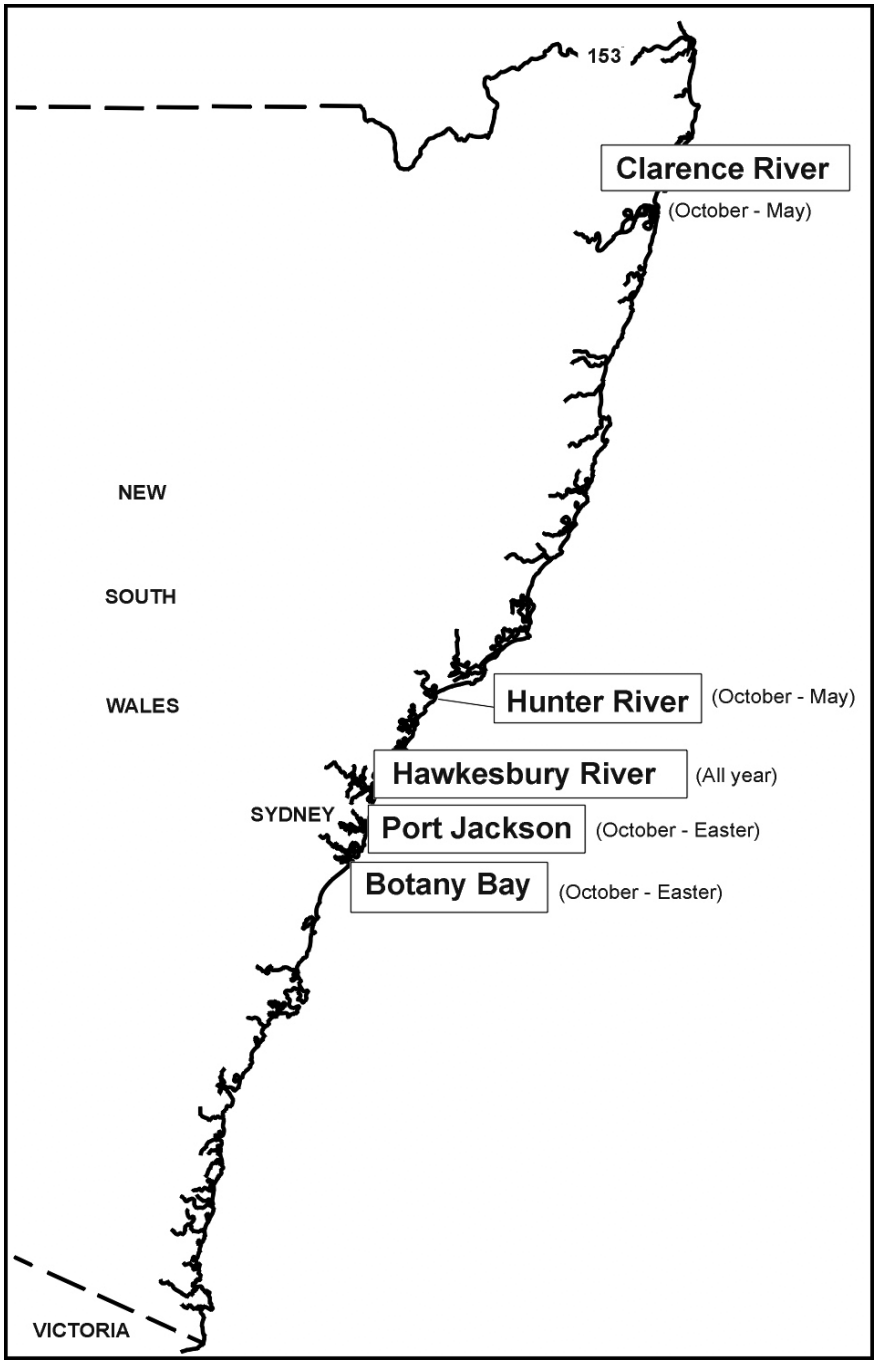

Figure B2. Location of the five estuaries where the Estuary Prawn Trawl Fishery operates and the period when fishing is permitted.

b) Method of harvesting

i) Types of vessels

Vessels used in the Estuary Prawn Trawl Fishery are of both planing and displacement hull designs. Some of these vessels are also used to fish in other fisheries such as the Ocean Prawn Trawl, Estuary General and Ocean Trap and Line fisheries, hence the large range in vessel length and power. The characteristics of the fleet within each estuary are summarised in Table B2.

Table B2. Summary of the characteristics of vessels used in the Estuary Prawn Trawl Fishery in each estuary.

Characteristic	Parameter	Estuary				
		Clarence River	Hunter River	Hawkesbury River	Port Jackson	Botany Bay
Hull Design	Displacement or Planing	Both	Both	Both	Displacement	Displacement
Length	Range (m)	17.2 - 4.3	13.1 - 6.2	15.7 - 4.7	9.2 - 5.6	9.6 - 4.5
	Average (m)	9.9	8.6	8	8	8.1
Engine Power	Range (kW)	269 - 6.3	134 - 30	165.5 - 20.1	156.6 - 22.4	250 - 41
	Average (kW)	97.12	71.73	81.12	77.78	91.36

ii) Gear used in the fishery

An endorsement in the fishery allows a commercial fisher to use an otter trawl net to target prawns (and in the case of the Hawkesbury River also squid) in estuarine waters. A trawl net is a funnel of net towed along close to the seabed (see Figure B3). The net to be used is restricted by the definition of an otter trawl net for prawns under the *Fisheries Management (General) Regulation 1995* (see Appendix B3).

The net is held open by otter boards. These are small flat boards set at an angle to the direction of the towed net and act as hydrovanes. As the boards move through the water, the forces exerted on these boards spread the net open. Between the otter boards and nets are sweeps (ropes) which attach the net to the otter board. Long sweeps are not allowed on prawn trawlers as they herd and increase finfish catch.

Otter boards are attached by means of a bridle leading to the main warp. These are wire ropes connecting the trawl boards to the vessel. The head rope is attached to the upper sweep, which is attached to the upper section of otter board (see Figure B3). A footrope is attached to a few links of chain for the purposes of adjustment and then to the lower sweep and otter board. The purpose of the footrope is to skim the surface of the seabed to trigger prawns to jump into the path of the oncoming net. A ‘lazy line’ is often used to retrieve the codend back onto the vessel so the catch can be emptied from the net.

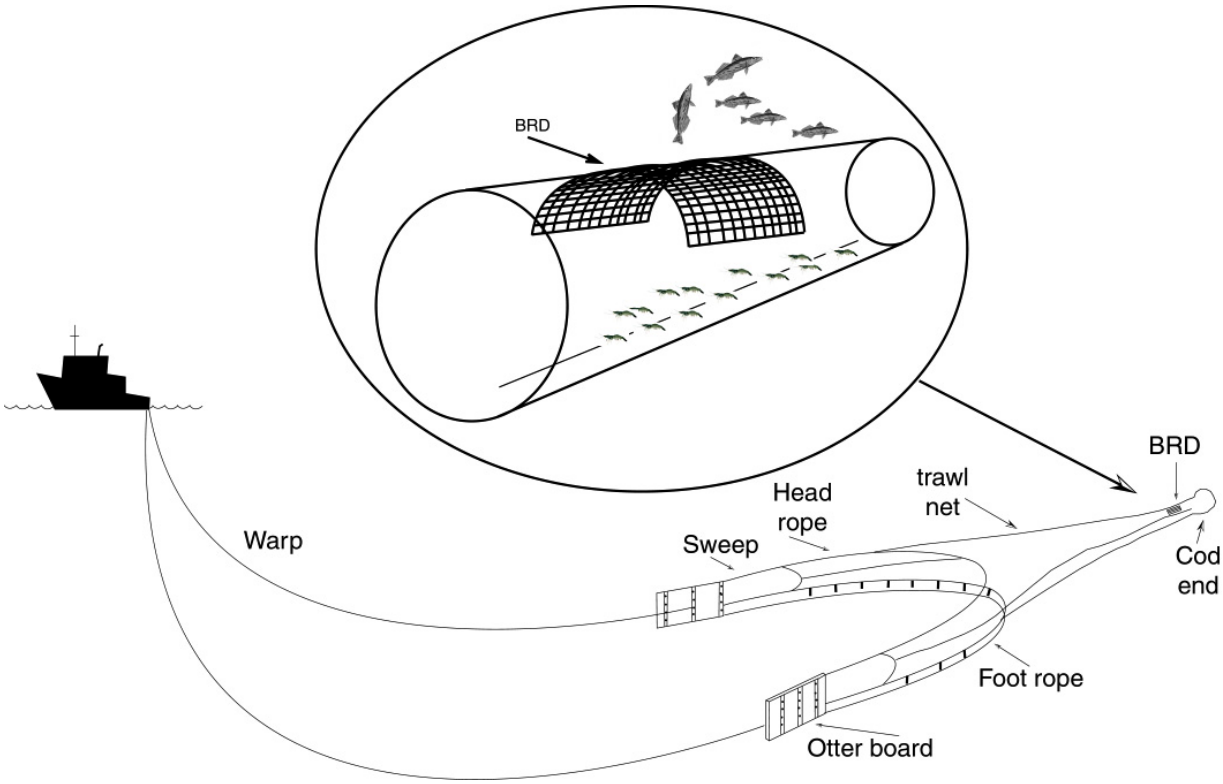

Figure B3. Diagram of an otter trawl net used in the Estuary Prawn Trawl Fishery.

The major components of the net are shown in the bottom of the figure. "BRD" refers to bycatch reduction device located near the codend.

The mesh size, amount of net (i.e. headrope length) and number of nets that may be towed behind the vessel are restricted to limit fishing capacity and may vary depending upon the target species. Table B3 summarises the restrictions applying to estuary prawn trawl nets.

Table B3. Summary of the characteristics of the nets permitted in each estuary.

Characteristic	Estuary				
	Clarence River	Hunter River	Hawkesbury River	Port Jackson	Botany Bay
Mesh size of net (mm)	40-60	40-60	40-60	40-60	40-60
Mesh size of codend (mm)	40-50	40-50	40-50	40-50	40-50
Maximum number of nets	2	1	2 (Broken Bay) 1 (Elsewhere)	2	2
Maximum headline length (m)	7.5m each net (if twin gear) 11m (if single gear) .	11	11	11	11
BRD	Yes	Yes	Yes*	Yes	Yes

* BRD not required in Broken Bay.

All prawn trawl nets, except for those used in Broken Bay (Hawkesbury River), must by law be fitted with a BRD that has been approved for use in the fishery (see Figure B3). Bycatch reduction devices are designed to allow species other than prawns to escape from the trawl net. Industry worked closely with NSW Fisheries to develop BRD's for their fishery and in a lot of cases voluntarily inserted the devices into their nets prior to BRD's becoming mandatory on 2 December 2000. Fishers

operating in Broken Bay target prawns and squid. Nets when fitted with the current BRDs have been found to be unsatisfactory when used to target squid. Research is underway to determine a design of fishing gear suitable for the squid component of the Hawkesbury River fishery and fishers are working to develop a BRD for the lower reaches of the Hawkesbury. Bycatch reduction devices used in the Estuary Prawn Trawl Fishery are outlined below (see Table B4) and further detailed in Appendix B4.

Table B4. Bycatch reduction devices (BRDs) approved for use in each estuary.

Estuary	BRD
Clarence River	1. Composite square mesh panel 2. Blubber chute 3. Nordmore grid 4.Quality Clarence panel
Hunter River	1. Composite square mesh panel 2. Blubber chute 3. Nordmore grid 4. Quality Clarence panel
Hawkesbury River	1. Composite square mesh pane 2. Blubber chute 3. Nordmore grid 4. Quality Clarence panel 5. Hawkesbury square mesh panel
Port Jackson	1. Port Jackson screen 2. Blubber chute 3. Nordmore grid 4. Composite square mesh panel
Botany Bay	1. Blubber chute 2. Nordmore grid 3. Composite square mesh panel

Maintenance of fishing gear

The commercial fishing gear used in this fishery requires near constant maintenance. The mesh of netting gets torn during trawling operations and after a period of months (depending upon the level of use) will shrink. Fishers generally re-use the head and foot ropes and replace the portion of damaged net. The warps and sweeps of the gear may stretch and winches periodically require greasing and overheads.

Trawlers require constant maintenance during the fishing season, the levels of fuel and oil in the engine and any hydraulics require constant checking and topping up and filters are cleaned and changed periodically. Operators carry out an annual refit when vessels are slipped, painted, checked for survey and any large maintenance jobs on the engine, hull or fishing equipment are carried out.

iii) Hazard issues

There are two broad categories of hazard: those that relate to commercial fishing and those that are external to it.

Factors related to commercial fishing that may create hazardous circumstances include collision with other fishing vessels and injuries from fishing equipment including winches and derricks. Fishers are exposed to the risk of personal injury from slipping on wet decks, having loose clothing caught in winches or worn or poorly maintained equipment collapsing. Due to the nature of the fishery fishers usually work by themselves spending a lot of time on the back deck. When several

vessels are working the one area, which is often the case, if attention is not paid to where each vessel is, collisions can occur.

Factors external to commercial fishing that may create hazards include the position of jetties, pontoons, moorings, snags, submerged logs, mud, non-lit navigational markers and watercraft such as ferries and ferry wires. These have the potential to snag nets and may result in damage to or loss of the gear and in extreme circumstances, damage to the vessel and/or injury to the operator.

4. Catch Information

a) Status of species

The exploitation status of the target and byproduct species of the Estuary Prawn Trawl Fishery are shown in Table B6. NSW Fisheries uses a standard set of definitions for reporting the exploitation status of shellfish and finfish stocks across all commercial fisheries. Determinations about the status of the stock are based upon available information which will vary between species but includes analyses of catch and effort information and where possible, formal stock analyses. Where it is known, an estimate of the recreational harvest is also taken into consideration. This reporting method uses terms as detailed in Table B5 to describe the stock status.

Table B5. Definitions used in determining exploitation status.

Exploitation Status	Definition
Under fished	The appraisal of a shellfish or finfish stock that suggests that the stock has the potential to sustain catches significantly higher than those currently being taken
Moderately fished	The stock is assessed to be fished at levels which would probably allow only limited increases in catches
Fully fished	The appraisal of a stock which suggests that current catches are sustainable and close to optimum levels (the definition of which may vary between fisheries; eg catches are close to maximum sustainable yield, or fishing effort is close to a biological reference point). In a fully fished fishery, significant increases in fishing effort above current levels may lead to overfishing
Over fished / Depleted	The appraisal suggests that current fishing levels may not be sustainable, and/or yields may be higher in the long term if the fishing level is reduced in the short term. This may be due to recruitment overfishing, growth overfishing and/or as a result of habitat degradation.
Uncertain	There is little or no information about the status of this stock (eg. no catch data or only very recent catch data)
Unknown	The only information about the status of this stock is long term fishery dependant catch data

The target species in the Estuary Prawn Trawl Fishery with the exception of the squid resources of the Hawkesbury River are considered to be fully fished (Glaister *et al*., 1990; Gordon *et al.*, 1995; NSW Fisheries, 2000a). However, Montgomery (2000) presented information that showed that the eastern king and school prawns were being exploited at sizes smaller than the optimum size at first capture, that is, that growth overfishing may be occurring in these species. Patterns in annual reported landings and CPUE for school prawns and eastern king prawns vary between estuaries in the Estuary Prawn Trawl Fishery (see Appendix B5 for descriptions) but there is little indication of recruitment overfishing of the stocks. It is likely however, that in the next review of the status of these resources that the species will be categorised as growth overfished.

The patterns in annual landings for squid for NSW show a downward trend over a recent eight year period. In contrast, the patterns in annual reported landings for squid from the Estuary Prawn Trawl Fishery in the Hawkesbury River, the main producer of squid in the fishery, show an upward trend between 1988-89 and 1998-99. Reasons for the difference in patterns in annual reported landings need to be identified.

With one exception, the exploitation status of all byproduct species in the Estuary Prawn Trawl Fishery are unknown. The exception to this is yellowtail which is considered to be fully fished. Some of these species are the target species of other commercial fisheries and will therefore be subject of stock assessments in the near future. Amongst the many bycatch species in the Estuary Prawn Trawl Fishery there are four which are considered as fully fished, two as moderately fished, two as under fished, whilst the status of the vast majority is unknown.

With the exception of squid, a target species in the Hawkesbury River and byproduct species in the other estuaries, none of the prominent byproduct species (those comprising more than 2% of the total reported catch for an estuary of the Estuary Prawn Trawl Fishery) show patterns in annual reported landings or CPUE that would be cause for concern (see Appendix B5).

There are also two bycatch species that are considered to be overfished; namely eastern sea garfish *Hyporhamphus australis* and silver trevally *Pseudocaranx dentex*. Both these species comprise only a negligible part of the bycatch of the Estuary Prawn Trawl Fishery. For instance, Liggins and Kennelly (1996) and Liggins *et al.* (1996) recorded low catch rates (0-1 fish per day) of these species during observer-based studies between 1989 and 1992 of the Estuary Prawn Trawl Fishery in the Clarence River, Port Jackson and Botany Bay. In addition, these studies were done before BRDs were made mandatory in the Estuary Prawn Trawl Fishery and it is likely that the low numbers caught in the fishery have been reduced further since BRDs were introduced.

b) Catch levels and value

Annual reported landings in 1998-99 in the Estuary Prawn Trawl Fishery were around 493 tonnes and worth approximately $3.97 million. In 1999-2000 the fishery had reported landings of around 527 tonnes and a value of approximately $3.96 million. Catch and value are discussed on an estuary level in section 7 of this chapter, whilst the patterns in landings for the target species and prominent byproduct species are detailed in Appendix B5.

Table B6. Exploitation status and related information for target and byproduct species in the Estuary Prawn Trawl Fishery.

Common Name	Exploitation Status	Target or Byproduct	Targeted by other Commercial Fisheries	Stage in Lifecycle when Harvested
School prawns[1]	Fully Fished	Target	Estuary General Fishery Ocean Prawn Trawl Fishery Queensland	Sub-adult
Eastern king prawns[2]	Fully Fished	Target	Estuary General Fishery Ocean Prawn Trawl Fishery Queensland	Juvenile to sub-adult
Greasyback prawns	Unknown	Byproduct	Estuary General Fishery Ocean Prawn Trawl Fishery Queensland	Juvenile to adult
Tiger prawns	Unknown	Byproduct	Estuary General Fishery Ocean Prawn Trawl Fishery Queensland	Juvenile to adult
Blue swimmer crab	Unknown	Byproduct	Estuary General Fishery Ocean Prawn Trawl Fishery Queensland	Juvenile to adult
Mud crab	Unknown	Byproduct	Estuary General Fishery Queensland	Juvenile to adult
Squid (at least two species)	Unknown	Target and Byproduct	Estuary General Fishery Ocean Prawn Trawl Fishery Ocean Fish Trawl Fishery Ocean Trap & Line Fishery Victoria	Unknown
Mantis shrimp (at least three species)	Unknown	Byproduct	–	Unknown
Octopus (at least three species)	Unknown	Byproduct	Ocean Prawn Trawl Fishery Victoria	Juvenile to adult
Trumpeter whiting	Unknown	Byproduct	Estuary General Fishery Queensland	Unknown
Flounder (at least two species)	Unknown	Byproduct	Ocean Fish Trawl Fishery	Unknown
Silver biddy	Unknown	Byproduct	Estuary General Fishery	Unknown
Sole (black)	Unknown	Byproduct	–	Unknown
Trumpeter	Unknown	Byproduct	–	Unknown
Whitebait (at least two species)	Unknown	Byproduct	–	Unknown
Catfish (at least three species)	Unknown	Byproduct	–	Juvenile to adult
Yellowtail	Fully Fished	Byproduct	Ocean Hauling Fishery Estuary General Fishery Commonwealth	Unknown
Pike, long-finned	Unknown	Byproduct	Ocean Trap & Line Fishery	Juvenile to adult
Dory, john	Unknown	Byproduct	Offshore Fish Trawl Fishery	Juvenile to adult
Crab, sand	Unknown	Byproduct	–	Juvenile to adult
Bullseye (at least two species).	Unknown	Byproduct	Offshore Prawn Trawl Fishery	Unknown

1 See (Montgomery 2000).

2 See (Glaister *et al* 1990; Gordon *et al* 1995; and Montgomery 2000).

5. Existing Management Strategy

a) History and status of commercial fisheries management in NSW

Controls on commercial fishing in NSW date back as far as 1865 when the first fisheries legislation was introduced. Since that time, several Acts have been introduced to improve the ability to manage impacts of fishing. *The Fisheries & Oyster Farms Act 1935* provided a range of management tools, such as licensing rules, gear controls and fishing closures, and was in force for some 60 years.

With the advent of new technology and ongoing increases in effective fishing capacity, more contemporary management tools were needed. The *Fisheries Management Act 1994* replaced the *Fisheries & Oyster Farms Act 1935* and provided a more comprehensive set of tools to manage fisheries. Table B7 below provides an insight into the historical development of fisheries management in NSW.

Table B7. Chronology of major management events in NSW.

Year	Management event
Mid 1800s	Commercial fishing commenced in NSW estuaries
1865	*Fisheries Act 1865* commenced in response to concerns of overfishing, declaring seasonal and area fishing closures
1881	*Fisheries Act 1881* commenced, allowing for the regulation of fishing gear, including controls over mesh sizes in nets, and the licensing of fishers and fishing boats
1935	*Fisheries and Oyster Farms Act 1935* introduced
1980	Access to abalone fishery limited
1984	Freeze on the issue of new fishing boat licences introduced
1986	Access to estuary and offshore prawn trawling limited
1987	Freeze on the issue of new fisher licences ("commercial fishing licences") introduced
1990	Warning issued by Government against new investment and/or new diversification in commercial fishing activities
1993	Access to the lobster fishery limited
1994	Licensing Policy introduced, commencing the process of catch validation
1995	Commencement of the *Fisheries Management Act 1994* which provided for the establishment of 'share management fisheries' and 'restricted fisheries'. Ocean hauling was declared a restricted fishery
1996	1994 Licensing Policy revised and re-issued
1997	Restricted fisheries introduced for major marine commercial fisheries: ocean prawn trawl, ocean fish trawl, ocean trap & line, purse seining, estuary prawn trawl, estuary general (NB. the abalone and lobster fisheries were declared share management fisheries)
2000	Commencement of share fishery management plans for the abalone and lobster fisheries Amendment to the *Fisheries Management Act 1994* provides an alternate management framework called category 2 share management fisheries
2001	Declaration of Recreational Fishing Areas

The FM Act provides several broad frameworks for managing commercial fisheries including category 1 and category 2 share management fisheries and restricted fisheries. Each framework has different levels of access, security, costs and responsibility for industry. Table B8 provides a comparison between the three management frameworks.

Table B8. Comparison of the restricted fishery and share management fishery frameworks.

Item	Restricted fishery	Category 1 share management fishery	Category 2 share management fishery
Right issued	Validated catch history which gives rise to an 'entitlement' *	Shares	Shares
Access	Endorsement	Endorsement	Endorsement
Transferability	Subject to transfer policy	Subject to the management plan	Subject to the management plan
Statutory compensation payable?	No	Yes, if shares are cancelled	Yes, if shares are cancelled within 15 year term
Statutory management plan required?	No	Yes, five year plan	Yes, five year plan
Appeal mechanism	Statutory review panel	Statutory review panel	Statutory review panel
Cost recovery	Partial; moratorium on full cost recovery	Full cost recovery	Partial; full cost recovery after 8 years
Community contribution payable?	No	Yes	Rental payment

* exceptions apply in some fisheries where validated catch history is not required to hold the endorsement

The Estuary Prawn Trawl Fishery has been declared a category 2 share management fishery, and the process of conversion from the existing restricted fishery framework is underway.

b) Management Controls

The existing management rules for the Estuary Prawn Trawl Fishery were published by NSW Fisheries as part of a series of fisheries profiles (NSW Fisheries 1999c). A document "Management Rules for the Clarence River Estuary Prawn Trawl Fishery" was drafted by Clarence River fishers as a comprehensive guide to the rules applying to that fishery in January 2001 (Anon 2001) to give fishers a better understanding of their fishery and similarly in November 2001 the Hawkesbury River Trawl Association released their "Environmental Action Plan" that contained the proposed rules for their fishery (Hawkesbury River Trawl Association 2001). No such documents have been forthcoming for the other estuaries.

There are two broad types of fishery management controls, known as input controls and output controls. Input controls limit the amount of effort commercial fishers put into their fishing activities, indirectly controlling the amount of fish caught. They need to continually be modified in response to increases in fishing effort usually caused by advances in fishing technology. Input controls can include restrictions on the number of licences, the size and engine capacity of boats, the length and mesh size of nets, and the areas and times which can be worked. Output controls, on the other hand, directly limit the amount of fish that can be taken from the water and are well suited for single species, high value fisheries using single gear types (Goulstone, 1996).

The Estuary Prawn Trawl Fishery in NSW is managed exclusively by input controls. The following sections set out in broad terms the controls that apply to the fishery.

i) Fishing licences

A commercial fishing licence is required by an individual before she or he can take shellfish and finfish for sale or be in possession of commercial fishing gear in or adjacent to waters. The licence only authorises activities that are covered by endorsements issued in respect of each part of a fishery and specified on the licence.

Generally speaking, commercial fishing licences are currently available to persons who held a licence immediately prior to the commencement of the FM Act, or owners of recognised fishing operations (RFOs). An RFO is a fishing business that has a minimum level of past participation (validated catch history) in the fishery or a particular type of fishing entitlement. Businesses allocated an estuary prawn trawl endorsement fall into the latter category and are automatically granted RFO status (with the exception of those with a Lake Wooloweyah endorsement). The RFO policy was introduced via the Licensing Policy issued by NSW Fisheries in June 1994.

A commercial fishing licence may also be issued to an individual who is the holder of shares in a share management fishery. This will become the more relevant requirement as the Estuary Prawn Trawl Fishery moves to category 2 share management.

The common objectives of the 1994 Licensing Policy and its replacement in 1996 were to:

- provide transitional arrangements which do not pre-empt future management whilst longer term management arrangements are being introduced
- provide a mechanism which allows existing fishers with catch history to identify and subsequently dispose of their fishing business
- allow new entrants into the industry in a manner which ensures that active fishing effort only is being replaced
- provide a mechanism for the consolidation of smaller fishing businesses.

Because estuary prawn trawl fishing businesses (with the exception of those with a Lake Wooloweyah endorsement) are automatically granted RFO status and a new owner is automatically issued an entitlement to access the fishery it has not been possible in this fishery to ensure that active effort has been replaced by the new fishing business owner.

In addition to each fisher having to be licensed, every fishing boat used in connection with estuary prawn trawling must also be licensed.

ii) Limited entry

Access to the fishery was first limited in 1985. Access was limited to vessels with a demonstrated history of participation in the fishery. On 1 March 1997 the Estuary Prawn Trawl Fishery and the remaining open access fisheries all moved into the restricted fishery management regime. Because access to the Estuary Prawn Trawl Fishery had already been restricted, the fishery was implemented with no change to the number of boats authorised to access the fishery.

Following changes to the FM Act in December 2000 the Estuary Prawn Trawl Fishery, along with other major commercial fisheries, was selected to become a category 2 share management fishery. At this moment, the fishery is operating under the restricted fishery regulations, with the same rules and obligations that have applied since 1997. This situation will continue until a share

management plan for the fishery has been made by regulation. Further information relating to the progression to full share management can be found in section 6(a) of Chapter C.

iii) Endorsements in the Estuary Prawn Trawl Fishery

In determining the number of fishers in the Estuary Prawn Trawl Fishery, it is important to understand the difference between endorsements and entitlements in the fishery and how they relate to commercial fishing licences.

In summary, entitlements in the fishery are associated with fishing businesses, while endorsements appear on the commercial fishing licence of individuals and/or boat licence and authorise the use of specific gear or the taking of specific species.

A person or vessel is not permitted to fish in the Estuary Prawn Trawl Fishery unless they hold an endorsement in this fishery. The endorsement is known as the 'estuary prawn trawl endorsement'. This endorsement authorises the fisher to use an otter trawl net (prawns) to take prawns for sale from the relevant estuary waters.

Fishing vessels used to take prawns in the Estuary Prawn Trawl Fishery are also subject to a particular set of boat licence conditions. These conditions (S1, S2, S3, S4, S5 and S6) are used to restrict each vessel, when trawling, to one or more of the estuaries, or parts thereof, where prawn trawling is permitted.

Table B9. Number of estuary prawn trawl entitlements (as at 26th November 2001).

Estuary	Number of entitlements
Clarence River Access to Lake Wooloweyah and the Clarence River (S5) Access to Lake Wooloweyah only (S6)	 120 3
Hunter River (S4)	32
Hawkesbury River (S3)	68
Port Jackson (S2)	31
Botany Bay (S1)	48
Total number of entitlements	302

There are a total of 289 fishing business with prawn trawl entitlements, however, a number of those businesses have entitlements to trawl for prawns in more than one estuary (see Table B9).

There are inactive prawn trawl entitlements in each estuary in addition to entitlements that are seldom used (see Table B10). This is not a concern as long as those entitlements continue to be operated in that way, but the potential exists for them to become more active, particularly upon transfer of the business to a new owner. A more detailed review has shown that some of the active businesses have a very low level of participation in the fishery.

Table B10. Level of activity of prawn trawl entitlements (as at 26 November 2001).

The number of inactive businesses (those that fished no more than 2 days) for 1999 and 2000, and the number of businesses that participated in the fishery for less than 15 days during 1999 and 2000.

Estuary	Current number of endorsements	FBs that worked 2 days or less	FBs that worked 3-15 days
		Average 1999 & 2000	Average 1999 & 2000
Botany Bay	48	26	4
Clarence River	120	38	17
Hawkesbury River	68	30	5
Hunter River	32	9	6
Lake Wooloweyah	3	2	1
Port Jackson	31	18	3

Note: The figures in the column "Number of businesses with 15 days or less" includes the inactive businesses from the previous column.

iv) Controls on the size and design of fishing boats and fishing gear

Size and design restrictions relating to the dimensions of fishing gear are legislated in the *Fisheries Management (General) Regulation 1995*. The Regulation also provides for variations to 'standard' gear types that may be applicable to particular estuaries, or parts of particular estuaries (See Appendix B3).

A policy with respect to the replacement of boats in this fishery exists and is another mechanism of managing potential increases in fishing effort. How this policy relates to each estuary is discussed under the specific management strategies for each estuary (section 7 in this chapter).

v) National licence splitting policy

The Commonwealth and the State Governments have a long standing nationally agreed policy in place on licence splitting. The policy prevents entitlements held by one person or entity and issued by more than one jurisdiction, from being split and transferred separately. The transfer of a fishing business is not approved unless all entitlements issued to the business by other jurisdictions are also transferred to the same person, or surrendered, or the approval of all agencies involved has been obtained.

Where fishing effort has been historically 'shared' across a number of entitlements held by a person, the policy prevents the increase in effort that would occur by creating two separate entitlements that could operate at full capacity.

vi) Transfer of fishing business entitlements

Commercial fishing licences and endorsements to participate in a fishery are not freely transferable. Currently, commercial fishing licences and endorsements can only become available to a new entrant under guidelines issued by the Director, NSW Fisheries.

Under the current Licensing Policy, fishing businesses must be sold as an entire package (i.e. the catch history or endorsements cannot be split). Proposals regarded as licence splitting, or contrary to the intention of the Licensing Policy are generally not approved. Variations to the Licence Splitting Policy are provided on a case by case basis where there are demonstrable extenuating circumstances and where there are no net increases in fishing effort as a result.

Under the guidelines issued by the Director, NSW Fisheries and currently in place, upon transfer of a business with an estuary prawn trawl entitlement (with the exception of holders of a Lake Wooloweyah endorsement) the new owner automatically becomes eligible for a commercial fishing licence and an estuary prawn trawl entitlement.

The recent variation to this arrangement applies in the Hawkesbury River. In response to industry concern over the potential for fishing effort to increase in the Hawkesbury River, a 'freeze' on the issue of Hawkesbury River prawn trawl endorsement to new business owners was introduced on 27 May 2001.

vii) Transfer of licensed fishing boats

All licensed fishing boats that are authorised for prawn trawling in estuarine waters (except for S6 endorsements) are classified as "boat history" vessels, whereby the validated, historic catch associated with the vessel is transferred whenever the fishing boat licence is transferred. The fishing boat licences for vessels in this fishery cannot be transferred separate to the remainder of the fishing business.

Fishing vessels with licence conditions S1, S2, S3, S4, and S5 are automatically granted RFO status. Those businesses with a S6 Lake Wooloweyah endorsement only are not automatic boat history vessels and do not automatically obtain RFO status.

Any transfer of a fishing boat licence must first be approved by the Director, NSW Fisheries.

viii) Nomination policy

Part of the introduction of the restricted fishery regime was the creation of rules to allow the endorsements of a fishing business to be nominated to a person. This was necessary due to some fishing businesses being held in company or partnership names and because fishing licences can only be issued to natural persons.

Under the current nomination policy, if the owner of a fishing business is eligible for an endorsement in the Estuary Prawn Trawl Fishery, the owner may nominate another person to take shellfish and finfish on behalf of the business. If a person nominates another fisher to take shellfish and finfish on their behalf, that person forgoes his/her right to fish (under all endorsements) while the nomination is active.

Out of the 289 fishing businesses with estuary prawn trawl entitlements, nine are licensed in company names and a further 24 are licensed to partnerships (NSW Fisheries Licensing Database – 26 November 2001). This equates to 11.2% of the total number of estuary prawn trawl fishing businesses. There are eight people, partnerships or companies that own two estuary prawn trawl businesses.

Anecdotal evidence suggests that the nomination policy has caused increases in fishing effort through so called part-time businesses or ageing fishers effectively leasing their business to new fishers. Once nominated, the businesses are generally operated at a much harder rate than by the owner, and there is less incentive to operate in a manner that will promote the long term sustainability of the resource and viability of the fishery.

ix) Time and area closures

Closures are an important tool in achieving resource management goals. The Minister for Fisheries under section 8 of the Fisheries Management Act 1994 may by notification, prohibit,

absolutely or conditionally, the taking of fish or a specified class of fish, from any waters or from specified waters. These closures either prohibit or restrict activities of commercial and/or recreational fishers in a given area for a specified time. For instance, a notification made under the FM Act may provide for the use of fishing closures to:

- protect areas of key habitat
- manage the amount of fishing effort that may be applied in an estuary or designated parts of an estuary
- to manage conflicts between stakeholders over the use of the resource and to ensure it is equitably shared
- protect populations during their times of spawning
- minimise bycatch and the impacts of the fishery on threatened and protected species.

The Minister for Fisheries may introduce absolute or conditional closures. Closures may relate to species that are prohibited from being taken, areas that are not open to fishing, times that fishing may not be undertaken, and gear types that are prohibited from being used.

The specific time and area closures applying to each of the five estuaries are discussed under the specific management controls for each estuary in section 7 of this chapter. Approximately 50% of the area in each estuary of the Estuary Prawn Trawl Fishery are permanently closed to trawling. These closed areas are mostly located in the less marine dominated upper reaches of these estuaries with the exception of the Hawkesbury River which has substantial closures on it's lower reaches. The Clarence and Hunter Rivers and Port Jackson and Botany Bay are closed during winter to conserve prawn stocks and stocks of juvenile finfish. These estuaries contain mostly small prawns during winter, when the prawns grow very little and tend to stay in the estuary before moving to sea over summer and autumn (Racek, 1959; Ruello, 1973b; Glaister, 1978b). The Hawkesbury River remains open year round. McDonall and Thorogood (1988) found quantities of prawns of a marketable size in the Hawkesbury River year round. Apart from biological reasons, closures have been introduced into the Estuary Prawn Trawl Fishery to reduce conflict between the fishery and recreational fishers, address noise level issues, lower the profile of trawling when the public is most likely to be using the waterways and to protect areas of key habitat.

Closures are currently applied by notification issued under section 8 of the FM Act. See Appendix B6 for the existing closure notifications, which apply to the Clarence River, Hunter River, Hawkesbury River, Sydney Harbour and Botany Bay.

Fishing closures are required to be published in the NSW Government Gazette, however if the Minister for Fisheries considers that a fishing closure is required urgently, the Minister may introduce the closure and advise the public through media outlets and by displaying prominent signs in areas adjacent to the waters affected. In the case of an urgent closure, the Minister is to publish the closure in the Government Gazette as soon as practicable.

x) Permits

Section 37 of the FM Act allows for permits to be issued for research and other authorised purposes (see Table B11). These permits provide a legal framework for activities that fall outside normal operating rules set out in the FM Act or its Regulation. Each permit sets out a number of

conditions, which vary depending on the purpose of the permit. These conditions ensure that permits are used only for the intended purpose and may be used to limit the extent of the permitted activity.

Table B11. Types of permits that will be issued.

Permit type	Description
Research	Permits are issued to research scientists (including NSW Fisheries staff, Universities and other research organisations) and commercial fishers assisting in undertaking research programs. The permits generally authorise the retention of prohibited size shellfish and finfish, shellfish and finfish in excess of the possession or bag limits or use of gear not prescribed in the regulation
Trial of bycatch reduction devices (BRDs)	The development of an effective BRD requires significant testing under normal operating conditions to assess their effectiveness. Permits are often required to trial types of fishing gear with dimensions or configurations not prescribed in the regulation
Development of new fishing gear	This permit provides a legal framework for the possible development of a more selective and passive fishing method for this species
Crossover or V bridles	Permits have been issued to six fishers from the Hawkesbury River (as at 27 June 2001) to allow the use of crossover or V bridles on their prawn trawl gear. Crossover or V bridles lift the trawl net off the bottom of the estuary floor and are fitted when targeting squid in the Hawkesbury River.

Permits issued under section 37 are valid only if they do not conflict with approved determinations of Native Title made under the Commonwealth *Native Title Act 1993*.

Permits are valid for the period specified in the permit, and may be suspended or cancelled at any time by the Minister. Permits are not transferable.

xi) Size limits

Size limits are implemented to allow a sufficient proportion of the population to survive to maturity, breed at a rate necessary to sustain the population in the long term.

Clause 34 of the Regulation prescribes the species that may be retained after being taken in a prawn trawl net from estuarine waters. In summary, it is lawful for a fisher to retain:

- species that are not subject to a prohibited size class or
- species that are not protected (i.e. no prohibition against taking)
- crustaceans (other than lobsters) that are not of a prohibited size.

The size limits that apply to all commercial fisheries and recreational fisheries are given in Appendix B7. The appendix includes information on the possession limits and bag limits applying to recreational fishers. A size limit in the form of a "prawn count" applies in the Hunter River (see Table AB17 in Appendix B and section 7(b) of this chapter. This "count" was voluntarily imposed by fishers working in the Hunter River and is now gazetted.

xii) Protected fish

The Regulation identifies a number of species which are protected, either from commercial fishing, or fishing by all sectors.

Protected fish include:

Ballina angelfish
Black rockcod
Eastern blue devil fish
Elegant wrasse
Estuary cod
Macquarie perch
Giant Queensland groper
Green Sawfish
Great white shark
Grey nurse shark
Herbst nurse shark
Weedy seadragon
Australian grayling
Eastern freshwater cod
Trout cod

Fish protected from commercial fishing include:

Atlantic salmon
Australian bass
Black, blue and striped marlin
Blue groper
Brook, brown and rainbow trout
Eel-tailed catfish
Estuary perch
Freshwater crayfish
Silver perch

Fishers in the Estuary Prawn Trawl Fishery are not likely to have any direct or indirect interaction with the majority of the species appearing in the lists above because a large percentage of them are found only in freshwater. Most interaction between the fishery and protected fish are more likely to be through incidental capture of Australian bass, estuary perch and estuary cod.

xiii) Catch limits and quotas

Table B12. Daily bycatch limit as applies to Australian salmon north of Barrenjoey Headland and to tailor in all NSW waters taken by commercial fishing nets.

Commercial fishing activity	Daily possession limit per species (kg)
Hauling crew	100
Meshing crew (or individual)	50
Any other licensed commercial fishing vessel containing a commercial fishing net	50

xiv) Seafood safety programs

Food safety programs which relate to the Estuary Prawn Trawl Fishery are administered by SafeFood Production NSW under the *Food Act 1989*. The aim of these programs is to provide the consumer with seafood free of disease. Currently programs for all commercial fisheries are being prepared by SafeFood Production NSW.

xv) Skipper policy

There are two types of licensed skippers that can operate in the Estuary Prawn Trawl Fishery; general skippers and employee skippers. Skipper endorsements are held by:

(1) licensed persons who were part owners of a fishing business in 1996 and held entitlements in the Estuary Prawn Trawl Fishery or other boat based fisheries

(2) licensed persons who were operating as employed skippers for other fishing business owners in 1996[5].

xvi) Provision for unlicensed crew

The holder of a commercial fishing licence or fishing boat licence endorsed in the Estuary Prawn Trawl Fishery may apply for an authorisation to employ unlicensed crew (commonly referred to as a "block licence") or may employ a person who themselves are registered as crew. A fee for each applies (see section 5(c)(ii) of this chapter).

An application for a crew registration may be refused if the applicant has been convicted of an offence under the Acts or Regulations of NSW, the Commonwealth, other States or Territories, or New Zealand.

A licensed fisher employing crew must maintain records about his/her crew. Information relating to crew must be recorded on the mandatory catch and effort return submitted each month by the licence holder.

xvii) Training licences

Licences are available to eligible persons for the purposes of training a new entrant to the commercial fishing industry. There are two types of training licences available.

Trainer's licence: The seller of a fishing business may apply to continue to hold his/her fishing licence for up to one year to work with the purchaser of the fishing business for the purpose of training the new entrant. Licence conditions apply and the trainer must surrender his/her licence at the end of the one year period unless a further recognised fishing operation (RFO) is acquired.

Trainee's licence: Within six months of acquiring an RFO a new entrant may request that the RFO be placed in abeyance whilst they gain skills working with an experienced fisher. This arrangement may apply for a period of up to two years. The methods and areas that the new entrant may work are limited to those of the new entrant's RFO.

c) Administration

i) Renewal of licences and permits

Commercial fishing licences and fishing boat licences must currently be renewed annually. Fishers are sent renewal application forms approximately one month before the expiry date on their licence. If a commercial fishing licence is not renewed within 60 days of the expiry date on the licence, then the renewal application is taken to be an application for a new licence. Additional fees apply to late renewal applications (see section 5(c)(ii) in this chapter).

[5] 1996 was the year that preceded the commencement of restricted fisheries for the major commercial fisheries in NSW.

Abeyance period for fishing boat licences

Fishing boat licences can be held in abeyance for a period of up to two years from the date of expiry of the licence or when NSW Fisheries is advised in writing by the owner. Fishing boat licence fees are not payable during the period of abeyance, but the full amount due is payable if the licence is reinstated.

ii) Fees

A number of fees are payable in the Estuary Prawn Trawl Fishery. The fees may vary over time to account for changes in the Consumer Price Index. A summary of the cost recovery policy and fees is listed below.

Cost recovery policy

NSW Fisheries recoups costs that are attributable to industry through a cost recovery policy. The cost recovery policy applies to existing services traditionally provided by NSW Fisheries in administering and regulating commercial fishing.

In November 2000, the Government announced a new cost recovery policy. As part of the second reading speech for the *Fisheries Management and Environmental Assessment Legislation Amendment Act 2000,* the Minister for Fisheries, the Hon. Eddie Obeid, gave the following commitment for the fisheries that were moving to category 2 share management fisheries:

"Over the next five years the Government will develop and implement a cost recovery framework for category 2 share management fisheries. This framework will be subject to extensive industry consultation."

"During this period, the total amount of money collected for NSW Fisheries, for its existing management services, will not increase without the support of the relevant management advisory committee."

"After five years, the costs that have been identified as attributable to the industry will be progressively introduced over a further three-year period."

Commercial fishing licences

The following fees are payable on application for issue or renewal of a licence:

New Licence application:

Fee……$416

Contribution to industry costs……....$208

FRDC research levy…….……$115

Licence renewal received within 30 days of expiry:

Fee……...$208

Contribution to industry costs…….$208

FRDC research levy…….…...$115

Licence renewal received more than 30 days after expiry:

Fee……...$312

Contribution to industry costs…….……$208

FRDC research levy……$115

Unlicensed crew……..$52 per crew member.

Fishing boat licences

The following fees are payable on application for renewal of a fishing boat licence:

Renewal application lodged within 30 days after licence expiry:

Boats not greater than 3 metres in length……$42

Boats in excess of 3 metres in length according to the scale hereunder:

Boats over 3 metres but not over 4 metres……..$63

Boats over 4 metres but not over 5 metres……..$84

Boats over 5 metres but not over 6 metres……..$105

Boats over 6 metres but not over 7 metres……..$126

Boats over 7 metres but not over 8 metres……..$147

Boats over 8 metres but not over 9 metres……..$168

etc….for each additional meter or part thereof, add an additional $21.

Renewal application received over 30 days after licence expiry:

Boats not greater than 3 metres in length……$145

Boats in excess of 3 metres in length according to the scale hereunder:

Boats over 3 metres but not over 4 metres……..$166

Boats over 4 metres but not over 5 metres……..$187

Boats over 5 metres but not over 6 metres……..$208

Boats over 6 metres but not over 7 metres……..$229

Boats over 7 metres but not over 8 metres……..$250

Boats over 8 metres but not over 9 metres……..$271

etc… for each additional metre or part thereof, add an additional $21

The fee to replace an existing licensed boat with a new boat is $104, plus the cost of the new boat licence fee, which depends on the length of the boat.

Share management fishery rental charge

The FM Act provides that a rental charge of $100 applies to shareholders in a category 2 share management fishery (irrespective of the number or type of shares held). This charge applied from the commencement of category 2 share management fisheries on 23 March 2001.

Environmental impact assessment charges

Arrangements have been made under Part 5 of the *Environmental Planning and Assessment Act 1979* for recovery of the costs associated with the preparation of the Environmental Impact Statements (EIS). The EIS charge is payable annually for three years and commenced from 1 July 2001. The person is charged for each fishery in which he or she is eligible to hold shares on the scale of $150 for the first two fisheries, then $100 for each fishery thereafter.

A charge of $80 is also payable to contribute to the costs incurred in arranging for the Fisheries Resource Conservation and Assessment Council (FRCAC) to perform its functions in relation to the EIS, commencing from 1 July 2001.

Fishers have the option of paying these charges and the share management fishery rental charge in one or four instalments over the course of each year.

Research levy

An annual fee of $115 is collected upon commercial fishing licence renewal and paid directly to the Commonwealth Fisheries Research and Development Corporation (FRDC) to support funding of fisheries related research programs around Australia. The FRDC has historically supported a number of research programs relating to the Estuary Prawn Trawl Fishery in NSW.

Other transaction fees

There are several other fees payable in the fishery to cover the costs of individual licensing transactions, however, these only apply to the persons utilising these services. An example is the $260 fee payable for the transfer of a fishing boat licence.

iii) Appeals mechanisms

Fishers may lodge an appeal to the Administrative Decisions Tribunal (ADT) against a decision to refuse to issue or renew, suspend, cancel or place conditions on a commercial fishing licence (or an endorsement on that licence) or a fishing boat licence.

The main role of the ADT is to review administrative decisions of New South Wales government agencies. To lodge an appeal with the ADT, a request must first be made to NSW Fisheries for an internal review of the decision, then a written application should be lodged with the ADT no more than 28 days after the internal review is finalised.

The ADT can make various orders concerning an appeal application including:

- upholding the original decision
- reversing the decision completely or in part
- substituting a new decision for the original decision
- ordering the agency to reconsider the decision in light of the ruling.

For further information, refer to the *Administrative Decisions Tribunal Act 1997* or the following website: http://www.lawlink.nsw.gov.au.

d) Research

NSW Fisheries prepared, in 1998, the 'Strategic Plan for Research on the Fisheries Resources of NSW 1998-2003' for the Advisory Council on Fisheries Research (ACFR). The ACFR was at the time one of two peak fishery based research advisory bodies in NSW. The second was the Fishing Industry Research Advisory Committee (FIRAC). Both these bodies have been superseded by a new body called the Fisheries Research Advisory Committee.

The major objectives for the Estuary Prawn Trawl Fishery under the 1998-2003 Research Strategic Plan are:

- to collect scientific information to enable the management of this fishery to be based upon a solid understanding of the status of the major exploited species
- to investigate methods to determine the most efficient fishing techniques for the sustainable management of the estuarine resources.

The current Research Strategic Plan for the Estuary Prawn Trawl Fishery is given in Appendix B8.

Table B13 provides a brief description of the main research programs that relate to the Estuary Prawn Trawl Fishery and that were being done by NSW Fisheries in 2000-01. This is not a comprehensive list of research relevant to the fishery because many other research groups, including universities undertake programs that provide valuable information for use in fisheries management. For example, the University of Sydney is doing research into the biology of squid resources in the Hawkesbury River and in conjunction with NSW Fisheries are designing a trawl net to catch this species.

Table B13. Research programs relating to the Estuary Prawn Trawl Fishery and underway in 2000-01 by NSW Fisheries.

Project title	Funding	Project objectives
Stock assessment of eastern king prawns off NSW	This project is funded by NSW Fisheries and is ongoing	•To develop population models for the eastern king and school prawn resource •To determine optimal biological conditions for harvesting eastern king and school prawns
Studies of the catches of the Clarence and Hawkesbury River trawl fisheries	This project is funded by NSW Fisheries and is ongoing	•To repeat observer-based surveys of the Estuart Prawn Trawl Fishery in the Clarence and Hawkesbury Rivers •To determine whether the relative abundance's and size-structures of those species retained or discarded have changed between the survey done previously and the survey proposed in this project •To assess whether the implementations of BRDs into the estuary prawn trawl nets has been successful at reducing the quantity of incidental catch •To recommend possible management and research strategies for ameliorating any adverse effects on animals by trawling for prawns

Note: Operating funds for these projects were suspended in 2001-02 whilst the Fishery Management Strategy for the Estuary Prawn Trawl Fishery is prepared.

The current research programs are not adequate to provide the information necessary to manage the Estuary Prawn Trawl Fishery in an ecologically sustainable and equitable manner. Consequently, section 6(c) of the draft Chapter C outlines the research that is needed to fill this void.

e) Catch monitoring

Records of commercial catch have been collected in NSW for over 50 years. The forms used by fishers to record catches have changed numerous times over the years (Pease and Grinberg, 1995), and most recently in July 1997. The information collected on commercial landings assists in the ongoing monitoring and assessment of the status of shellfish and finfish stocks.

Fishers in the Estuary Prawn Trawl Fishery are required to submit records on a monthly basis detailing their catch and fishing effort. The information includes catch for each species, the effort expended (for each method) to take the catch, and the area/s fished. This information is entered onto a database by NSW Fisheries and allows for analysis of fishing activity, catch levels and effort levels.

The accuracy of the data provided on catch returns, particularly with respect to fishing effort data, is variable. A number of quality control procedures are in place and attempt to maximise data quality and reliability of the information provided on catch returns. It is, however, inevitable that the accuracy of data supplied by fishers cannot be directly assessed and can sometimes be variable, particularly with respect to fishing effort. Consequently, the commercial catch statistics supplied by fishers and maintained in the commercial catch records database are most accurately described as representing "reported landed catch".

f) Compliance

NSW Fisheries has 94 positions for fisheries officers who are responsible for coordinating and implementing compliance strategies in NSW. These strategies include:

- maximising voluntary compliance
- providing effective deterrence
- providing effective support services.

Sixteen of these fisheries officer positions are located in areas along the NSW coast where the Estuary Prawn Trawl Fishery occurs. Part of their duties include patrols, inspecting commercial fishers and fishing gear and recording rates of compliance. During the period from July 2000 to February 2001 the rate of compliance of commercial fishers in the Estuary Prawn Trawl Fishery was 91%.

Effective implementation of any fisheries management regime requires a compliance framework that leads to optimal levels of compliance within that management regime. According to the Strategic Direction for Australian Fisheries Compliance and Framework for Fisheries Agencies, an optimal level of compliance is defined as:

> *'that which holds the level of non-compliance at an acceptable level, which can be maintained at a reasonable cost for enforcement services while not compromising the integrity and sustainability of the resource.'*

NSW Fisheries manages compliance service delivery for each significant fishing or target program through a district compliance planning process administered within the Fisheries Services Division. Each district fisheries office is responsible for compliance service delivery within a geographical area and develops a district plan based on the particular priorities associated with that area. These priorities vary throughout the State, and may be determined by a focus of certain fishing activities in that area and may also be driven by the existence of areas of importance or sensitive habitat within that area.

The district plan for the location sets out the percentage of available time officers from that office will spend on particular compliance duties. All coastal fisheries offices in NSW focus a set number of resources toward achieving optimal levels of compliance in the Estuary Prawn Trawl Fishery through their business plans. Other target service areas including the recreational fishery, related commercial fisheries and patrolling of fishing closures (whilst carrying out routine duties) all provide indirect compliance benefits for the fishery.

The FM Act and Regulation also provide a number of offences relating to fishing activities that encompass the methods used, and species taken in the Estuary Prawn Trawl Fishery. These offences and the maximum penalties are summarised in Table B14. The table is not a comprehensive list of offences under the FM Act or its regulations, but highlights the offences that are most relevant in the Estuary Prawn Trawl Fishery.

The Regulation lists a number of forfeiture offences for the seizure of boats and motor vehicles. A court may order the forfeiture of these items if it is satisfied that they were used to commit forfeiture offence/s.

Forfeiture offences include:

- Offences under the *Fisheries Management Act 1994*

Section 8	Closure of waters to fishing
Section 17	Bag limits–taking of fish
Section 18	Bag limits–possession of fish
Section 24	Lawful use of nets or traps
Section 25	Possession of illegal fishing gear
Section 247	Obstructing/impersonating a fisheries officer.

- Offences under the *Fisheries Management (General) Regulation 1995*

Clause 111	Use of explosive substances
Clause 113	Use of electrical devices.

- An offence against the *Fisheries Management (Aquatic Reserves) Regulation 1995.*

Table B14. Maximum penalties imposed for major offences in the Estuary Prawn Trawl Fishery.

Offence	Maximum Penalty
Take fish* in contravention of a closure	$22000 and/or 6 months imprisonment
Take prohibited size fish*	$11000 and/or 3 months imprisonment
Take fish* of a prohibited size class	$11000 and/or 3 months imprisonment
Take fish* protected from commercial fishing	$11000 and/or 3 months imprisonment
Use or possess illegal fishing gear	$22000 and/or 6 months imprisonment

Please note that these offences and penalties are the current offences and penalties under the *Fisheries Management Act* and its Regulation (as at April 2001), and apply to both commercial and recreational fishers.

*Note that under the *Fisheries Management Act 1994* the term "fish" refers to marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history (whether alive or dead) and includes any part of a fish. This includes (a) oysters and other aquatic molluscs, (b) crustaceans, (c) echinoderms, and (d) beachworms and other aquatic polychaetes. However, in this Act, fish does not include whales, mammals, reptiles, birds, amphibians or other things excluded from the definition by the regulations.

g) Consultation

There are a range of consultative bodies established in NSW to assist and advise the Minister and NSW Fisheries on fisheries issues. There are committees that are established to provide advice on specific issues as well as bodies to advise on matters, which cut across different fisheries or sectors.

The NSW Government strongly supports consultation with stakeholder groups over changes to fishery management policies and law.

i) Management advisory committees

Share management and restricted fisheries in NSW each have a management advisory committee (MAC) that provides advice to the Minister for Fisheries on:

- the preparation of any management plan or regulations for the fishery
- monitoring whether the objectives of the management plan or those regulations are being attained
- reviews in connection with any new management plan or regulation
- any other matter relating to the fishery.

Table B15 details the membership on the Estuary Prawn Trawl MAC. The industry members of the MAC comprise representatives that are elected by endorsement holders in the fishery (or shareholders in the share management fishery). The members hold office for a term of three years, however the terms of office are staggered by expiring the terms of half of the industry members every 18 months.

The non-industry members on the MAC are appointed by the Minister for Fisheries and also hold terms of office for up to three years. To ensure that all issues discussed by the committee are fairly represented the MAC is chaired by a person who is not engaged in the administration of the FM Act and is not engaged in commercial fishing.

Although the MAC receives advice from NSW Fisheries observers on research, compliance and administrative issues relating to the fishery, only members of the MAC have voting rights on the decisions of the MAC.

Table B15. Membership on the Estuary Prawn Trawl MAC.

Position	Group represented
Independent chairperson	–
Clarence River	Clarence River prawn trawl fishing business owners and endorsement holders
Hunter River	Hunter River prawn trawl fishing business owners and endorsement holders
Hawkesbury River	Hawkesbury River prawn trawl fishing business owners and endorsement holders
Port Jackson	Port Jackson prawn trawl fishing business owners and endorsement holders
Botany Bay	Botany Bay prawn trawl fishing business owners and endorsement holders
Recreational fishing	Recreational fishing interests across all estuaries
Indigenous fishing	Indigenous interests across all estuaries
Conservation	Conservation interests across all estuaries
NSW Fisheries	Government interests across all estuaries
Any others determined by the Minister from time to time	–

ii) Ministerial advisory councils

Four Ministerial advisory councils (MACs) are currently established under the FM Act. These Councils provide advice on matters referred to them by the Minister for Fisheries, or on any other matters the Councils consider relevant. They report directly to the Minister.

The Ministerial advisory councils currently established are the:

- Advisory Council on Commercial Fishing (ACCF)
- Advisory Council on Recreational Fishing (ACoRF)
- Advisory Council on Fisheries Conservation (ACFC)
- Advisory Council on Aquaculture (ACoA).

The Estuary Prawn Trawl Fishery and each of the other share management and restricted fisheries have representatives on the Advisory Council for Commercial Fishing. These representatives are nominated by each of the respective management advisory committees and appointed by the Minister.

Representatives from the commercial fishing industry in NSW, or people who in the opinion of the Minister have expertise in commercial fishing are also represented on the Advisory Council on Fisheries Conservation.

The name and composition of the Ministerial advisory councils are determined by regulations under the FM Act, and may change from time to time.

iii) Fisheries Resource Conservation and Assessment Council

The Fisheries Resource Conservation and Assessment Council (FRCAC) has been established to play a key role in advising the Government on fisheries conservation and assessment throughout the State. The members on the council represent a wide range of interests and includes representatives from commercial fishing, recreational fishing, fish marketing, the fishing tackle industry, charter boat fishing, regional tourism, academic expertise, conservation, aquaculture and Indigenous peoples.

The FRCAC advises the Minister for Fisheries on the preparation and revision of fishery management strategies for fishing activities, including this draft FMS for the Estuary Prawn Trawl Fishery.

The legislated role of the FRCAC includes:

- the preparation or revision of a fishery management strategy, (and for that purpose to review the environmental impact statement prepared in connection with a draft fishery management strategy)
- other matters as may be referred to it by the Minister.

In summary, the FRCAC's duties involve:

- fostering relationships between community groups, recreational fishing interests, commercial fishing interests and government agencies
- advising on the preparation and revision of fishery management strategies
- reviewing environmental impact statements prepared in connection with draft strategies
- providing an opportunity for key stakeholder groups to have input into issues papers prepared for the selection processes of recreational fishing areas
- reviewing community consultation reports that arise from the selection process for recreational fishing.

Both the FRCAC and the ACCF are consultative bodies that facilitate cross-sectoral and cross-fishery consultation, respectively.

The composition and role of the FRCAC are set by the FM Act and it's regulations and decisions by the Minister for Fisheries. These arrangements may change from time to time.

6. Interaction With Other Fisheries and the Environment

a) Interaction with other fisheries

Various fisheries catch prawns at different stages in the prawn life cycle. It is important therefore to carefully balance the exploitation relationships between the fisheries that harvest the resource. School prawns have a life span of approximately 12 to 18 months, and eastern king prawns of between one and two years, possibly even three years. Prawns spawn at sea, and their larvae enter estuaries where they grow to adolescents before migrating back to ocean waters prior to spawning. The three commercial fisheries and recreational fisheries that harvest school and eastern king prawns are therefore fishing the same stocks of prawns, and consequently rely upon management measures in each others fisheries to be responsible for sustaining the resource rather than a particular fishery.

i) Other commercial fisheries

The Ocean Prawn Trawl Fishery relies upon the Estuary General Fishery and Estuary Prawn Trawl Fishery to let sufficient numbers of prawns to escape from estuaries to provide economical numbers of prawns to catch in ocean waters. Conversely, the Estuary General Fishery and Estuary Prawn Trawl Fishery rely upon the Ocean Prawn Trawl Fishery to leave sufficient spawners to produce enough recruits to make fishing for prawns economically viable in the estuaries. For the same economic reasons the estuary general and estuary prawn trawl fishers rely upon one another to leave prawns that are too small to capture.

The over-riding consideration is that sufficient numbers of prawns escape the fishing process to sustain the population. To achieve these goals representatives from the three commercial fisheries, the recreational fishery and conservation groups meet as the "Juvenile Prawn Summit Working Group" to develop common management measures directed toward sustaining the populations of prawns.

A summary of the relative catches between fisheries of school and eastern king prawns and other key species in the Estuary Prawn Trawl Fishery can be found in Appendix B5.

ii) Recreational fishing

A high level of competition over the years between the commercial sector and recreational sector has resulted in a substantial level of ongoing conflict between these groups. Many of the closures with respect to commercial fishing in estuaries have been introduced (many as industry initiatives) to resolve long standing conflict issues.

Recreational fishers harvest school and eastern king prawns in estuarine waters with the use of hand hauled prawn nets, push or scissor nets and dip or scoop nets. There is very little competition between commercial fishers in the Estuary Prawn Trawl Fishery and recreational fishers for prawns in the estuaries within which the fishery takes place. Notwithstanding this, recreational fishers are significant harvesters of prawns in some estuaries in NSW (Montgomery and Reid, 1995) and overall contribute around 5% by weight to the total catch of prawns in NSW. Additional information about the significance of the recreational fishing for prawns will be provided from the results of the National Recreational and Indigenous Fishing Survey, which will be completed in late 2001. Preliminary results from this survey also shows that substantial quantities of prawns are caught by recreational fishers

together with significant quantities of blue swimmer crabs and squid. All these species are either target or byproduct species in the Estuary Prawn Trawl Fishery (see Tables C16 and C17 in Chapter C).

The main conflict between the Estuary Prawn Trawl Fishery and the recreational fishing sector comes from recreational fishers concerns about the incidental catch of the prawn trawl fishery. This incidental catch contains some species which are targeted by recreational fishers including; sand whiting, yellowfin bream, tarwhine, snapper, leatherjacket, flounder, flathead, tailor, and mulloway. These species occur in estuaries for varying times as both juveniles and adults and are caught primarily in the juvenile stages by the Estuary Prawn Trawl Fishery. The initiatives Clarence River fishers have taken to address the issue of bycatch are discussed in section 6(b) of this chapter.

The Government has recently initiated a program that will provide a program where revenue from the new general recreational fishing licence will be used to create recreational fishing areas, and financial compensation will be paid to commercial fishers in exchange for their fishing entitlements. The aim of this program is to increase recreational fishing opportunities.

Under this program the Botany Bay Estuary Prawn Trawl Fishery will close in May 2002 and financial compensation will be paid to those fishers effected.

iii) Aquaculture

The aquaculture industry in NSW is currently dominated by oyster farming, which is valued at approximately $30 million per year. A range of other freshwater and marine species (finfish, shellfish and crustaceans) are farmed, mostly in land-based facilities (collectively valued at an additional $11.5 million/year).

There are few direct interactions between aquaculture operations and the Estuary Prawn Trawl Fishery. Competition in the market place and competition for space within the estuary are the two main interactions.

Prawn farming

Prawn farming is the most valuable land based aquaculture sector in NSW, and is worth approximately $7 million annually. All producing farms are located on either the Clarence or Richmond Rivers.

Black tiger prawns (*Penaeus monodon*) are used as broodstock in aquaculture, and juveniles are sourced from North Queensland and local hatcheries. Over the past few seasons, NSW hatchery production of black tiger prawns has not been sufficient to stock all NSW prawn farms. To accommodate the shortfall, prawn larvae have been imported from Queensland. All live prawn imports from interstate must comply with strict importation permit conditions, which address disease and other translocation concerns.

Prawns from farms can possibly make their way into natural waterways. Once in the wild, farmed prawns may compete for food and habitat with the natural stocks of school, eastern king and brown tiger prawns. Escaping prawns may also introduce diseases into wild populations. It is important therefore, that aquaculture development is appropriately managed.

Most prawn farms in NSW discharge effluent into adjacent estuaries. The Environment Protection Authority (EPA) strictly regulates the discharge of effluent. All fish farms that discharge to waterways require a licence under the *Protection of the Environment Operations Act 1997*.

Sustainable Industry Development

The NSW North Coast Sustainable Aquaculture Strategy applies to the coastal catchments from the Manning River, north to the Tweed River. The strategy was recently developed by the NSW Government as a planning document to streamline approvals for aquaculture development proposals in the north coast region. It provides a mechanism for sustainable industry development on the north coast. Proposed developments are assessed in accordance with level of environmental risk. The strategy promotes the use of best practice aquaculture principles by the industry. It is being used as a model to develop parallel strategies for the rest of the State, including estuarine and near off-shore waters.

b) Species interactions

A number of the species taken in the Estuary Prawn Trawl Fishery are of significant importance in other commercial and recreational fisheries. Some of these species such as prawns constitute a large percentage of the catch in other commercial fisheries and the recreational fishery. Other species are the future recruits of populations of commercial and recreational importance.

Estuaries along the NSW coast also provide a nursery area for a number of species that become principal species in other fisheries later in their lifecycle. The Estuary Prawn Trawl Fishery catches large quantities of some of these species during the juvenile phase of their life cycles. Snapper and mulloway are examples of this interaction with large populations of juveniles residing in estuaries and these animals forming part of the bycatch of prawn trawls. The Estuary Prawn Trawl Fishery also catches species such as herrings and silver biddies that are part of the diet of other species.

Fishers in the Estuary Prawn Trawl Fishery are constantly seeking ways to significantly reduce their catch of species besides prawns. Fishers in the Estuary Prawn Trawl Fishery in the Clarence River recently relinquished the right to retain for sale species that have a legal minimum length (this includes yellowfin bream, tailor, flathead and mulloway) and have implemented an incidental catch ratio rule (ratio of weight of incidental catch to weight of prawn species) to minimise the catch of incidental species. They have inserted BRDs into their nets and configure their trawling gear to have minimum impact upon the substrate.

c) The estuarine ecosystem and its management

This section provides a brief overview of estuarine habitats and their ecological importance. A more comprehensive review of the habitat types important for the long term sustainability of the Estuary Prawn Trawl Fishery is included in section 1 of Chapter F. Table B16 provides a summary of the geological features and human land uses of the five estuaries in which prawn trawling takes place.

i) NSW coastal climate

The climate of South-East Australia is primarily influenced by a mixture of mid latitude (frontal) and sub tropical (anti cyclonic) weather systems. Long-term variations (spanning several years) due to major shifts in ocean temperatures and wind patterns across the tropical Pacific Ocean are also important (e.g. El Nino).

Rainfall, though relatively high along the coast and nearby ranges, is notoriously variable. Coastal rainfall is enhanced by the prevalence of onshore winds for much of the year, the presence of the Great Dividing Range and by the relatively warm offshore ocean temperatures associated with the

East Australian Current. Sea level rises (discussed later in this discussion) may also have an effect on water temperature.

Rainfall is markedly seasonal on the north coast with most falling in the first six months of the year. In general, the overall amount of rainfall also decreases from north to south however, significant departures from this trend do occur as a result of local topography. An example is the relatively high rainfall along the Illawarra escarpment south of Sydney.

In terms of temperature and humidity, coastal NSW is split between two climatic zones: "warm humid" in the north (from about Port Stephens) and "temperate" in the southern half (Australian Bureau of Meteorology, www.bom.gov.au). Whilst temperature extremes are therefore rare, occasional winter frosts and summer heatwaves do occur, particularly away from the coast.

The larger estuaries are likely to experience considerable gradients in water temperature, with upper reaches being considerably warmer in summer and cooler in winter. Water temperatures within the lower reaches of such estuaries are seasonally 'dampened' by a combination of oceanic influences, including relatively constant ocean water temperatures, tidal mixing and the sea breeze effect.

These gradients, and in particular their seasonal variations, are likely to have a significant influence on the seasonal movement of fish within the larger estuaries, and would consequently be expected to affect fishery operations.

The issue of climate change is relevant to the Estuary Prawn Trawl Fishery, particularly in the medium to long term. Current projections suggest that globally average surface air temperatures will rise by between 1 and 5.8 degrees Celsius by the year 2100 as compared with 1990 (IPCC, 2001a). Global mean sea level is likewise projected to rise by between 9 and 95 cm. Changes in rainfall patterns are also likely, with extreme events such as floods and droughts becoming more common.

The magnitude and nature of these changes will vary between different regions, and whilst temperature increases in south east Australia are expected to be less than those faced by much of the northern hemisphere, significant effects on local estuaries and their biota are likely. Possible increases in summer rainfall (particularly in terms of extreme events such as intense east coast lows) are likely to affect the salinity regimes of all estuaries and the opening behaviour of coastal lagoons. Any increased tendency for entrance opening or low level flooding may also be exacerbated by the predicted rise in sea levels.

The projected changes are liable to cause significant shifts in the characteristics of estuaries, and therefore their biota, at least in the long term. Certain habitats, particularly saltmarshes and mangroves, are at risk in terms of their extent and productivity (IPCC, 2001b). The anticipated rate of climate change, coupled with existing stresses due to pollution and habitat alteration, is likely to make it difficult for ecosystems or species to adapt (IPCC, 2001b). Potential changes to fish stocks are difficult to predict. Furthermore, there remains much uncertainty about the extent of future climate change and sea level rise (see section 10 in Chapter F).

Table B16. Environmental features of the five trawled estuaries in NSW.

("✓" = feature present and "—" = absence of feature in estuary)

			HYDROGRAPHIC ZONES									
ESTUARY	**CATEGORY**		**FRESH WATER ZONE**	**ESTUARINE ZONE**				**SEAGRASS**		**MAIN CATCHMENT LAND USE**		
	Barrier Estuary	Drowned River Valley		Riverine Channel	Fluvial Delta	Central Mud Basin	Marine Tidal Delta	Posidonia	Zostera	Industrial	Urban	Rural
Clarence River	Mid stage	–	√	√	√	–	√	–	√	–	–	√
Hunter River	Mid stage	–	√	√	√	–	√	–	–	√	√	√
Hawkesbury River	–	Mature stage	√	√	√	–	√	–	√	√	√	√
Parramatta River (Port Jackson)	–	Immature stage	NA (weir)	√	√	√	√	√	√	√	√	–
Georges River (Botany Bay)	–	Immature stage	NA (weir)	√	√	√	√	√	√	√	√	–

ii) Estuarine habitats

Estuaries are partially closed bodies of water characterised by brackish water derived from the mixing of oceanic and fresh waters. Three main types of estuary are recognised in NSW: drowned river valley, barrier estuary and intermittent lagoon (more recently known as an ICOLL, intermittently closed and open lakes and lagoons). Further, and irrespective of type, when sea level stabilised 6,500 years ago all estuaries had four geological zones: marine tidal delta, central mud basin, fluvial delta and riverine channel. Estuarine infilling takes place at different degrees depending on the size of the catchment, soil type, and rainfall. The central mud basin in the Clarence and Hunter Rivers (barrier estuaries) and Hawkesbury River (drowned river valley) is now completely filled. The Parramatta and Georges Rivers, also drowned river valleys, are in an evolutionary younger stage as their central mud basins are not yet filled. NSW Fisheries is presently conducting investigations on fish diversity and abundance in these estuarine zones.

Estuaries along the NSW coast are complex habitats originally determined by the physical factors mentioned above but also by chemical and biological processes. These habitats are interrelated and include floodplains, sandy, muddy and rocky shorelines, shallows and deep holes. Habitat complexity is in turn enhanced by many vegetation communities including melaleuca and tea tree forests, reed beds, saltmarsh, mangrove, seagrass and kelp. Some habitats, for example seagrass beds exposed to storm waves, may show large variability in space and time whereas others may be relatively stable (NSW Fisheries, 1999).

Apart from trawling, each of the trawled estuaries is subject to varying degrees of impacts as a consequence of human population and development pressures. These pressures include: (i) land clearing; (ii) contaminants from agriculture, industry, effluent and runoff; and (iii) reduced stream flows. Such pressures impact upon the environment by reducing habitat and water quality. The catastrophic fish kills in the Macleay and Richmond Rivers in March 2001 and the long fishery closures that were a necessary consequence were an example of the devastation caused by natural high rainfall events in degraded catchments. A more detailed assessment of the impacts on the fishery from activities external to the fishery is provided in section 10 of Chapter F.

iii) Biodiversity in estuarine ecosystems

Estuaries support a wide variety of fish and invertebrates, and provide a range of key habitats – including seagrasses, mangroves and sheltered rocky reef (West *et al*., 1985; Bell and Pollard, 1989; NSW Fisheries, 1999b).

Estuaries provide abundant food and excellent shelter, and represent critical nursery areas for many species of importance to commercial and recreational fisheries (Blaber and Blaber, 1980; SPCC, 1981a,b; Bell and Pollard, 1989; McNeill *et al*., 1992; Gray *et al*., 1996). They are also used as feeding areas by the adults of many such species (SPCC, 1981b).

Estuaries and their immediate surrounds also support a wide variety of wildlife, particularly in less developed areas. Associated habitats such as mud flats, mangroves, saltmarsh and casuarina forest provide food, shelter and breeding sites for a variety of terrestrial animals including insects, reptiles, mammals and, especially, birds. The specialised nature of these habitats ensures that estuaries make a significant contribution to terrestrial biodiversity.

iv) Habitat management

The importance of maintaining healthy fish habitat in ensuring the long term sustainability of shellfish and finfish stocks is understood and well recognised. Fish habitat is vulnerable to catchment uses that result in reduced water quality through increased runoff, turbidity and/or pollution.

Proper management of land-based catchment uses is essential to the long term survival of shellfish and finfish habitat and stocks.

The FM Act provides for the protection of shellfish and finfish habitats. These provisions can be found in Part 7 of the FM Act, and the primary habitat related provisions of this part are:

Habitat protection plans - which allow for the preparation and gazettal of management plans for the protection of specific aquatic habitats. NSW Fisheries has gazetted two plans under this provision. The first of these plans summarises various protective measures in the FM Act, but also protects 'snags' such as fallen trees and logs. The second plan deals specifically with the protection of seagrasses. A further plan on the Hawkesbury Nepean River system has recently been completed.

Aquatic reserves - which allow for the creation and management of aquatic reserves.

Dredging and reclamation – which allows for the control and regulation of dredging and reclamation activities which may be harmful to shellfish and finfish and their habitats. It establishes requirements to obtain a permit from, or consult with NSW Fisheries.

Protection of mangroves and certain other marine vegetation – which allows for the regulation of damage to, or removal of, certain marine vegetation. At this stage, mangroves, seagrasses and macroalgae (seaweed) are the only forms of marine vegetation protected in this way. A permit is required to remove or damage marine vegetation.

Noxious shellfish and finfish and noxious marine vegetation – which allows for the declaration of undesirable shellfish and finfish and marine vegetation as noxious. Once declared noxious these shellfish and finfish or vegetation may be liable to be seized and destroyed.

Release or importation of shellfish and finfish – which allows for the control of the release, import, sale or possession of shellfish and finfish not originating from NSW waters. The purpose of this provision is to prevent the spread of disease and the introduction of undesirable species. A permit is required to import shellfish and finfish into, or release them in, NSW waters.

Miscellaneous (including fish passage) – which provides for the free passage of fish past barriers such as dams and weirs. This facilitates the installation of fishways, and/or implementation of appropriate operational procedures for weirs.

While the FM Act provides NSW Fisheries with a number of tools to control the direct effects of certain activities on aquatic habitats, some impacts upon habitat arise from past and present land and water management practices. Water quality and quantity has a significant influence on the distribution and abundance of aquatic vegetation, and increased siltation can result in the loss of deep pools, and the smothering of seagrasses and snags.

Other legislation is in place, such as the *Environmental Planning and Assessment Act 1979*, to ensure that all environmental impacts are taken into account during the approval of new developments or alterations of existing developments. Development applications, which have the potential to harm shellfish and finfish or their habitat, are referred to NSW Fisheries for comment or recommendations.

In 1999 NSW Fisheries published an updated version of Policy and Guidelines Aquatic Habitat Management and Fish Conservation. The document aims to improve the conservation and management of aquatic habitats in NSW and is targeted at local and State government authorities, proponents of developments and their advisers, and individuals and organisations concerned with planning and management of aquatic resources, including conservation organisations.

There are a range of other whole-of-government programs underway to manage the environmental problems across catchments and to enable the consideration of flow on effects from activities undertaken in an area. These include:

- the Coastal Council of NSW
- the Healthy Rivers Commission
- total catchment management, involving catchment management boards
- water reform
- improving community access to natural resource information
- acid sulphate soils management.

v) Marine protected areas

NSW is committed under international, national and state agreements to conserve marine biodiversity and manage the ecologically sustainable use of shellfish and finfish and marine vegetation. A key component of these commitments is to establish a system of marine protected areas, which adequately represent the biodiversity found in the oceans and estuaries of Australia.

Marine protected areas preserve many different types of marine environments, and the animals and plants that live in them. 'No take' marine protected areas allow for shellfish and finfish to spawn and grow with minimal human interference, provide unspoilt natural sites for people to visit, and offer representative areas for education and research.

The NSW system comprises a number of distinct types of marine protected areas and these are discussed below.

Marine parks

Marine parks are areas of coastal, estuarine or oceanic waters and adjoining lands permanently set aside to protect the organisms, including plant life, shellfish and finfish species, birds and other animals that live in that environment. Marine parks are managed to effectively conserve biodiversity and associated natural and cultural resources, while still allowing for the sustainable use and enjoyment of these areas by the community. Marine Parks have been declared for:

Lord Howe Island

Solitary Islands

Jervis Bay.

A marine park has been proposed also for Byron Bay and community consultation is continuing over this proposal.

The community has a vital role in the management of marine parks. Community input is provided at two levels – at the state-wide level through the Marine Parks Advisory Council, and at the local level through advisory committees established for each park.

Aquatic reserves

Aquatic reserves are administered by NSW Fisheries and play an important role in conserving biodiversity and protecting significant marine areas. Eight aquatic reserves have been declared in NSW and each aquatic reserve is unique, with the type of protection varying throughout the reserves. In some areas, diving and observing are the only activities permitted whilst in others, activities such as recreational angling is allowed.

The eight aquatic reserves already declared include:

- Julian Rocks off Byron Bay (approx. 10 hectares)
- Fly Point in Port Stephens (approx. 75 hectares)
- Long Reef off Dee Why (approx. 60 hectares)
- North (Sydney) Harbour near Manly (approx. 75 hectares)
- Towra Point in Botany Bay (approx. 333 hectares)
- Shiprock near Port Hacking (approx. 3 hectares)
- Cook Island off Tweed Heads (approx. 12 hectares)
- Bushrangers Bay south of Wollongong (approx 3 hectares).

Intertidal protected areas

Intertidal protected areas (IPAs) were created at 14 locations around Sydney in July 1993. They extend from the mean high water to 10 metres seaward, beyond the mean low water. The IPAs around the Sydney area include:

Barranjoey Headland	South of Bondi Beach
Bungan Head	Bronte south to Coogee
Mona Vale Headland	Long Bay
Narrabeen Head	La Perouse
Dee Why Head	Inscription Point
Shelly Beach	Boat Harbour
Sydney Harbour	Cabbage Tree Point.

Intertidal protected areas prohibit the collection of some invertebrates from within those areas. These invertebrates include crabs, snails, cunjevoi, octopus, sea urchins, anemones, pipis, cockles, mussels, oysters, and nippers (saltwater yabbies).

The 14 IPAs outlined above have been chosen to preserve and protect the intertidal animals and habitat, and may act as reservoirs to repopulate other areas. Recreational and commercial fishing is permitted adjacent to IPAs whilst commercial rock lobster and abalone fishing is permitted within these areas. Bait must not be gathered from within the designated areas.

Marine or estuarine components of national parks or nature reserves

There are currently 35 national parks or nature reserves dedicated or reserved under the *National Parks and Wildlife Act 1974* that contain marine protected areas. These areas adjoin terrestrial based National Parks and are administered by the NSW National Parks and Wildlife Service.

d) Stakeholders

There are a significant number of stakeholders in the Estuary Prawn Trawl Fishery as it operates in estuary waters which are accessible and visible, and used by many other people for a diverse array of recreation activities.

i) Commercial fishers

The primary stakeholders in the Estuary Prawn Trawl Fishery are the 289 fishing business owners with entitlements to operate in the fishery.

Commercial fishers clearly have the greatest direct stakeholding in the management strategy as it affects how they operate and, ultimately, the amount of income received from fishing. A well managed, sustainable fishery will provide ongoing financial benefits to commercial fishers, their families and the community well into the future.

There is a diverse level of participation within the fishery ranging from fishers who work full-time and solely in this particular fishery, to licence holders who engage in alternative forms of employment and only fish during peak periods, if at all.

Commercial fishers provide an important service to that part of the community who enjoy eating seafood and who are either unable or unwilling to venture out and catch fish themselves. Seafood provided by estuary prawn trawl fishers is often fresh because it is landed daily and the fishing activity is generally carried out close to population centres. Estuary prawn trawl fishers also supply significant quantities of bait, including species such as prawns and squid, that is bought and used by recreational fishers.

The knowledge of estuary prawn trawl fishers about the stocks of animals that they target and the environment in which they operate assists considerably in the assessments of stocks of finfish and shellfish and in the maintenance of the estuarine environment.

ii) Recreational fishers

Recreational fishing for prawns is a popular pastime in NSW and preliminary results from the National Recreational and Indigenous Fishing Survey done in 2001 suggests that of the one million recreational fishers in this State approximately 30,000 people fish for prawns each year. The results from this survey also suggested that the numbers of prawns caught by recreational fishers were the highest of any species. Recreational fishing for prawns occurs only in estuaries. It is carried out by wading, from boats and from wharfs, jetties or the foreshore.

There is no information about the capacity of the recreational fishery in estuaries where trawling is permitted. Notwithstanding this, the recreational fishery is a significant harvester of prawns in some estuaries in NSW (Montgomery and Reid, 1995) and overall contributes around 5% by weight to the total catch of prawns in NSW. Montgomery and Reid (1995) found that recreational fishers caught mainly eastern king prawns though significant catches of school prawns were taken in some

estuaries, and that the sizes of prawns in catches did not vary between commercial and recreational fishers.

Recreational fishers also take squid, trumpeter whiting and octopus, however these species are believed to be taken in relatively low quantities. A number of recreational fishers use bait, in particular school prawns and squid, that are harvested in the Estuary Prawn Trawl Fishery. A large number of recreational fishers are also consumers of seafood harvested by the Estuary Prawn Trawl Fishery.

Recreational fishers are interested in the impact of trawling on species of recreational importance and on the habitats that support the ongoing recruitment of these species. With this in mind, commercial fishers in the Clarence River assisted in the recent introduction of a restriction which prevents the landing of shellfish and finfish that are subject to a minimum size class, which included many of the species targeted by recreational fishers. This restriction now applies to all estuary prawn trawlers. The introduction and further development of BRDs in prawn trawl nets also aims to minimise the impact of trawling on species important to recreational fishers.

Recreational fishers are acknowledged as stakeholders in the Estuary Prawn Trawl Fishery and for this reason are represented on the MAC. The recreational fishing representative on the MAC has full voting power and equal privileges to the commercial fishing, conservation and Indigenous representatives.

iii) Indigenous people

Indigenous people are also stakeholders in the Estuary Prawn Trawl Fishery. There are Indigenous people who have traditionally caught and continue to catch prawns in for consumption, trade or barter within their communities.

NSW Fisheries is in the process of developing an Indigenous Fisheries Strategy which will lead to the development of a range of initiatives and programs to facilitate Aboriginal fishing in NSW. The aim of the Indigenous Fisheries Strategy is to focus on:

- Indigenous peoples interests in fisheries, including customary marine tenure and traditional fishing practices
- the extent of Indigenous people's involvement in management of fisheries and the marine environment
- impediments to Indigenous people's participation in commercial fisheries and mariculture operations
- the impact of commercial fishing on fishing for traditional purposes
- cultural awareness and improved relations between Indigenous people's and other stakeholder groups.

The exact number of Aboriginal people directly involved in this fishery is not presently known. Similarly, there is no information on the number of Aboriginal fishers who participate in recreational fishing activities, however such information is being collected as part of the National Recreational and Indigenous Fishing Survey.

In 1997, NSW Fisheries conducted a small survey on Aboriginal coastal fishing. The survey showed that Aboriginal people fished regularly and that they often fished to feed large or extended families. When certain circumstances exist, the Minister for Fisheries may issue a permit under the FM

Act that authorises Aboriginal people to meet specific cultural obligations with respect to traditional fishing.

As stakeholders in the Estuary Prawn Trawl Fishery, Indigenous people are represented on the Estuary Prawn Trawl MAC. The Indigenous representative on each MAC has full voting power and equal participation to the commercial fishing, conservation and recreational representatives.

iv) Conservationists

Conservationists are a stakeholder in the resources harvested by the Estuary Prawn Trawl Fishery. They have a broad interest in conservation of biological diversity, habitats and species. Some conservationists also fit into the category of 'divers' who enjoy seeing a wide range of species and habitat without having any desire to harvest it.

Conservationists place a significant value on non-consumptive uses of the resource. The interest may simply be to be confident that the aquatic resources impacted upon by the Estuary Prawn Trawl Fishery are being managed in a way that will ensure that these are conserved for future generations.

The Nature Conservation Council of NSW (NCC) is the peak umbrella organisation for around 130 conservation and environment groups in New South Wales. The NCC has a representative on the Estuary Prawn Trawl MAC with full voting power and equal participation to the commercial fishing, recreational and Indigenous representatives.

The goals of the NCC are to conserve the environment of NSW. Specifically, the Council aims to conserve and protect:

- the diversity of living plants and animals in NSW, especially rare and threatened species
- NSW unique ecosystems, from the western arid lands to the eastern coastline
- the environmental quality of NSW land, air, waterways, and adjacent sea, and of the urban environment.

The conservationist interest in the Estuary Prawn Trawl Fishery might extend from concerns over the sustainability of the prawn resources and the primary and byproduct species, the effects of trawling on habitat, non-target species and threatened species. As in all trawl fisheries there is likely to be particular concern about the amount of discards compared to the total landings, and about the effectiveness of bycatch reduction devices.

v) The community

The fisheries resources of NSW are owned by the community at large. The Minister for Fisheries is responsible for the legislation under which fisheries are managed and the development and implementation of government policy in relation to fisheries.

The community includes people with interests in one or more of the stakeholder groups discussed above. The other group in the community having a stakeholding in the fishery is the fish eating public.

Yearsley *et al*. (1999) notes that Australians are beginning to understand the health benefits of eating seafood and the fact that it is generally widely available and quick and easy to prepare. It is also estimated that 60% of the seafood consumed in Australia is imported from overseas, leaving 40% to be supplied from domestic fisheries.

It is important to acknowledge the demand generated by the broader community to access seafood products harvested by the commercial fishing industry.

vi) Fisher based organisations

There are a number of fishermen's co-operatives in NSW that provide services for fishers in this fishery. The major co-operatives are the Clarence River Fishermen's Co-operative (Maclean), Newcastle District Fishermen's Co-operative (Newcastle) and Hawkesbury River Fishermen's Co-operative (Brooklyn).

The co-operative system is not only important for fishers in terms of a way of distributing catch and selling shellfish and finfish taken in the fishery, but also provides a link for communication within industry, and between industry and other organisations, including NSW Fisheries.

A number of other fisher based organisations exist in NSW including the Northern Professional Fisherman's Association, Master Fish Merchants Association, Metropolitan Fishermen's Association, Australian Seafood Industry Council, New South Wales Seafood Industry Council, Oceanwatch and Profish NSW.

vii) Marketing

The *Fisheries Management Act 1994* places restrictions on the marketing of shellfish and other species taken in commercial fisheries. Shellfish and other species taken by a commercial fisher when using a commercial fishing boat or commercial fishing gear are deemed by the FM Act to have been taken for sale.

Prior to 1999, commercial fishers were required to sell their catch through a recognised market, being either the Sydney Fish Market or a Fisherman's Co-operative trading society. In areas not serviced by a recognised market the fisher could sell his catch to a Certificate of Exemption (COE) holder, or direct to the public if the fisher held a consent under the FM Act. Consents were issued to fishers who were able to show they resided a certain distance from a recognised market, or that the market did not cater for their product (e.g. live prawns).

Under the regulated marketing system prior to 1999, there were 22 Fisherman's Co-operatives, 45 COE holders and 154 consent holders that serviced New South Wales. In November 1999, this marketing system was replaced by a deregulated system of fish receivers. The Sydney Fish Market remained but Co-operatives and COE holders were granted Registered Fish Receiver (RFR) certificates and consent holders were granted Restricted Registered Fish Receiver (RRFR) certificates. Commercial fishers of the Estuary Prawn Trawl Fishery do not require an RRFR to sell their own catch directly to the public for that person's consumption.

Under deregulation any person, commercial fisher, business or company may apply for a Fish Receiver certificate. These new registered fish receivers are now servicing areas that previously had no local market structure. New markets in the Shoalhaven and Hastings areas are examples of the new deregulated regime.

Little of the landings from the Estuary Prawn Trawl Fishery are exported. However, the fishery is affected by other markets through the price that is paid in NSW for prawns. When there is an over supply of prawns on international seafood markets and prawns that are normally exported from fisheries in other states in Australia are imported onto markets in NSW, then the price paid for local

prawns may fall. The price paid for locally caught prawns is also affected by the large quantities of prawns that are imported into Australia each year.

7. Estuary Specific Information

a) Clarence River

i) Stocks of shellfish and finfish

The target species in the Estuary Prawn Trawl Fishery of the Clarence River is school prawns *Metapenaeus macleayi* (see Figure B4). In addition, the fishery takes a quantity of a small number of non target species that are caught as part of the prawn trawl operation and which have significantly contributed traditionally to the marketed catch of the fishery. These are referred to as byproduct species (see Table B17).

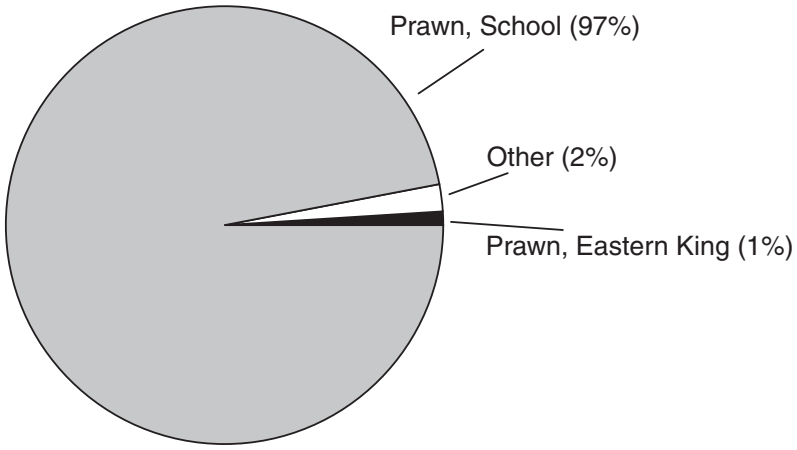

Figure B4. The mean proportion of the most abundant (by weight) species in the annual reported landings for 1997-98 and 1998-99 from the Estuary Prawn Trawl Fishery in the Clarence River.

Note the "other" category contains species that made up less than 2% of the landings.

The fishery also catches a wide range of other species that are returned to the water and these are referred to as bycatch. Appendix B1 gives a detailed list of the species caught during an observer study of the Estuary Prawn Trawl Fishery of the Clarence River (Liggins and Kennelly, 1996).

Table B17. Byproduct species of the Estuary Prawn Trawl Fishery in the Clarence River and the average proportion each species comprised in the annual reported landings for 1997-98 and 1998-99.

Quantities marked with a "-" comprised less than 0.01% of the total annual reported landings.

Common name	Species or family name	Percentage of Total Catch
Catfish, estuary	PLOTOSIDAE	0.11
Catfish, forktailed	*Arius graeffei*	0.01
Catfish, unspecified	PLOTOSIDAE	0.06
Cockle	*Katelysia spp. / Anadara spp.*	–
Crab, blue swimmer	*Portunus pelagicus*	0.01
Crab, mud	*Scylla serrata*	0.18
Eel, conger	*Conger wilsoni*	–
Eel, longfin river	*Anguilla reinhardtii*	0.1
Eel, pike	*Muraenesox bagio*	–
Eel, shortfin river	*Anguilla australis*	0.05
Eel, unspecified	–	–
Flounder, unspecified	BOTHIDAE	–
Garfish, river	*Hamporhamphus regularis*	0.01
Garfish, sea	*Hyporhamphus australis*	–
Garfish, shortbill	*Arrhamphus sclerolpis*	0.01
Longtom	TYLOSURUS	–
Mullet, fantail	*Liza argentea*	–
Mullet, sand	*Myxus elongatus*	0.01
Mulloway	*Argyrosomus hololepidotus*	0.04
Octopus	OCTOPODA	–
Old maid	*Selenotoca multifasciata*	0.06
Pilchard	*Sardinops neopilchardus*	–
Prawn, greasyback	*Metapenaeus bennettae*	0.02
Prawn, tiger	*Penaeus esculentus*	0.09
Scallop	Family Pectinidae	0.08
Shark, black tip	*Carcharhinus spp.*	0.08
Silver biddy	*Gerres subfasciatus*	0.04
Squid	*Loliolus spp.*	–
Squid, arrow	*Nototodarus gouldi*	0.01
Tailor	*Pomatomus saltatrix*	–
Trevally, silver	*Pseudocaranx dentex*	–
Whiting, trumpeter	*Sillago maculata*	0.01

ii) Catch information

Patterns in the reported landings and value of individual species in the catch of the Estuary Prawn Trawl Fishery in the Clarence River can be found in Table B18.

Table B18. Weight (kg) and value ($) of the reported landings of catch for the Estuary Prawn Trawl Fishery on the Clarence River in 1998-99 and 1999-2000.

Common Name	1998-1999		1999-2000	
	Weight (kg)	Value ($)	Weight (kg)	Value ($)
Eastern king	4,124	170,967	749	15,137
School	288,927	2,043,612	334,640	2,279,752
Tiger	317	*4874	-	-
Blue swimmer crab	28	124	2	14
Squid	31	80	-	-
Octopus	10	28	-	-
Finfish	6,928	30,140	1,861	7,881
Total	**300,365**	***2149825**	**337,252**	**2,302,784**

NOTE: Values were calculated using the average price provided by industry members on the Estuary Prawn Trawl MAC. Values not marked with a "*" were calculated using the average monthly price paid for the species at auction at the Sydney Fish Market.

iii) Existing management strategy

The estuary is managed by a suite of input controls which have been complemented by industry compiling their own set of additional fishing rules. These fishing rules have previously been gazetted as the management rules for the fishery and are summarised in the following sections.

Area of operation

The mouth of the Clarence River is located on the north coast of NSW, between the coastal townships of Yamba and Iluka. The river has a large number of islands separated by numerous deep and shallow channels and creeks. The main arm is navigable for 80 kilometres through Grafton upstream to Copmanhurst and stretches over 200 kilometres to South East Queensland. A number of smaller rivers and streams feed into the main river from The Great Dividing Range.

Trawling for prawns is permitted between the mouth of the estuary and the wires of the vehicular ferry at Ulmarra and includes Lake Wooloweyah, a large, shallow coastal lagoon which lies to the south of the river entrance and is linked by narrow channels to the main estuary. A second large, shallow lagoon "The Broadwater" west of Maclean township was closed to trawling by industry request, in the mid-1990s to protect juvenile prawns and finfish, and the extensive seagrass beds present (see Figure B5).

Periods when trawling is permitted are shown in Table B19 and commences in early October in Lake Wooloweyah and in early December in the river with both areas closing at the end of May the following year. Taking into account night, winter and weekend closures approximately 22% of the total time (hours) in a year is available for operators to work.

Table B19. Times when prawn trawling is permitted in the Clarence River.

(The following table is a summary of the current closures to prawn trawling and is to be used as a guide only. The local fisheries office should be consulted for the most recent closure notices as these are frequently modified).

Estuary	Periods when trawling is permitted
Clarence River	From 8am to 6pm on Monday, and 7am to 6pm on each of the days Tuesday to Friday (inclusive) and from 7am to 9am on Saturday, each week during the period from Monday nearest 1 December in each of the years 1999 to 2004 inclusive, to Friday nearest the 31 May in each succeeding year.
The waters of Lake Wooloweyah	From 8am to 6pm on Monday, and 7am to 6pm on each of the days Tuesday to Friday (inclusive) and from 7am to 9am on Saturday, in each week during the period from the first Tuesday on/or after 1 October in each of the years 1999 to 2004 inclusive, to the Friday nearest 31 May in each succeeding year.

Limited Entry

There are a total of 123 entitlements to trawl in the Clarence River and Lake Wooloweyah. Three of these entitlements are to trawl in Lake Wooloweyah only. There are many inactive and seldom used prawn trawl entitlements in this estuary of the fishery (see Table B10).

Types of boats used

Vessels used in the Clarence River are of both planing and displacement hull designs though the majority fall into the latter category (displacement hulls). Some of these vessels are also used to fish in other fisheries such as the Ocean Prawn Trawl, Estuary General and Ocean Trap and Line fisheries. Table B2 summarises the characteristics of the vessels in each estuary.

Boat replacement policy

Clarence River prawn trawlers are subject to specific vessel and engine capacity restrictions. A Clarence River prawn trawler may be replaced, but within any ten year period the length, depth or breadth must not increase by more than 10%. Similarly, within any ten year period the engine must not be replaced or modified so as to increase the power rating by more than 10%.

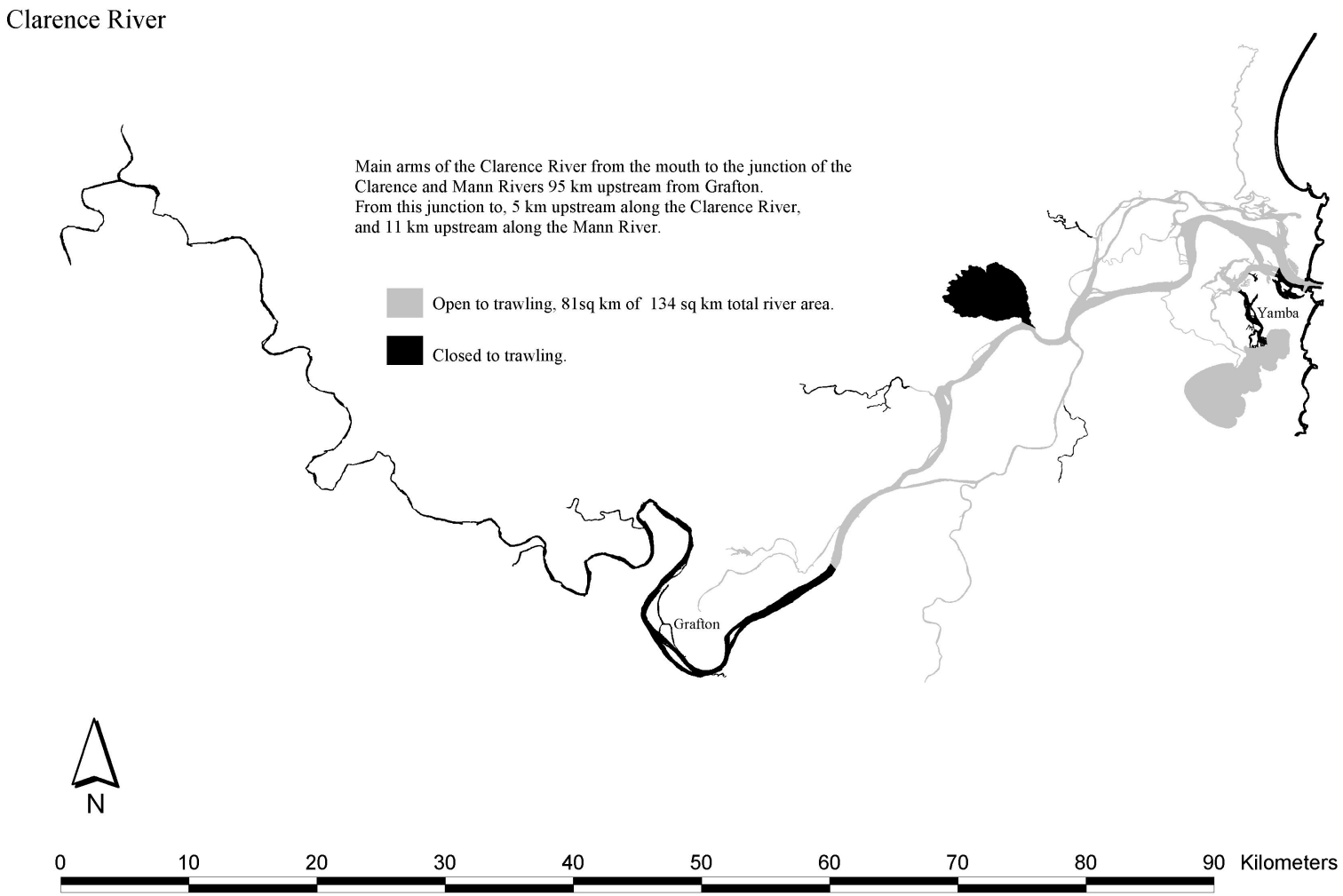

Figure B5. The areas of operation of the Estuary Prawn Trawl Fishery in the Clarence River.

Gear controls

The mesh size of the main part of the net must be between 40 and 60 mm and in the codend it must be between 40 and 50 mm. The headrope length on single gear can be a maximum of 11 metres while 7.5 metres applies to each of the nets if twin gear is used.

Table B3 outlines the restrictions placed upon the otter trawl net and Appendix B3 provides the regulations regarding the prawn trawl net.

Fishers in the Estuary Prawn Trawl Fishery have sought to limit the impact their fishing may have upon the ecosystem by limiting the fishery to target species through gear configuration and by inserting BRDs into fishing nets (see Figure B3). BRDs are located on the top side of the throat of the net immediately above the bag and work by allowing stronger swimming fish to escape by exiting via an escape panel while slower swimming prawns are trapped in the bag.

All prawn trawl nets used in the Clarence River must be fitted with a BRD that has been approved for use in that fishery. Four designs are approved for the Clarence River being the Composite Square Mesh Panel, Blubber Chute, Nordmore Grid and Quality Clarence Panel. A description of the BRDs used in the Estuary Prawn Trawl Fishery is given in Appendix B4. Fishers are encouraged to experiment with these and other designs to develop improved versions. Any fisher wishing to do so must be in possession of a current section 37 permit that authorises the use of the modified net.

Time and area closures

Seasonal and area closures were introduced in 1961 following research (Racek, 1959) to protect juvenile prawns and finfish. Since then, additional closures have been implemented to protect key habitat and juvenile fish. Additional time closures have been imposed to reduce conflict with recreational fishers and to address complaints by waterside residents about noise.

Estuary prawn trawling is restricted to waters seaward of the vehicular ferry at Ulmarra and some tributaries, including the Broadwater are closed to trawling (see Figure B5). Trawling is limited essentially to week days and Saturday mornings between the Tuesday nearest the 1 October (opening date for Lake Wooloweyah) and the Friday nearest the 31 May (inclusive) the following year. The Clarence River prawn trawl closure operates for the same day periods and opens on the Monday nearest the 1 December and closes on the Friday nearest the 31 May (inclusive) the following year. Appendix B6 and Table B19 details the time closures.

Size limits and other restrictions

Until December 2000, fishers operating in the Estuary Prawn Trawl Fishery in this estuary were permitted to retain species that had a legal minimum size, but under their management rules they relinquished this right in the interests of resource sharing. Appendix B7 lists the species that are subject to size and bag limits. In addition the Clarence River Fishermen's Co-operative imposes a maximum count on school prawns for sale of 180 green prawns per half kilogram or, 150 cooked prawns per half kilogram.

The Clarence River Fishermen's Co-operative restricts the daily landings of eastern king prawns from each estuary prawn trawl vessel to 10% of the daily landings of the total prawn catch from the vessel.

The management rules for this estuary provide for the controls to be reviewed when the incidental catch is greater than 1/6 of the total prawn catch (by weight).

b) Hunter River

i) Stocks of shellfish and finfish

The target species in the Estuary Prawn Trawl Fishery of the Hunter River is school prawns *Metapenaeus macleayi* (see Figure B6). The fishery catches a wide range of species (see Appendix B1 on bycatch) but land relatively few of these. In addition, the fishery takes a quantity of a small number of byproduct species which have contributed traditionally to the marketed catch of the fishery (see Table B20).

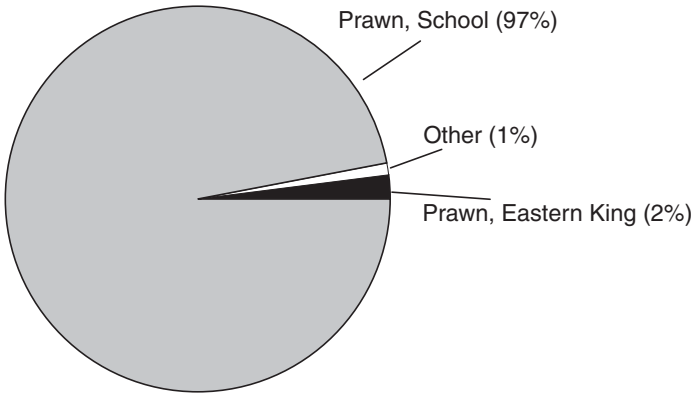

Figure B6. The mean proportion of the most abundant (by weight) species in the annual reported landings for 1997-98 and 1998-99 from the Estuary Prawn Trawl Fishery in the Hunter River.

Note: the "other" category contains species that made up less than 2% of the landings.

Table B20. Byproduct species of the Estuary Prawn Trawl Fishery in the Hunter River and the average proportion each species comprised in the annual reported landings for 1997-98 and 1998-99.

Quantities marked with a "-" comprised less than 0.01% of the total annual reported landings.

Common Name	Species or Family Name	Percentage of Total Catch
Catfish, estuary	PLOTOSIDAE	–
Mullet, sand	*Myxus elongatus*	0.1
Prawn, greasyback	*Metapenaeus bennettae*	0.11
Squid	Orders Teuthoidea	–

There has been no observer based survey to provide information about what is caught by estuary prawn trawl fishers operating in the Hunter River. Ruello (1971) recorded the species caught during a two year fishery independent survey using a prawn trawl in the Hunter River (see Appendix B1). Much needed information on the incidental catch of the fishery in the Hunter River will come from observer based survey proposed in section 6(j)(ii) in chapter C.

ii) Catch information

Patterns in the reported landings and value of individual species in the catch of the Estuary Prawn Trawl Fishery in the Hunter River can be found in Appendix B5. Table B21 gives the production for this estuary over the past two years for which data is available.

Table B21. Weight (kg) and value ($) of the reported landings of catch for the Estuary Prawn Trawl Fishery on the 1998-99 and 1999-2000.

Common Name	1998-1999		1999-2000	
	Weight (kg)	Value ($)	Weight (kg)	Value ($)
Eastern king	-	-	3,453	68,207
School	37,110	324,713	40,406	353.525
Greasyback	-	-	-	-
Tiger	-	-	-	-
Blue swimmer crab	-	-	-	-
Squid	-	-	-	-
Octopus	-	-	-	-
Finfish	228	302	252	981
Total	**37,338**	**325,015**	**44,111**	**354506**

NOTE: Values were calculated using the average price provided by industry members on the Estuary Prawn Trawl MAC. Values not marked with a "*" were calculated using the average monthly price paid for the species at auction at the Sydney Fish Market.

iii) Existing management strategy

The estuary is managed by a suite of input controls which have been complemented by industry compiling their own set of fishing rules. These collective input controls are summarised in the following sections.

Area of operation

The Hunter River joins the Pacific Ocean at Newcastle on the lower north coast of NSW. The river has a busy maritime port in the harbour area located near its confluence with the Pacific Ocean. The Hunter River reaches in a north-westerly direction toward Singleton and into fresh water areas in the upper catchment. The industry has divided the area into seven subdivisions for the purposes of closing areas of the river when counts of prawns exceed predetermined limits. This is aimed at conserving juvenile prawns until they grow to a better marketable size.

Trawling for prawns is permitted between the mouth of the estuary and the junction of the Williams and Hunter Rivers (see Figure B7). This is a daytime fishery with closures on weekends and public holidays. The fishery opens in early October for two days a week until December 1 when operators can work five days a week through to Easter. From Easter through to the end of May fishers are again restricted to two days a week. Times when trawling is permitted is shown in Table B22. Taking into account winter, night, weekend and public holiday closures approximately 17% of the total time (hours) in a year are available for operators to work.

Table B22. Times when prawn trawling is permitted in the Hunter River.

(The following table is a summary of the current closures to prawn trawling and is to be used as a guide only. The local fisheries office should be consulted for the most recent closure notices as these are frequently modified).

Periods when trawling is permitted
Subject to rules about prawn size.
From 6 am to 6 pm Monday and Wednesday only, but excluding the period from 6 am to 6 pm each public holiday, during the period 4 October 2000 to 30 November 2000 (inclusive). (Note: If a public holiday should fall on a Monday or Wednesday the following day may be worked instead, from 6 a.m. to 6 p.m.)
From 6 am to 6 pm Weekdays only, but excluding the period from 6 am to 6 pm each public holiday, during the period 1 December 2000 to 17 April 2001 (inclusive).
Periodic closures may occur during this time when juvenile prawns are abundant. This arrangement is further explained in Appendix B6.

Limited entry

The total number of endorsements entitled to trawl in the Hunter River is restricted to 32. There are many inactive or seldom used prawn trawl entitlements in this estuary of the fishery (see Table B10). A more detailed review would show that some of the active businesses have a very low level of participation in the fishery.

Types of boats used

Vessels used in the Hunter River are of both planing and displacement hull designs though the majority fall into the latter category (displacement hulls). Some of these vessels are also used to fish in other fisheries such as the Ocean Prawn Trawl, Estuary General and Ocean Trap and Line fisheries. Table B2 summarises the characteristics of the vessels in each estuary.

Boat replacement policy

Vessels 5.8 metres and less may be replaced with boats up to 5.8 metres in length. Vessels that are greater than 5.8 metres in length may only be replaced with those that are no more than 10% or 1 metre greater in length, whichever is lesser. The 10% tolerance continues to relate to the original boat length to avoid a progressive increase in length over time. There is no restriction on vessel engine power.

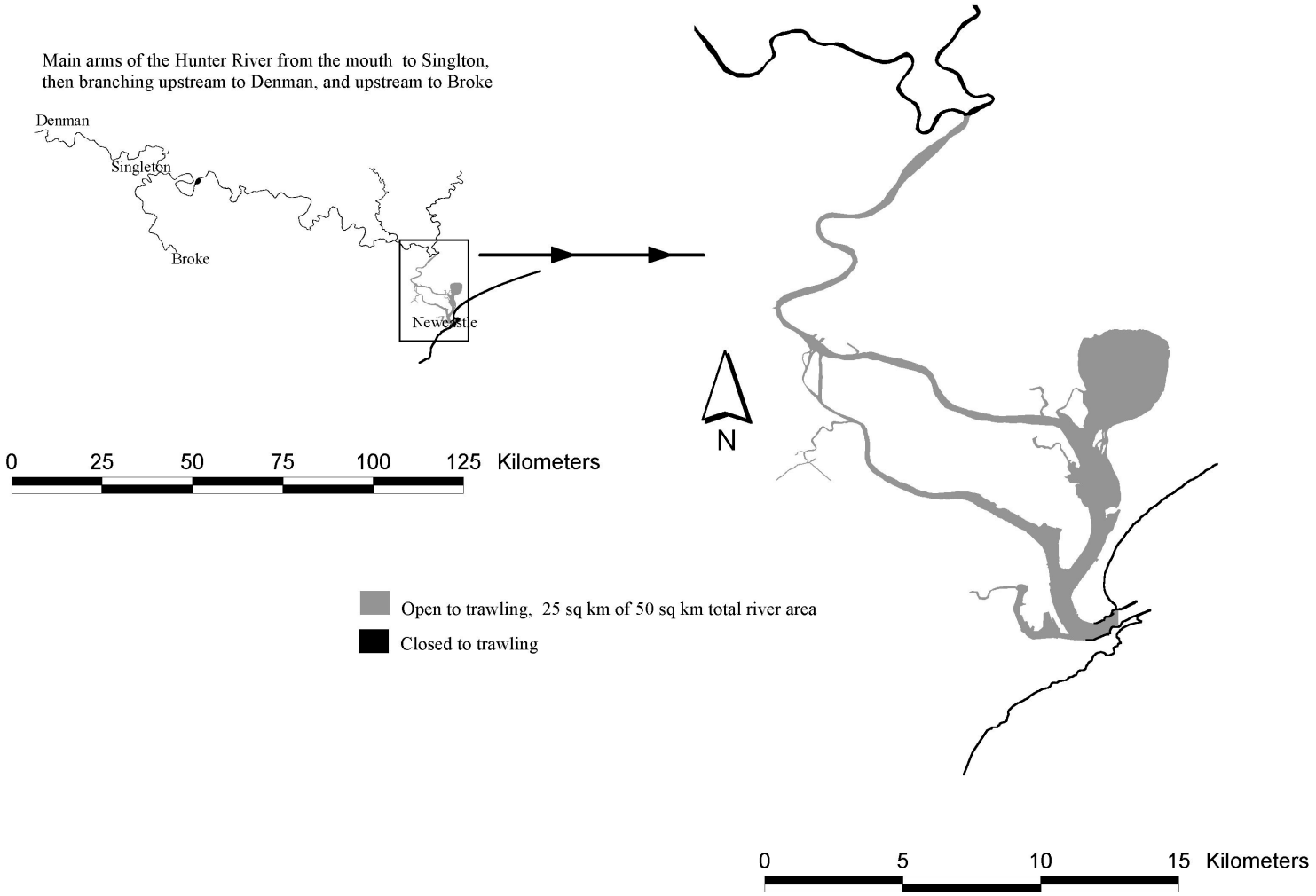

Figure B7. The areas of operation of the Estuary Prawn Trawl Fishery in the Hunter River.

Gear controls

The amount of net (i.e. headrope length) and number of nets that may be towed behind the vessel are restricted to limit fishing effort. Single nets must be used in the Hunter River fishery by all vessels. The headrope length on single gear can be a maximum of 11 meters.

Table B3 outlines the restrictions placed upon the design of the otter trawl net and Appendix B3 provides the regulations regarding the prawn trawl net.

All prawn trawl nets used in the Hunter River must be fitted with a BRD that has been approved for use in that fishery. Four designs are approved for the Hunter River including the Composite Square Mesh Panel, Blubber Chute, Nordmore Grid and Quality Clarence panel (see Appendix B4).

Time and area closures

An area closure on the upper section of the Hunter River and a winter closure were introduced in 1961 following research (Racek, 1959) to protect juvenile finfish and prawns. A weekend closure was introduced in 1971 to reduce conflict between the Estuary Prawn Trawl Fishery and recreational fishers. It also addressed complaints from waterside residents concerned with levels of noise. For the same reasons, the Hunter River was closed from 1987 to all night time fishing.

Estuary prawn trawling is restricted to waters downstream of the junction of the Williams and Hunter Rivers (see Figure B7). The area is divided into seven subdivisions for the purposes of conserving small prawns (see Appendix B6). In the future these Subdivisions will be used also to control the quantities of incidental catch.

Periods when trawling is permitted are shown in Table B22. The fishery opens in early October for two days a week until December 1 when operators can work five days a week through to Easter. From Easter through to the end of May fishers are again restricted to two days a week. Appendix B6 and Table B22 detail the time closures.

Size limits and other restrictions

Fishers operating in the Estuary Prawn Trawl Fishery in this estuary are not permitted to retain species that have a legal minimum size (see Appendix B7). The Hunter River Fishermen's Co-operative imposes a maximum count on school prawns for sale of 150 green prawns per half kilogram or, 130 cooked prawns per half kilogram to conserve prawns of non-marketable sizes. Subdivisions of the river are closed when the count of prawns exceeds this number (see Appendix B6).

c) Hawkesbury River

i) Stocks of shellfish and finfish

The target species in the Estuary Prawn Trawl Fishery of the Hawkesbury River are school prawns *Metapenaeus macleayi,* eastern king prawns *Penaeus plebejus* and several species of squid, the main species of which are the broad squid *Photologio etheridgei*, and the bottle squid *Loliolus noctiluca* (see Figure B8). In addition, the fishery takes a number of byproduct species (see Table B23).

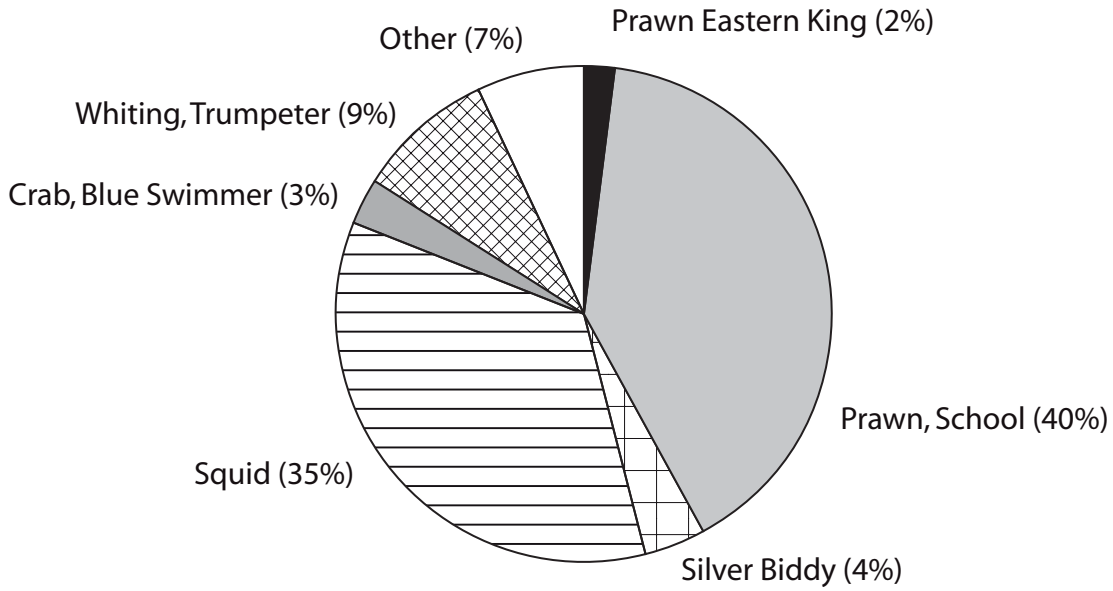

Figure B8. The mean proportion of the most abundant (by weight) species in the annual reported landings for 1997-98 and 1998-99 from the Estuary Prawn Trawl Fishery in the Hawkesbury River. Note the "other" category contains species that made up less than 2% of the landings.

The fishery also catches a wide range of other species that are returned to the water and are referred to as bycatch. Appendix B1 gives a detailed list of the species caught during an observer study of the Estuary Prawn Trawl Fishery of the Hawkesbury River (Kennelly, 1993).

Table B23. Byproduct species of the Estuary Prawn Trawl Fishery in the Hawkesbury River and the average proportion each species comprised in the annual reported landings for 1997-98 and 1998-99.

Quantities marked with a "-" comprised less than 0.01% of the total annual reported landings.

Common Name	Species or Family Name	Percentage of Total Catch
Bonito	*Sarda australis*	–
Bullseye, red	*Priacanthus macracanthus*	–
Catfish, estuary	PLOTOSIDAE	0.34
Catfish, forktailed	*Arius graeffei*	–
Catfish, unspecified	PLOTOSIDAE	0.03
Crab, blue swimmer	*Portunus pelagicus*	2.87
Crab, coral	*Charybdis cruciata*	0.01
Crab, mud	*Scylla serrata*	0.02
Cuttlefish	*Sepia sp.*	–
Dory, John	*Zeus faber*	–
Eel, longfin river	*Anguilla reinhardtii*	0.01
Eel, pike	*Muraenesox bagio*	–
Eel, shortfin river	*Anguilla australis*	0.02
Flounder, unspecified	BOTHIDAE	1.04
Hairtail	*Trichiurus lepturus*	0.25
Mackerel, blue	*Scomber australasicus*	0.01
Mullet, fantail	*Mugil georgii*	0.04
Mulloway	*Argyrosomus hololepidotus*	0.02
Octopus	OCTOPODA	0.14
Old maid	*Selenotoca multifasciata*	–
Pike	DINOLESTIDAE	–
Pilchard	*Sardinops neopilchardus*	0.9
Prawn, greasyback	*Metapenaeus bennettae*	0.04
Prawn, tiger	*Penaeus esculentus*	0.02
Shark, blue whaler	*Prionace glauca*	–
Shark, carpet	*Orectolobus maculatus*	0.02
Shark, fiddler	*Trygonorrhina fasciata*	0.14
Shark, hammerhead	Sphyrna spp.	0.02
Shark, school	*Furgaleus macki*	0.02
Shark, shovelnose	Family – RHINOBATIDAE / RHYNCHOBATIDAE	0.01
Shrimp, mantis	Squilla sp.	0.03
Silver biddy	*Gerres subfasciatus*	3.95
Sole, black	*Synaptura nigra*	0.04
Sole, mixed	SOLEIDAE	0.01
Spanner crab	*Ranina ranina*	–
Stingray	DASYATIDIDAE / UROLOPHIDAE	0.01
Tailor	*Pomatomus saltatrix*	0.14
Trevally, silver	*Pseudocaranx dentex*	0.28
Trumpeter	*Pelates quadrilineatus*	0.01
Whitebait (at least two species)	Various	0.25
Whiting, school	*Sillago flindersi*	0.01
Whiting, trumpeter	*Sillago maculata*	8.75
Yellowtail	*Trachurus novaezelandiae*	1.2

ii) Catch Information

Patterns in the reported landings and value of individual species in the catch of the Estuary Prawn Trawl Fishery in the Hawkesbury River can be found in Appendix B5. Table B24 gives the production for this estuary over the past two years for which data is available.

Table B24. Weight (kg) and value ($) of the reported landings of catch for the Estuary Prawn Trawl Fishery on the Hawkesbury River in 1998-99 and 1999-2000.

Common Name	1998-1999		1999-2000	
	Weight (kg)	Value ($)	Weight (kg)	Value ($)
Eastern king	2,621	57,636	3,742	82,358
School	31,823	333,187	44,596	445,068
Greasyback	103	*465	702	*3,375
Tiger	38	*606	80	*1,275
Blue swimmer crab	3,804	23,017	1,847	12,844
Squid	46,982	522,909	30,865	*383,035
Octopus	210	919	223	1,608
Finfish	27,702	80380	31,655	94,428
Total	**113,283**	**1,019,119**	**113,710**	***1,023,991**

NOTE: Values were calculated using the average price provided by industry members on the Estuary Prawn Trawl MAC. Values not marked with a "*" were calculated using the average monthly price paid for the species at auction at the Sydney Fish Market.

iii) Existing management strategy

The estuary is managed by a suite of input controls which are summarised in the following sections.

Area of operation

The Hawkesbury River is located to the north of Sydney with the overall water body encompassing Pittwater in the northern suburbs of Sydney and Brisbane Water near Gosford on the lower central coast of NSW. The river is a drowned river valley that is incised into a rock foundation and has relatively deep sections in the lower reaches.

The river reaches in a westerly direction and into brackish waters toward the north west outskirts of Sydney. Parts of the lower reaches of the river meander through National Park areas with numerous inlets and bays. As such the river is popular as a recreational boating destination.

Trawling is permitted between a line drawn from the southern extremity of Box Head to the northern extremity of Barrenjoey Head, upstream for 80 kilometres to the vehicular ferry crossing at Lower Portland. Within this area many tributaries are closed to trawling (see Figure B9 and Appendix B6).

Both day and night trawling is permitted in the Hawkesbury River except for Marra Marra Creek and Coba Bay, which is daytime trawl only. Trawlers can operate all year around down stream of Juno Point with the area upstream of this location closed on weekends (see Table B25).

Table B25. Times when prawn trawling is permitted in the Hawkesbury River.

(The following table is a summary of the current closures to prawn trawling and is to be used as a guide only. The local fisheries officer should be consulted for the most recent closure notices as these are frequently modified).

Periods when trawling is permitted
Periods when closures are in place in the Hawkesbury River include: • The Hawkesbury River entrance upstream to a line drawn from Juno Point to Eleanor Bluff excluding Brisbane Waters and Pittwater are open to trawling all year round • The waters of the Hawkesbury River from a line drawn from Juno Point to Eleanor Bluff upstream to a line drawn from Croppy Point to Green Point trawling is closed from 6 p.m. Friday to 6 p.m. Sunday (weekend closure) • The waters of the Hawkesbury River from the rail bridge at Brooklyn upstream to the vehicular ferry at Wiseman's Ferry excluding the waters of Berowra Creek, Marra Marra Creek and Coba Bay are closed between 6 p.m. Friday and 6 p.m. Sunday (weekend closure). • The waters of Marra Marra Creek and Coba Bay are open to trawling from sunrise to sunset Monday to Thursday and from sunrise to 6 p.m. Friday (night time and weekend closure) • Mangrove Creek from it's junction with the Hawkesbury River upstream to the Oyster Shell Road Bridge is closed from 6 p.m. Friday to 6 p.m. Sunday (weekend closure) • The waters of the Hawkesbury River from Wiseman's Ferry vehicular ferry upstream to the vehicular ferry at Lower Portland excluding the MacDonald and Colo (upstream of the West Portland Bridge) Rivers and Webbs Creek are closed from 6 p.m. Friday to 9 p.m. Sunday (weekend closure) Details of these closures are in Appendix B6.

Limited Entry

The total number of endorsements entitled to trawl in the Hawkesbury River is restricted to 68. There are many inactive and seldom used prawn trawl entitlements in this estuary of the fishery (see Table B10). A more detailed review would show that some of the active businesses have a very low level of participation in the fishery.

In the Hawkesbury River only 23 of the 68 prawn trawl businesses targeted squid in 1998-99. Consequently, there is potential for fishing effort to increase through the taking of squid by prawn trawl businesses in the Hawkesbury River that have not historically done so. However, because of the size of the river and the widespread geographical distribution of Hawkesbury River fishers, it is considered that the greatest risk of increased effort upon the squid stock would come from new entrants to the fishery.

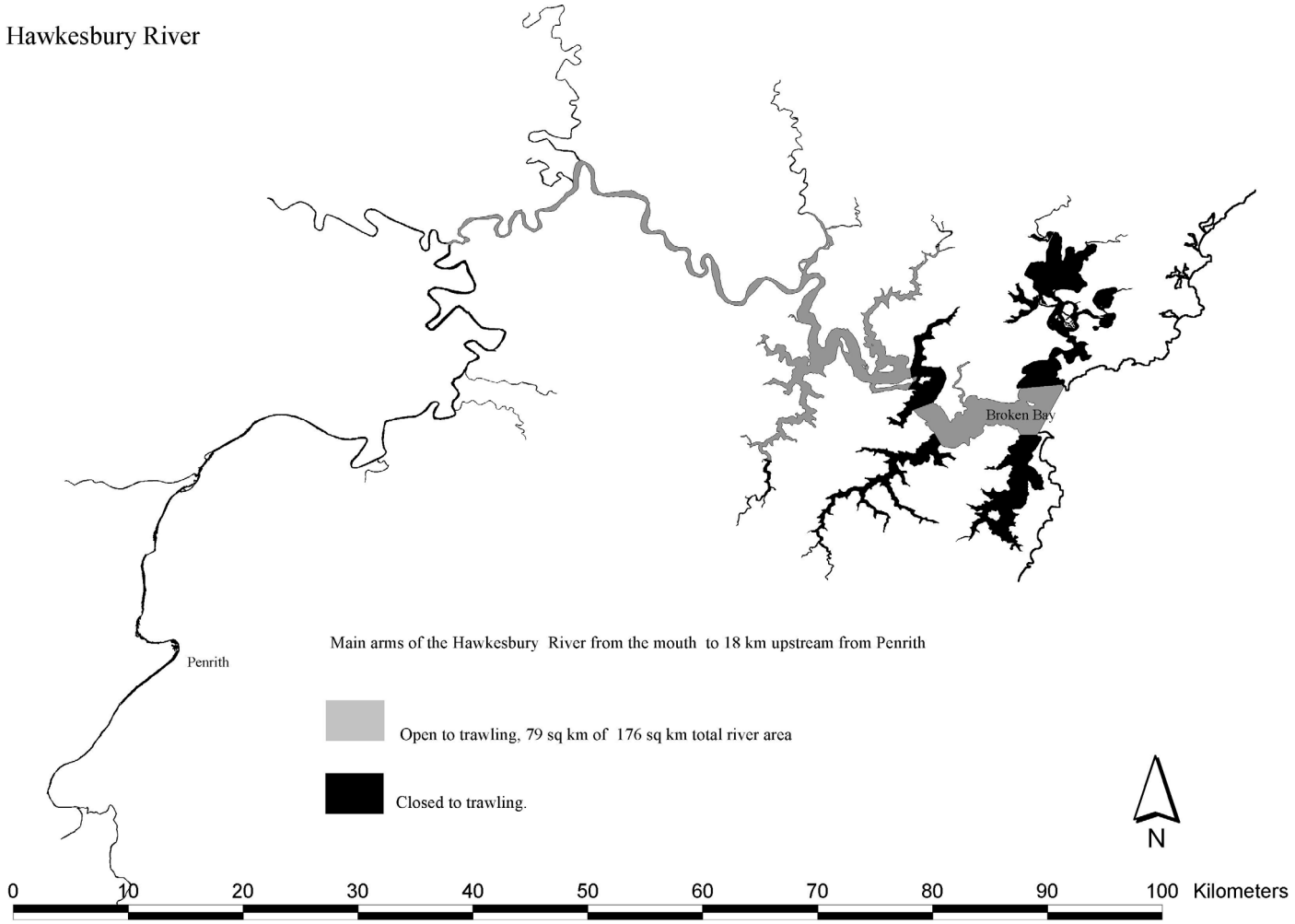

Figure B9. The areas of operation of the Estuary Prawn Trawl Fishery in the Hawkesbury River.

Types of boats used

Vessels used in the Estuary Prawn Trawl Fishery on the Hawkesbury River are of both planing and displacement hull designs. Some of these vessels are also used to fish in other fisheries such as the Ocean Trap and Line Fishery. Most of the vessels working the lower areas of the river are of displacement type and those operating in the upper reaches of planing type. Table B2 summarises the characteristics of the vessels in each estuary.

Boat replacement policy

Vessels 5.8 metres and less may be replaced with boats up to 5.8 metres in length. Vessels that are greater than 5.8 metres in length may only be replaced with those that are no more than 10% or 1 metre greater in length, whichever is lesser. The 10% tolerance continues to relate to the original boat length to avoid a progressive increase in length over time. There is no restriction on vessel engine power.

Gear controls

In the Hawkesbury River vessels can tow single gear upstream of a line between Juno Point and Eleanor Bluff or have a choice of single or twin gear downstream of this location. Although two nets may be used in Broken Bay (Hawkesbury River), most vessels only use one net. The headrope length on prawn trawl gear used in this estuary can be a maximum of 11 metres.

Table B3 summarises the restrictions applying to estuary prawn trawl nets and Appendix B3 provides the regulations regarding the prawn trawl net.

All prawn trawl nets used in the Hawkesbury River upstream of a line drawn from Juno Point to Eleanor Bluff must be fitted with a BRD that has been approved for use in that fishery while fishers operating downstream of this location are not required to use BRD's. Five designs are approved for the Hawkesbury River including the Composite Square Mesh Panel, Blubber Chute, Nordmore Grid, Quality Clarence Panel and the Hawkesbury Square Mesh Panel (see Appendix B4). Fishers operating downstream of Juno Point target prawns and squid. Nets when fitted with the current BRD's have been found to be unsatisfactory when used to target squid. Research is underway to determine a design of fishing gear suitable for the squid component of the Hawkesbury River.

Time and area closures

Estuary prawn trawling is restricted to waters downstream of the vehicular ferry crossing at lower Portland to the entrance of the South Pacific Ocean. Both day and night trawling is permitted in the Hawkesbury River except for Marra Marra Creek and Coba Bay, which is daytime trawl only.

Trawlers can operate all year around downstream of Juno Point with areas upstream of this location closed on weekends. This weekend closure was sought by industry in the interests of resource sharing with other waterway users. Within this river system there are several area closures and these and the time closures are detailed in Appendix B6 and Table B25.

Size limits and other restrictions

Fishers operating in the trawl fishery in this estuary are not permitted to retain species that have a legal minimum length. Appendix B7 lists the species that are subject to size and bag limits.

d) Port Jackson

i) Stocks of shellfish and finfish

The target species in the Estuary Prawn Trawl Fishery of Port Jackson is the eastern king prawn *Penaeus plebejus* (see Figure B10). In addition, the fishery takes a number of byproduct species (see Table B26). Appendix B1 gives a detailed list of the species caught during an observer study of the Estuary Prawn Trawl Fishery of Port Jackson (Liggins *et al*., 1996).

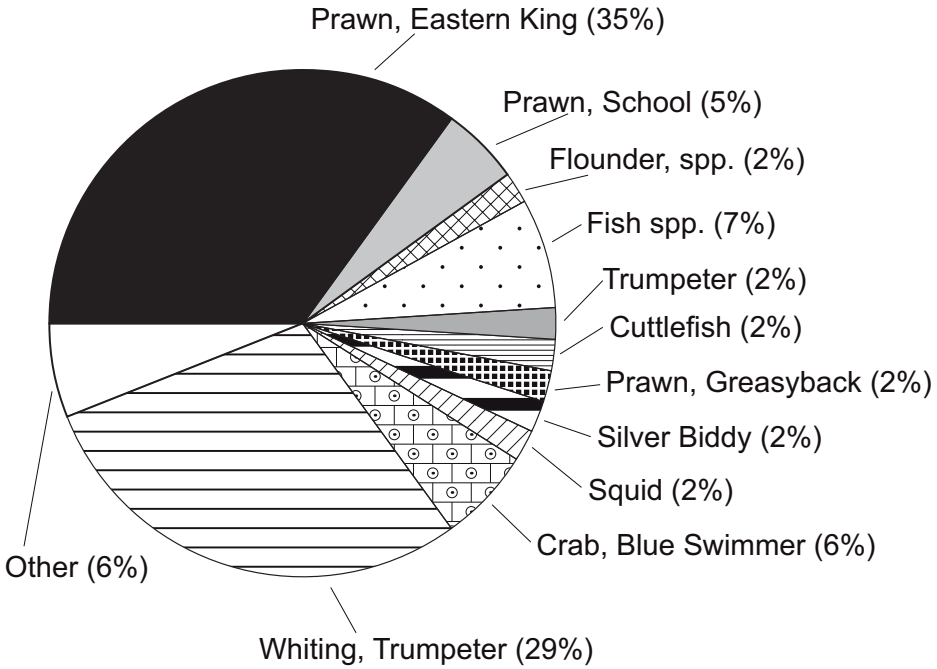

Figure B10. The mean proportion of the most abundant (by weight) species in the annual reported landings for 1997-98 and 1998-99 from the Estuary Prawn Trawl Fishery in the Port Jackson.

Note the "other" category contains species that made up less than 2% of the landings.

Table B26. Byproduct species of the Estuary Prawn Trawl Fishery in Port Jackson and the average proportion each species comprised in the annual reported landings for 1997-98 and 1998-99.

Quantities marked with a "-" comprised less than 0.01% of the total annual reported landings.

Common Name	Species or Family Name	Percentage of Total Catch
Catfish, estuary	PLOTOSIDAE	0.47
Crab, blue swimmer	*Portunus pelagicus*	5.94
Crab, mud	*Scylla serrata*	0.04
Cuttlefish	Sepia spp.	1.59
Dory, john	*Zeus faber*	0.47
Eel, shortfin river	*Anguilla australis*	0.04
Flounder, unspecified	BOTHIDAE	2.26
Mado	*Atypichthys strigatus*	0.6
Octopus	OCTOPODA	0.94
Prawn, greasyback	*Metapenaeus bennettae*	1.97
Prawn, school	*Metapenaeus macleayi*	4.88
Prawn, tiger	*Penaeus esculentus*	0.38
Scallop	Chlamys spp.	0.31
Shark, fiddler	*Trygonorrhina spp.*	0.04
Shark, shovelnose	*Aptychotrena spp.*	0.08
Shrimp, mantis	Squilla sp.	1.06
Silver biddy	*Gerres subfasciatus*	2.21
Squid	Order Teuthoidea	2.19
Trumpeter	*Pelates quadrilineatus*	2.12
Whiting, trumpeter	*Sillago maculata*	28.75

ii) Catch information

The Estuary Prawn Trawl Fishery in Port Jackson supplies prawns, shellfish, and finfish to the domestic market as fresh local seafood, and as bait to the recreational fishery and other commercial fisheries. The proximity of Port Jackson to the Sydney Metropolitan area provides fishers with the opportunity to supply a live seafood market. Patterns in the reported landings and value of individual species in the catch of the Estuary Prawn Trawl Fishery in Port Jackson can be found in Appendix B5. Table B27 gives the production for this estuary over the past two years for which data were available.

Table B27. Weight (kg) and value ($) of the reported landings of catch for the Estuary Prawn Trawl Fishery in Port Jackson in 1998-99 and 1999-2000.

Common Name	1998-1999		1999-2000	
	Weight (kg)	Value ($)	Weight (kg)	Value ($)
Eastern king	3,340	64,987	2,470	50,951
School	250	2,218	653	4,102
Greasyback	191	1,251	142	695
Tiger	73	1,000	17	266
Blue swimmer crab	725	4,541	702	4,769
Squid	346	877	1,012	1,751
Octopus	167	666	474	2,964
Finfish	6,207	20,923	11,903	35,994
Total	**11,299**	**96,463**	**17,373**	**101,492**

NOTE: Values were calculated using the average monthly price paid for the species at auction at the Sydney Fish Market.

iii) Existing management strategy

The estuary is managed by a suite of input controls which are summarised in the following sections.

Area of operation

Port Jackson includes Sydney Harbour, Middle Harbour, Manly Cove and the Parramatta River, which are located in the centre of the urban Sydney environs. The port is a drowned river valley, which is incised into a sandstone rock foundation and has many deep sections. The river reaches in a westerly direction through suburban areas and access is restricted by a weir near Parramatta. Sydney Harbour is a busy commercial port with large amounts of commercial and recreational boating occurring throughout both the harbour and river.

Trawling for prawns is permitted throughout Port Jackson but Manly Cove and Lane Cove River are closed to trawling together with parts of Middle Harbour (see Figure B11 and Appendix B6).

Estuary prawn trawling in Port Jackson is a night fishery opening 31 October and closing Good Friday the following year. Early opening trials are carried out from mid-October and if a preset criterion is reached trawling commences from that time. Trials are also done in April to extend the season until mid May. The criterion used in both cases is that one out of five, 40 minute test tows must yield 1 kilogram or more of prawns (see Appendix B6).

Weekend closures are in place. Times when trawling is permitted are shown in Table B28 and calculated using winter, daytime and weekend closures is approximately 20% of the total time (hours) in a year not including possible extensions of the season as determined by the local District Fisheries Officer.

Table B28. Times when prawn trawling is permitted in Port Jackson.

(The following table is a summary of the current closures to prawn trawling and is to be used as a guide only. The local fisheries officer should be consulted for the most recent closure notices as these are frequently modified).

Periods when trawling is permitted
Subject to rules about prawn size
From 5 pm Mondays to Thursdays (inclusive) to 9 am the following day, and from 5 pm Friday to 8 am Saturday in each week, commencing 31st October 2000 for a period of one year.
Following are the periods of operation in the event that the estuary is opened early or closed late as a result of trial shots
From 5 pm Mondays to Thursdays (inclusive) to 9 am the following day, and from 5 pm Friday to 8 am Saturday in each week, the commencing and terminating dates as determined by the District Fisheries Officer, Sydney North, as detailed in the closure notification which establishes the operating times in this estuary.

Limited entry

The total number of endorsements entitled to trawl in Port Jackson is restricted to 31. There are inactive and seldom used prawn trawl entitlements in this estuary of the fishery (see Table B10). A more detailed review would show that some of the active businesses have a very low level of participation in the fishery.

Types of boats used

Vessels used to estuary prawn trawl in Port Jackson are of displacement hull design. Some of these vessels are also used to fish in other fisheries such as the Estuary General and Ocean Trap and Line fisheries. Table B2 summarises the characteristics of the vessels in each estuary.

Boat replacement policy

Vessels 5.8 metres and less may be replaced with boats up to 5.8 metres in length. Boats that are greater than 5.8 metres in length may only be replaced with boats that are no more than 10% or 1 metre greater in length, whichever is lesser. The 10% tolerance continues to relate to the original boat length to avoid a progressive increase in length over time. There is no restriction on vessel engine power.

Gear controls

The amount of net (i.e. headrope length) and number of nets that may be towed behind the vessel are restricted to limit fishing effort. Single or twin nets may be used in the Port Jackson. The total headrope length can be a maximum of 11 metres whether single or twin gear is used. Although permitted to tow two nets, fishers tow only one net.

Table B3 summarises the restrictions applying to estuary prawn trawl nets and Appendix B3 provides the regulations specifying the prawn trawl net.

All prawn trawl nets used in Port Jackson must be fitted with a BRD that has been approved for use in that fishery. Four designs are approved for Port Jackson including the Composite Square Mesh Panel, Blubber Chute, Nordmore Grid and the Port Jackson Screen (Appendix B4).

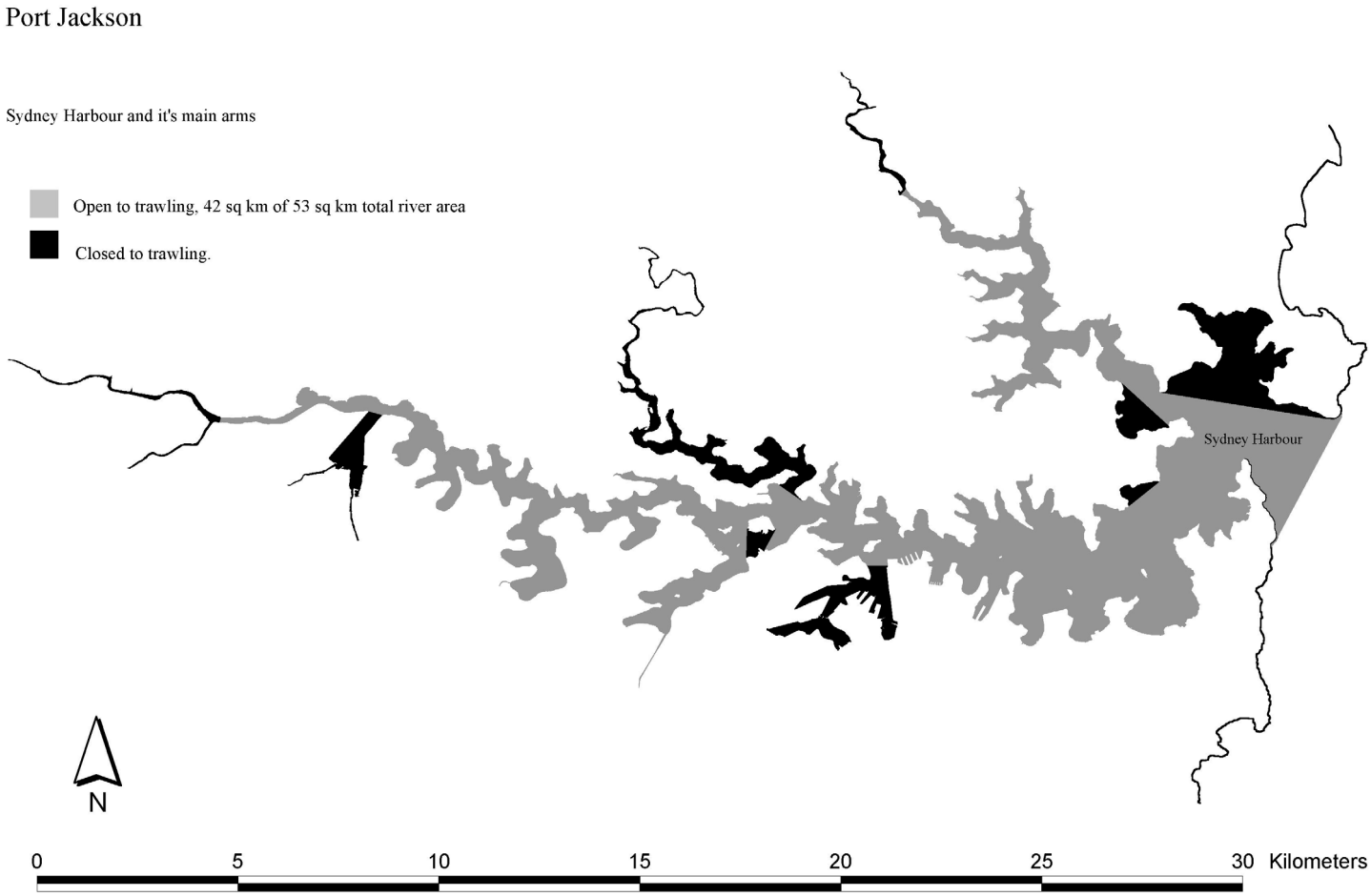

Figure B11. The areas of operation of the Estuary Prawn Trawl Fishery in Port Jackson.

Time and area closures

A winter closure to trawling on Port Jackson was implemented in 1972 to reduce conflict with recreational fishers and to control the "black marketing" of catches. Closures to day time trawling were introduced in response to complaints from the public.

Estuary prawn trawling is restricted to waters of Port Jackson, Middle Harbour and the Parramatta River, with several area closures in place within this area (see Appendix B6).

Trawling is permitted from November to Easter each year with provisions for an earlier opening during October and a later finishing to the season during April if predetermined catch rate criteria is met.

Size limits and other restrictions

Fishers operating in the Estuary Prawn Trawl Fishery in this estuary are not permitted to retain species that have a legal minimum length. Appendix B7 lists the species that are subject to size and bag limits.

e) Botany Bay

i) Stocks of shellfish and finfish

The target species in the Estuary Prawn Trawl Fishery on Botany Bay is eastern king prawns *Penaeus plebejus*. In addition, the fishery takes a number of byproduct species including octopus, that are caught as part of the prawn trawl and which have significantly contributed traditionally to the marketed catch of the fishery (see Figure B12 and Table B29).

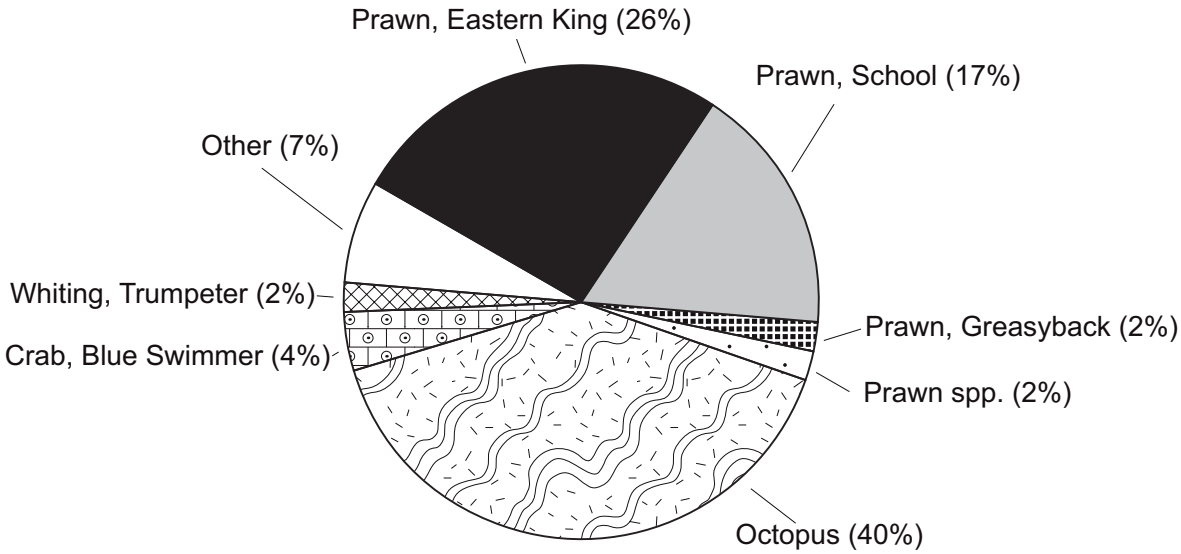

Figure B12. The mean proportion of the most abundant (by weight) species in the annual reported landings for 1997-98 and 1998-99 from the Estuary Prawn Trawl Fishery in the Botany Bay.

Note the "other" category contains species that made up less than 2% of the landings.

The landings of octopus contribute a greater proportion by weight to the annual reported landings of the fishery in Botany Bay. The reason for this is unclear, but possible explanations are that:

a) octopus are far heavier than prawns and so by weight may contribute more

b) that fisheries have not reported accurately their catch, particularly of prawns, on their monthly catch returns

c) that there has been targeting of octopus stocks.

The fishery also catches a wide range of other species that are returned to the water and are referred to as bycatch. Appendix B1 gives a detailed list of the species caught during an observer study of the Estuary Prawn Trawl Fishery of Botany Bay (Liggins *et al*., 1996).

Table B29. Byproduct species of the Estuary Prawn Trawl Fishery in Botany Bay and the average proportion each species comprised in the annual reported landings for 1997-98 and 1998-99.

Quantities marked with a "-" comprised less than 0.01% of the total annual reported landings.

Common Name	Species or Family Name	Percentage of Total Catch
Calamari, southern	*Sepioteuthis australis*	0.08
Cockle	Anadara sp.	0.2
Crab, blue swimmer	*Portunus pelagicus*	4.01
Crab, sand	PORTUNIDAE	0.04
Flounder, unspecified	PLEURONECTIDAE	0.3
Leatherjacket, unspecified	MONACANTHIDAE	0.06
Octopus	OCTOPODA	40.44
Old maid	*Selenotoca multifasciata*	1.25
Pipi	*Donax deltoides*	0.11
Prawn, greasyback	*Metapenaeus bennetae*	1.56
Prawn, tiger	*Penaeus esculentus*	–
Scallop	Pectinidae	0.99
Silver biddy	*Gerres subfasciatus*	0.21
Tarwhine	*Rhabdosargus sarba*	0.07
Trevally, silver	*Pseudocaranx dentex*	0.5
Whitebait (at least two species)	Various	0.17
Whiting, trumpeter	*Sillago maculata*	2.43

ii) Catch information

The Estuary Prawn Trawl Fishery in Botany Bay supplies prawns, other shellfish, and finfish to the domestic market as fresh local seafood, and as bait to the recreational fishery and other commercial fisheries. Fishers in this estuary supply a live seafood market in the Sydney metropolitan area. Patterns in the reported landings and value of individual species in the catch of the Estuary Prawn Trawl Fishery in the Botany Bay can be found in Appendix B5. Table B30 gives the production for this estuary over the past two years for which data were available.

Table B30. Weight (kg) and value ($) of the reported landings of catch for the Estuary Prawn Trawl Fishery in Botany Bay Zone in 1998-99 and 1999-2000.

Common Name	1998-1999		1999-2000	
	Weight (kg)	Value ($)	Weight (kg)	Value ($)
Eastern king	8,156	158,870	4,514	99,747
School	7,150	55,858	918	6,447
Greasyback	306	1,838	279	1,533
Blue swimmer crab	2,166	14,043	148	1,120
Octopus	9,656	50,823	7,310	60,474
Finfish	3,114	10,967	1,660	5,048
Total	**30,548**	**292,399**	**14,829**	**174,369**

NOTE: Values were calculated using the average monthly price paid for the species at auction at the Sydney Fish Market.

iii) Existing management strategy

The estuary is managed by a suite of input controls which are summarised in the following sections.

Area of operation

Botany Bay is located in the southern residential and commercial areas of Sydney with the estuary reaching in a westerly and southwesterly direction into the Georges and Woronora rivers. There are extensive areas of seagrass within the bay. Towra Point Aquatic and Nature Reserves are located on the southern shore of the bay protecting internationally recognised wetlands listed under the RAMSAR convention and some of the seagrass beds. The shoreline of the estuary is adjacent to a combination of commercial, residential and undeveloped crown land. There is a commercial shipping port in Botany Bay and both the bay and rivers are popular as recreational boating destinations.

Trawling for prawns is permitted in Botany Bay from a line drawn between Endeavour Light to the Northern Extremity of Sutherland Point upstream (westerly) to a line from Dolls Point to Towra Point. The Cooks River is closed to trawling, as are parts of the port development and airport. (see Figure B13 and Appendix B6).

Estuary prawn trawling in Botany Bay is a night fishery opening 30 October and closing Good Friday the following year. Early opening trials are carried out from mid October and if a preset criterion is reached trawling commences from that time. Trials are also done in April to extended the season until mid May. The criterion used in both cases is that one out of five, 40 minute test shots must yield 1 kilogram or more of prawns (Appendix B6). The fishery has weekend closures. Times when trawling is permitted are shown in Table B31 and calculated using winter, weekend and daytime closures is approximately 20% of the total time (hours) in a year not including possible extensions of the season as determined by the local District Fisheries Officer.

Table B31. Times when prawn trawling is permitted in Botany Bay.

Periods when trawling is permitted
Subject to rules about prawn size
From official sunset on any day to official sunrise on the following day, except from sunset Saturday to sunrise Monday in each week, commencing official sunset Friday 30th October 2000, to official sunrise, Friday 13 April 2001
Following are the periods of operation in the event that the estuary is opened early or closed late as a result of trial shots
From official sunset on any day to official sunrise on the following day, except from sunset Saturday to sunrise Monday in each week, the commencing and terminating dates as determined by the District Fisheries Officer, Sydney South, as detailed in the closure notification which establsihes the operating times in this estuary

In August 2001, the NSW Government announced that Botany Bay would become a recreational fishing area, commencing from May 2002. From that time, prawn trawling will not be permitted in Botany Bay and fair compensation will be paid to commercial fishers in exchange for their fishing entitlements.

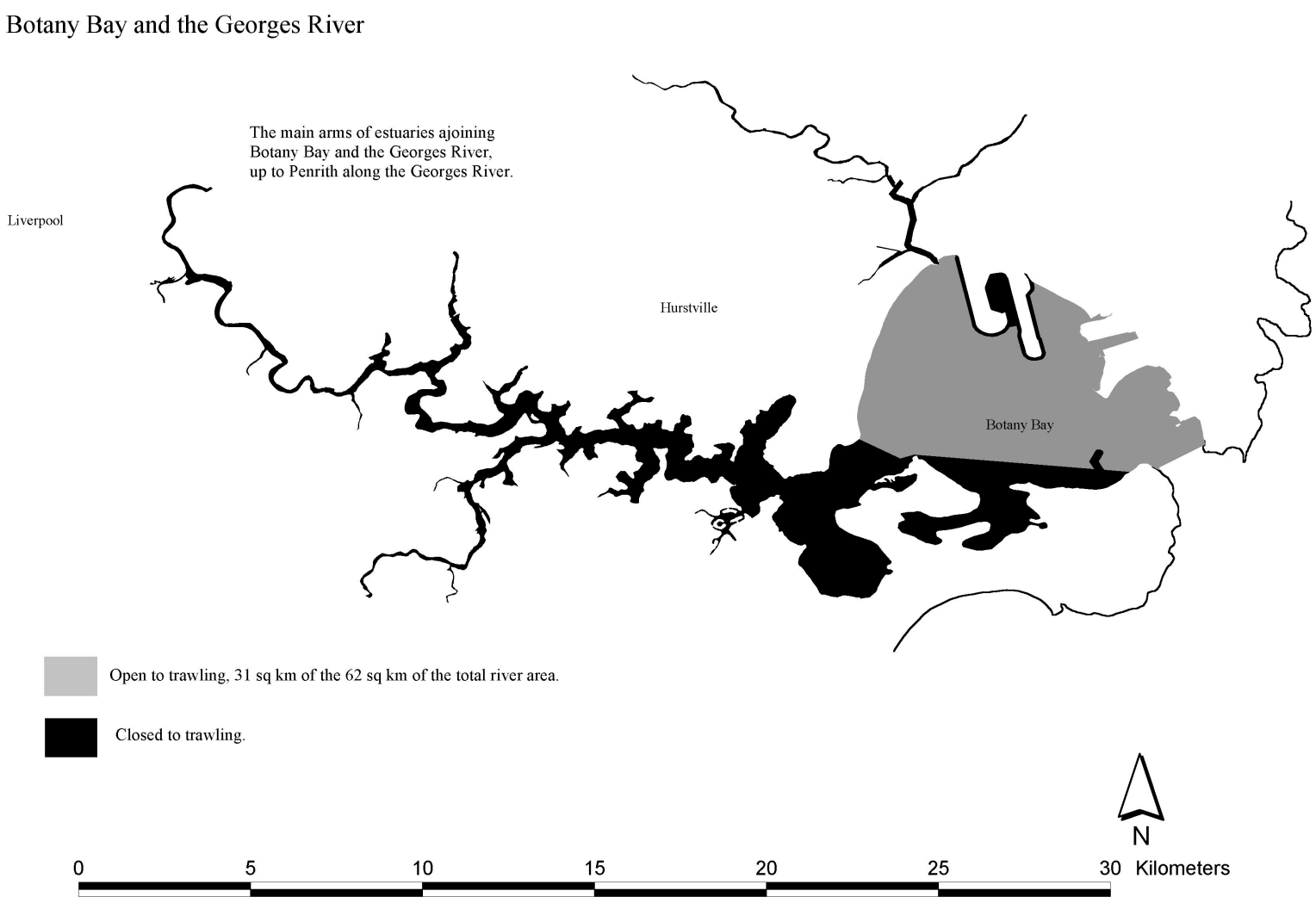

Figure B13. The areas of operation of the Estuary Prawn Trawl Fishery in Botany Bay.

Limited entry

The total number of endorsements entitled to trawl in the Botany Bay is restricted to 48. There are many inactive and seldom used prawn trawl entitlements in this estuary (see Table B10). A more detailed review would show that some of the active businesses have a very low level of participation in the fishery.

Types of boats used

Vessels used in the Estuary Prawn Trawl Fishery in Botany Bay are of displacement hull designs. Some of these vessels are also used to fish in other fisheries such as the Ocean Trap and Line Fishery. The characteristics of the vessels used in the fishery are summarised in Table B2.

Boat replacement policy

Vessels 5.8 metres and less may be replaced with boats up to 5.8 metres in length. Boats that are greater than 5.8 metres in length may only be replaced with boats that are no more than 10% or 1 metre greater in length, whichever is lesser. The 10% tolerance continues to relate to the original boat length to avoid a progressive increase in length over time. There is no restriction on vessel engine power.

Gear controls

The amount of net (i.e. headrope length) and number of nets that may be towed behind the vessel are restricted to limit fishing effort. In Botany Bay vessels can use one or two nets with a total headrope length not to exceed 11 metres. Although permitted to tow two nets, fishers tow only one net.

Table B3 summarises the restrictions applying to otter trawl nets and Appendix B3 provides the regulations specifying the prawn trawl net.

All prawn trawl nets used in Botany Bay must be fitted with a BRD that has been approved for use in that fishery. Three designs are approved for Botany Bay including the Blubber Shute, Nordmore Grid and the Composite Square Mesh Panel (Appendix B4).

Time and area closures

A winter closure to trawling on Botany Bay was implemented in 1972 to reduce conflict with recreational fishers and to control the “black marketing” of catches. Closures to day time trawling were introduced in response to complaints from the public.

Estuary prawn trawling is restricted to waters of Botany Bay. There is an aquatic reserve on the southern shore of the bay and an exclusion zone around the runways to Sydney Kingsford Smith Airport. The Georges and Cooks Rivers are closed to trawling (see Appendix B6).

Trawling is permitted from November to Easter each year but there are provisions for an earlier opening during October and a later finish to the season during April if preset catch rate criteria is met (Appendix B6 and Table B31 detail the time closures).

Size limits and other restrictions

Fishers operating in the Estuary Prawn Trawl Fishery in this estuary are not permitted to retain species that have a legal minimum length.

8. Outcomes of Review

The purpose of this part of the EIS is to present a review of the current operation of the Estuary Prawn Trawl Fishery. The review will provide a baseline to measure the likely effectiveness of the FMS for the Estuary Prawn Trawl Fishery.

It should be remembered that Botany Bay has been gazetted as a Recreational Fishing Area from May 1 2002 (see Table AB21(a) in Appendix B). As a consequence trawling will cease in Botany Bay from the close of the 2001-02 season in April 2002 and this estuary will not be considered as a part of the review of current operations.

The review of the current operation of the fishery has highlighted a number of issues that need to be addressed in the draft FMS. This section describes each of those issues. A discussion on how they are proposed to be addressed can be found in section 3 of Chapter C.

a) Issues for the Estuary Prawn Trawl Fishery

i) Protecting areas of key habitat

Whilst trawling is permitted in only five of the 130 coastal estuaries it may be impacting upon key habitats within those estuaries. It is well understood that saltmarsh, seagrass and mangrove habitats are vital for the long-term survival of many shellfish and finfish species, including most of the species landed in the Estuary Prawn Trawl Fishery. They provide shelter for juvenile fish, and provide habitat for many small organisms that serve as a valuable food source for fish species. Evidence shows that the area of these habitats has been greatly reduced compared to past decades, mostly through land use and water management practices, but fishing gear types that move across the substratum, such as prawn trawl nets, also have the potential to affect habitat.

There is little current information about the distribution of key habitat areas for each of the estuaries of the Estuary Prawn Trawl Fishery, nor is there information about the impact of trawling on the various types of habitat found in estuaries of the Estuary Prawn Trawl Fishery. There is presently no plan to protect from trawling, the remaining areas of seagrass or areas of high abundance of juvenile shellfish and finfish within the boundaries of the fishery in each estuary.

ii) Ensuring stock sustainability

It is important that the Estuary Prawn Trawl Fishery operates in a manner that not only minimises the risk of overfishing of the target species but also that of species in the incidental catch.

There are reasons for concern about the level of exploitation upon the target species of the Estuary Prawn Trawl Fishery. The NSW Fisheries' Status of Fisheries Resources 2000 lists the eastern king and school prawn resources as fully fished. However Montgomery (2000) showed that these species are being caught at sizes that are smaller than the optimum size at first capture. For this reason it is likely exploitation of these species will change to "growth overfished" at the next review of the status of the fisheries resources by NSW Fisheries. Also there is cause for concern at the resource level for squid. The long term downward trend in the State's annual reported landings for squid is reason for alarm even though data on annual reported landings and CPUE from the Hawkesbury River suggest that the stock or sub-stock fished by the Estuary Prawn Trawl Fishery is not currently adversely affected by fishing.

Further, the whilst Estuary Prawn Trawl Fishery targets few species it catches a great many, the exploitation status of the majority of which is unknown. With the exception of squid (which is a target species in the Hawkesbury River only) the patterns in landings for the prominent byproduct species show little reason for concern about the level of exploitation. However some of these species are target species of other commercial fisheries and have an exploitation status of being fully fished. There is a large component of latent fishing effort in the Estuary Prawn Trawl Fishery that could place increased fishing pressure upon these resources which may jeopardise the sustainability of these stocks.

Presently there is no defined course of action prescribed to address the potential problems of over exploitation of the target species of the Estuary Prawn Trawl Fishery nor the potential for over exploiting an incidental species. To effectively manage the recovery of any overfished species, there needs to be a mechanism to allow for recovery programs to be developed in consultation with all relevant harvesting groups. This recovery plan must be conducted at the species level, rather than through a fragmented approach at the individual fishery level.

iii) Reducing incidental catch

The incidental catch is the non-targeted catch of the Estuary Prawn Trawl Fishery. It includes species that were not targeted but are retained for sale (byproduct) and species which are not retained for sale (bycatch). Some of these species are the target species of other commercial fisheries and the recreational fishery. The impacts of trawling upon non-target organisms have been widely documented. These can include significant effects to biodiversity and in some cases to the sustainability of adjacent fisheries. Both the environmental assessment guidelines of Planning NSW and, the Commonwealth's guidelines for ecological sustainability, place a significant emphasis on properly managing bycatch problems in fisheries.

NSW Fisheries is recognised internationally as leaders in the field of research on reducing incidental catch, as this has been the focus of a number of joint industry and government research and management programs in NSW trawl fisheries for many years. Studies by Kennelly (1993), Liggins and Kennelly (1996) Liggins *et. al.,* (1996) and Gray *et. al.,* (1990) quantified the significant quantities of incidental species caught in the Estuary Prawn Trawl Fishery. Following on from the results of this research Broadhurst and Kennelly (1994, 1995, 1996), and Broadhurst *et. al.,* (1997) in conjunction with industry developed BRDs that reduced the incidental catch in the trawl net by up to around 77%. Subsequently many fishers inserted BRDs into their nets and then on 2 December 2000, BRDs were made mandatory in the Estuary Prawn Trawl Fishery. NSW Fisheries is continuing to do research in conjunction with industry to minimise the impact of the trawl upon incidental species and the rest of the ecosystem.

The effectiveness in the fishery of those BRD's to reduce incidental catch in the Estuary Prawn Trawl Fishery is unknown. A research project to collect this information was planned for 2000-01 but the need to produce a fishery management strategy for the Estuary Prawn Trawl Fishery has delayed the start of this research.

iv) Minimising the multi-species character of the fishery

Overall, byproduct species contribute around 14% to the total annual reported landings of the Estuary Prawn Trawl Fishery, but the byproduct species of octopus, trumpeter whiting and crabs contribute appreciably to the annual total reported landings of the fishery in Botany Bay, Port Jackson

and Hawkesbury River and so give the impression that the fishery in these estuaries at least is multi-species in character.

Previous observer based studies on the catches of the Estuary Prawn Trawl Fishery in NSW found higher ratios (by weight) of bycatch to prawns in Botany Bay and Port Jackson than in the Clarence River (Liggins and Kennelly 1996, Liggins *et al.* 1996) suggesting that perhaps the faunal assemblages in Botany Bay, Port Jackson and the Hawkesbury River are different to those of the other two estuaries. However, other possible explanations for the high byproduct component are differences in the distance from the mouth of each estuary to the trawl grounds and small differences in gear design between estuaries.

Clause 34 of the *Fisheries Management (General) Regulation 1995* makes it clear that the trawl net used in the estuaries is for the targeting of prawns, and that the taking of other species is lawful under certain conditions but only as the byproduct of target fishing for prawns. With the exception of squid component of the fishery in the Hawkesbury River, the targeting of species other than prawns by the fishery should cease. There is a need to manage byproduct levels taken in the fishery to reduce the risk that the capture of non-target species may substantially alter the structure and function of ecosystems of the estuaries of the Estuary Prawn Trawl Fishery.

v) Controlling latent effort activation and major effort shift

Latent effort relates specifically to the number of never used, or little used, estuary prawn trawl entitlements. Entitlements that are not worked are not a problem whilst these remain that way, but if these become more active then there is a potential risk to the environment and to the sustainability of the resources as fishing pressure would increase. Presently, there are high levels of latent fishing effort in the Estuary Prawn Trawl Fishery. Approximately 50% of the entitlements in the fishery fish less than 15 days per season or year. There are currently no controls preventing the increased use of entitlements and while it is highly unlikely that this effort would all be activated at once, there is potential for effort to increase significantly if economic circumstances change.

vi) Minimising the effects of trawling

Little is known about the impact trawling has on the biodiversity upon grounds in the Estuary Prawn Trawl Fishery. In the only known peer reviewed study so far about the effects of trawling on benthic organisms in estuaries of NSW, Gibbs et al. (1980) found that trawling did not significantly affect the macrobenthic fauna in the sandy substratum in Botany Bay. A study currently being done by the University of Sydney will add to this knowledge by providing information about the effects of trawling upon benthic communities in the Clarence River.

Most information about the impact of trawling comes from studies done in the oceanic environment and these have implicated otter trawling in changing the ecosystem (for reviews see Hall, 1999; Kaiser and de Groot, 2000). However, relating these conclusions to trawling in estuaries is not straight forward because the oceanic environment differs to what is found in the estuaries. Studies in other countries about the effects of trawling on estuarine-type environments have found that there is great natural variability in the abundances of species in the estuarine ecosystem, such that the impact of trawling may not necessarily be major in what are naturally unstable environments (e.g. Kaiser and de Groot, 2000; Lindegarth *et al*., 2001).

Information about the impact of trawling upon marine fauna caught in the prawn trawl net of the Estuary Prawn Trawl Fishery comes from observer-based studies by Liggins and Kennelly, (1996)

and Liggins *et al.,* (1996) who found that the fishery caught many species, some of which are the target species of other commercial fisheries and recreational fishers and some may be a food source for other species.

There is little information about the impact of trawling upon the various habitats in the estuaries of the Estuary Prawn Trawl Fishery. Estuary prawn trawl fishers have sought to minimise the impact that their fishing may have upon the ecosystem by modifying their trawl nets and by inserting BRDs into the fishing nets. There are presently no controls on the amount of byproduct that can be taken and the amount of incidental catch that can be caught by the Estuary Prawn Trawl Fishery and little information about the impact of trawling upon the estuarine ecosystem.

vii) Equitably allocating resources

It is recognised that the Estuary Prawn Trawl Fishery targets species that are also the target species of the Estuary General, Ocean Trap and Line and Ocean Prawn Trawl fisheries and recreational fishers which operate in the same or adjacent waters. All sectors want an equal share of the resources, but sharing must be done so that the resources remain sustainable. Considering that the stocks of each of the target species in the estuaries of the Estuary Prawn Trawl Fishery are showing signs of reduced stock sizes and growth overfishing it is imperative that fishing upon the stocks be effectively controlled. In June 2000 a Juvenile Prawn Summit was attended by all stock holder groups to discuss the size at which prawns should be caught. There is no plan for this consultative process to be ongoing.

To effectively manage the allocation of resources there needs to be a process whereby in consultation with all harvesting groups stocks are assessed and an independent review of the assessments is done together with a determination on the allocation of the resources across all harvesting sectors. This process must be at the species level, rather than through a fragmented approach at the individual fishery level.

viii) Conserving threatened and protected species, populations and ecological communities

Activities which impact upon species or populations that are listed as being threatened must, under several sources of legislation, be modified or phased out so as to mitigate those impacts. Protected vegetation and animals must also receive a higher conservation status. This includes threatened mammals, birds and reptiles, as well as fish species.

While there are no firm data, it is thought that the impact of the Estuary Prawn Trawl Fishery on threatened species populations and ecological communities is small. A profile of the threatened and protected species is given in Appendix F4. Amongst these the green sawfish is probably the most susceptible to capture in the Estuary Prawn Trawl Fishery (Clarence River only). It is important to quantify and monitor any threatened species interactions, and have a management framework that is adaptive to change in the event that impacts are identified and found to be unacceptable.

ix) Minimising the conflict with other resource users and with the community

Apart from the Estuary Prawn Trawl Fishery, activities associated with estuaries include other commercial fishing, recreational fishing, participants in water orientated sports (e.g. motor cruising, water skiing, sailing) and walking or picnicking on the shore. Many in the community perceive

trawling to be a wasteful practice because much of the catch is discarded and probably damaged through the fishing process. For this reason, some wish access to the waterways without the sight of prawn trawlers operating. Others in the public want to be able to use the waterways without having to compete with trawlers. Industry has voluntarily given up trawling times and areas to share the waterways with these other user groups. However, the question of trawlers operating on the State's estuaries continues to be the topic of a substantial amount of the Department's correspondence and communication with the public. A plan about how to share waterways and seafood resources is needed.

x) Information needs and research

Improving the information base used to make management decisions concerning the fishery is an important issue for the draft FMS. There is clearly an important need for improved biological and stock assessment information for the fishery and a need to understand the impact of the trawl upon estuarine ecosystems.

Although there is a long time series of information, there is a strong reliance on commercial landings and effort information reported on monthly catch return forms. The abundance of a species may not be accurately reflected in commercial catch records, particularly when factors such rainfall and market values may influence catch levels.

Research needs in the fishery extend beyond stock assessments and encompass the need for estimating and minimising levels of bycatch, mapping trawl grounds and identifying the impacts of fishing on threatened species, habitats, trophic interactions and ecosystems.

The study of shellfish and finfish stocks and the marine environment is often complex and innately expensive. With the move to full cost recovery in the fishery between year 2005 and 2008, the fishers will have a limited capacity to fund additional research programs. Consequently, there is a need to identify the essential research programs, to prioritise research projects and to appropriately allocate the available resources based on those priorities.

CHAPTER C. THE DRAFT FISHERY MANAGEMENT STRATEGY

1. Introduction to the Estuary Prawn Trawl Fishery

a) Brief fishery description

The Estuary Prawn Trawl Fishery is one of eight major commercial fisheries in New South Wales (see Table C1 for a comparison of marine commercial fisheries). It uses otter trawl nets to target a single group of species, the prawns of the family Penaeidae. The only exception to this is the fishery for squid in the Hawkesbury River. There are 289 fishing businesses endorsed to operate in the fishery (as of July 2001).

The prawn stocks of NSW are ranked first in value amongst the wild caught seafood resources managed solely by the State Government. Fisheries for these resources contribute 48%[6] by weight and 28% by value to seafood production in NSW. Over the period from 1995/96 to 1999/2000 the Estuary Prawn Trawl Fishery contributed on average around 28% (430 tonnes) by weight and 16% ($3 million) by value to the production from prawns.

The Estuary Prawn Trawl Fishery currently operates for defined seasons (with the exception of the Hawkesbury River) in five of the 130 significant coastal estuaries within NSW and within each estuary is confined to a specific area, though from May 2002 the fishery will operate in only four estuaries.

[6] Unless otherwise stated, the information about annual reported landings and their value come from the catch statistics database of NSW Fisheries. Information about value is calculated by multiplying the landings recorded on fisher's monthly return forms by the monthly price for species auctioned at the Sydney Fish Market.

Table C1. Overview of the major marine commercial fisheries in NSW.

(Source: Fletcher & McVea, 2000; Tanner & Liggins, 2000; NSW Fisheries Licensing database – March 2001)

	Estuary Prawn Trawl	Estuary General	Ocean Trap and Line	Ocean Prawn Trawl	Ocean Fish Trawl	Ocean Hauling	Lobster	Abalone
Methods	Otter trawl net	Handline, Trap, Hauling net, Mesh/gill net, Hand collecting	Demersal trap Handline Setline Dropline Lift net	Otter trawl net	Otter trawl net	Beach seine net, Purse seine net	Trap pot	Diving (hookah)
Species	School prawn King prawn squid	Yellowfin bream, Dusky flathead, Sand whiting, Longfinned eels, Sea mullet	Snapper, Kingfish, Morwong, Spanner crabs, Silver trevally	King prawn, School prawn, Royal red prawn, Balmain bugs, Octopus	Silver trevally, Tiger flathead, Redfish	Sea mullet Sea garfish, Luderick, Yellowtail, Pilchards	Rock lobster (eastern)	Black lip abalone
Total catch in 1998/99 (t)	493	4,943	1,995	3,429	413	2,463	110	323
Est. value in 1998/99 (A$m)	4	17.5	9.6	22.7	1.5	4.1	4.2	12.6
No. of authorised fishing businesses	289	944	630	330	102	374	170	37
Standard boat length (m)	9	5	6-8	14	14	4	6-8	6
General no. of unlicensed crew	1	0*	0-1	2	2-3	0**	0-1	1

* unlicensed crew permitted only when undertaking boat based prawn seining.

** unlicensed crew permitted in some forms of boat based hauling.

b) Objects of the *Fisheries Management Act 1994*

The *Fisheries Management Act 1994* (the FM Act) seeks to achieve ecologically sustainable development for the fisheries of NSW through the achievement of its stated objectives, which are:

To conserve, develop and share the fishery resources of the State for the benefit of present and future generations. In particular the objectives of the FM Act include:

(a) to conserve fish stocks and key fish habitats

(b) to conserve threatened species, populations and ecological communities of fish and marine vegetation

(c) to promote ecological sustainable development, including the conservation of biological diversity

and, consistently with those objects:

(d) to promote viable commercial fishing and aquaculture industries

(e) to promote quality recreational fishing opportunities

(f) to appropriately share fisheries resources between the users of those resources

(g) to provide social and economic benefits for the wider community of NSW.

i) Ecologically sustainable development

Ecologically sustainable development (ESD) has been defined under the National Strategy for ESD as "development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends". It can be achieved through the implementation of the following principles and programs[7]:

- precautionary principle – if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- intra-generational equity – the benefits and costs of pursuing ESD strategies should be distributed as evenly as practicable within each generation
- inter-generational equity – the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations
- conservation of biological diversity and ecological integrity – conservation of biological diversity and ecological integrity should be a fundamental consideration
- improved valuation, pricing and incentive mechanisms – such as user pays and the use of incentive structures to promote efficiency in achieving environmental goals.

c) The role of the fishery management strategy

This draft Fishery Management Strategy (FMS) forms part of the rules, regulations and programs that are in place to manage the taking of fish by estuary prawn trawl fishers. Outlining the proposed rules in the draft FMS allows an environmental assessment to consider the potential impacts of the activities proposed to be regulated in accordance with the draft FMS on biophysical, economic and social environments.

This draft FMS has been prepared by NSW Fisheries in consultation with the Estuary Prawn Trawl Management Advisory Committee (MAC), but does not in all cases reflect the views of the MAC. The composition of the MAC is detailed in Table B15.

Information about the impacts of harvesting by other fishing sectors (such as recreational fishing) is also provided, however the rules applying to such sectors are dealt with under separate management arrangements.

There are various pieces of State and Commonwealth legislation that deal with the environmental impacts of commercial fishing. These requirements and their implications for the Estuary Prawn Trawl Fishery are discussed below.

[7] Adapted from section 6 (2) of the NSW *Protection of the Environmental Administration Act 1991*.

i) The NSW Environmental Planning and Assessment Act

The evolution of the new environmental assessment process for commercial fisheries in NSW stems largely from a decision handed down by the Land and Environment Court in January 2000. The Court decided that the issue of an individual commercial fishing licence had to meet the requirements of the *Environmental Planning and Assessment Act 1979* (the EP&A Act). This meant that the environmental impacts of any authorised activities had to be assessed at the time the licence was issued or renewed.

It is widely accepted that in most cases the best way of assessing the impact of fishing activity is by considering the total impact of fishing, instead of the potentially minor impacts of individual fishers. The Government was concerned that requiring assessment for each individual licence would be an unnecessarily expensive and time consuming activity. Licensed fishers would have faced a high level of uncertainty and significant individual costs.

After thorough consultation with stakeholders, the Government decided that the best approach would be to assess the environmental impact of fishing activities at the fishery level. This provides the best approach for both our aquatic environment and stakeholders. The legislation was subsequently amended to provide for the development of fishery management strategies and the environmental assessment of those strategies.

ii) The Commonwealth Environment Protection and Biodiversity Conservation Act

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) makes it an offence for a person to undertake an action that has the potential to significantly impact on a matter of 'national environmental significance' without first obtaining a permit from the Commonwealth Minister for Environment and Heritage. Matters of national environmental significance include: declared World Heritage areas; declared RAMSAR wetlands; listed threatened species and ecological communities; listed migratory species; listed marine species; nuclear actions; and the environment of Commonwealth marine areas. This draft FMS details the controls proposed to manage the impacts of the Estuary Prawn Trawl Fishery on such matters.

The EPBC Act was also amended in January 2002 to incorporate the provisions of the Wildlife Protection Act (which was repealed at the same time). The new Part 13A of the EPBC Act has the effect of removing the previous blanket exemption from export controls for marine fish species. As a result, the export of all marine organisms will come under the controls of the FM Act and be subject to ecological sustainability assessments based on guidelines established by the Commonwealth. To give time in which those assessments may be made, the exemption will continue until 1 December 2003. Until then, current arrangements regarding export of marine species will remain in effect, that is, the export of most marine fish and the bulk of marine invertebrates will continue to be exempt from export controls under the Act.

If a fishery is not assessed as exempt, it will more than likely be able to continue to supply product for export through an approved wildlife trade operation (section 303FN). These declarations will have conditions attached that will bring the management and operations of the fishery in line with the Commonwealth guidelines. Once declarations are made, exporters will need to apply for and

obtain from Environment Australia a permit to export. The responsibility of implementing the necessary changes to the fishery management arrangements will rest with the management authority.

iii) The NSW Marine Parks Act

The *Marine Parks Act 1997* was introduced to provide for the declaration of marine parks in NSW. The Act and associated regulations aim to protect biodiversity and provide for a variety of users (where consistent with the target objective) by way of zoning and operational plans. These are required for all marine parks and the zones clearly identify the conservation and management priorities within marine parks (MPA, 2000). The objects of the Act are as follows:

(a) to conserve marine biological diversity and marine habitats by declaring and providing for the management of a comprehensive system of marine parks

(b) to maintain ecological processes in marine parks

(c) where consistent with the preceding objects:

(i) to provide for ecologically sustainable use of fish (including commercial and recreational fishing) and marine vegetation in marine parks

(ii) to provide opportunities for public appreciation, understanding and enjoyment of marine parks.

The draft FMS has been prepared taking into account, and ensuring consistency with, the objects of the *Marine Parks Act 1997*.

At the time of drafting the FMS and EIS for the Estuary Prawn Trawl Fishery, there were no regulations in place with respect to zoning plans for any marine park in NSW. Consultation was taking place however, on draft zoning plans for the Solitary Islands Marine Park and the Jervis Bay Marine Park and the permissible uses proposed under those plans.

d) The role of the Share Management Plan

The FM Act requires that a share management plan be developed and implemented for share management fisheries. A share management plan is made by regulation and provides a legislative structure for the class or classes of shares and the rights of shareholders under a full share management regime. Further information on the transition of the Estuary Prawn Trawl Fishery to full share management can be found in section 6(a) of this chapter.

The share management plan may also formalise a number of aspects of the fishery that are described in this draft FMS. A share management plan must include objectives and performance indicators, which for the Estuary Prawn Trawl Fishery will be consistent with those outlined in section 5 of this draft FMS. These include; the shellfish and finfish that may be taken, the areas for taking shellfish and finfish, the times or periods for operating the fishery, the protection of fish habitats and the use of boats and fishing gear.

e) Issues within the Estuary Prawn Trawl Fishery

The review of the existing operation of the Estuary Prawn Trawl Fishery in Chapter B identified a number of issues in the fishery that need to be addressed by the FMS. The issues are:

- protecting areas of key habitat

- ensuring stock sustainability
- reducing bycatch
- minimising the multi-species character of the fishery
- controlling activation of latent effort and major shifts in effort
- minimising the effects of trawling
- equitably allocating resources
- conserving threatened and protected species, populations and ecological communities
- minimising the conflict with other resource users and the community
- information needs and research.

Section 3 of this chapter outlines these issues and describes how this draft FMS proposes to address these through the implementation of management responses.

2. Vision and Goals for the Fishery

a) Fishery vision

The long term vision for the Estuary Prawn Trawl Fishery is to have:

A fishery that is managed under the principles of ecological sustainable development, with equitable sharing of resources and good economic viability, that uses environmentally friendly fishing gear to provide fresh, high quality seafood to the community.

b) Fishery goals

The goals that have been set for the fishery to assist in achieving this vision are:

1. To manage the Estuary Prawn Trawl Fishery in a manner that promotes the conservation of biological diversity in the estuarine environment
2. To maintain target and byproduct species harvested by the Estuary Prawn Trawl Fishery at sustainable levels
3. To promote the conservation of threatened species, populations and ecological communities associated with the operation of the Estuary Prawn Trawl Fishery
4. To appropriately share the resource and carry out fishing in a manner that minimises social impacts
5. To promote a viable commercial fishery (consistent with ecological sustainability)
6. To ensure cost-effective and efficient management and compliance in the Estuary Prawn Trawl Fishery
7. To improve the knowledge of the community about the operations and management of the Estuary Prawn Trawl Fishery
8. To improve the knowledge about the Estuary Prawn Trawl Fishery and the resources upon which the fishery relies.

3. Proposed Changes to the Operation of the Fishery

The draft FMS aims to; (i) provide a set of management rules that constrain the Estuary Prawn Trawl Fishery to sustainable targeting of the traditional species of prawns (and squid in the Hawkesbury River), (ii) limit the byproduct that can be landed and (iii) minimise the impact of trawling upon the ecosystem. It will be reviewed at the same time as the associated management plan(s), every five years. Chapter B described the key management issues arising from the existing operation of the fishery that need to be addressed by the draft FMS. These issues are listed below along with a description of the proposed actions to address them. Please refer to Chapter B for a full description of how the fishery currently operates and in particular, section 8 in Chapter B for a further discussion of the management issues that have been identified.

a) Protecting areas of key habitat

Healthy fish habitats are essential for the ongoing sustainability of shellfish and finfish populations. Many areas within estuaries act as nursery areas for juvenile shellfish and finfish. Mangrove, seagrass and saltmarsh areas are believed to provide very important habitats for fish and crustaceans.

There is a range of activities that take place in coastal catchments that have the ability to damage shellfish and finfish habitat and need to be appropriately managed, with fishing being only one. The draft FMS proposes several measures to minimise the activities of this fishery on marine habitats and adjacent terrestrial habitats. These include:

- closing areas of seagrass and other areas of key habitat to trawling. It is noteworthy that industry has voluntarily closed many such areas (by June 2003 and then as required)
- modifying fishing gear to reduce the impact upon the river bed (current and ongoing)
- involving the Estuary Prawn Trawl MAC in reviews of the NSW Fisheries habitat management policy and guidelines and habitat protection plans which aim to prevent or reduce impacts of all activities on aquatic habitats, including seagrass, saltmarsh and mangrove habitats (current and ongoing)
- involvement of the Estuary Prawn Trawl MAC in the development of habitat management policies and habitat rehabilitation works (current and ongoing).

b) Ensuring stock sustainability

This relates to ensuring that the species harvested by this fishery are fished at a level that minimises the risk of overfishing the stocks. Because the fishery is managed by input controls, the key issue with respect to controlling the level of harvest is controlling the amount of fishing effort that is applied to the stock. Controlling fishing effort can include very specific measures such as regulating the size and dimensions of the fishing gear used, but at a broader level involves measures such as controls on the number of fishers who have access to (or are 'endorsed' to operate in) each part of the fishery.

The review of the existing operation of the fishery has highlighted several risks with respect to potential activation of latent effort (ie. fishing entitlements not used or seldom used) and/or major shifts of effort into or within the fishery.

To address these issues, this draft FMS proposes:

- implementing either a new share-based restructuring program to operate in each estuary to cap the number of fishers with access to the fishery at historically active levels, or a cap of the total level of fishing effort applied to prawn stocks by estuary prawn trawl fishers to be determined annually by an independent expert committee (called the 'Total Allowable Catch Setting and Review Committee'[8]) (by July 2003)
- implementing a policy that prevents fishing business owners from nominating another person to operate their business on their behalf (thus activating inactive entitlements) (by July 2003)
- doing scientific assessments of the status of the stocks of target species (pilot study 2002-2003, full scale by July 2003)
- introducing incidental catch ratios to prevent trawling in areas of high abundance of incidental species (ongoing)
- in consultation through the Prawn Resource Forum, introducing prawn counts to increase the sizes of prawns taken (by June 2006)
- implementing stronger compliance programs, including a penalty points scheme and share forfeiture for serious and or habitual offenders (by July 2003).

c) Reducing incidental catch

The incidental catch is the non-targeted catch of the Estuary Prawn Trawl Fishery. It includes species that are retained for sale (byproduct) and those which are discarded (bycatch). Estuaries are extremely dynamic environments with a high diversity of species, and incidental catch occurs as other species become inadvertently caught in the gear while it is being used to catch target species. When handled properly, some of the bycatch that is taken and returned to the water can survive.

Several research programs have been conducted in the NSW Estuary Prawn Trawl Fishery to quantify the level of incidental catch taken in the estuary prawn trawl nets (Liggins and Kennelly, 1996; Liggins *et al*., 1996; Gray and McDonall, 1993). Industry is sensitive to its impact upon the environment and this fishery was one of the first fisheries in Australia to embrace the concept of bycatch reduction devices (BRDs) to reduce the catch of unwanted species. The effectiveness of BRDs is continually being improved as fishers experiment with new ideas and with advances in fishing technology. Improvements in reducing incidental catch will continue to change the operations of the fishery.

The draft FMS proposes a number of initiatives to further increase our understanding and management of bycatch issues, including:

- introducing an observer-based survey to quantify catches in estuary prawn trawl operations (by July 2003 and ongoing)
- continuing to modify fishing practices to reduce bycatch (e.g. BRDs) and to improve the survival of bycatch species (eg. holding tanks and release tubes) (current and ongoing)

[8] Despite the name of the committee, it has legal jurisdiction to recommend total allowable **effort** levels as well as total allowable catch levels.

- banning the use of fish spikes, clubs and any other such implement that could unduly harm bycatch (by June 2003 and then as required)
- introducing ratios of incidental catch to target species which, if exceeded, lead to the temporary closure of those areas (by July 2003).

d) Minimising the multi-species character of the fishery

The estuary prawn trawl fishery predominantly targets two species of prawn and at least one species of squid, although fishers are permitted to retain byproduct from their fishing operation except species that are subject to a minimum legal length. The draft FMS proposes several direct measures to minimise the risk of the fishery adopting a more multi-species character. These include:

- introducing limits on the landings of byproduct species that are related to the amount of target species landed (by June 2003 and then ongoing)
- introducing an observer-based survey to quantify catches in estuary prawn trawl operations (by July 2003 and ongoing)
- introducing incidental catch ratios to prevent trawling in areas with high abundance of incidental species (by July 2003).

e) Controlling latent effort and major effort shifts

Latent effort relates to the number of never used, or seldom used, estuary prawn trawl entitlements. Entitlements that are not worked are not a problem whilst they remain that way, but if they become more active then there is a potential risk to the environment as fishing pressure would increase. The draft FMS proposes a number of initiatives to control latent fishing effort:

- implementing either a new share-based restructuring program to operate in each estuary to cap the number of fishers with access to the fishery at historically active levels, or a cap of the total level of fishing effort applied to prawn stocks by estuary prawn trawl fishers to be determined annually by an independent expert committee (called the 'Total Allowable Catch Setting and Review Committee') (by July 2003)
- implementing a policy that prevents fishing business owners from nominating another person to operate their business on their behalf (thus activating inactive entitlements) (by July 2003).

f) Minimising the effects of trawling

Notwithstanding the action that is being taken to minimise the effects of fishing through management responses to reduce bycatch, protect environmentally sensitive habitat and reduce latent fishing effort, there is the need to understand the impact of trawling upon the ecosystem.

Industry members on the Estuary Prawn Trawl MAC believe that any impact trawling may have upon biodiversity is insignificant when compared to that caused upon river systems by adjacent land use practices and natural phenomenon such as flooding.

Results from a study being undertaken by the University of Sydney will set the platform for future research projects dedicated to answering specific questions on the effects of fishing on the ecosystem. In the meantime, additional management responses proposed in this draft FMS to further address the issue of the impact of trawling upon the ecosystem include:

- closing areas of key habitat (by June 2006 and then as required)
- introducing incidental catch ratios to discourage trawling in areas with high abundance of incidental species (by July 2003)
- developing a research strategy to assess the impact of trawling upon biodiversity (by June 2005)
- collaborating with other institutions to better understand the concepts of ecosystem function and the individual importance of harvested and other species populations and ecological communities (current and ongoing)
- participating in the management of marine protected areas that are declared along the NSW coast (current and ongoing)
- modifying the mandatory catch and effort returns, in consultation with the Estuary Prawn Trawl MAC, to collect and monitor information on sightings or captures of threatened species (as required).

g) Equitably allocating resources

This draft FMS proposes a process for assessing the amount of fishing effort that can be exerted upon prawns (and squid in the case of the Hawkesbury River) and for allocating fishing effort across all fisheries. The proposal relies upon calling a meeting each year of a group of stakeholder representatives. The composition of the group would include representatives of ocean and estuary commercial prawn fishers, the Advisory Council on Recreational Fishing, Nature Conservation Council of NSW, the Seafood Industry Council and government. The meeting would be known as the Prawn Resource Forum (PRF). Recommendations would be made to the Minister on the allocation of fishing effort on prawn stocks and other cross-fishery management measures. Stock assessments of the resources would be considered as part of a process to assess the status of the stocks. The independent TAC Committee would consider all available information (including the stock assessments and submissions from the public and industry) about the allocation of fishing effort across the various fishing sectors and about the management measures being used to manage the resource.

The steps in the annual consultation process to determine and allocate fishing effort are:

Step 1. The status of the stocks of target prawn species are assessed annually and presented as a stock assessment

Step 2. The stock assessment will be reviewed by the relevant MACs and the Prawn Resource Forum and then recommendations on total prawn fishing effort, the allocation of prawn fishing effort between fisheries, and other cross-fishery issues (as required) will be made to the TAC committee

Step 3. The TAC Committee will review the stock assessment together with submissions from the Prawn Resource Forum, other interested parties, and the public to determine the level of total fishing effort to apply to each fishery, for the approval of the Minister for Fisheries

Step 4. Once approved, the Minister for Fisheries refers the determination and any other decisions to the relevant advisory bodies and NSW Fisheries for implementation.

h) Conserving threatened and protected species, populations and ecological communities

A vital part of conserving biological diversity in the marine environment is managing impacts on threatened species, populations and ecological communities. While there are no firm data, it is thought that the impact of the Estuary Prawn Trawl Fishery on threatened and protected species is small.

The draft FMS aims to minimise any impacts of the Estuary Prawn Trawl Fishery on threatened species by:

- gathering information on threatened and protected species interactions by requiring endorsement holders to record interactions or sightings on the mandatory monthly catch and effort returns, and recording incidences during observer based surveys and fishery independent surveys (by July 2003)
- using closures to avoid direct interactions with protected species and threatened species, populations or ecological communities (eg. closures in areas where threatened species are known to occur, as required)
- ensuring that the provisions of any threatened species recovery plans or threat abatement plans are adopted, and any necessary changes to the operation of the fishery are made (as required).

i) Minimising conflict with other resource users and with the community

The Estuary Prawn Trawl Fishery operates in close proximity to residential areas, popular picnic areas and other general users of the State's waterways. It catches species that are actively targeted in other commercial fisheries, the charter boat fishery and the recreational fishery, or that may have significant conservation value. The social interaction between estuary prawn trawl fishing operations and other stakeholders is a significant issue in this fishery and needs careful management.

The draft FMS seeks to appropriately share the resource and promote harmony between estuary prawn trawl fishers and other stakeholders by:

- investigating whether estuaries should be closed to trawling on weekends and public holidays (immediate)
- introducing limits on levels of landings of byproduct species (by June 2003 and ongoing)
- introducing incidental catch ratios (by July 2003)
- introducing prawn counts to prevent the harvesting of small prawns (by July 2002)
- monitoring the relative catch levels of each harvest sector and undertaking reviews where appropriate (by July 2003 and then annually)
- being adaptive and able to accommodate the provisions of an Indigenous Fisheries Strategy (as required)
- publishing material about the Estuary Prawn Trawl Fishery to educate the public and industry (ongoing)

- implementing a "basic skills course" for new entrants into the fishery (by June 2005).

j) Information needs and research

By their very nature, fish stocks and marine ecosystems are very complex and costly to study. There is a general lack of information and knowledge about many of the species taken in the Estuary Prawn Trawl Fishery and about the impacts of fishing on the general environment. This situation is not unique to NSW. Management decisions need to be made using the best available information at the time and need to be precautionary where there are uncertainties in the information and threats of serious or irreversible environmental damage from the activity.

A major issue for management for many species is the current reliance on catch and effort information reported by the commercial fishery as the main indicator of stock abundance. In addition to stock assessments of target species, the other basic areas of research needed in the fishery can be categorised into six broad areas: (i) quantification and reduction of the bycatch and discarding of non target species; (ii) effects of fishing methods on habitats; (iii) effects of habitats on fish populations; (iv) importance of ecological processes to fish populations; (v) impacts of fishing on trophic interactions and ecosystems; and (vi) impacts of fishing on threatened species.

The draft FMS proposes to address the data deficiencies in the future by:

- improving the quality of information collected from estuary prawn trawl fishers through the mandatory monthly catch and effort returns submitted to NSW Fisheries (current and ongoing)
- increasing the level of monitoring, analysis and reporting of commercial landings data at both a species level and at the individual estuary level (by July 2003)
- developing fishery-independent methods of data collection for stock assessment purposes (pilot study 2002-2003 and full scale July 2003)
- commencing an observer-based survey to collect bycatch and discarding information on quantities of species caught and either retained or discarded (by July 2003 and then ongoing)
- conducting targeted, short-term research projects to address the significant gaps in knowledge about the physical impacts of trawling on habitats and about the effects of fishing on trophic interactions and ecosystems (as required)
- developing targeted, short term research projects on a threatened species, population and/or ecological community basis that examines the biology and ecology of those species, populations and ecological communities, to assess the potential impacts of many factors (only one of which would be the Estuary Prawn Trawl Fishery) (as required).

In addition, an important area of information need is broadening the provision of general information about the fishery. The fishing practices, target species, and incidental catch of the Estuary Prawn Trawl Fishery are poorly understood. This draft FMS proposes a range of management responses that will improve the flow of information to and from the fishery including the following:

- publishing successful prosecution results for nominated offences in relevant publications and media to discourage illegal activity (current and ongoing)
- providing a continuing education strategy for fishers and NSW Fisheries' contact officers (current and ongoing)

- making the final FMS, environmental assessment and other relevant documentation widely available to the public by:
  - placing them on the NSW Fisheries website (ongoing)
  - providing copies at Fisheries Offices throughout the State (ongoing)
  - targeted mail outs to key stakeholders (ongoing).
- surveying the communities of fishing ports to keep abreast of their understanding of the Estuary Prawn Trawl Fishery (by July 2003)
- responding to inquiries by industry or the public with respect to the final FMS or the fishery generally (current and ongoing)
- publishing educational information concerning the protection of fish habitat on the NSW Fisheries website and in other relevant publications and media (current and ongoing).

4. Goals, Objectives and Management Responses

This section sets out the goals, objectives and management responses for the Estuary Prawn Trawl Fishery draft FMS.

a) A model framework

Figure C1. A model of the framework for a FMS.

The link between the goals, objectives and management responses is not as simple as that portrayed in Figure C1. The reality is that most fishery management responses assist in achieving more than one goal.

A fishing closure is one example of a management tool that has been used in the past in the Estuary Prawn Trawl Fishery which can contribute towards achieving objectives and goals in addition to those for which it was put in place. A closure to protect juvenile shellfish and finfish from capture fits into "Goal 2, maintaining stock sustainability", but it will also protect the habitat and biodiversity in the closed area from the effects of fishing and may reduce conflict between commercial and recreational fishers (see Figure C2).

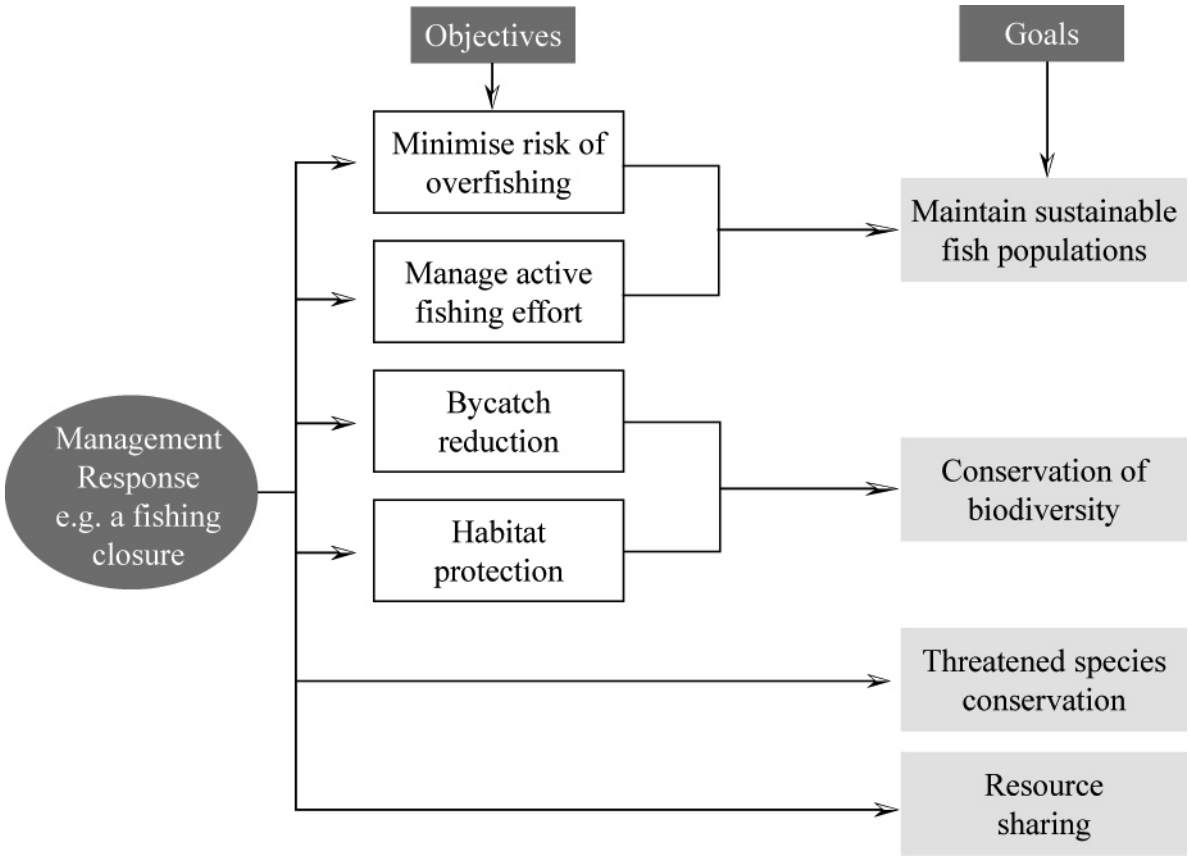

Figure C2. An example of how a single management response affects multiple goals and objectives.

This complex structure has been dealt with in the following section by listing each of the management responses once only, under the objective that the response contributes most towards achieving. Below each management response is a box that sets out the implementation plan for the particular response and cross references the response to other goals that the response may assist in achieving.

When identifying the responses that are in place to achieve a particular objective, it is important to look at the cross referenced responses as well as any listed individually under the objective (i.e. the "Other important responses" must be taken into account).

Information under each response is also provided detailing the time frames in which the action will be done, the agency or group responsible for implementation and the authority under which the action will be implemented.

b) Draft goals, objectives and management responses

GOAL 1. To manage the Estuary Prawn Trawl Fishery in a manner that promotes the conservation of biological diversity in the estuarine environment

Objective 1.1 To minimise the impact of fishing activities on non-retained shellfish and finfish (including prohibited size, unwanted fish and fish protected from commercial fishing)

Other important responses: 1.2a,b,d; 2.1a,i; 2.3e; 2.4a; 4.4a; 5.1a; 6.1a,b; 8.1a

(a) Continue the restrictions on the use of fishing gear contained within the *Fisheries Management (General) Regulation 1995* including controls on the dimensions, construction materials and modes of operation.

Note: This management response is part of the current rules operating in the fishery.

Contributing to Goals	Timeframe	Responsibility	Authority
2,4,5	Current and Ongoing	NSW Fisheries	Regulatory

(b) Using the best available knowledge and appropriate technology, modify fishing practices (such as by adopting bycatch reductions devices (BRDs)) to reduce the impacts of trawling upon organisms **other than target and byproduct species.**

Background: The incidental catch of the Estuary Prawn Trawl Fishery prior to the introduction of Bycatch Reduction Devices (BRDs) is well documented. Extensive research has been done on the effects of various designs of BRDs on abundances of incidental species in the prawn trawl. Bycatch reduction devices are mandatory in all but the lower Hawkesbury estuary where because of the effects on catches of current BRD's, research has been continuing to develop alternatives. These devices will be mandatory in the eastern king prawn component of the fishery in this area by December 2002 and in the squid component of this fishery by June 2003 The improvement of BRDs will be an on-going process and fishers will be able to apply for permits to trial new designs.

An observer based sampling strategy will be used to collect information about quantities of the various species caught in the prawn trawl net and the effectiveness of BRDs to reduce the catch of incidental species under commercial fishing conditions.

The National Policy on Fisheries Bycatch provides a national framework for coordinating efforts to reduce incidental catch. It provides options by which each jurisdiction can manage incidental catch according to its situation in a nationally coherent and consistent manner.

Contributing to Goals	Timeframe	Responsibility	Authority
2,4	Current and Ongoing	NSW Fisheries and EPT fishers	Regulatory

(c) Using available knowledge and appropriate technology, develop and introduce alternate fishing gears to minimise the capture of target and byproduct species of non marketable quality.

Background: Research is being done by the University of Sydney to develop an environmentally sensitive fishing gear for the new Hawkesbury River squid component.

Studies will be undertaken to investigate alternate gear configurations for the otter trawl to reduce the catch of small, non-marketable prawns and to minimise any possible impact upon non-target species.

An observer-based sampling strategy will collect the information to ascertain whether this management response is being successful at minimising the capture of target and byproduct species of non-marketable quality.

Contributing to Goals	Timeframe	Responsibility	Authority
2,5	June 2003 for a squid net June 2006 for small prawns	NSW Fisheries	Regulatory

(d) Ban the riddling of cooked prawns and investigate the banning of riddling green prawns.

Background: Prawn fishers in some estuaries use a device known as a riddler to grade the sizes of prawns in their catch and in some cases to separate debris from the prawn catch. A riddler is a screen of wire mesh stretched over a frame. The mesh size of this screen varies but is usually around 50 mm. The riddler is used like a "chute" as it is positioned at an angle of about 60 degrees and the prawn catch is passed over the top of the screen. Small prawns pass through the screen and are collected in a container underneath, while larger prawns pass over the top and are collected in a container at the lower end of the "riddler". The unwanted portion of the prawn catch from riddling is discarded with green prawns returned to the water and cooked prawns disposed of. There is little information about the survival of "riddled" green prawns once they are returned to the water.

A research program to be undertaken by NSW Fisheries and funded by the Fisheries Research and Development Corporation will investigate the impact of riddling upon school prawns and then eastern king prawns..

Contributing to Goals	Timeframe	Responsibility	Authority
2,4,5	School prawns by July 2003 and eastern king prawns by July 2004	NSW Fisheries and EPT Fishers	Regulatory

(e) Use best-practice techniques for the handling of non retained animals; in particular ban invasive implements such as spikes and encourage non invasive tools like tongs and scoops.

Background: Fishers use various implements to sort through their catch efficiently, remove debris and to avoid injury from poisonous aquatic life or from the spines on some animals. One such implement is a spike which is used mainly to discard harmful animals over board.

Fishers are experimenting with ways to keep their catch alive whilst on the deck of their trawler. Some techniques that are being used are "swim tanks" to keep the catch alive whilst it is being sorted and "release tubes" to release discarded fauna below the surface away from predators such as birds and fish near the surface.

Contributing to Goals	Timeframe	Responsibility	Authority
4	By June 2003 for spikes and then as required	NSW Fisheries and EPT Fishers	Regulatory

(f) [Continue to] use fishing closures to control the area and time fished to:

(i) conserve target and byproduct species

(ii) prevent trawling in areas and at times of high abundances of incidental species

(iii) avoid direct interactions with threatened species, populations or ecological communities

(iv) protect key habitats and areas of environmental sensitivity; in particular, prohibit trawling over beds of *Zostera* and *Posidonia* seagrass

(v) equitably share the resource between stakeholders.

Background: Fishing closures prohibit fishing over an area either absolutely or conditionally. These closures can be implemented under section 8 of the FM Act or by regulation.

As of July 2002 all but four of the 130 coastal estuaries of NSW will be closed to trawling. In addition, approximately 50% of the area of each of the four estuaries (Clarence River, Hunter River, Hawkesbury River and Port Jackson) where trawling is permitted, is closed.

Industry members of the Estuary Prawn Trawl MAC advise that trawling is not done over seagrass beds in the Clarence, Hunter or Hawkesbury Rivers.

Numerous other closures already exist in the Estuary Prawn Trawl Fishery for a range of reasons. Each closure generally has benefits to numerous aspects of the resource and the fishery.

Closures are reviewed at least every five years and are occasionally modified to address changing fishing patterns and/or environmental conditions.

Contributing to Goals	Timeframe	Responsibility	Authority
2,3,4,5	(i), (iii) and (iv) ongoing and(ii) and (v) by July 2003 and then ongoing	NSW Fisheries	Regulatory

(g) Continue the prohibition on using firearms, explosive or electrical devices to take shellfish and finfish in the fishery.

Note: This management response is part of the current rules operating in this fishery and in all other NSW fisheries.

Contributing to Goals	Timeframe	Responsibility	Authority
2,4	Current and ongoing	NSW Fisheries	Regulatory

Objective 1.2 To minimise the impact of activities in the fishery on marine and estuarine habitat

Other important responses: 1.1c,f,g; 1.3f; 2.1a; 2.3b; 2.5b,d; 4.4a; 6.1b; 8.1a

(a) Clearly define areas of key habitat and/or environmental sensitivity (at the ecosystem level) and non-trawled areas within the area where trawling is currently permitted within each estuary.

Background: The Estuary Prawn Trawl MAC has placed a high priority on research into mapping the environmentally sensitive areas of the Estuary Prawn Trawl Fishery. Applications for grant funding to do this research will be submitted by February 2003. Also, research is being undertaken by the University of Sydney on the effects of trawling upon benthic communities in the Clarence River. Results from this and other studies will provide direction

for future research to investigate the effects of trawling upon the ecosystem. Discussions will be held with industry, researchers and other stakeholders about closing any areas that are identified as being key habitat areas (including nursery areas for juvenile shellfish and finfish) and/or areas of environmental sensitivity.

Contributing to Goals	Timeframe	Responsibility	Authority
2,4,7	June 2006 and then ongoing	NSW Fisheries and EPT fishers	Regulatory

(b) There will be no increase in the current total area that is trawled within the boundaries of each estuary.

Background: Current non-trawled areas within the boundaries of the fishery within each estuary may become desirable trawled areas over time because of changing environmental conditions. For instance, shifting substrate may cover rocky areas making trawling possible in that previously non-trawled area. The grounds of the estuaries will be mapped and although the total area trawled in the estuary will not change, the grounds within the boundaries of the fishery within the estuary may, as fluctuating environmental conditions prohibit trawling in one area but enable trawling in another.

Contributing to Goals	Timeframe	Responsibility	Authority
2,4,7	June 2006 and then ongoing	NSW Fisheries and EPT fishers	Regulatory

(c) Continue the prohibition on wilfully damaging marine vegetation.

Note: This management response is part of the current rules operating in this fishery and all other NSW fisheries.

Contributing to Goals	Timeframe	Responsibility	Authority
4,7	Current and ongoing	NSW Fisheries	Regulatory

(d) Prohibit the removal of woody debris from the river bed.

Background: The removal of large woody debris from rivers and steams was declared a key threatening process in November 2001 under the FM Act.

Contributing to Goals	Timeframe	Responsibility	Authority
7	Current and ongoing	NSW Fisheries	Regulatory

(e) Develop a code of conduct for the fishery with respect to:

(i) guidelines for operating near river banks, seagrass, saltmarsh or mangrove habitat and in any other area of environmental sensitivity in a manner that minimises environmental impacts in those areas

(ii) operating in the vicinity of listed Ramsar wetlands or known JAMBA and CAMBA migratory bird habitat in a manner that minimises disturbance

(iii) respecting the rights and recognising the needs of other users of the water ways and residents along the estuaries

(iv) minimising the levels of pollutants associated with the fishing operation, including exhaust, noise and fuels and oils in bilge water

(v) assisting in reducing the amount of rubbish in estuaries by retaining for disposal onshore the rubbish recovered during fishing operations

(vi) operating in the vicinity of threatened species, populations, and ecological communities.

Background: Fishers of the Estuary Prawn Trawl Fishery are responsible stewards of the ecosystem from which they earn an income. Formalising the actions that are already done by many will go a long way towards improving the relations between the commercial fishing industry and other stakeholders.

Contributing to Goals	Timeframe	Responsibility	Authority
3,4	By June 2003	Ept MAC and NSW Fisheries	Voluntary and Regulatory

Objective 1.3 To reduce the likelihood of species, populations and ecological communities from being changed in a manner which threatens ecosystem integrity (i.e. composition and function)

Other important responses: 1.1a-c, e-g; 1.2a-e; 2.1b,i; 2.3b; 2.4a; 2.5a-d; 2.6a,b; 4.2c; 4.4a; 6.1a,b; 6.4a; 8.1a,b; 8.2a,b

(a) Implement incidental catch ratios in each estuary.

Note: The incidental catch ratio is the ratio, by weight, of the target species to all other species in the catch (incidental catch) of a trawl. This ratio will be used to identify areas were the abundance of incidental species is too great to allow trawling to occur.

The process by which incidental catch ratios are adhered to within an estuary will largely be the responsibility of industry. Enforcement of the incidental catch ratios will be done as part of a compliance quality inspection by Fisheries Officers. Penalty points will apply to fishers who have breached the incidental catch ratios. If on more than two occasions on any one day vessels are boarded during a compliance quality inspection and the incidental catch ratio is exceeded, the estuary will be closed to trawling for a specified period.

The period of time for which the estuary is closed will be on a case by case basis. The Estuary Prawn Trawl MAC will be consulted about developing a set of criteria for reopening estuaries closed to trawling as a result of excessive incidental catches.

The incidental catch ratios have been calculated from studies by Broadhurst and Kennelly (1994), Broadhurst and Kennelly (1995), Broadhurst et al. *(1996) and Broadhurst* et al. *(1997) and are based upon data collected in years before BRDs were made mandatory in the fishery. The incidental catch ratio will be reviewed annually in light of up to date information from the observer program. The incidental catch ratios (weight of target prawn species to the combined weight of all other species) are:*

Clarence River	*1 : 0.16*
Hunter River	*1 : 0.44*
Hawkesbury River	*1 : 0.44*
Port Jackson	*1 : 0.78*
Botany Bay	*1 : 0.44*

Contributing to Goals	Timeframe	Responsibility	Authority
2,4,7	By July 2003	EPT fishers	Regulatory

(b) Promote research on the impacts of fishing on the general environment; in particular, pursue the research priorities identified in section 6(j) of this draft FMS.

Background: Like most fisheries around the world, direct effects of the Estuary Prawn Trawl Fishery on habitats and species of importance are poorly understood and indirect effects are unknown. The Estuary Prawn Trawl Fishery needs to promote and support long-term research that aids understanding of the impact of the fishery in an ecological setting. An observer study will provide information that will be useful when determining the direct impact of the fishery. Information from the current study by the University of Sydney into the impacts of trawling upon benthic communities in the Clarence River and from other studies done on the impact of trawling will provide direction for future research.

Contributing to Goals	Timeframe	Responsibility	Authority
8	Ongoing	NSW Fisheries and EPT MAC	-

(c) Collaborate with other institutions to better understand the concepts of ecosystem function and the individual importance of species, populations and ecological communities.

Background: There is a general lack of knowledge about the way in which biodiversity in marine ecosystems is affected by fishing and how to meaningfully measure these effects. This is especially true for diverse and complex systems like the environment in which the Estuary Prawn Trawl Fishery operates. A better knowledge of how these ecosystems function is needed to understand the effects of trawling upon these systems.

Contributing to Goals	Timeframe	Responsibility	Authority
6,8	Current and ongoing	Other institutions and NSW Fisheries	-

(d) Develop a performance indicator to measure the impact of trawling upon biodiversity.

Background: There is no simple performance measure currently available to give an accurate representation of the impacts of the Estuary Prawn Trawl Fishery on biodiversity. Performance measures are needed for biodiversity impacts at the species, community and ecosystem levels. Careful thought must be given to deciding the most appropriate performance measure (and trigger points), so as to avoid expending resources unnecessarily on monitoring unrepresentative or inappropriate indicators. This will require substantial research over many years to determine the best approach and useful performance measures may be unavailable for some time. Collaboration among fishery management, scientific and stakeholder groups will be essential to the development of appropriate indicators.

Contributing to Goals	Timeframe	Responsibility	Authority
8	By June 2007	Other institutions and NSW Fisheries	-

(e) Develop a research strategy to assess the impact of trawling upon biodiversity within the fished area of each estuary.

Background: Once a performance indicator has been agreed to by stakeholders then a research strategy will need to be developed to provide the information necessary to implement the performance indicator.

Contributing to Goals	Timeframe	Responsibility	Authority
2,3,6,7,8	When required	NSW Fisheries	-

(f) The Estuary Prawn Trawl MAC will have the opportunity to comment on the selection and ongoing management of marine protected areas in estuarine waters.

Background: A comprehensive system of representative marine protected areas (i.e. marine parks and aquatic reserves) is being declared in NSW to protect and enhance marine and estuarine biodiversity. Large marine bioregions have been identified by the Interim Marine and Coastal Regionalisation for Australia (IMCRA) report.

Contributing to Goals	Timeframe	Responsibility	Authority
2,3,4,7	Current and ongoing	EPT MAC	-

Objective 1.4 To prevent the introduction and translocation of marine pests and diseases

Other important responses: 2.5b,c; 6.4a

(a) Implement, in consultation with the Estuary Prawn Trawl MAC, measures required in accordance with any marine pest or disease management plans.

Background: NSW Fisheries or other agencies may alter management arrangements from time to time to minimise or mitigate the impact of marine pests and/or diseases. A recent example of the need for a link with other strategies was the suspected incidence of white spot disease in NSW. A system of closures and monitoring was implemented in NSW during that suspected outbreak. The industry views with concern the use of prawns being sold as bait without AQIS certification.

Contributing to Goals	Timeframe	Responsibility	Authority
2,6	Current and ongoing	NSW Fisheries and EPTMAC	To be determined

GOAL 2. To maintain target and byproduct species harvested by the Estuary Prawn Trawl Fishery at sustainable levels

Objective 2.1 To maintain the stocks of target and byproduct species of the Estuary Prawn Trawl Fishery at or above a level that minimises the risk of overfishing

Other important responses: 1.1b,d,f,g; 1.2a,b; 1.3a,f; 2.2a; 2.3a-c; 2.4b; 2.6a-c; 4.1a; 4.2a-d; 4.4a; 5.1a,b; 5.4b; 6.1a,b; 8.1a,b; 8.2a,b

(a) Maintain the size and dimensions of gear permitted to be used in each estuary to the specifications provided in Appendix B6, subject to any changes proposed in this draft FMS.

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,5,6	Current and ongoing	NSW Fisheries	Regulatory

(b) Monitor the quantity, length, and/or age and sex composition of target and byproduct species caught in the Estuary Prawn Trawl Fishery.

Background: Information on the structure of populations in catches is essential for stock assessment purposes. Monitoring will be done through; (1) an observer based program to collect information on the quantities and sizes individuals of species caught in the trawl net, (2) fishery independent survey to collect information on the relative abundance and size of individuals in populations impacted by the Estuary Prawn Trawl Fishery and (3) fishers monthly return forms. For further details see Goal 8 of this section and section 6(j) of this chapter.

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,5,8	By July 2002 and then ongoing	NSW Fisheries	-

(c) Together with all harvest sectors of squid in NSW review the exploitation status of the squid resources.

Background: Data from fisher's monthly return forms show a long-term decline in the level of annual total reported landings of squid (Appendix B5 Figure AB41). This pattern is different to that shown from the same data source for the Estuary Prawn Trawl Fishery in the Hawkesbury River where squid is a target species (Appendix B5 Figure AB43). The Estuary Prawn Trawl Fishery contributes 36% by weight to the annual total reported landings of squid and 99% of its contribution comes from the Hawkesbury River.

The review should investigate reasons for the decline in the total annual reported landings of squid and information about the species composition of catches and stock structure. Funding for this review and any subsequent action required should be forthcoming from all participants in fisheries that harvest squid.

Contributing to Goals	Timeframe	Responsibility	Authority
4,5,8	By July 2002 and then as requirted	NSW Fisheries and EPT fishers	-

(d) Promote research that contributes to more robust and reliable stock assessments of prawn and squid populations and through the Estuary Prawn Trawl MAC prioritise research programs.

Background: NSW Fisheries will be undertaking a study, funded by the Fisheries Research and Development Corporation, to collect information on the growth and mortality of the school prawn populations. A desktop study to provide updated estimates of population parameters for eastern king prawns is also needed. Management response 2.1c proposes a review of studies currently being done by the University of Sydney and some information will be available from the results to help determine the exploitation status of the squid resources. Results from these studies and annual stock assessments will provide direction about the priorities for future research to improve the reliability of the stock assessments.

Contributing to Goals	Timeframe	Responsibility	Authority
4,5,8	By July 2002 and then ongoing	NSW Fisheries	-

(e) Implement maximum counts on prawns taken for sale in each estuary.

Background: Legal minimum lengths are used to protect animals from capture. This assists to conserve stock and promote recruitment to the spawning population so that the risks of recruitment overfishing are minimised. In the case of prawns it is it is difficult to manage a legal minimum length because of the size of the prawns and the quantities that are landed. A maximum count of prawns (number to the half kilogram) is used instead.

The Juvenile Prawn Summit Working Group which has representatives from all stakeholder groups recommended that counts on prawns for sale be implemented in all fisheries state wide. These counts will be reviewed by December 2006 when the results from pending research will be available (see management response 2.1f).

Contributing to Goals	Timeframe	Responsibility	Authority
4,5	By July 2002	NSW Fisheries	Regulatory

(f) Review maximum counts for eastern king and school prawns in light of available information and information collected between 2002 and 2005 on the growth and mortality of school prawns.

Background: A three year research project funded by the Fisheries Research & Development Corporation will begin in July 2002 to investigate the growth and mortality of school prawns. Information on the growth and mortality of school prawns will provide information about the optimal biological conditions with greater levels of precision than is currently possible for harvesting school prawns. This information may effect decisions about the maximum counts, see management response 5.1a. Results from this research will be available by December 2006.

Contributing to Goals	Timeframe	Responsibility	Authority
4,5	By June 2007	NSW Fisheries and EPT MAC	-

(g) Ascertain the need for a legal minimum length for squid and implement as required.

Background: Research is being undertaken by the University of Sydney to determine the optimal levels of certain input controls for the Hawkesbury River squid component. A decision about whether a legal minimum length is necessary will be made by July 2003.

Contributing to Goals	Timeframe	Responsibility	Authority
5	By June 2004	NSW Fisheries and EPT MAC	-

(h) Encourage the adoption of complementary counts for prawns and legal minimum lengths for squid in other fisheries.

Contributing to Goals	Timeframe	Responsibility	Authority
4,5	Current and ongoing	NSW Fisheries and EPT MAC	-

(i) Develop a system for and do formal stock assessments of the target species within five years and review the system of assessment at least every three years thereafter.

Background: Stock assessments will provide information that can be used by the Total Allowable Catch Setting and Review Committee to make determinations about levels of fishing effort on the target species. These will be done in consultation with stakeholder groups

including the EPT MAC and Prawn Resource Forum (see section 6(l)(iv) of this chapter). Stock assessments will also provide information about the optimum sizes (prawn counts and legal minimum lengths) at which to catch the target species, appropriate levels of spawner biomass and results about patterns in annual reported landings and catch per unit effort.

Information to assess the impact of fishing on stocks of target species is at different stages of completion, ranging from having lots of information on rates of growth and mortality to having little information beyond that on catch and effort. It is important to note that stock assessments are done on a species basis and must take a holistic approach to assessing the impact of exploitation upon the stock by considering the catch taken from all sectors including recreational, Indigenous and commercial fisheries.

The process of doing stock assessments will need to be reviewed at least every three years to ensure that the system of collecting information and analysis remain the most appropriate for this fishery.

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,5,7,8	By June 2007	NSW Fisheries, EPT MAC and Prawn Resource Forum	-

Objective 2.2 To achieve levels of spawner biomass on a stock basis that will reduce the risk of recruitment overfishing

Other important responses: 1.1d,f; 2.1a,d,e,g,h,i; 2.3a,b; 2.4b; 2.6a-c; 4.2a,d; 5.1b; 8.1a,b; 8.2a

(a) Encourage other prawn harvest sectors to adopt an appropriate level of fishing effort on the spawning stocks of target species.

Background: It is generally accepted that maintaining a spawning biomass of around a certain level of the virgin spawning biomass helps guard against recruitment overfishing. Appropriate levels of spawner biomass will be determined from the population models used for stock assessments (see management response 2.1d and i).

Contributing to Goals	Timeframe	Responsibility	Authority
5	Ongoing	NSW Fisheries and EPT MAC	-

Objective 2.3 To conserve shellfish stocks by managing levels of active effort in the fishery

Other important responses: 1.1a,f,g; 1.2a,b; 1.3f; 2.1a,c,d,i; 2.4a,b; 2.6a-c; 4.2c,d; 4.4a; 6.1a,b; 6.2a; 8.2a

(a) Implement separate management rules for each estuary open to prawn trawling.

Background: Trawling in each estuary will be subject to separate arrangements based upon the management tools outlined in this draft FMS.

Contributing to Goals	Timeframe	Responsibility	Authority
4	Current and ongoing	NSW Fisheries	Regulatory

(b) The Minister for Fisheries will require the Total Allowable Catch Setting and Review Committee to make determinations relating to the maximum level of effort exerted upon the target species,

after considering submissions from the public, management advisory committees and the Prawn Resource Forum.

Background: This does not mean that a total allowable catch will be set in this fishery. It is acknowledged that prawn catches fluctuate greatly. The TAC Committee would only recommend the level of fishing ***effort*** *put into catching prawns. For further information see section 6(l) of this chapter.*

Note: Representatives of industry on the Estuary Prawn MAC do not agree with this management response. Their alternative response can be found in Chapter D section 1(f) of this EIS.

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,5	Annually from 2003	NSW Fisheries, EPT MAC and Prawn Resource Forum	Section 28(4) of the FM Act

(c) Implement either of the following:

(i) minimum shareholdings over set time periods to limit the number of vessels and operators in each estuary to historically active levels

(ii) limit the number of total fishing days for each estuary

(iii) limit the number of fishing days available to each business based upon past participation.

Background: The draft FMS requires a meaningful control on fishing effort in this fishery. Representatives of industry and the Department will continue to consult through the Estuary Prawn Trawl MAC about how best to treat latent fishing effort.

Note: Representatives of industry on the Estuary Prawn Trawl MAC do not agree with this management response. Their alternative response can be found in Chapter D section 1(e) of this EIS.

Contributing to Goals	Timeframe	Responsibility	Authority
4,5	By July 2003	NSW Fisheries	Regulatory

(d) continue the licensing arrangements described in the proposed management strategy (see section 6(h) of this draft FMS).

Contributing to Goals	Timeframe	Responsibility	Authority
5,6,8	Current and ongoing	NSW Fisheries	Various

(e) Restrict the engine power of vessels in the Estuary Prawn Trawl Fishery in Port Jackson.

Background: Restricting engine power of trawlers indirectly limits fishing effort (i.e. input control). Engine restrictions already apply to Clarence River prawn trawlers.

Contributing to Goals	Timeframe	Responsibility	Authority
1,5	By July 2003	NSW Fisheries	Regulatory

Objective 2.4 To prevent the activation of latent (unused) fishing effort

Background: For the purpose of this draft FMS latent effort relates specifically to the number of never used, or seldom used, estuary prawn trawl entitlements. The Estuary Prawn Trawl MAC considers that there are benefits in maintaining the status quo in the fishery where fishers have fishing businesses with endorsements in several fisheries. These fishers tend to only use their estuary prawn trawl endorsement in years when the prawns are most abundant and can sustain higher fishing pressure. This maintains a lower level of fishing effort during years when catch rates of prawns are not high.

It is the intention of this draft FMS that any restructuring of fishing effort considers the benefits of having fishing business with several endorsements in the fishery. The Estuary Prawn Trawl MAC advises that fishery specific restructuring could result in a move from multi-endorsed businesses to fishery specific businesses, particularly where a business is active across a number of fisheries and has a relatively low level of participation in each. Where restructure mechanisms are introduced, the MAC considers that they should apply at the fishing business level rather than the fishery level.

Other important responses: 2.3b; 4.4a; 8.2a

(a) Implement an owner-operator rule for estuary prawn trawl fishing businesses (i.e. no new nominations & sunset existing nominations), except in cases of short term illness.

Background: There have been instances in the industry where fishers who have worked their entitlements very little in recent years have used the nomination provisions to 'pass' their entitlements to new entrants who are working at significantly greater levels than the owner had been, thus substantially increasing the level of fishing effort. The nominated fishers also have less incentive than fishing business owners to attain resource sustainability in the long term, or to operate in a manner sensitive to the surrounding community. Any owner-operator rule will need to consider special circumstances such as illness. Also it will need to consider the circumstance where a person owns more than one estuary prawn trawl endorsement.

Contributing to Goals	Timeframe	Responsibility	Authority
1,5	By July 2003	NSW Fisheries	Regulatory

(b) Establish minimum entry requirements for new entrants at the fishing business level (i.e. taking into account entitlements held in other fisheries) that will prevent increases in effort by small businesses.

Background: Similar to how the Recognised Fishing Operation (RFO) policy works for other NSW commercial fisheries, safeguards are needed to ensure that new entrants to the fishery replace active fishing effort before they can operate. Representatives of industry and the Department will continue to consult through the Estuary Prawn Trawl MAC about how best to treat latent fishing effort.

Operators need to be in a position after a five year period to afford to pay for the attributable costs of management from their fishing revenue. Viable fishing businesses also have a greater incentive to support long term management decisions that are needed now and into the future.

Note: Representatives of industry on the Estuary Prawn Trawl MAC do not agree with this management response. Their alternative response can be found in Chapter D section 1(e) of this EIS.

Contributing to Goals	Timeframe	Responsibility	Authority
4,5,6,7	By July 2003	NSW Fisheries	Regulatory

Objective 2.5 To minimise the impact of activities external to the Estuary Prawn Trawl Fishery on the resources harvested by the fishery and on fishery related habitats

Other important responses: 1.3e,f; 1.4a; 2.1d,i; 2.2a; 2.6c;

(a) NSW Fisheries will continue to review and, where legislatively enforceable under the *Fisheries Management Act 1994*, place conditions on development applications referred to it by other determining authorities, in order to avoid or minimise impacts on fishery resources from coastal developments within the catchment area of each estuary of the Estuary Prawn Trawl Fishery.

Background: Development applications submitted under the Environmental Planning and Assessment Act 1979 *that have the potential to adversely impact on fish or fish habitat are often referred to NSW Fisheries for review and comment. Using it's legislative powers under the FM Act, the Department has the ability to recommend refusal of the development (if inconsistent with the Act or Policy and Guidelines for Aquatic Habitat Management and Fish Conservation 1999), recommend the approval of the development without changes, or in some cases, recommend the approval of the development with conditions to be attached to limit the potential impacts of the activity. Where issues do not fall within the legislative jurisdiction of the Department, NSW Fisheries may still provide advice to the relevant determining authority to ensure that these issues are considered and appropriately addressed.*

Contributing to Goals	Timeframe	Responsibility	Authority
1,7	Current and ongoing	NSW Fisheries	EP&A Act

(b) The Estuary Prawn Trawl MAC will consider the impacts upon the resources of activities external to the fishery (including those of other fisheries) and bring any detrimental impacts to the attention of NSW Fisheries and/or the relevant managing agency.

Contributing to Goals	Timeframe	Responsibility	Authority
1,3,5,6,7	Current and ongoing	EPT MAC and EPT fishers	-

(c) The Estuary Prawn Trawl MAC will contribute to NSW Fisheries' reviews of the habitat management policy and guidelines or habitat protection plans which aim to prevent or reduce impacts of all activities on aquatic habitats, including seagrass, saltmarsh and mangrove habitats.

Background: Habitat management guidelines and plans have been and will continue to be prepared under the FM Act to prevent or minimise the impact of all types of activities on shellfish and finfish habitat.

Contributing to Goals	Timeframe	Responsibility	Authority
1,6,7	Current and ongoing	NSW fishers and EPT MAC	Various

(d) NSW Fisheries and commercial fishers will contribute to the development of policies or legislation established by the NSW Government to ensure that shellfish and finfish stocks and habitat issues are properly considered in other environmental planning regimes.

Background: NSW Fisheries and fisheries stakeholders are already represented on many natural resource management committees (e.g. Catchment Management Boards, Healthy Rivers Commission, Coastal Council of NSW, etc.) that operate in areas relevant to the Estuary Prawn Trawl Fishery.

Contributing to Goals	Timeframe	Responsibility	Authority
1,6,7	Current and ongoing	NSW Fisheries and EPT Fishers	-

Objective 2.6 To promote the recovery of overfished species

Other important responses: 1.1c; 2.1e,i; 2.2a; 2.3b,c; 2.4b

Background: The process of determination of the species' status is described in 6(e)(v) of this chapter. This process may commence with a trigger point review (explained in section 5 in this chapter). It is important to note that an indicator for a species that has exceeded it's trigger point does not automatically mean that the species is overfished. Trigger points are set conservatively, (that is they are likely to trigger false alarms) in order to maximise the chance of detecting a genuine event of importance (see section 5(a) in this chapter).

The implementation of recovery programs includes those developed by the Commonwealth or other states for the same populations that are harvested by the Estuary Prawn Trawl Fishery.

(a) Where the fishery is a major harvester of an overfished species, develop and implement a recovery program for the species within a specified timeframe.

Background: The fishery may be a major harvester of both target and byproduct species.

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,5,6	Recover plan drafted for consultation within 6 months	NSW Fisheries and EPT MAC	To be determined

(b) Where the fishery is a minor harvester of an overfished species, contribute to the development of a recovery program for the species and adopt any measures required by that plan.

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,5,6	As required	NSW Fisheries	To be determined

(c) During the period of development of a recovery program for a species that has been determined as being recruitment overfished, implement precautionary actions including, but not limited to, any of the following:

- total harvest controls
- reductions in effort associated with the harvest of the species
- the implementation of fishing closures
- incidental catch management provisions
- mandatory gear changes.

Background: In the event that a species is determined to be recruitment overfished urgent action is needed to prevent the risk of a stock collapse. Growth overfishing on the other hand relates to maximising the yield from the stock and does not necessarily require immediate measures prior to the introduction of a recovery program.

Contributing to Goals	**Timeframe**	**Responsibility**	**Authority**
5,6	As required	NSW Fisheries	Various

GOAL 3. To promote the conservation of threatened species, populations and ecological communities associated with the operation of the Estuary Prawn Trawl Fishery

Objective 3.1 **To identify and minimise any impacts of fishing activities in the fishery on threatened species, populations and ecological communities (including mammals, birds, reptiles, amphibians, shellfish and finfish, and vegetation), and where possible promote their recovery**

Other important responses: 1.1f; 1.2e; 1.3e,f; 2.5b; 6.4a; 8.1b

(a) Modify the catch and effort returns, in consultation with the Estuary Prawn Trawl MAC, to collect and monitor information on sightings or captures of threatened species.

Background: The guidelines for a "ecologically sustainable" fishery approved by the Commonwealth under the EPBC Act include a requirement to collect information on interactions with endangered, threatened or protected species and threatened ecological communities. These species populations and communities are listed in the FM Act, Threatened Species Conservation Act 1995 *and the EPBC Act. Information on the occurrence of threatened species will come from modified catch and effort return forms, observer based surveys and fishery independent surveys (see management responses 8.1a and b).*

Fishers will be trained on the identification of species during port visits, via documentation and by interaction with scientific staff as part of the observer program.

Contributing to Goals	Timeframe	Responsibility	Authority
6,8	By July 2003	NSW Fisheries and EPT MAC	-

(b) Implement, in consultation with the Estuary Prawn Trawl MAC, the provisions of any relevant threatened species recovery plans or threat abatement plans.

Background: Consultation with the Estuary Prawn Trawl MAC to discuss such matters may not need to wait for the next scheduled meeting of the MAC.

Contributing to Goals	Timeframe	Responsibility	Authority
6,7,8	As required	NSW Fisheries and EPTMAC	Various

(c) Continue the prohibition on taking protected fish and on fish protected from commercial fishing as set out in the *Fisheries Management (General) Regulation 1995.*

Background: 'Protected fish' refers to species of fish that are protected from all forms of fishing. 'Fish protected from commercial fishing' as the name suggests, refers to species of fish that are protected from commercial fishing only. Protected fish includes species identified as threatened, endangered or vulnerable under the Fisheries Management Act 1994.

At the commencement of this draft FMS, the marine and estuarine species of protected fish included Ballina anglefish, black rock cod, eastern blue devil fish, elegant wrasse, estuary cod, giant Queensland groper, green sawfish, grey nurse shark, herbst nurse shark, great white shark and weedy sea dragon. Fish protected from commercial fishing included marlin (black, blue and striped), groper (blue, brown and red), Australian bass and estuary perch.

Contributing to Goals	Timeframe	Responsibility	Authority
4	Current and ongoing	NSW Fisheries	Regulatory

(d) Continue the prohibition of taking any species in commercial fishing operations protected under other jurisdictions' arrangements (this may include invertebrates, fish, reptiles, birds, mammals, plants, algae etc)**.**

Background: Protected species are identified under the Threatened Species Conservation Act 1995, National Parks and Wildlife Act 1974, EPBC Act.

Contributing to Goals	Timeframe	Responsibility	Authority
4,6	As required	NSW Fisheries	Various

GOAL 4. To appropriately share the resource and carry out fishing in a sustainable manner that minimises social impacts

Objective 4.1 **To monitor and provide an appropriate allocation of the fisheries resource between fishing sector groups, acknowledging the need of seafood consumers to access fresh quality shellfish and finfish**

Other important responses: 1.1a,f; 2.1c-e,h,i; 2.3a-c; 2.6a,b; 4.2b,c,d; 4.4a; 5.1a; 8.2b

(a) Estimate as far as practicable, the size of the non-commercial catch and the catch by indigenous peoples and the relative impact of such harvesting on the resource, taking into account the results of the National Recreational and Indigenous Fishing Survey.

Background: Estimates of all harvest rates are vital for stock assessments. Results from this survey are expected to be available in early 2002 and includes. It is envisaged that this survey will be repeated periodically within NSW. The non-commercial catch includes any 'black market' catch sold by both licensed commercial fishers and unlicensed fishers. Information on illegal catch will come from surveys of commercial fishers and fish receivers.

Contributing to Goals	Timeframe	Responsibility	Authority
2,5,8	By June 2006	NSW Fisheries	-

Objective 4.2 **To monitor and manage a fair and equitable sharing of the fisheries resource among commercial fisheries**

Other important responses: 1.1a,b,d,f; 2.1b-e,h,i; 2.3a,b; 2.4b; 2.6a,b; 4.1a; 4.4a; 5.1a; 8.2b

(a) Monitor catch levels and management structure in fisheries that are outside NSW jurisdiction but where catches in those fisheries impact on stocks shared with the Estuary Prawn Trawl Fishery.

Background: The Estuary Prawn Trawl Fishery shares an eastern king prawn resource with fisheries under Victorian, Queensland and Commonwealth jurisdictions.

This draft FMS must provide for regular updates on catch and changes in management or catch composition in these other fisheries. Where possible, it is important to have consistent or complimentary management arrangements for shared stocks, between jurisdictions.

Contributing to Goals	Timeframe	Responsibility	Authority
2,5,8	By July 2002 and then annaully	NSW Fisheries	-

(b) Monitor the annual reported landings of the prawn and squid species that are also taken in other commercial fisheries (i.e. Estuary General and Ocean Prawn Trawl) in New South Wales.

Contributing to Goals	Timeframe	Responsibility	Authority
2,8	By July 2002 and then annually	NSW Fisheries	-

(c) Limit the annual landings of byproduct species within each estuary in the Estuary Prawn Trawl Fishery to the quantities in Table C2.

Background: The landing limits proposed in Table C2 are based upon reported landings from the commercial fisher's monthly return forms. Whereas the incidental catch (byproduct plus bycatch) ratios in management response 1.3a are based upon the weight of incidental catch at the time the codend is landed on the vessel, the byproduct limits are based upon the weight of each byproduct species (relative to the weight of target species) that are reported as landed for sale. These landing limits will be monitored through fisher's month return forms and the Compliance Quality Inspection Scheme. These will be reviewed as part of the annual performance report and in light of up to date information from the observer program.

Contributing to Goals	Timeframe	Responsibility	Authority
1,2	By June 2003 and then ongoing	NSW Fisheries and EPT MAC	-

Table C2. Quantities in kg of byproduct species that can be landed for sale per 1,000 kg of target species.

Common Name	Scientific Name	Port Jackson	Hawkesbury River			Hunter River	Clarence River
			[1]Zone 1	[2]Zone 2	[3]Zone 3		
Prawn, eastern king	*Penaeus plebejus*	[4]na	[4]na	[4]na	[4]na	[4]na	15
Prawn, school	*Metapenaeus macleayi*	139	[4]na	[4]na	[4]na	[4]na	[4]na
Prawn, greasy back	*Metapenaeus bennetae*	50	0.3	8.5	7.8	1.1	0.2
Prawn, tiger	*Penaeus esculentus*	10.7	1.1	0	0	0	0.9
Octopus	Octopoda	30	6	0.8	0	0	0
Squid	Loliginidae, Sepiolidae & Teuthoidae	60	[4]na	[4]na	[4]na	0	0.1
Crab, Blue	*Portunus pelagicus*	170	56	10	0.2	0	0.1
Crab, Mud	*Scylla serrata*	1	0.9	0	0	0	2
Crab, Sand	Portunidae	0.6	0	0	0	0	0
Mantis Shrimp	Squillidae	30	8	0.1	0	0	0
Whiting, Trumpeter	*Sillago maculata*	820	313	10	0.9	0	0.1
Flounder	Bothidae	60	26	0.4	0	0	0
Sole	Soleidae	0	1	3.5	0	0	0
Silver biddy	*Gerres subfasciatus*	60	135	10	2	0	0.4
Trumpeter	Tetrapontidae	60	1.8	0	0	0	0
Whitebait (glass	sprat	0	6.5	0	0	0	0
Catfish	Plotosidae	13.4	3.2	1.1	0	0	2
John Dory	*Zeus faber*	13.5	0	0	0	0	0
Bullseyes	Pempheridídae	0	0.1	0	0	0	0
Hairtail	*Trichiurus lepturus*	0	9	0.3	0	0	0
Yellowtail	*Trachurus novaezelandiae*	0	25	0	0	0	0
Pike	*Dinolestes lewini*	0	2	0.3	0	0	0

Note: Fishers will nominate their "home zone" and will be limited to the byproduct ratios for that zone. The zones are:

[1] Zone 1 is downstream of Juno Point

[2] Zone 2 is Juno Point to Spencer

[3] Zone 3 is upstream of Spencer

[4] "na" means not applicable to this estuary because the species is a target species for the fishery in that particular estuary.

(d) Use the Prawn Resource Forum to discuss management issues (e.g. maximum prawn counts) relevant to more than one fishery and ensure equitable and sustainable use of the target species.

Background: For further information about the Prawn Resource Forum see section 6(l)(iv) of this chapter.

Contributing to Goals	Timeframe	Responsibility	Authority
2,5,6,8	By July 2002 and then annually	NSW Fisheries	-

Objective 4.3 To minimise any negative impacts of the Estuary Prawn Trawl Fishery on Aboriginal and other cultural heritage

Other important responses: 1.1a; 2.1d; 4.1a; 6.4a

(a) Participate in the development and subsequent reviews of any Indigenous Fisheries Strategy

Contributing to Goals	Timeframe	Responsibility	Authority
6	As required	NSW Fisheries	-

(b) Respond, wherever practicable, to new information about areas or objects of cultural significance in order to minimise the risk from fishing or fishing activities.

Background: The Estuary Prawn Trawl Fishery must respond appropriately to new information about items or locations of cultural significance. The NSW NPWS is the authority determining items of cultural significance.

Contributing to Goals	Timeframe	Responsibility	Authority
-	Immediate	NSW Fisheries and EPT Fishers	-

Objective 4.4 To promote harmony between the commercial fishery and other resource users, including recreational fishers, Indigenous fishers and local communities, through fair and equitable sharing of the fisheries resource

Other important responses: 1.1a,b,e,g; 1.2a-c,e; 1.3a,f; 2.1a,d-f,h; 2.3b,c; 3.1c,d; 4.1a; 4.2c,d; 4.3a,b; 5.3b; 6.3a,b; 6.4a; 7.1a-c; 7.2a; 8.1a; 8.2a,b; 8.3a

(a) Investigate closing all estuaries to trawling on weekends and public holidays.

Background: This is already mandatory in the Hunter River, Port Jackson and Botany Bay. The Clarence River is open to trawling on weekends during the permitted season between 7 am and 9 am on Saturdays and is open on public holidays. Trawling is permitted year round in the Hawkesbury River but upstream of Juno Point is closed on weekends. Most closures in each estuary on weekends have been at the initiative of industry in the interests of sharing resources.

Note: Representatives of industry on the Estuary Prawn Trawl MAC do not agree with any additional closures on weekends or public holidays. Their objection and alternative response can be found in section 1(j) of Chapter D.

Contributing to Goals	Timeframe	Responsibility	Authority
1,2	Immediate	NSW Fisheries	Regulatory

GOAL 5. To promote a viable commercial fishery (consistent with ecological sustainability)

Objective 5.1 To manage the prawn and squid stocks so that the best outcome in terms of optimising biological yield and maximising economic return to the fishery is achieved

Other important responses: 1.1a,c,d,f; 2.1a,c-i; 2.2a; 2.3b; 2.6a-c; 4.1a; 4.2a,d; 8.1b

(a) Taking into account available results of research, determine a size at first capture for eastern king and school prawns and each species of squid and an appropriate count for each target species of prawn.

Background: This response relates to the equitable sharing of the resources across all fisheries. The sizes will depend upon the results of research currently being done on the Hawkesbury River squid fishery and pending research between 2002 and 2005 on the school prawn resources. When determining counts of prawns consideration must be given to sustainability and equitable sharing of the resources. These issues form part of the deliberations of the MACs, Prawn Resource Forum and the TAC Setting and Review Committee. Once implemented, these sizes will be enforced through the compliance audit scheme and monitored as part of the scientific observer program. The "counts of prawns for sale," (see management response 2.1e) will be reviewed also at this time.

Note: Representatives of industry on the Estuary Prawn Trawl MAC do not agree with this management response. Their alternative response can be found in Chapter D of this EIS.

Contributing to Goals	Timeframe	Responsibility	Authority
1,2,4	By June 2006	NSW Fisheries and Prawn Resource Forum	-

(b) Implement maximum counts of prawns to the half kilogram at the codend (to be referred to as the codend count) and if considered necessary, minimum legal lengths for squid.

Background: Once appropriate sizes at first capture have been agreed upon through management response 5.1a, the time and place where target species can be caught within each estuary must be controlled to ensure that the greatest possible proportion of animals in the catch are larger than the agreed upon minimum sizes.

The process of managing codend counts of prawns and legal minimum lengths (if any) for squid will be the same as that described in management response 1.3a for managing incidental catch ratios (ie. largely the responsibility of industry). Enforcement of the codend prawn counts will be done as part of a compliance audit scheme by Fisheries Officers. Penalty points will apply to fishers who have breached the codend counts or legal minimum lengths for squid. If the codend count is exceeded on more than two occasions on any one day that vessels are boarded, the estuary will be closed to trawling for a specified period.

The period of time for which the estuary is closed will be on a case by case basis. The Estuary Prawn Trawl MAC will be consulted about developing a set of criteria for reopening estuaries closed to trawling as a result of excessive codend prawn counts.

Contributing to Goals	Timeframe	Responsibility	Authority
2	By June 2006	NSW Fisheries and EPT Fishers	-

Objective 5.2 To promote the economic viability of estuary prawn trawl fishing

Other important responses: 1.1a,d; 2.1a,d-g,i; 2.3c,e; 2.4a,b; 2.5b; 2.6a,b; 4.1a; 4.2d; 5.1a,b; 5.3a,b

(a) NSW Fisheries will develop, in consultation with the Estuary Prawn Trawl MAC, a performance measure for economic viability at the individual fishing business level.

Background: A performance indicator is already proposed in Table C6 to measure economic viability on a fishery-wide basis. This management response would provide a further measure of economic viability to monitor the relationship with other aspects of economic viability.

Contributing to Goals	Timeframe	Responsibility	Authority
7	By December 2005	NSW Fisheries and EPT MAC	-

(b) NSW Fisheries will develop, in consultation with the Advisory Council on Commercial Fishing, a cost recovery framework.

Background: On 2 November 2000, the Government announced that over the succeeding five years NSW Fisheries would develop and implement a fair and transparent cost recovery framework for category 2 share management fisheries. During this period, the total amount of money collected by NSW Fisheries, for it's existing management services, will not increase without the support of the relevant MAC. Each estuary prawn trawl fisher currently pays the same commercial fishing licence fees for the Estuary Prawn Trawl Fishery, irrespective of their level of access. A cost recovery framework needs to be developed in order that fishers pay according to their level of access in the fishery.

Contributing to Goals	Timeframe	Responsibility	Authority
6	By November 2005	NSW Fisheries and ACCF	Ministerial determination

Objective 5.3 To provide secure fishing entitlements for estuary prawn trawl fishers

Other important responses: 2.1b,i; 2.3b,d; 2.4a,b; 2.5b; 4.2d; 6.2a

(a) Implement the share management provisions of the *Fisheries Management Act 1994.*

Background: The category 2 share management provisions allow for the allocation of shares with a 15 year term to eligible persons, and with a statutory right to compensation if the Government cancels the shares during their term.

Contributing to Goals	Timeframe	Responsibility	Authority
6	By July 2003	NSW Fisheries	FM Act

(b) Prohibit shareholders in the fishery from owning more than 5% of the total number of each class of share issued in the fishery.

Contributing to Goals	Timeframe	Responsibility	Authority
4	By July 2003	NSW Fisheries	Regulatory

Objective 5.4 To appropriately manage food safety risks in the harvesting of shellfish and finfish in the fishery

Other important responses: 2.3d; 6.1d; 6.4a; 8.3a

(a) Co-operate with Safefood Production NSW in the development and implementation of food safety programs relevant to the fishery.

Background: Safefood Production NSW is currently in the process of developing food safety plans for harvest and post-harvest seafood industry, and the plans may impose statutory requirements on fishers to comply with the approved standards. Supporting food safety programs is a responsible way of promoting consumer confidence in fish product harvested by the fishery and protecting viability of the industry.

Contributing to Goals	Timeframe	Responsibility	Authority
6	Current and ongoing	EPT Fishers	FP Act

(b) Continue the prohibition on the processing or mutilation of shellfish and finfish taken in this fishery on, or adjacent to, water.

Background: This management response is part of the current rules operating in the fishery. The term processing as used here does not include the cooking of shellfish and finfish.

Contributing to Goals	Timeframe	Responsibility	Authority
2,6,8	Current and ongoing	NSW Fisheries	Regulatory

GOAL 6. To ensure cost-effective and efficient management and compliance in the Estuary Prawn Trawl Fishery

Objective 6.1 To maximise compliance with the Estuary Prawn Trawl Fishery Management Strategy

Other important responses: 2.1a; 2.3d; 5.3a; 5.4b; 6.2a,b; 6.3a; 7.1a-c; 8.2a,b; 8.3a

(a) Develop, implement and monitor, in consultation with the Estuary Prawn Trawl MAC, a compliance audit scheme and operational plans for each estuary and encourage voluntary compliance through educational programs.

Background: NSW Fisheries already develops and implements operational plans for compliance. However it is proposed under this draft FMS to conduct a compliance audit of all operators in the fishery prior to the commencement of each prawn trawling season, and in the case of Hawkesbury River operators each September. The compliance audit will be carried out by Fisheries Officers on board trawlers. The purpose of the audit is to check prawn trawl nets and associated fishing gear for compliance with mesh size and other legal requirements, and to give operators an opportunity to replace or modify illegal gear without penalty before commencing operations for the season.

Contributing to Goals	Timeframe	Responsibility	Authority
1,2,8	By July 2003	NSW Fisheries and EPTMAC	Policy

(b) Implement an endorsement suspension scheme and share forfeiture scheme based on a demerit point scale for serious offences and habitual offenders.

Note: "serious offences" need to be defined and could include offences such as interfering with fishing gear.

Contributing to Goals	Timeframe	Responsibility	Authority
1,2,8	By July 2003	NSW Fisheries	Policy

(c) Publish successful prosecution results for nominated offences in relevant publications and media to discourage illegal activity.

Contributing to Goals	Timeframe	Responsibility	Authority
7,8	Current and ongoing	NSW Fisheries	Policy

(d) Continue the requirement that shellfish and finfish taken in this fishery are marketed through a registered fish receiver or a restricted fish receiver as outlined in the Regulation.

Background: This management response is part of the current rules operating in this fishery and all other NSW commercial fisheries.

Contributing to Goals	Timeframe	Responsibility	Authority
5,8	Current and ongoing	NSW Fisheries	Regulatory

Objective 6.2 To encourage cooperation between fishers and compliance officers in detecting offences

Other important responses: 2.3d; 2.5b-d; 4.3a; 5.3a; 6.1a; 6.3a; 7.1a-c; 8.3a

(a) Continue using regulatory conditions, including conditions on fishing licences, endorsements and permits to ensure that the authority conferred by the authorisation is consistent with the goals and objectives of the draft FMS.

Background: This management response is part of the current rules operating in this fishery and all other NSW fisheries.

Contributing to Goals	Timeframe	Responsibility	Authority
2,5	Current and ongoing	NSW Fisheries	Various

(b) Continue the requirement that fishers comply with directives given by Fisheries Officers, including to allow officers to board fishing boats to inspect catch, and to produce "authorities to fish" when requested.

Background: This management response is part of the current rules operating in this fishery and all other NSW fisheries.

Contributing to Goals	Timeframe	Responsibility	Authority
-	Current and ongoing	NSW Fisheries	FM Act

Objective 6.3 To provide effective and efficient communication and consultation mechanisms in relation to the Estuary Prawn Trawl Fishery

Other important responses: 1.3c; 2.3d; 2.4b; 2.5b-d; 2.6a,b; 4.2d; 4.3a; 5.2b; 5.4a; 6.1a,c; 7.1a-c; 7.2a; 8.1d; 8.2a,b; 8.3a

(a) Continue to recognise the Estuary Prawn Trawl MAC as the primary consultative body for issues affecting the fishery.

Contributing to Goals	Timeframe	Responsibility	Authority
4	Current and ongoing	NSW Fisheries	-

(b) Continue to use the services of a Chair in the Estuary Prawn Trawl MAC who is not engaged in the administration of the *Fisheries Management Act 1994*, nor engaged in commercial fishing.

Contributing to Goals	Timeframe	Responsibility	Authority
4	Current and ongoing	NSW Fisheries	FM Act

Objective 6.4 **To implement this fisheries management strategy in a manner consistent with related Commonwealth and State endorsed programs aimed at protecting aquatic environments, and achieving the objects of the Act and the principles of ecological sustainable development**

Other important responses: 1.3e; 1.4a; 2.3d; 2.4b; 2.5d; 2.6a-c; 3.1a,b,d; 4.3a; 8.1c

(a) Manage the Estuary Prawn Trawl Fishery consistently with other jurisdictional or natural resource management requirements, such as the marine parks program, aquatic biodiversity strategy**,** threatened species program and others.

Background: This draft FMS will be operating alongside other programs relating to the management of marine resources, and must be consistent with those programs. The FMS must be adaptive and able to be modified if inconsistencies between the programs become apparent. This response provides for a whole-of-government approach to the management of the estuarine ecosystem.

Contributing to Goals	Timeframe	Responsibility	Authority
1,3,4,5	Current and ongoing	NSW Fisheries	Policy

GOAL 7. To improve the knowledge of the community about the operations and management of the Estuary Prawn Trawl Fishery

Objective 7.1 To improve the community's understanding and public perception of the Estuary Prawn Trawl Fishery

Other important responses: 1.2a,b; 1.3a,f; 2.1i; 2.4b; 2.5a,b,d; 3.1b; 5.2a; 6.1c; 7.2a; 8.1a,d; 8.2b

(a) Make the Fishery Management Strategy and Environmental Impact Statement and other relevant documentation widely available to the public by:

(i) placing them on the NSW Fisheries website

(ii) providing copies at Fisheries Offices throughout the State

(iii) targeted mail outs to key stakeholders

Background: This would include key public documents relevant to the performance review of the final FMS, such as reviews arising from exceeded trigger points.

Contributing to Goals	Timeframe	Responsibility	Authority
4,6,8	Ongoing	NSW Fisheries	-

(b) Produce or contribute to the production of brochures, newsletters, signs and do targeted advisory and educational programs, as considered appropriate by NSW Fisheries.

Background: This education strategy needs to be developed in consultation with the different communities within NSW so that it is designed to most effectively communicate within each community.

Contributing to Goals	Timeframe	Responsibility	Authority
4,6,8	Ongoing	NSW Fisheries and EPT fishers	-

(c) Respond to inquiries by industry or the public with respect to this fishery management strategy or the fishery generally.

Contributing to Goals	Timeframe	Responsibility	Authority
4,6,8	Current and ongoing	NSW Fisheries	-

Objective 7.2 To promote community awareness as to the importance of shellfish and finfish habitat to shellfish and finfish stocks

Other important responses: 1.1f; 1.2a-d; 1.3e; 2.4b; 2.5a-d; 8.2b; 8.3a

(a) Publish educational information concerning the protection of fish habitat on the NSW Fisheries website and in other publications and media that NSW Fisheries considers relevant.

Contributing to Goals	Timeframe	Responsibility	Authority
4,6,8	Current and ongoing	NSW Fisheries	-

GOAL 8. To improve the knowledge about the Estuary Prawn Trawl Fishery and the resources upon which the fishery relies

Objective 8.1 To promote appropriate scientific research and monitoring to collect information about target, byproduct and bycatch species

Other important responses: 1.3b-e; 2.1b-d,i; 3.1a,b; 4.1a; 4.2a,b,d 5.4b; 8.2a,b

(a) Design and implement an industry-funded scientific observer program to:

(i) collect information on the quantity and composition of retained and discarded species, and interactions with threatened and protected species

(ii) provide quality control information on commercial catch and effort data.

Background: Observer surveys are proposed in each year to collect information on what is being caught when the FMS is first introduced and to determine whether bycatch reduction devices have been effective in reducing bycatch. On some days during the trawl season observers with go on randomly chosen trawlers and, count, measure and weigh individuals of each species caught during each trawl shot that day. Information from the observer based survey will:

(i) help assess the impact of gear modifications upon fish "populations"

(ii) provide information to determine whether the levels of incidental catch ratios are adequate

(iii) help determine whether the targeted reduction in incidental catch is realistic (see Table C3)

(iv) determine the occurrence of threatened species

(v) collect information to help verify levels of annual reported landings

(vi) collect information for stock assessment purposes.

Contributing to Goals	Timeframe	Responsibility	Authority
1,2,4,7	By July 2003 and ongoing	NSW Fisheries	Regulatory

(b) Design and implement in consultation with the Estuary General and Ocean Prawn Trawl Fisheries an industry funded program to conduct fishery independent surveys of the school and eastern king prawn, and squid resources of the Estuary Prawn Trawl Fishery.

Background: Fishery independent surveys will provide less biased information than that from fishery dependent surveys. These will provide information about distribution and abundances of species, sizes and sex composition of individuals in the populations, occurrence of threatened and protected species and samples that may be used to collect biological information on the various bycatch species in the Estuary Prawn Trawl Fishery and so contribute towards understanding species interactions and the impact of trawling upon the ecosystem.

Contributing to Goals	Timeframe	Responsibility	Authority
1,2,3,5	Pilot study 2002-2003 and full scale July 2003	NSW Fisheries	Regulatory

(c) Provide for the issue of permits under section 37 of the *Fisheries Management Act 1994* authorising modified fishing practices to assist research programs or for any other purpose consistent with the vision and goals of this fishery management strategy.

Background: Permits are required to work outside parameters specified in this draft FMS or elsewhere in the FM Act. The techniques required to investigate new approaches to using fishing gear may require formal approval. Such approval is also commonly given to industry members who are participating in research to provide a formal exemption from prosecution

Contributing to Goals	Timeframe	Responsibility	Authority
6	Current and ongoing	NSW Fisheries	Regulatory

(d) determine, in consultation with stakeholder groups identified by NSW Fisheries, the priorities for research for the fishery, taking into account the research needs identified in this strategy and the Environmental Impact Statement.

Background: NSW Fisheries has commenced consultation with a broad range of stakeholder groups over the development of research priorities relating to the State's fisheries resources, including the Estuary Prawn Trawl Fishery. This is done primarily through the NSW Fisheries Research Advisory Committee (FRAC), which advises funding agencies on fisheries research priorities for the state. Further information on the role of FRAC can be found on the NSW Fisheries website at: www,fisheries.nsw.gov.au. This process will need to incorporate feedback from the stakeholder groups on the research needs identified in the FMS. The priority setting process will identify the research priorities (including priorities for stock assessments) for the Estuary Prawn Trawl Fishery by June 2002 and will be done annually thereafter. It is also critically important to provide feedback from new research programs, such as the observer study, into this priority setting framework.

Contributing to Goals	Timeframe	Responsibility	Authority
6,7	Current and ongoing	NSW Fisheries and EPT MAC	-

(e) allocate research resources and where appropriate make grant applications to support research relevant to the fishery in accordance with the priorities identified from the process described in management response 8.1b.

Background: Research into the Estuary Prawn Trawl Fishery is currently funded through a combination of NSW Fisheries core expenditure and external grants from State and Commonwealth research and development programs.

Contributing to Goals	Timeframe	Responsibility	Authority
-	Ongoing from June2002	NSW Fisheries, EPT fishers and EPT MAC	-

Objective 8.2 To improve the quality of the catch and effort information collected from endorsement holders.

Other important responses: 2.1b,d; 2.3d; 3.1a; 4.1a; 4.2b; 6.1a,b,d; 8.1b; 8.3a

(a) Periodically review, in consultation with the Estuary Prawn Trawl MAC, the mandatory catch and effort return forms submitted by estuary prawn trawl fishers and implement changes if:

(i) the data collected is perceived to be of poor quality or insufficient for the purpose of conducting an environmental assessment

(ii) the forms are found to be exceedingly complex for fishers to complete, ensuring an emphasis on the quality rather than quantity of information collected.

Background: NSW commercial fishers are required to report their catches to NSW Fisheries. These records are a vital part of fisheries assessments and understanding of the activities of fishers. It may be necessary under the FMS for fishers of the Estuary Prawn Trawl Fishery to complete a daily log sheet. Further, it may be necessary at some time within the period of this FMS for fishers to install a Vessel Monitoring System on their vessels and to use an Electronic Catch Recording System.

Contributing to Goals	Timeframe	Responsibility	Authority
1,2,4,6	Current and ongoing	NSW Fisheries and EPT MAC	-

(b) Determine accuracy of current recording of species identification in catch records and provide advice to industry to make needed changes (may need to wait for results from observer study).

Background: Correct species identification is critical to many areas of the performance of this strategy. Most species in the fishery are clearly and easily identified and accurately reported. However, it is not unequivocally clear whether terms like whitebait, octopus, squid and trumpeter relate in each case to the correct species. The proposed observer study will be of great value in implementing this management response. Observers will provide first hand information on what common names are used to identify what species and any patterns in the use of terms. This information will be used to make certain that industry advice and education is appropriately targeted.

Contributing to Goals	Timeframe	Responsibility	Authority
1,2,4,6,7	By June 2004	NSW Fisheries and EPT MAC	-

Objective 8.3 To train new entrants to the fishery

Other important responses: 6.1c; 7.1a-c; 7.2a;8.1a, 8.2b

(a) Implement a "Basic Skills Course" for new entrants to the Estuary Prawn Trawl Fishery.

Background: Industry wish to begin, in conjunction with a tertiary institution, a "Basic Skills Course" for new entrants to the fishery. This 3-4 day course would teach the new entrants stewardship of the environment, water safety, occupational health and safety issues, first aid and the basic seamanship skills required to operate a trawler. The costs to run the course would be fully covered by the participants. This course would become a prerequisite to operating an endorsement in the Estuary Prawn Trawl Fishery.

Contributing to Goals	Timeframe	Responsibility	Authority
4,5,6,7	By June 2005	EPT MAC	-

5. Performance Monitoring and Review

a) Performance monitoring

Many of the management responses assist in achieving multiple goals. Therefore, rather than examining the performance of each individual response or objective, it is more efficient and appropriate to measure the performance of the draft FMS against the eight goals (i.e. the major objectives). An annual report will, however, be prepared (as outlined later in this section) detailing the progress made in implementing each of the management responses.

i) Performance indicators

The performance indicators provide the most appropriate indication of whether the management goals are being attained. A number of monitoring programs will be used to gather information to measure performance indicators. These monitoring programs are detailed later in this section in Table C13.

With the implementation of the new research proposals for the fishery outlined in section 6(j) of this draft FMS, a broader information base relating to the fishery and its impacts may allow for more precise performance indicators to be developed.

ii) Trigger points

The trigger points specify when a performance indicator has reached a level that suggests there is a problem with the fishery and a review is required.

Some performance indicators vary naturally from time to time and the trigger point levels chosen have been selected to be conservative in light of that natural change. That is, trigger points are chosen to be well within the expected range of variation. This has the effect that the trigger will be exceeded more frequently because of natural variation in the performance indicator than because of a problem in the fishery. If the natural variation of the performance indicator is known, then the trigger level will be set such that that the performance indicator must be outside the range in which 80% of observations fall to trigger a review.

Tables C3 to C10 propose the performance indicators and trigger points that will be used to measure whether each of the management goals described in section 4 of this draft FMS are being attained.

b) Reporting on the performance of the FMS

A performance report assessing each performance indicator must be submitted to the Minister for Fisheries 12 months after the commencement of the FMS, and annually thereafter. The performance report is the formal mechanism for detecting when the performance indicators reach the trigger points.

The annual performance report will also review the progress made in implementing each of the management responses. Each performance report will be displayed on the NSW Fisheries web site.

The vast majority of management actions proposed in the draft FMS are linked to specified implementation timeframes. Some of these management actions are subject to specific trigger points

that ensure reviews and appropriate remedial actions if the target timeframes are not met. The progress of all other management actions will be monitored through the annual performance report.

If the performance report identifies that any specified target timeframe has not been met, a review will be undertaken and any necessary remedial measures recommended to the Minister.

A fishery will continue to be regarded as being managed within the terms of this FMS whilst any remedial measures associated with breaches in timeframes or triggering of performance indicators are being considered through the review process and/or by the Minister for Fisheries.

c) Reviews arising from triggered performance indicators

i) The review process

If a performance indicator reaches the corresponding trigger point, the Minister for Fisheries will firstly consult with the relevant fishery's management advisory committee about the scope of the review and give notice of the impending review to the relevant Ministerial advisory councils. The notice will include a proposal about the scope of the review. This advice should include information such as the extent to which the trigger point was breached, the stakeholder groups that should be involved and any specific issues that might need to be examined during the review to determine the suspected reasons for the change. The Minister, having given the MAC and the relevant Ministerial advisory councils an opportunity to comment on the proposal, will then determine the scope of the review.

If the performance indicator and trigger point relates to a species that is caught in more than one fishery, the Minister may determine that the review should involve representatives from those other fisheries.

Reviews arising from landings exceeding trigger points should consider (but not be limited to) the following factors:

- changes in the relative levels of landings among harvest sectors (including those beyond NSW jurisdiction)
- new biological or stock information (from any source) available since the most recent review of the species
- changes in the activities or effectiveness of fishing businesses targeting the species
- changes in principal markets or prices for the species.

ii) The review report

A report on the review must be forwarded to the Minister within three months of the trigger point breach being detected. The report must include appropriate recommendations for remedial action. All review reports will be publicly available.

A review report should indicate whether the suspected reasons for the trigger point being reached are the result of a fishery effect or an influence external to the fishery, or both.

iii) Review outcomes

If a review concludes that the reasons for the trigger point being breached are considered to be due to the operation of the fishery, or if the fishery objectives are compromised if the fishery

continued to operate unchanged, management action should be taken to ensure that the performance indicator returns to within an acceptable range within a specified time period. The objective of any remedial action proposed would vary depending on the circumstances that have been identified as responsible for the trigger point being reached.

If a review considers that the management objectives or performance monitoring provisions are inappropriate and need to be modified, the FMS itself may be amended by the Minister for Fisheries. If the reasons are considered to be due to the impacts on the resource from factors external to the fishery, these factors should be identified in the review and referred to the relevant managing agency for action.

A review may recommend modifications to any one of the fishery management strategies that allow harvesting of that species. This approach to the review process will avoid triggering multiple reviews for a species which is caught in multiple fisheries.

There may be circumstances where no change to the management arrangements or FMS is deemed necessary following the review. For example, a review could be triggered because the landed catch of a species declines. However, there would be little cause for concern over the performance of the FMS if the decline in landed catch of a species was clearly caused by a drop in market prices or a fall in rainfall and subsequent river discharge. Any price fluctuations can result in fishers adjusting their activities, and river discharges often determine the availability of prawns in an estuary.

d) Contingency plans for unpredictable events

In addition to the circumstances outlined above, the Minister for Fisheries may order a review and/or make a modification to the FMS in circumstances declared by the Minister as requiring contingency action, or upon the recommendation of the Estuary Prawn Trawl MAC. In the case of the former, the Minister must consult the Estuary Prawn Trawl MAC on the proposed modification or review.

These circumstances may include (but are not limited to) food safety events, environmental events, results of research programs or unpredictable changes in fishing activity over time. Notwithstanding the above, the Minister for Fisheries may also make amendments to this FMS that the Minister considers to be minor in nature at any time.

e) Predetermined review of performance indicators and trigger points

It is likely that changes to the activities authorised under the FMS will evolve over time. It is also likely that better performance indicators will become apparent over the course of the next few years and it would then be an inefficient use of resources to continue monitoring the performance indicators that appear in this draft FMS. If new information becomes available as a result of research programs, more appropriate performance indicators and trigger points can be developed and the FMS amended by the Minister for Fisheries accordingly.

It is prudent to review the appropriateness of all performance indicators and trigger points not more than two and a half years from the commencement of the FMS.

f) Performance indicators and trigger points for the Estuary Prawn Trawl Fishery

The following tables establish the performance indicators and trigger points that will be used to measure whether each of the management goals are being attained.

Table C3. Performance indicators and trigger points for Goal 1 of the draft FMS

GOAL 1. To manage the Estuary Prawn Trawl Fishery in a manner that promotes the conservation of biological diversity in the estuarine environment.			
	Performance indicator	**Trigger point**	**Comments**
1	[A performance indicator will be developed to monitor biodiversity impacts at the species, community and ecosystem levels]	[No trigger point set at this stage]	There are no available performance indicators to measure the impact of this fishery on biodiversity. As such, surrogate indicators (below) will be used until a suitable indicator is developed. Species composition and abundance in samples from fishery independent surveys may also assist in monitoring this indicator
2	Identify and map areas of environmental sensitivity that are currently open to trawling and implement closures in those areas	Closures in identified areas not implemented by July 2006	If closures are not in place by the agreed date, a review will be undertaken
3	Quantity of incidental catch	If five years after the start of the FMS, the quantity of incidental catch in the Estuary Prawn Trawl Fishery is not reduced by, or maintained at, a level of 40% of that of the baseline years	The baseline years will be those of 1989 to 1992 when surveys of catches were last done. Note: that different baseline years will be used for the Hunter River. The progress in reducing incidental catch, which increases the achievable level, will be reviewed annually as part of the review of management responses
4	Response of the fishery to marine pest and disease incursions	The Director, NSW Fisheries, determines that the fishery does not respond appropriately to marine pest and disease management programs that recommend that estuary prawn trawl fishing be modified as a result of marine pest or disease incursions	The marine pest and disease management program is responsible for monitoring marine pests and diseases (ie. noxious fish), and developing contingency plans in the event of new incursions. Section 210 of the FM Act provides an offence for selling fish that are or have been declared noxious. This performance indicator and trigger point ensures that the fishery is responsive to existing or threatening marine pest or disease incursions

Table C4. Performance indicators and trigger points for Goal 2 of the draft FMS

GOAL 2. To maintain primary and byproduct species harvested by the Estuary Prawn Trawl Fishery at sustainable levels.			
	Performance indicator	**Trigger point**	**Comments**
1	Stock assessments available for target species	Stock assessments are not available for each species from the following dates: - school prawns by July 2006 - eastern king prawns by July 2003 - squid by July 2003	A desk top study is required to improve the population model for eastern king prawns. The stock assessments on school prawns and squid will rely upon information collected during research projects that are scheduled to finish in December 2005 and December 2002, respectively
2	Total annual reported landings of each byproduct species for NSW	Annual reported landings are outside the range of catch for two consecutive years, with the range calculated from the period 1984-85 to 1998-99 (see comments)	A zero landings level is considered outside the range even if there have been years when no catch of the species was taken
3	Total annual landings of prominent byproduct species for NSW	An analysis for assessing long term trends will be determined before December 2003 (Table C11b in this chapter)	A zero landings level is considered outside the range even if there have been years where no catch was recorded
4	[A trigger point based upon relative abundance of target species will be developed]	An analysis for assessing long term trends will be determined before December 2003 (see section 5(g) and Table C11a in this chapter)	Use as an index of the size of the populations of school prawns and squid in each estuary of the fishery
5	[Relative abundance of spawner biomass]	Relative abundance of spawner biomass does not fall below a proportion of virginal spawner biomass or against a range of reference years. Bench marks for level of spawner biomass to be available within five years of the commencement of this draft FMS	Maintain spawning populations The applicability (i.e. whether a stock-recruitment relationship is prevalent) of this performance indicator for each species will be determined over the next five years Reference years have yet to be determined

Table C5. Performance indicators and trigger points for Goal 3 of the draft FMS

GOAL 3. To promote and support the conservation of threatened species, populations and ecological communities associated with the operation of the Estuary Prawn Trawl Fishery.			
	Performance indicator	**Trigger point**	**Comments**
1	Number of incidental captures related to listed threatened species, population or ecological community	[No trigger point has been set at this stage]	Data will be sourced from the scientific observer program, fishery independent surveys and catch return records
2	Response of the fishery to threatened species declarations	A threatened species recovery plan or threat abatement plan requires a modification to estuary prawn trawl fishing which the Director, NSW Fisheries considers is not adequately provided for in this FMS	The NSW Fisheries Office of Conservation and the NSW National Parks and Wildlife Service monitor sightings of threatened species and develop threatened species recovery plans when required to do so

Table C6. Performance indicators and trigger points for Goal 4 of the draft FMS

GOAL 4 . To appropriately share the resource and carry out fishing in a manner that minimises the social impacts.			
	Performance indicator	**Trigger point**	**Comments**
1	Estimates by NSW Fisheries of the catch of target species for all sectors (including recreational and Indigenous)	Estimates not available within three years from the commencement of the FMS	This information is also needed for stock assessments as outlined in Goal 2
2	Annual reported landings from the commercial sector compared to estimates of annual catch by the recreational and Indigenous sectors (excluding catches attributable to recreational fishing areas)	After estimates beome available, relative landings and catch levels between sectors shifts on average by 25% or more over five years	This relates primarily to the objective of monitoring and managing equitable allocations between fishing sector groups
3	Annual reported landings of target species taken in the estuary prawn trawl fishery relative to those from the same estuary by other commercial fisheries	Relative landings levels between commercial fisheries shifts on average by 25% or more over five years	This relates primarily to the objective of monitoring and managing equitable allocations between commercial fisheries

Table C7. Performance indicators and trigger points for Goal 5 of the draft FMS

GOAL 5. To promote a viable commercial fishery (consistent with ecological sustainability).			
	Performance indicator	**Trigger point**	**Comments**
1	Codend counts (number of individuals per half kilogram) for eastern king or school prawns	Codend counts for prawns have not been implemented to the satisfaction of the Director, NSW Fisheries	Codend counts should be working in the fishery to the satisfaction of the Director of NSW Fisheries by June 2006
2	Median fishery-wide gross return of estuary prawn trawl fishers from commercial fishing in NSW	No trigger point set at this stage	Trigger will depend upon economic analyses and will be determined in consultation with industry
3	Average market value of estuary prawn trawl shares	No trigger point set at this stage	It is not possible to predict how the value of shares will change during the first few years of share trading. However, in the long term average share value may be a good indicator of economic health of the fishery

Table C8. Performance indicators and trigger points for Goal 6 of the draft FMS

GOAL 6. To ensure cost-effective and efficient management and compliance in the Estuary Prawn Trawl Fishery.			
	Performance indicator	**Trigger point**	**Comments**
1	Rate of compliance relating to the Estuary Prawn Trawl Fishery as indicated by quality inspections conducted by NSW Fisheries	Overall rate of compliance with quality inspections as estimated by the Director, NSW Fisheries, is less than 85%	The reported estuary prawn trawl compliance rate during the 1999/00 financial year was 91 %. As quality inspections are a more comprehensive evaluation of compliance by fishers than the previous measure used, it is possible that the 91% level may decrease
2	Number of Estuary Prawn Trawl MAC meetings held each year	Less than two meetings held in a calendar year, unless otherwise agreed by the Estuary Prawn Trawl MAC	This trigger point is currently a requirement of the Regulation
3	[Cost of managing the fishery]	To be determined	
4	Occasions when this FMS is in direct conflict with other approved Commonwealth or State programs	Any occasion when the Director, NSW Fisheries determines that the FMS is inconsistent with other approved Commonwealth and State programs	This includes programs such as the aquatic biodiversity strategy, marine parks and aquatic reserves program

Table C9. Performance indicators and trigger points for Goal 7 of the draft FMS

GOAL 7. To improve the knowledge of the community about the operations and management of the Estuary Prawn Trawl Fishery.			
	Performance indicator	**Trigger point**	**Comments**
1	Dissemination of information to the public	Less than two pieces of information material for the public (eg pamphlets, information kit, posters etc) is published every three years	The Estuary Prawn Trawl MAC is to be consulted prior to the material being released
2	Level of community awareness	Less than 50% of those surveyed are aware of the operation and management of the estuary prawn trawl fishery	To be part of a survey done every three years to assess the awareness of fishing communities and approval of these communities for the management of the Estuary Prawn Trawl Fishery. Survey to be paid for by financial contributions from industry

Table C10. Performance indicators and trigger points for Goal 8 of the draft FMS

GOAL 8. To improve the knowledge about the Estuary Prawn Trawl Fishery and the resources upon which the fishery relies.			
	Performance indicator	**Trigger point**	**Comments**
1	Total level of funding committed to research projects that the Director, NSW Fisheries determines provide a flow of benefits to the Estuary Prawn Trawl Fishery of 25% or more	To be determined	
2	Number of research grant applications submitted to external funding agencies annually relating to the Estuary Prawn Trawl Fishery	To be determined	
3	Accuracy of catch return data (measured annually) for target and byproduct species	The total annual reported landings of all endorsement holders calculated from their monthly catch return forms is greater or less than 80% of the total landings summed from market records. Or, if data from a sample of endorsement holders is used then the scaled-up value of reported landings from fishermen's monthly return forms is to be no less on average (plus or minus a level of precision of 20%), than 80% of the total market record	Accuracy to be measured by comparing fishermen's monthly catch return forms to market records using all or a sample of endorsement holders. Precision is to be calculated as the standard error of a sample divided by the mean of that sample. Extrapolations will also be made from data from the observer program

g) Monitoring performance of stock assessment

Stock assessment involves the use of various statistical and mathematical calculations to make quantitative predictions about the reactions of fish populations to alternative management choices (Hilborn and Walters, 1992). These calculations can vary from simple graphical presentations of commercial landings to sophisticated computer models that predict the biomass of the stock under various harvest regimes. The data and the scientific expertise required to apply these methods varies enormously. Stock assessment processes for the Estuary Prawn Trawl Fishery need to be defined to suit the resources available. To achieve this outcome, short-term and long-term approaches will be applied. The short-term approach will be to use landings of target species to monitor the performance of this fishery. The long term approach will be to develop a process for doing stock assessments of the target species.

The long-term approach will involve undertaking the following science and reassessing the future direction of research as stock assessments improve and information needs are highlighted through the stock assessment process. A desktop study of the information available for eastern king prawns will be completed by July 2003. A study to collect information on the growth and mortality of school prawns will be done between July 2002 and December 2005 and a stock assessment on the species completed by July 2006. The University of Sydney will complete a preliminary stock assessment for the squid fishery in the Hawkesbury River by July 2003. The future needs for a stock assessment for squid will be assessed once these studies have been completed and as part of the proposed review of the exploitation status of the squid resources of NSW (management response 2.1c).

Two principles will apply to the long-term proposal for stock assessments:

- assessment methods will be consistent with the data (i.e. the assessment program design will not rely on data sources that are not funded)
- assessment methods will be at least equivalent to approaches for fisheries of similar value in other Australian jurisdictions.

h) Setting trigger points for monitoring changes in annual reported landings

A system to detect undesirable trends in catch per unit of effort (CPUE; weight per fisher day) will be used while stock assessments are being developed for target species. Once stock assessments are available more sensitive biological reference points will be developed. Some of the byproduct species are the target species of other commercial fisheries and will therefore be the subject of formal stock assessments under the management strategy for that fishery. Where necessary, the stock assessments for these species will be integrated into the FMS for the Estuary Prawn Trawl Fishery. The status of the stocks of the prominent byproduct species of the Estuary Prawn Trawl fishery (i.e. species comprising more than 2% of the annual reported landings for the fishery from the particular estuary) that are not subject of a formal stock assessment in the short term, will be determined by assessing patterns in annual reported landings. The species to be assessed in this manner will change between estuaries because the list of prominent byproduct species changes between estuaries of the Estuary Prawn Trawl Fishery.

Catch per unit of effort data must be used with caution in stock assessments. Most stock assessment models assume that CPUE is directly proportional to stock abundance. This can only be the case if fishing effort is randomly distributed, and we know that this is seldom the case. Some fisheries (including prawn fisheries) target aggregations of shellfish and finfish, which can mean that CPUE stays high, even as total abundance drops because the remaining shellfish and finfish continue to aggregate.

The correct use of fishing effort data requires a good knowledge about the biology of each species that it is applied to, so that its spatial distribution can be adequately considered. Information about fishers' behaviour and gear is also important so that effort units can be standardised and changes over time can be accounted for. Catch per unit of effort has been used as an index of relative abundance in the Estuary Prawn Trawl Fishery because fishers during a single fishing day will usually target a single species within each estuary of the fishery and the fishing gear and vessels have remained relatively standard through time. In the longer term once a sufficient database on numbers of each species caught during the fishery independent surveys proposed in this FMS has been accumulated, there will be less reliance upon fishery dependent data and some of the risks associated with the biases mentioned above will be diminished.

The aim of trigger points based on changes in landings or CPUE is to force a review of a species' circumstance when the indicators go beyond a reasonable expected range. Trigger points must be set at a level where they are sensitive enough to be likely to register a real problem but not so sensitive that they constantly trigger when there is no need for a review.

Trigger points will be set in a precautionary manner to be within the known range of past variation in landings or CPUE. This is desirable insurance that ensures reviews will be done when management action is needed.

There are a number of factors that must be considered when selecting a trigger level based on performance of fishery or species landings or CPUE:

- level of variation in recorded historic annual reported landings or CPUE
- management changes over time that may affect levels of annual reported landings or CPUE
- changes in the catch recording system that limit interpretation of annual reported landings or CPUE data
- relevant environmental events
- changes in activities by important harvesters of that species.

All these factors have and will continue to influence how changes in landings and CPUE can be interpreted.

The trigger points are designed to measure different types of changes in annual reported landings and CPUE of the target species.

Firstly, a review should commence when the levels of annual reported landings or CPUE change dramatically from one year to the next – the "single year trigger". The change that triggers a review is not an unprecedented rate of change but rather a rate of change that was expected (perhaps) once every five to ten years. The single year triggers are based on the variation in year-to-year changes in the historical catch and effort data. The trigger points are set at a level of change that occurs less than 20% of the time. In other words, changes larger than the greatest 20% of historical

changes will trigger a review. This level of change is chosen to ensure that there will be a review if there is a dramatic change in the circumstances of the fishery over a short period. The reference level for this short term trigger will be the level of annual reported landings or CPUE from the previous year.

The second type of trigger point is designed to detect long term patterns in annual reported landings or CPUE that are of sufficient concern to require a review (e.g. a downward or upward trend over several years). An objective system for defining these types of trigger points will be developed and tested during the first nine months of the FMS and applied to all target species at the first annual review. Time series of annual reported landings or CPUE for any commercial species are likely to be correlated from one year to the next (i.e. the level of annual reported landings or CPUE one year is related to the level of annual reported landings or CPUE in one or more previous years.). This type of data structure will complicate the analysis of trends in annual reported landings or CPUE. It is not a trivial exercise to devise an objective system to force a review when annual reported landings or CPUE data exhibit certain patterns. For example, downward trends in annual reported landings or CPUE should cause concern but the monitoring system must consider the importance of the rate of decline and the time period over which the decline occurs. The analysis must address the likelihood of relationships between data points and any relevant biological considerations (e.g. does the species come from a group that is known to be relatively long- or short-lived?).

The assistance of a statistical expert will be sought to develop an objective system for defining trigger points that detect concerning trends in annual reported landings or CPUE. The system may involve several different measures, including the steepness of the trend and the period over which the trend occurs.

i) How trigger points based on landings will be applied

The single year trigger is explained in the examples shown in Figure C3. These examples explain how the single year trigger points will work with a hypothetical starting point (five years ago), trigger levels and existing catch data. For school prawns from the Clarence River (a) the accepted range in variability in Year 2 of the FMS is higher than the level of CPUE for Year 1 and the trigger is set off. Similarly, the trigger is set off in Year 2 for eastern king prawns in the Clarence River (c). Note that in the Clarence River eastern king prawns are considered as a byproduct species of the estuary Prawn Trawl Fishery and so the trigger is based upon annual reported landings rather than CPUE. Contrast this with patterns in CPUE for eastern king prawns from Port Jackson where the species is targeted. Whilst showing a downward trend in CPUE, the ranges in variability overlap with the previous year's level of CPUE and so the trigger is not set off. It is most likely though that the analysis being developed to detect unacceptable long-term trends in patterns of CPUE or annual reported landings (the second type of trigger point) would have a trigger that was set off for this data set.

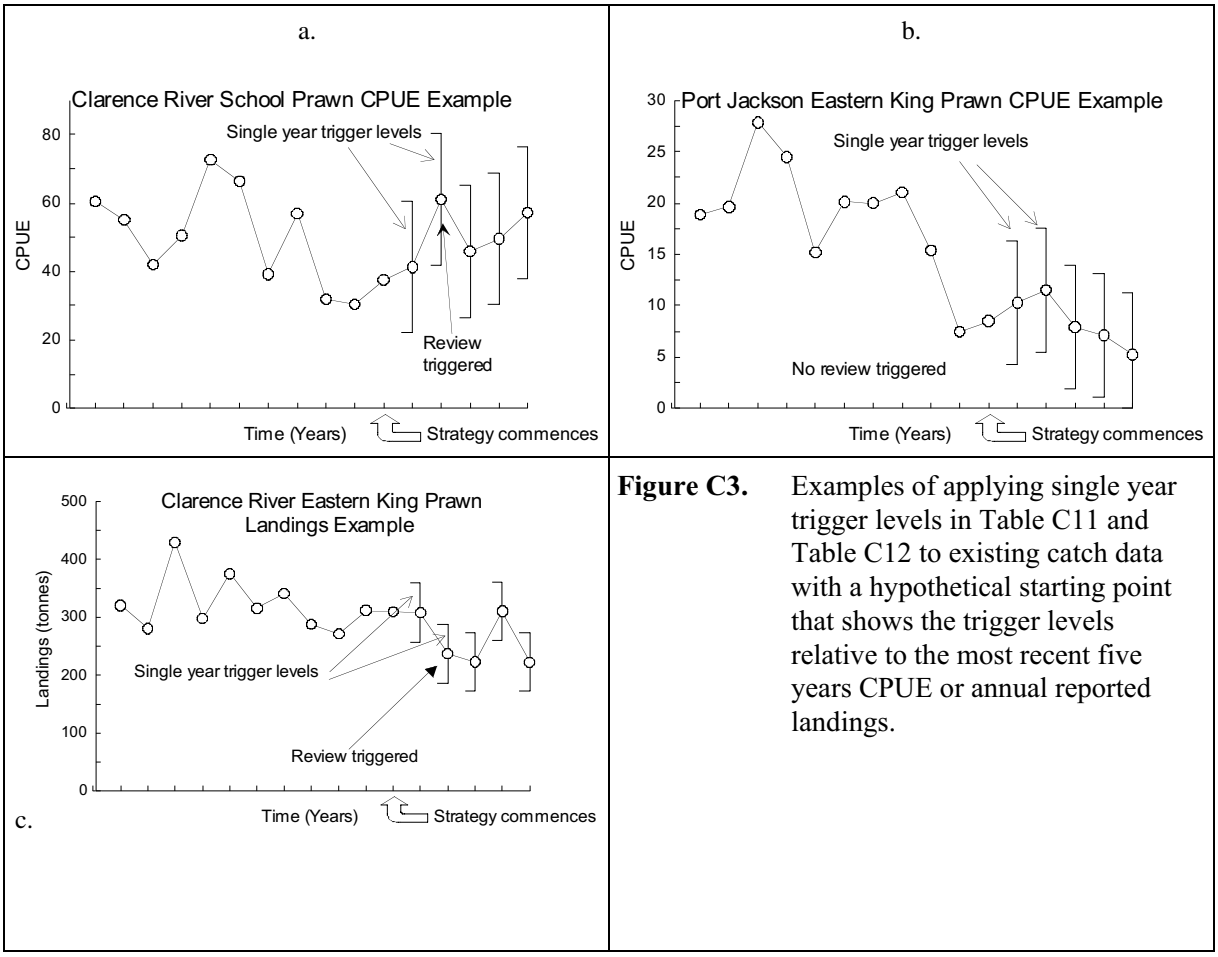

Figure C3. Examples of applying single year trigger levels in Table C11 and Table C12 to existing catch data with a hypothetical starting point that shows the trigger levels relative to the most recent five years CPUE or annual reported landings.

Table C11. Levels of trigger points for single year trigger to detect large change in CPUE for target species, from one year to the next.

Species Common Name	Clarence River		Hunter River		Hawkesbury River		Port Jackson	
	Upper Lim	Lower Lim	Upper Lim	Lower Lim	Upper Lim	Lower Lim	Upper Lim	Lower Lim
School prawn	76.6	40	44.1	25.9	30.2	14.1	byproduct	byproduct
Eastern king prawn	byproduct	byproduct	65.8	8	16.5	5.9	8.8	0
Squid	NA	NA	NA	NA	18.4	13.6	NA	NA

Note: These levels will apply for the first year of the fishery management strategy. At each annual review the trigger levels for the next year will be calculated, using the most recent year of catch data as the new reference level. The average annual change was calculated over the 27 years commencing in 1973-74 for the target species of the Clarence and Hunter Rivers and for the 16 years commencing 1984-85 for the other categories. All CPUE values are kilogram per fisher day.

"byproduct"- This is a byproduct species in this estuary and therefore a landing limit applies (see Table C12).

Table C12. Levels of trigger points for single year trigger to detect large change in annual reported landings for byproduct species from one year to the next. All values in the table are in tonnes.

Species Common Name	Clarence River		Hunter River		Hawkesbury River		Port Jackson	
	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit	Upper Limit	Lower Limit
Prawn, eastern king	273.2	171.5	132.6	Target	11.8	Target	8.3	Target
Prawn, school	516.3	Target	97.1	Target	92.7	Target	2.4	0
Prawn, greasy back	2.7	0.2	2.9	0	1.3	0.3	0.9	0
Prawn, tiger	4.8	0.2	0.2	0	0.5	0	0.2	0
Octopus	na	na	na	na	4.6	0.1	5.5	0.7
Squid	31.3	5.4	16.9	0	48.9	Target	11.7	0
Swimmer	7.1	2.3	na	na	10.8	0	3.1	0.1
Crab, Mud	6.3	0.0	na	na	8.9	0.0	1.1	0.0
Crab, Sand	na	na	na	na	na	na	2.8	0.0
Mantis Shrimp	na	na	na	na	0.8	0.4	0.4	0.0
Whiting, Trumpeter	1.2	0	na	na	20.6	13.7	10.9	6.7
Flounder	na	na	na	na	3.0	0.9	2.4	1.0
Sole	na	na	na	na	0	0	na	na
Silver biddy	3.2	0	na	na	0.02	0.01	17	0.2
Trumpeter	na	na	na	na	na	na	1.6	0.9
Whitebait (Glass fish & sandy sprat)	na	na	na	na	19.5	0	na	na
Catfish	28.7	17.6	3.2	1.1	0.8	0.0	1.4	0.2
John Dory	na	na	na	na	na	na	9.8	0.0
Bullseyes	na	na	na	na	0.2	0.0	na	na
Hairtail	na	na	na	na	2.6	0.0	na	na
Herring								
Yellowtail	na	na	na	na	38.7	27.0	na	na

Note: These levels will apply for the first year of the fishery management strategy. At each annual review the trigger levels for the next year will be calculated, using the most recent year of catch data as the new reference level. The average annual change was calculated over the 27 years commencing in 1973-74 for the target species of the Clarence and Hunter Rivers and for the 16 years commencing 1984-85 for the other categories.

Target species are subject to a maximum level of annual reported landings

Values for "Herring" will be determined by July 2002 after discussions with industry.

"na"- This species or group of species is not a byproduct species in this estuary.

"Target"- This is a target species in this estuary and therefore a CPUE trigger and maximum landings limit apply.

j) Monitoring programs

Table C13 outlines the research or monitoring programs that are in place or planned to monitor the performance indicators. Information gathered in these monitoring programs is the basis for monitoring the performance of the draft FMS.

Table C13. Monitoring programs in place or planned to measure the performance indicators.

Goal 1			
	Performance indicator	**Monitoring program**	**Timeframe**
1.1	Quantity of incidental catch	Observer surveys to start by July 2003 (management response 8.1a) will provide information about the quatitites and sizes of individual species in the catch. These data will be reviewed annually and will be compared to data from surveys done during 1989-92. these comparisons will provide information about whether the fishery will meet the target of a 40% reduction in incidental catch by 2007 or whether the target needs to be increased or decreased	Observer surveys will be used to collect information about the levels of incidental catch since bycatch reduction devices became mandatory. These survey years will then become the baseline years to monitor further reductions in incidental catch. Surveys will begin in 2002 and then be ongoing on an annual basis
1.2	Identify and map areas of key habitat and/ or environmental sensitivity that are currently opened to trawling and implement closures in those areas	Under management response 1.2(a), areas will be identified through consultation with EPT fishers and by externally funded studies. Maps will be produced using a GIS mapping system	Mapping will begin by July 2003 and closures will be implemented by July 2006
1.3	Response of the fishery to marine pest and disease incursions	Reports will be provided to the Estuary Prawn Trawl MAC through the marine pest management program on results of monitoring marine pests and diseases	Ongoing

Table C13 cont.

Goal 2			
	Performance indicator	**Monitoring program**	**Comment**
2.1	Stock assessments available for target species	A desk top study is required to improve the population model for eastern king prawns. A project to collect the information necessary to do stcok assessments of school prawn projects will begin in July 2002 (see management response 2.1f) and be completed in December 2005. A study on squid in the Hawkesbury River is scheduled to be completed in December 2002. This will provide some information that can be used in stock assessments, and together with the information collected during a review of the status of the squid resources of NSW (see management response 2.1c) will be used to set the direction of research for the purposes of improving the stock assessments on squid. (see management responses 2.1 d,i)	School prawns - July 2006. Eastern king prawns - July 2003. Squid - July 2003. Follow up studies will then be done at times determined by the Director, NSW Fisheries in consultation with the Estuary Prawn Trawl MAC
2.2	Total annual reported landings of each prominent byproduct species in each estuary of the Estuary Prawn Trawl Fishery	Data will be provided from the fisher's monthly return forms or a revised reporting system (see management responses 2.1a and 8.2a,b). Annual analysis of data by NSW Fisheries' scientists, in consultation with the Estuary Prawn Trawl MAC. Reports to be scrutinised in June/July and a final report made available in August of each year. These data will also be used to ascertain whether the annual reported landings for the Estuary Prawn Fishery have exceeded the levels in Table C12	Begin 2002 and ongoing subject to annual review
2.3	Relative abundance of target species (including spawner biomass)in each estuary	Data will be provided from (1) the fisher's monthly return forms or a revised reporting system (see management responses 2.1a and 8.2a,b), (2) observer-based sampling program (management response 8.1a and (3) fishery independent surveys (management response 8.1b). Annual analysis of data by NSW Fisheries' scientists. Reports scrutinised in June/July and final report made available in August of each year	Analysis of (1) fisher monthly return data by July 2002 and then ongoing, (2) observer-based data by July 2004 and then ongoing, and (3) fishery independent data from July 2004 and then ongoing

Table C13 cont.

	Performance indicator	Monitoring program	Comment
Goal 3			
3.1	Number of incidental captures related to listed threatened species, population or ecological community	Data will be provided from (1) the fisher's monthly return forms or a revised reporting system (see management responses 3.1a and 8.2a,b), (2) observer-based sampling program (management response 8.1a and (3) fishery independent surveys (management response 8.1b). Annual analysis of data by NSW Fisheries' scientists. Reports scrutinised in June/July and final report made available in August of each year	Analysis of (1) fisher monthly return data by July 2002 and then ongoing, (2) observer-based data by July 2004 and then ongoing, and (3) fishery independent data from July 2004 and then ongoing
3.2	Response of the fishery to threatened species declarations	Reports will be provided to the Estuary Prawn Trawl MAC containing recommendations from the Director, NSW Fisheries and/or the Director-General of the National Parks and Wildlife Service where appropriate actions may be needed to conserve threatened species (management response 3.1b). Monitoring the response of the fishery will be through the scientific, management and compliance services provided by NSW Fisheries	Ongoing
Goal 4			
4.1	Annual reported landings from the commercial sector compared to estimates of unreported annual catch by commercial fishers, annual catch by the recreational and Indigenous sectors (excluding catches attributable to recreational fishing areas)	Data will be collected from stratified recreational creel surveys and compliance reports arising from "quality patrols" (see management responses 4.1a and 6.1a)	Results from the National Receational and Indigenous Fishing survey will be available by 2002. Quality patrols by Fisheries Officers are ongoing but may be redesigned by June 2003 to collect additional information about unreported landings
4.2	Annual reported landings of target species taken in the Estuary Prawn Trawl Fishery relative to those from the same estuary by other commercial fisheries	Data will be provided from the fisher's monthly return forms or a revised reporting system (see management responses 2.1a and 8.2a,b). Annual analysis of data by NSW Fisheries, scientists, in consultation with the Estuary Prawn Trawl MAC. Reports to be scrutinised in June/July and a final report made available in August of each year	Begin 2002 and then ongoing. Subject to annual review

Table C13 cont.

	Performance indicator	Monitoring program	Comment
Goal 5			
5.1	Median fishery wide gross return of estuary prawn trawl fishers derived from commercial fishing in NSW	Part of the annual review will involve calculating the median gross return of fishers endorsed in the Estuary Prawn Trawl Fishery, by multiplying their monthly catches with respective average Sydney Fish Market price and prices provided by the Estuary Prawn Trawl MAC	Ongoing
5.2	Average market value of estuary prawn trawl shares	The market value of shares will be collected and recorded by the Share Registrar upon each share transfer. The average market value will be calculated each year as part of the annual review	Ongoing
5.3	Viability of the Estuary Prawn Trawl Fishery and its contribution to businesses of fishers therein	Performance indicator and associated monitoring to be developed (see management response 5.2a)	By December 2005
Goal 6			
6.1	Rate of compliance relating to the Estuary Prawn Trawl Fishery as indicated by quality inspections conducted by NSW Fisheries	The compliance rate will be calculated using the outcomes of quality inspections conducted as part of the compliance program for the fishery (see management response 6.1a)	Ongoing
6.2	Number of Estuary Prawn Trawl MAC meetings held each year	The number of Estuary Prawn Trawl MAC meetings held will be determined as part of the annual review based on the records held by NSW Fisheries	Ongoing
6.3	Occasions when this FMS is in direct conflict with other approved Commonwealth or State programs	The major concurrent programs will be considered during the annual review, however other programs considered by the Director, NSW Fisheries to be in conflict with this FMS will be reprted to the Estuary Prawn Trawl MAC on a case by case basis	Ongoing
Goal 7			
7.1	Dissemination of information to the public	List of publications for public information relevant to the Estauary Prawn Trawl Fishery to be reviewed annually in consulatation with the Estuary Prawn Trawl MAC	To begin 2002, and ongoing
7.2	Level of community awareness	A survey every three years to collect information about the community's awareness of management and its knowledge and perceptions of the Estuary Prawn Trawl Fishery	To begin in 2005, subject to funding being provided by industry

Table C13 cont.

Goal 8			
	Performance indicator	**Monitoring program**	**Comment**
8.1	Total level of funding committed to research projects that the Director, NSW Fisheries determines provide a flow of benefits to the Estuary Prawn Trawl Fishery of 25% or more	Annual review by the Director, NSW Fisheries of total research funding from consilidated and external funds that are being spent on the Estuary Prawn Trawl Fishery	Begin 2002
8.2	Number of research grant applications submitted to external funding agencies annually relating to the Estuary Prawn Trawl Fishery	After consultation with the Estuary Prawn Trawl MAC, submit at least one grant application that relates to the fishery to external funding agencies annually (see management response 8.1e)	Begin 2002
8.3	Accuracy of catch return data (measured annually)	Data will be provided from the fisher's monthly return forms or a revised reporting system (see management responses 2.1a and 8.2a,b) and from the records of the Fish Receivers. Data from these sources will be compared by NSW Fisheries, scientists, in consultation with the Estuary Prawn Trawl MAC. Reports to be scrutinised in June/July and a final report made available in August of each year. Data from the observer based survey will be useful in ascertaining whether the level of annual reported landings of a species determined from fishers catch return records is reliable	Begin 2002
8.4	Fishery independent surveys are established and are providing quality data	Implement fishery independent surveys that will provide estimates of mean abundance with an agreed upon level of precision (see management response 8.1b)	Begin in 2003 and ongoing, subject to bi-annual review

6. Proposed Harvesting Strategy

a) Fishery status

i) Number of fishers

As at November 2001 there were a total of 289 fishing business with estuary prawn trawl entitlements. Of these, three businesses have entitlements to trawl for prawns in more than one estuary. The total number of businesses authorised to operate in the Estuary Prawn Trawl Fishery will not increase under the proposed harvest strategy, but will most likely reduce depending on the type of effort control strategy implemented (see management response 2.3c in section 4 of this draft FMS). The freeze on the issue of new boat licences will also remain under the proposed harvest strategy (see management response 2.3e in section 4 of this draft FMS). There will be a reduction the number of businesses in the fishery in 2002 due to Botany Bay being gazetted as a Recreational Fishing Area from 1 May 2002 (see Table AB21a in Appendix B) and the entitlements being bought out. Consequently, proposed management arrangements for Botany Bay are not included in the remainder of this draft FMS.

ii) Implementation of share management

The Estuary Prawn Trawl Fishery moved from being a restricted fishery (under section 111 of the FM Act) to a category 2 share management fishery following changes to the FM Act in December 2000. The progression to a share management regime involves a staged implementation.

The fishery is first identified as a share management fishery by being included in Schedule 1 of the FM Act. Criteria for the allocation of shares are then determined and when the allocation formula has been decided, a public notice is published inviting applications for shares. Based on the criteria and applications received, provisional shares are issued.

After provisional shares are issued, a legal order is placed in the NSW Government Gazette commencing the "limited access stage" of share management. Once the limited access stage commences a person must hold at least one provisional share (issued on a provisional basis) in the fishery to be eligible to hold an endorsement. Throughout this stage, the fishery continues to operate under the Regulation.

Applications for appeals against the allocation of shares are lodged before the fishery is formally commenced. The management plan for the fishery is prepared and put into regulation, final shares are issued and the fishery then commences as a full share management fishery.

At present the Estuary Prawn Trawl Fishery at the stage of consulting over the criteria for the allocation of shares. A share management plan for the fishery will be prepared in accordance with the agreed goals, objectives and management responses outlined in the final FMS.

It is possible that, in the future, the fishery may become a category 1 share management fishery. It is intended that this FMS will apply to the fishery whether it has category 1 or category 2 share management status.

b) Fishery description

The Estuary Prawn Trawl Fishery is one of nine major commercial fisheries in New South Wales. It is a single method fishery that targets school and eastern king prawns, and also squid in the Hawkesbury River. Byproduct (retained incidental catch) is also taken in the fishery with the species and quantities taken limited to those species and quantities historically taken and marketed in the fishery (listed in Table C18).

There are five types of endorsements in this fishery, which, with the exception of the Clarence River, corresponds to one type of endorsement for each estuary. The endorsement is known as the 'estuary prawn trawl endorsement'. An endorsement authorises the fisher to use an otter trawl net (prawns) to take prawns for sale from the relevant estuary waters.

Fishing vessels used to take prawns in the Estuary Prawn Trawl Fishery are also subject to a particular set of boat licence conditions. These conditions (S2, S3, S4, S5 and S6) are used to restrict each vessel, when trawling, to one or more of the estuaries, or parts thereof, where prawn trawling is permitted.

Table C14. Classes of prawn trawl entitlements.

Estuary	Class of entitlement
Clarence River	
Access to Lake Wooloweyah and the Clarence	S5
Access to Lake Wooloweyah only	S6
Hunter River	S4
Hawkesbury River	S3
Port Jackson	S2

c) Area of the fishery

As at May 2002 trawling for prawns will be limited to four estuaries namely, the Clarence, Hunter and Hawkesbury Rivers and Port Jackson (see Figure B2). There will be a reduction of around 7% in total fishing area available to the Estuary Prawn Trawl Fishery with the establishment of a recreational fishing area in Botany Bay in 2002 (see Table AB21a in Appendix B). Each estuary in the Estuary Prawn Trawl Fishery is subject to separate management arrangements. The areas of operation in each estuary are described in section 6(g) of this draft FMS.

The overall area of the Estuary Prawn Trawl Fishery will not increase under the proposed harvest strategy, but will decrease as closures are implemented; to protect key habitats including *Zostera* and *Posidonia* seagrasses (see management response 1.1e), and to prevent trawling over previously non-trawled areas within the overall area of the fishery (see management response 1.2a).

d) Method of operation

An endorsement in the fishery allows a commercial fisher to use an otter trawl net to target prawns (and also squid in the Hawkesbury River) in estuarine waters. A trawl net is a funnel of net towed along close to the seabed (Figure B3). The net to be used is restricted by the definition of an otter trawl net for prawns under the *Fisheries Management (General) Regulation 1995* (see Appendix B2).

Restrictions apply to the size of mesh that the net may be used in the net (see Table C15). The amount of net (i.e. headrope length) and number of nets that may be towed behind the vessel is also restricted to limit fishing effort (see Table C15). Although two nets may be used in Broken Bay (Hawkesbury River), and Port Jackson almost all vessels only use one net. In the Clarence River most trawlers use two nets.

Table C15. Summary of the characteristics of the nets permitted in each estuary.

Characteristic	**Estuary**			
	Clarence River	Hunter River	Hawkesbury River	Port Jackson
Mesh size of net (mm)	40-60	40-60	40-60	40-60
Mesh size of codend (mm)	40-50	40-50	40-50	40-50
Maximum number of nets	2	1	2 (Broken Bay) 1 (Other)	2
Maximum headline length (m)	7.5m each net (if twin gear) 11m (if single gear)	11	11	11
BRD	Yes	Yes	Yes (see below)	Yes

All prawn trawl nets, except for those used in Broken Bay (Hawkesbury River), must be fitted with a BRD that has been approved for use in the fishery (see Table C16). A description of the BRDs used in the Estuary Prawn Trawl Fishery is given in Appendix B4.

Bycatch reduction devices have not yet been introduced in Broken Bay because the devices presently used would severely reduce catches of squid. A joint research project involving fishers, NSW Fisheries and University of Sydney is currently underway on the Hawkesbury River squid fishery which, amongst other things, aims to develop gear to minimise incidental catch without reducing squid catch.

Table C16. Bycatch reduction devices (BRDs) approved for use in each estuary.

Estuary	BRD
Clarence River	1. Composite square mesh panel 2. Blubber chute 3. Nordmore grid 4.Quality Clarence panel
Hunter River	1. Composite square mesh panel 2. Blubber chute 3. Nordmore grid 4. Quality Clarence panel
Hawkesbury River	1. Composite square mesh pane 2. Blubber chute 3. Nordmore grid 4. Quality Clarence panel 5. Hawkesbury square mesh panel
Port Jackson	1. Port Jackson screen 2. Blubber chute 3. Nordmore grid 4. Composite square mesh panel

The current gear restrictions will remain under the proposed harvest strategy (see management responses 1.1a and 2.1a) unless: more effective BRDs are introduced (see management response 1.1b), nets are modified to minimise the capture of target and byproduct species of non-marketable quality (see management response 1.1c), or a new net is developed to selectively harvest squid or gear is to be modified under a recovery program for an overfished stock (see management response 2.6c).

e) Species

Species in the catch of the Estuary Prawn Trawl Fishery can be categorised into target, byproduct or bycatch (see section 2a in Chapter B). Also, the *Fisheries Management (General) Regulation 1995* provides for a review process to identify species that warrant protection from either commercial fishing or all fishing sectors and those that are threatened.

Table C17. The target species caught in each estuary of the EPT Fishery.

"Yes" signifies that the species is a target species in that estuary

"No" signifies that the species is not target species in that estuary

Common Name	Scientific Name	Estuary			
		Port Jackson	Hawkesbury River	Hunter River	Clarence River
Eastern king prawn	*Penaeus plebejus*	Yes	Yes	Yes	No
School prawn	*Metapenaeus*	No	Yes	Yes	Yes
Broad squid	*Photololigo*	No	Yes	No	No
Bottle squid	*Loliolus noctiluca*	No	Yes	No	No

i) Target species

The target species in the Estuary Prawn Trawl Fishery are prawns (for a list of species see Table C17), but the target species may vary between estuaries. An exception to this is the Hawkesbury River where squid are also recognised as a target species. Information about patterns in landings and catch rates for each species within each estuary of the fishery can be found in Appendix B5 and will continually be monitored under the proposed harvesting strategy (see management

response 1.1a). A formal stock assessment on each target species will be undertaken within five years (see management response 2.1i).

An independent Total Allowable Catch Setting and Review Committee will provide independent advice to the Minister for Fisheries on the maximum level of effort that the NSW prawn stocks could sustain (see management response 2.3b). The Prawn Resource Forum will provide advice to the Minister for Fisheries on how the available prawn stocks should be shared between commercial fisheries and recreational fishers (see management response 4.2b).

If effort in the Estuary Prawn Trawl Fishery must be decreased this will be achieved by either reducing the number of businesses in the fishery using minimum shareholding requirements, limiting the total number of days fishing within each estuary, or limiting the number of days fishing by each business based on past participation. If restructuring is the method used to reduce fishing effort, a determination will be made as to the number of businesses that must be removed from each estuary.

Maximum counts will be introduced during 2002 for all species of prawn taken in the Estuary Prawn Trawl Fishery (see management response 2.1e). The introduction of counts will stop the taking, possession and sale of small prawns. A count is a relative measure of the size of prawns in a catch. A count is expressed as the number of prawns per half a kilogram.

In the Hawkesbury River, squid is a target species. Current research by the University of Sydney will provide information on the optimal size of harvest for squid. This draft FMS provides a two year timeframe for determining whether or not there is a need to introduce a legal minimum length for squid (see management response 2.1g). It also provides for a review of the exploitation status of squid (see management response 2.1c) and if the research shows that the level of exploitation of squid stocks is too high, then consideration would also be given to limiting fishing effort upon the stock consistent with management response 2.3c.

ii) Byproduct species

Byproduct species are those that are caught as part of the Estuary Prawn Trawl Fishery and which have significantly contributed traditionally to the marketed catch of the fishery. These are listed in Table C18 and the prominent byproduct species (those that contributed more than 2% (by weight) to the annual reported landings of an Estuary Prawn Trawl Fishery between 1997-98 and 1998-99) are described in Appendix B5.

Table C18. The byproduct species permitted to be landed as part of the future management of the Estuary Prawn Trawl Fishery. Note that not all species in Tables B16, B19, B22 and B25 will be permitted to be landed under the proposed management strategy FMS for the fishery.

"Yes" signifies that the species is a by-product species in that estuary. "No" signifies that the species is not a by-product species in that estuary. "Target" signifies that the species is a target species in that estuary.

Common Name	Scientific Name	Estuary			
		Port Jackson	Hawksbury River	Hunter River	Clarence River
School prawn	*Metapenaeus macleayi*	Yes	Target	Target	Target
Eastern king prawn	*Penaeus plebejus*	Target	Target	Target	Yes
Greasyback prawn	*Metapenaeus bennettae*	Yes	Yes	Yes	Yes
Tiger prawn	*Penaeus esculentus*	Yes	Yes	Yes	Yes
Trumpeter Whiting	*Sillago maculata*	Yes	Yes	No	Yes
Large-toothed flounder	*Pseudorhombus arsius*	Yes	Yes	No	No
Small-toothed flounder	*Pseudorhombus jenynsii*	Yes	Yes	No	No
Black sole	*Synaptura nigra*	No	Yes	No	No
Silverbiddy	*Gerres subfasciatus*	Yes	Yes	No	Yes
Striped trumpeter	*Pelates quadrilineutus*	Yes	Yes	No	No
Whitebait(glass fish)		No	Yes	No	No
Fork-tailed catfish	*Euristhmus lepturus*	Yes	Yes	No	Yes
Estuary catfish	*Cnidoglanis macrcephalus*	No	No	No	Yes
Striped catfish	*Plotosis lineatus*	Yes	Yes	No	Yes
John dory	*Zeus faber*	Yes	No	No	No
Bullseyes	*Pempheridídae*	No	Yes	No	No
Hairtail	*Trichiurus lepturus*	No	Yes	No	No
[1] Herring	Clupeidae		Yes		
Pike	*Dinolestes lewini*	No	No	No	No
Yellowtail	*Trachurus novaezelandiae*	No	Yes	No	No
Sand Crab	Portunidae	Yes	No	No	No
Blue swimmer crab	*Portunus pelagicus*	Yes	Yes	No	Yes
Mud crab	*Scylla serrata*	Yes	Yes	No	Yes
Octopus	ORDER OCTOPODA	Yes	Yes	No	No
Mantis shrimp	*Oratsquilla oratoria*	No	No	No	No
Mantis shrimp	*Erugosquilla grahami*	Yes	Yes	No	No
Mantis shrimp	*Harpiosquilla harpex*	Yes	Yes	No	No
Arrow squid	*Nototodarus gouldi*	Yes	No	Yes	Yes
Broad squid	*Photololigo etheridgei*	Yes	Target	Yes	Yes
Slender squid	*Loligo* sp.	Yes	Target	Yes	Yes
Bottle squid	*Loliolus noctiluca*	Yes	Target	Yes	No
Bubble quid	*Eupyrmna stenodactyla*	Yes	Target	No	No
Candy-striped squid	*Sepioloida lineolata*	Yes	Target	No	No
Southern calamari	*Sepioteuthis australis*	Yes	No	No	No

[1.] the status of the species in each estuary except the Hawkesbury River has yet to be determined.

The draft FMS limits the taking of byproduct in each estuary to those species historically taken within the estuary. The quantity of byproduct reported as taken in each estuary will be monitored (see management response 2.1b) and validated through and observer study (see management response 8.1a). Annual reported landings of byproduct will be limited to historical levels and proportional to the annual reported landings of target species (see management response 4.2b). This will prevent targeting and increased catches of byproduct species.

iii) Bycatch species

Appendix B1 gives a detailed list of the species caught during observer studies of the Estuary Prawn Trawl Fishery in the Clarence and Hawkesbury Rivers, Port Jackson and Botany Bay. Details of this research can be found in Kennelly (1993), Gray and McDonall (1996), Liggins and Kennelly (1996) and Liggins *et al*. (1996). In addition, Ruello (1971) provided lists of species caught during fishery independent surveys of the Hunter River. Whilst many species are caught in the Estuary Prawn Trawl Fishery, only the relative few listed in Tables C17 and C18 will be permitted to be landed.

Species that are considered to be of high commercial and recreational importance which are incidentally caught in the Estuary Prawn Trawl Fishery include sand whiting, yellowfin bream, tarwhine, snapper, leatherjacket, flounder, flathead, tailor, and mulloway. Three strategies will be used to ensure that bycatch in the Estuary Prawn Trawl Fishery is minimised. These are:

1. the current prohibition against retaining fish that are subject to a size limit will remain under the proposed FMS (see management response 2.3d)

2. bycatch reduction devices will be improved to further reduce bycatch (see management response 1.1b)

3. ratios of incidental catch will be introduced to close areas where the abundance of incidental species is high (see management response 1.3a).

Estuary prawn trawl fishers are attempting to minimise their catch of incidental species by incorporating within this draft FMS the use of bycatch reduction devices, incidental catch ratios and limits on the quantities of annual reported landings of by-product species, “compliance audits”, a compliance penalty points scheme and an observer program. Again, only species listed in Tables C17 and C18 can be retained for sale.

iv) Status of species within the fishery

The exploitation status of the species caught in the net of the Estuary Prawn Trawl Fishery are discussed in Chapter B section 4. While eastern king and school prawn are categorised in Table B6 as “fully fished” they may in the next review of the status of the fisheries resources of NSW be changed to overfished. This draft FMS has taken a precautionary approach to this situation by introducing several management responses that would be implemented if the species were considered as growth overfished (see section 6(e)(v) of this chapter).

In addition the squid resources show a pattern in annual reported landings that requires an explanation. Accordingly this draft FMS provides a management response to review the status of the stock(s) of squid and to collect the basic information needed to review the exploitation status of this resource (see management response 2.1c).

There are also several prominent byproduct species that under section 4(g) of this chapter set off the “one year trigger” and so would require a review of the exploitation and management of this species. However in these cases the draft FMS has already addressed this by implementing management responses to:

(a) limit the landings of byproduct species (see management response 4.2b)

(b) temporarily close areas when the abundance of incidental species is considered too great (see management response 1.3a)

(c) introduce BRDs into the fishery (see management response 1.1b)

v) Overfished species

If a species taken in this fishery is determined as 'overfished', this draft FMS requires the implementation of, or assistance in developing, a recovery program for that species (see objective 2.6 and related management responses in section 4 of this draft FMS). A recovery program must include a description of the actions proposed to return to acceptable levels those parameter(s) which have led to the determination of the species being overfished. The recovery program will also set out a timeframe for that process and may specify further appropriate action should recovery targets not be met.

Definitions of overfished status

There are two types of overfishing, both of which, when detected, require management action. It is important to note that the two types of overfishing are not mutually exclusive. "Growth overfishing" occurs when individual fish are typically harvested under the size that takes best advantage of the species growth in relation to expected natural mortality. "Recruitment overfishing" can be far more serious and occurs when fishing pressure has reduced the ability of a stock to replenish itself.

Designating a species as overfished

The information needed to clearly determine that a species has been growth overfished is more likely to be available than the information needed to detect recruitment overfishing. Most formal definitions of recruitment overfishing are determined on the basis of an understanding of relative rates of fishing mortality, population growth and population biomass, as well as the relationship between spawners and recruitment (e.g. Hilborn and Walters, 1992). Even the most thoroughly studied species in NSW may not have relevant information on all those topics.

NSW Fisheries will consider advice from fisheries scientists as part of the annual assessment of the status of shellfish and finfish stocks in NSW. That advice could come as results of internal research become available, or from other agencies or institutions doing research relevant to the assessment of species harvested in NSW. If a species is the subject of a formal stock assessment process, the indication of overfishing is likely to come from having some performance indicator outside acceptable parameters. Other species' status will be reviewed on the basis of the best available biological and catch information.

A stock that has had sufficient fishing mortality to cause a reduction in recruitment requires effective rehabilitation. However, information that clearly demonstrates that a species' recruitment has been impacted by fishing is difficult and expensive to collect, and likely to be rare. Management responses will need to be precautionary and are likely to draw inference from catch and catch composition, rather than from direct measurements of recruitment. For example, rapid declines in catch (especially when the species is targeted in a spawning aggregation), decreases in average size or missing size and/or age class compositions are all indicative of potential problems with recruitment.

When new information that is likely to change the present status of a species is received by NSW Fisheries, NSW Fisheries scientists will review the status determination for that species against the criteria specified in Table B5 and report on the updated status in the annual report "Status of

Fisheries Resources". If a species is designated as overfished, a recovery program involving all harvest sectors will be developed.

Appropriate management responses for different types of overfishing

Growth overfishing generally implies the productivity of a stock is being mismanaged by harvesting animals at too small of size, or young an age. Fish stocks that are growth overfished are not necessarily in danger of imminent collapse and populations can be growth overfished and still be stable. However, growth overfishing may increase the risk to the population of subsequent recruitment failure arising from increased fishing pressure or external factors. The typical and most appropriate response to growth overfishing is to increase the average size at first harvest. This is commonly done by imposing a minimum size limit or increasing an existing one. The efficacy of such a response depends largely on the methods of capture and whether the selectivity of those methods can be appropriately altered to match the new size limit, otherwise wasteful discarding can occur. Careful thought must be given to changing size limits where there are problems in adjusting the selectivity of the primary fishing methods for that species.

Recovery programs for species suspected of having depressed recruitment due to overfishing must include strong precautionary action. Actions could include (but may not be limited to) temporary fishery closures or caps on either catch or fishing effort. Recovery programs for recruitment overfished species may also include changes to the monitoring program for that species and/or require targeted research to improve the assessment of risk to the species in critical areas.

Montgomery (2000) used available information to show that school and eastern king prawns were being captured at sizes smaller than that which optimised biological yield per recruit. The assessment fell short of categorising this as growth overfishing because of the preliminary nature of the analyses, low level of precision about some population parameters and insufficient information about the sizes of prawns caught by all harvesting sectors for prawns.

Considering the results presented by Montgomery (2000), a precautionary approach has been taken in the FMS which contains several management responses to address the likelihood of growth overfishing, namely:

(a) modifying fishing gear to reduce the capture of prawns of non-marketable quality (see management response 1.1b).

(b) protecting areas of key habitat (see management responses 1.1e and 1.2a)

(c) implementing a legal minimum size in the form of a count of prawns to the half kilogram (see management responses 2.1d, 2.1f and 5.1a)

(d) conserving the spawning stock (see management response 2.2a)

(e) using a Prawn Resource Forum to discuss the management issues that are relevant to more than one fishery

(f) using the Total Allowable Catch Setting and Review Committee to determine levels of fishing effort on prawn resources across all fisheries.

In addition, objective 2.6 in section 4 of the draft FMS provides a mechanism for the fishery to participate in the recovery of overfished species. The objective has three major management responses as set out below, and the most appropriate management response for the fishery to adopt

will be dependent upon the catch levels relative to other fisheries. The three management responses for objective 2.6 are:

(a) where the fishery is a major harvester of an overfished species, develop and implement a recovery program for the species within a specified timeframe

(b) where the fishery is a minor harvester of an overfished species, contribute to the development of a recovery program for the species and adopt any measures required by that plan

(c) during the period of development of a recovery program for a species that has been determined as being recruitment overfished, implement precautionary actions including, but not limited to, any of the following:

- total harvest controls

- reductions in effort associated with the harvest of the species

- the implementation of fishing closures

- bycatch management provisions

- mandatory gear changes.

vi) Size limits and other restrictions

Clause 34 of the *Fisheries Management (General) Regulation 1995* prescribes the species that may be retained after being taken in a prawn trawl net from estuarine waters. In summary, it is lawful for a fisher to retain species:

- that are not subject to a prohibited size class
- that are not protected (i.e. no prohibition against taking)
- crustaceans (other than lobsters) that are not of a prohibited size.

See Appendix B7, for further details on species with prohibited size classes.

In addition, under this draft FMS fishers will be limited to taking the species prescribed in Tables C17 and C18 for the estuary in which they fish.

Protected fish

The *Fisheries Management (General) Regulation 1995* identifies a number of species which are protected, either from commercial fishing, or fishing by all sectors.

Protected fish include:

Ballina Angelfish	Herbst nurse shark
Eastern blue devil fish	Black rock cod
Elegant wrasse	Weedy sea dragon
Estuary cod	Australian grayling
Giant Queensland groper	Eastern freshwater cod
Grey nurse shark	Trout cod
Great white shark	Macquarie perch
Green sawfish	

Fish protected from commercial fishing include:

Black, blue and striped marlin	Blue groper
Atlantic salmon	Silver perch
Australian bass	Brook, brown and rainbow trout
Eel-tailed catfish	Freshwater crayfish
Estuary perch	

Of the species which appear in the lists above, fishers in the Estuary Prawn Trawl Fishery are not likely to have any direct or indirect interaction with the majority of the species as a large percentage of them are freshwater and oceanic species (see Appendix F4). Any interactions of the fishery on protected fish are more likely to be through incidental capture of Australian bass, estuary perch, giant Queensland groper and estuary cod. Anecdotal evidence indicates that Australian bass and estuary perch may be taken in numbers when a fresh or flood washes fish downstream into trawled areas where they are usually not found during the summer months. These species migrate downstream into estuarine areas to breed during the cooler winter months when estuaries (except the Hawkesbury River) are closed to trawling. Estuary cod and giant Queensland groper are captured far less frequently thanks to their preference for rocky substrate and structures which are avoided by trawl fishers. Anecdotal evidence suggests that large specimens which inhabitat deep holes at some locations may have been recaptured a number of times over the years and with proper care in returning them to the water survive these captures.

vii) Interactions with threatened species and species of public concern

Although interactions with threatened species have not been commonly recorded in this fishery, this draft FMS proposes three direct measures to obtain data on any such interactions. The first of these measures is to implement a scientific observer program, which will amongst other things, collect data on interactions. The second measure is to modify the monthly catch return forms completed by commercial fishers to include information on threatened species. The third measure is the records of occurrence of threatened species during fishery independent surveys.

A number of management responses aimed at minimising impacts with threatened species also appear in section 4 of this chapter. These include using fishing closures, modifying gear and implementing the provisions of any threatened species recovery plans and threat abatement plans.

f) Catch and landings

This draft FMS incorporates rules to control the quantities of incidental species caught and byproduct species landed (see management responses 1.3a and 4.2b). The quantities of byproduct species that can be landed by the Estuary Prawn Trawl Fishery are expressed as a proportion to the landings of target species because in times of greater catches of target species, the incidental catch of byproduct species may also be greater. The ratios of incidental catch to target species catch are given in section 4 of this chapter and under estuary specific management controls below.

Management actions that may assist in achieving these controls include temporarily closing areas or estuaries to trawling and/or to review the FMS.

i) Catch monitoring

The information collected on commercial landings assists in the ongoing monitoring and assessment of the status of shellfish and finfish stocks. The catch and effort information collected

from commercial fishers has other critical roles in fisheries management including helping understand patterns of fishing activities and the mix of species from targeted and general fishing operations.

Fishers in the Estuary Prawn Trawl Fishery will be required to submit records on a monthly basis detailing their catch and fishing effort. The information includes catch for each species, the effort expended (for each method) to take the catch, and the area/s fished. This information will be entered onto a database by NSW Fisheries and allows for analysis of fishing activity, catch levels and effort levels.

The accuracy of the data provided on catch returns, particularly with respect to fishing effort data, is variable. There are a number of management responses proposed in this strategy to improve the quality and reliability of the information provided on catch returns, including a review of the current monthly catch return and validation of catch and effort data under the proposed scientific monitoring program.

To maximise the accuracy of the data collected on monthly catch returns a range of quality-control procedures are currently in place or scheduled for implementation in the near future. A brief synopsis of these quality control procedures is provided here:

- Every return is scanned for errors when received by the "Commercial Catch Records" Section in NSW Fisheries, and omissions and errors are queried with fishers (by phone and/or written correspondence) and corrected if needed
- Logical checks of data accuracy (range, consistency and validity checks) are performed automatically by computer during data-entry. Errors are queried with fishers (by phone and/or written correspondence) and corrected if needed
- Following a review in May 2001, fishers who have not submitted catch returns during the period July 1997 to December 2000 are being notified and asked to submit omitted returns. Following completion of this process and update of the database, a regular process whereby omitted returns are identified and rectified will be implemented
- Data from the commercial catch statistics database "FINS" is regularly downloaded to a database "COMCATCH", which can be accessed or queried by biologists and managers responsible for individual fisheries. Subsequently, any problems with data identified by the relevant biologists or managers are queried and may be corrected by the commercial catch records Section after consulting fishers where necessary
- A recent pilot survey was undertaken to assess the accuracy of data entry with respect to the catch records. The results showed that data-entry errors by staff were of minimal significance. Errors were rare and generally concerned minor species. It is planned to repeat this survey annually to provide ongoing monitoring of the quality and accuracy of data entry
- Following implementation of routine reporting of the quantities of fish handled by registered fish receivers in NSW, it will be possible to compare the quantity of catch (by species) reported by fishers on catch returns with the quantity handled by fish receivers in NSW. This will provide a cross-validation of weights of individual species caught and handled in NSW
- The information collected on catch returns and options for improving the catch return forms (and increasing the reliability of data) is reviewed periodically by the management advisory councils and annually by the "Catch and Effort Working Group" which comprises industry

representatives from each fishery. This working group was convened for the first time in April 2001.

g) Estuary specific details

i) Clarence River

Species

The target species is the school prawn *Metapenaeus macleayi* (see Table C17) and some byproduct species are also caught (see Table C18), but under this draft FMS only certain quantities of byproduct species can be landed annually (see Table C2).

Area of operation.

Trawling for prawns is permitted between the mouth of the estuary and the wires of the vehicular ferry at Ulmarra and is also permitted in Lake Wooloweyah, which lies to the south of the river entrance (see Figure B5). See Appendix B6 for closures within these boundaries.

Management controls specific to Clarence River

Limited entry

Restrictions on the number of entitlements to operate on the Clarence River will apply under the draft FMS. No additional entitlements will be issued, and any new entitlements will only be issued if they are replacing existing entitlements.

Boat replacement policy

Clarence River prawn trawlers are subject to specific vessel and engine capacity restrictions. A Clarence River prawn trawler may be replaced, but within any ten year period, the length, depth or breadth must not increase by more than 10%. Similarly, within any ten year period the engine must not be replaced or modified so as to increase the power rating by more than 10%.

Fishing gear

Table C15 outlines the restrictions placed upon the design of the otter trawl net and Appendix B3 provides the regulations regarding the prawn trawl net. Fishers are limited to one net with a headrope length of 11 metres or two nets each with a headrope length of 7.5 metres.

Time and area closures

The fishery is restricted to waters seaward of the vehicular ferry at Ulmarra and some tributaries, including the Broadwater are closed to trawling (Figure B5). Trawling in this estuary is limited essentially to week days and two hours on Saturday mornings between the first Tuesday in October to the Friday nearest the 31 May (inclusive) the following year (Lake Wooloweyah) and the Monday nearest the 1 December to the Friday nearest the 31 May (inclusive) in the following year in the Clarence River. Table B19 and Appendix B6 outline the time closures that occur during that period.

Limits on landings

Table C2 sets out the quantities of byproduct species that may be landed. Section 5 of this chapter lists trigger points and allowable commercial catch levels for target and prominent byproduct species for the fishery in this estuary. The upper catch level for the commercial catch of each of these species has been determined using the upper trigger point range and recorded landings.

Counts on prawns

The Juvenile Prawn Summit Working Group have recommended to the Minister for Fisheries that maximum counts for school and eastern king prawns taken for sale be implemented. These counts are currently under discussion by the working group and once consensus is reached the Minister will be advised of its recommendations. These will be implemented once approved by the Minister. This draft FMS proposes to introduce "codend counts" for prawns in 2006.

Incidental catch ratio

The draft FMS provides for sections of the river to be closed when the proportion of incidental species is greater than 0.16 (by weight) of the prawn catch.

ii) Hunter River

Species

The target species are the school prawn *Metapenaeus macleayi* and the eastern king prawn *Penaeus plebejus* (see Table C17). Some byproduct species are also caught (see Table C18), but under this draft FMS only certain quantities of byproduct species can be landed annually (see Table C2).

Area of operation

Trawling for prawns is permitted between the mouth of the estuary and the junction of the Williams and Hunter Rivers (see Figure B7). See Appendix B6 for closures within these boundaries.

Management controls specific to Hunter River

Limited entry

Restrictions on the number of entitlements to operate on the Hunter River will apply under the draft FMS. No additional entitlements will be issued, and any new entitlements will only be issued if they are replacing existing entitlements.

Boat replacement policy

Vessels 5.8 metres and less may be replaced with boats up to 5.8 metres in length. Boats that are greater than 5.8 metres in length may only be replaced with boats that are no more than 10% or one metre greater in length, whichever is lesser. The 10% tolerance continues to relate to the original boat length to avoid a progressive increase in length over time. There is no restriction on vessel engine power.

Fishing gear

Table C15 outlines the restrictions placed upon the design of the otter trawl net and Appendix B3 provides the regulations regarding the prawn trawl net. Fishers are limited to one net with a headrope length of 11 metres.

Time and area closures

This fishery is restricted to the Hunter River estuary downstream of the junction of the Williams and Hunter Rivers (see Figure B7). The area of the river open to trawling is divided into seven subdivisions for the purposes of closing sections of the river when counts of prawns exceeds 150 in half a kilogram. Codend counts are used in determining these numbers. In the future these same subdivisions will be used to control the quantities of bycatch and byproduct being caught. Table B22 and Appendix B6 outline the time closures that occur.

Limits on landings

Table C2 sets out the quantities of byproduct species that may be landed. Section 5 of this chapter lists trigger points and allowable commercial catch levels for target and prominent byproduct species for the fishery in this estuary. The upper catch level for the commercial catch of each of these species has been determined using the upper trigger point range and recorded landings.

Counts on prawns

The Juvenile Prawn Summit Working Group have recommended to the Minister for Fisheries that maximum counts for school and eastern king prawns taken for sale be implemented. These counts are currently under discussion and by the working group and once consensus is reached the Minister will be advised of its recommendations. These will be implemented once approved by the Minister. This draft FMS proposes to introduce "codend counts" for prawns in 2006.

Incidental catch ratio

The draft FMS provides for sections of the river to be closed when the proportion of incidental species is greater than 0.44 (by weight) of the prawn catch.

iii) Hawkesbury River

Species

The target species are the school prawn *Metapenaeus macleayi* and the eastern king prawn *Penaeus plebejus* and species of squid (refer to Table C17). Some byproduct species are also caught (see Table C18), but under this draft FMS only certain quantities of byproduct species can be landed annually (refer to Table C2).

Area of operation

Trawling is permitted between a line drawn from the southern extremity of Box Head to the northern extremity of Barrenjoey Head, upstream to the vehicular ferry crossing at Lower Portland. Within this area many tributaries are closed to trawling (see Figure B9). See Appendix B6 for closures within these boundaries.

Management controls specific to Hawkesbury River

Limited entry

Restrictions on the number of entitlements to operate on the Hawkesbury River will apply under the draft FMS. No additional entitlements will be issued, and any new entitlements will only be issued if they are replacing existing entitlements.

Boat replacement policy

Vessels 5.8 metres and less may be replaced with boats up to 5.8 metres in length. Boats that are greater than 5.8 metres in length may only be replaced with boats that are no more than 10% or one metre greater in length, whichever is lesser. The 10% tolerance continues to relate to the original boat length to avoid a progressive increase in length over time. There is no restriction on vessel engine power.

Fishing gear

Table C15 outlines the restrictions placed upon the design of the otter trawl net and Appendix B3 provides the regulations regarding the prawn trawl net. Fishers are limited to one net with a headrope length of 11 metres upstream of a line drawn between Juno Bluff and Eleanor Bluff or no more than two nets with a total combined headrope length of 11 metres downstream of this line. Although two nets may be used in this downstream area which includes Broken Bay most vessels only use one net.

Time and area closures

The fishery is restricted to waters downstream of the vehicular ferry crossing at lower Portland to the entrance of the South Pacific Ocean. However within this area there are many area closures and these area detailed in Appendix B6.

Trawling is permitted all year in the Hawkesbury River. There is a weekend closure to trawling in those waters upstream from a line drawn between Juno Bluff and Eleanor Bluff. This closure was sought by industry in the interests of resource sharing. Table B25 and Appendix B6 outline the time closures that occur.

Limits on landings

Table C2 sets out the quantities of byproduct species that may be landed. Section 5 of this chapter lists trigger points and allowable commercial catch levels for target and prominent byproduct species for the fishery in this estuary. The upper catch level for the commercial catch of each of these species has been determined using the upper trigger point range and recorded landings.

Counts on prawns

The Juvenile Prawn Summit Working Group have recommended to the Minister for Fisheries that maximum counts for school and eastern king prawns taken for sale be implemented. These counts are currently under discussion and by the working group and once consensus is reached the Minister will be advised of its recommendations. These will be implemented once approved by the Minister. This draft FMS proposes to introduce “codend counts“ for prawns in 2006.

Incidental catch ratio

The draft FMS provides for sections of the river to be closed when the proportion of incidental species is greater than 0.44 (by weight) of the prawn catch.

iv) Port Jackson

Species

The target species is the eastern king prawn *Penaeus plebejus* (see Table C17) and some byproduct species are also caught (see Table C18), but under this draft FMS only certain quantities of byproduct species can be landed annually (see Table C2).

Area of operation

Trawling for prawns is permitted throughout Port Jackson but Manly Cove and Lane Cove River are closed to trawling together with parts of Middle Harbour (see Figure B11). See Appendix B6 for closures within these boundaries.

Management controls specific to Port Jackson

Limited entry

Restrictions on the number of entitlements to operate in Port Jackson will apply under the draft FMS. No additional entitlements will be issued, and any new entitlements will only be issued if they are replacing existing entitlements.

Boat replacement policy

Vessels 5.8 metres and less may be replaced with boats up to 5.8 metres in length. Boats that are greater than 5.8 metres in length may only be replaced with boats that are no more than 10% or one metre greater in length, whichever is lesser. The 10% tolerance continues to relate to the original boat length to avoid a progressive increase in length over time.

Fishers agreed that the following restrictions be placed upon any engine replacement:

(1) boats with engines rated under 60 kw may replace the existing engine with one rated up to a maximum of 60 kw

(2) boats with engines rated over 60 kw are restricted to a maximum 10% increase in power. In the case that a vessel with an engine rated over 60 kw needs to have it's engine replaced a second time at some stage in the future the original engine rating shall apply.

*Note: An example of this would be a boat with an engine rated at 100kw may replace it with an engine up to 110kw in the first instance but should subsequent engine replacements be required the maximum rating allowed will remain at 110kw.

Fishing gear

Table C15 outlines the restrictions placed upon the design of the otter trawl net and Appendix B3 provides the regulations specifying the prawn trawl net. Fishers are limited to no more than two nets each of a headrope length of 11 metres. Although permitted to tow two nets, fishers tow only one net.

Time and area closures

The fishery is restricted to waters of Port Jackson, Middle Harbour and the Parramatta River, with several closures in place within this area (see Appendix B6).

Trawling is permitted from November to Easter each year with provisions for an earlier opening to the season during October and/or a later finish to the season in April if a catch rate criterion is met. Table B28 and Appendix B6 outline the time closures that occur.

Limits on landings

Table C2 sets out the quantities of byproduct species that may be landed. Section 5 of this chapter lists trigger points and allowable commercial catch levels for target and prominent byproduct species for the fishery in this estuary. The upper catch level for the commercial catch of each of these species has been determined using the upper trigger point range and recorded landings.

Counts on prawns

The Juvenile Prawn Summit Working Group have recommended to the Minister for Fisheries that maximum counts for school and eastern king prawns taken for sale be implemented. These counts are currently under discussion and by the working group and once consensus is reached the Minister will be advised of its recommendations. These will be implemented once approved by the Minister. This draft FMS proposes to introduce "codend counts" for prawns in 2006.

Incidental catch ratio

The draft FMS provides for sections of the river to be closed when the proportion of incidental species is greater than 0.78 (by weight) of the prawn catch.

v) Botany Bay

Botany Bay has been gazetted as a Recreational Fishing Area from 1 May 2002 (see Table AB21a in Appendix B). Consequently trawling will cease in Botany Bay from the close of the 2001-02 season in April 2002.

h) Management controls common to all estuaries

There are two broad types of fishery management controls, known as input controls and output controls. Input controls limit the amount of effort commercial fishers put into their fishing activities, indirectly controlling the amount of fish caught. They need to continually be modified in response to increases in fishing effort usually caused by advances in fishing technology.

The Estuary Prawn Trawl Fishery in NSW is managed predominantly by input controls. The following section sets out the controls that have common limitations to all estuaries.

i) Fishing licences

A commercial fishing licence is required by an individual before she/he can take fish for sale or be in possession of commercial fishing gear in or adjacent to waters. The licence only authorises activities that are covered by endorsements issued in respect of each part of a fishery and specified on the licence.

Generally speaking, commercial fishing licences are currently available to persons who held a licence immediately prior to the commencement of the *Fisheries Management Act 1994*, or owners of

recognised fishing operations (RFOs). An RFO is a fishing business that has a minimum level of past participation (validated catch history) in the fishery or a particular type of fishing entitlement. Businesses allocated an estuary prawn trawl endorsement fall into the latter category and are automatically granted RFO status. The RFO policy was introduced via the Licensing Policy issued by NSW Fisheries in June 1994.

A commercial fishing licence may also be issued to an individual who is the holder of shares in a share management fishery. This will be become the more relevant requirement as the Estuary Prawn Trawl Fishery moves to category 2 share management.

Because estuary prawn trawl fishing businesses are automatically granted RFO status and a new owner is automatically issued an entitlement to access the fishery it has not been possible in this fishery to ensure that active effort has been replaced by the new fishing business owner. In a share management fishery, minimum shareholdings may be used to restructure and consolidate estuary prawn trawl fishing businesses.

In discussions with the Estuary Prawn Trawl MAC during the development of this draft FMS there has been support for a structural adjustment program to better manage fishing effort and to maintain or improve the economic viability of fishers. The proposals in this draft FMS will supersede the provisions of the Licensing Policy as they are introduced.

ii) Limited entry

The Estuary Prawn Trawl Fishery was recently declared a category 2 share management fishery. Access to the fishery has been limited to vessels with a demonstrated history of participation since 1985.

Entry to the Estuary Prawn Trawl Fishery under the restricted fishery regime was defined by ownership of vessel/s with a commercial fishing boat licence that had the appropriate endorsement/s.

Following changes to the FM Act in December 2000, the Estuary Prawn Trawl Fishery, along with most other major commercial fisheries, was selected to become a category 2 share management fishery. Section 6(a) of this draft FMS outlines the process of moving from a restricted fishery regime to a share management regime.

It is possible that, in the future, the fishery may become a category 1 share management fishery. It is intended that the final FMS will apply to the fishery whether it has category 1 or category 2 share management status.

iii) Fishing endorsements

The eligibility to hold endorsements on a commercial fishing licence in a category 2 share management fishery is based on the shareholder holding the minimum number of shares specified in the share management plan for the fishery. Different minimum share holdings may apply to each endorsement of each estuary in the fishery, or both.

Section 4 of this draft FMS proposes a number of principles that will be adopted with respect to setting minimum shareholdings in the management plan. The principles relate to having a minimum shareholding at the fishing business level (taking into account shares in other fisheries) for new entrants to the fishery, and at the endorsement and estuary level to ensure that the number of endorsements available for use at any one time does not exceed the historic and sustainable levels of activity in the fishery.

It must be recognised that any application of minimum shareholdings in the Estuary Prawn Trawl Fishery is a long-term approach to restructuring fishing effort. Unless there is a direct link between shareholdings and fishing effort, other management tools (particularly closures) will be needed to achieve any required short term changes in fishing effort or practices.

iv) National licence splitting policy

The Commonwealth and the State Governments have a longstanding nationally agreed policy in place on licence splitting. The policy prevents entitlements held by one person or entity and issued by more than one jurisdiction, from being split and transferred separately. The transfer of a fishing business will not be approved unless all entitlements issued to the business by other jurisdictions are also transferred to the same person, or surrendered.

Where fishing effort has been historically 'shared' across a number of entitlements held by a person, the policy prevents the increase in effort that would occur by creating two separate entitlements that could operate at full capacity.

This fundamental component of the Licensing Policy will be retained under this strategy for the Estuary Prawn Trawl Fishery.

v) Transfer of fishing business entitlements

Commercial fishing licences and endorsements to participate in a fishery are not freely transferable. Currently, commercial fishing licences and endorsements only become available to a new entrant under guidelines issued by the Director of Fisheries.

Under the current Licensing Policy, fishing businesses must be sold as an entire package (i.e. the catch history or endorsements cannot be split). Proposals regarded as licence splitting, or contrary to the intention of the Licensing Policy are generally not approved. Variations to the licence splitting policy are provided on a case by case basis where there are demonstrable extenuating circumstances and where there are no net increases in fishing effort as a result.

While it is likely that shares will be able to be traded more freely between shareholders under the share management scheme, minimum shareholding may apply upon transfer of a business and restrictions will be included to prevent an increase in the number of entitlements in the fishery.

Under the guidelines issued by the Director of NSW Fisheries and currently in place, upon transfer of a business with an estuary prawn trawl entitlement the new owner automatically becomes eligible for a commercial fishing licence and an estuary prawn trawl entitlement.

The only variation to this arrangement applies in the Hawkesbury River, where there is a 'freeze' on the issue of Hawkesbury River prawn trawl endorsements to new business owners. The 'freeze' will be lifted as soon as suitable transfer criteria are introduced for the Hawkesbury River. The transfer criteria will ensure that new business owners gaining access to the fishery replace real fishing effort. Minimum shareholding and/or past participation requirements specified in the share management plan could supersede this policy.

vi) Transfer of licensed fishing boats

All licensed fishing boats that are authorised for prawn trawling in estuarine waters are classified as "boat history" vessels, whereby the validated, historic catch associated with the vessel is

transferred whenever the fishing boat licence is transferred. The fishing boat licences for vessels in this fishery cannot be transferred separate to the remainder of the fishing business.

Any transfer of a fishing boat licence must first be approved by the Director, NSW Fisheries.

vii) Nomination policy

Part of the introduction of the restricted fishery regime was the creation of rules to allow the endorsements of a fishing business to be nominated to a person. This was necessary due to some fishing businesses being held in company or partnership names and because fishing licences can only be issued to natural persons. Under the current nomination policy, if the owner of a fishing business is eligible for an endorsement in the Estuary Prawn Trawl Fishery, the owner may nominate another person to take fish on behalf of the business. If a person nominates another fisher to take fish on their behalf, that person forgoes her/his right to fish (under all endorsements) while the nomination is active.

If adopted, the owner operator policy proposed in this draft FMS will supersede the nomination policy. There would be no new nominations unless under extenuating circumstances, such as death or illness. In the case where a person owns two fishing businesses, then a nominated skipper can continue for one business.

viii) Permits

The *Fisheries Management Act 1994* allows for permits to be issued for research and other authorised purposes. These permits provide a legal framework for activities that fall outside normal operating rules set out in the FM Act or its Regulation. Each permit sets out a number of conditions, which vary depending on the purpose of the permit. These conditions ensure that permits are used only for the intended purpose and may be used to limit the extent of the permitted activity.

Table C19. Types of permits that will be issued.

Permit type	Description
Research	Permits are issued to research scientists (including NSW Fisheries staff, Universities and other research organisations) and commercial fishers assisting in undertaking research programs. The permits generally authorise the retention of prohibited size fish, fish in excess of the possession or bag limits or use of gear not prescribed in the regulation
Trial of bycatch reduction devices (BRDs)	The development of an effective BRD requires significant testing under normal operating conditions to assess their effectiveness. Permits are often required to trial types of fishing gear with dimensions or configurations not prescribed in the regulation
Development of new fishing gear	This permit provides for the legal framework for the possible development of a more selective and passive fishing method for this species. Permits may be issued to facilitate industry in developing alternative fishing practices in line with the goals of the Estuary Prawn Trawl FMS
Crossover or V bridles	Permits have been issued to six fishers from the Hawkesbury River (as at 27 June 2001) to allow the use of crossover or V bridles on their prawn trawl gear. Crossover or V bridles lift the trawl net off the bottom of the estuary floor and are fitted when targeting squid in the Hawkesbury River

Permits issued under section 37 are valid only in so far as they do not conflict with approved determinations of Native Title made under the Commonwealth *Native Title Act 1993*.

Permits are valid for one year or such other period as specified in the permit, and may be suspended or cancelled at any time by the Minister. Permits are not transferable.

ix) Seafood safety programs

Food safety programs which relate to the Estuary Prawn Trawl Fishery are administered by Safe Food Production NSW under the *Food Act 1989*. Food safety programs for all commercial fisheries are currently being prepared by Safefood Production NSW.

x) Skipper policy

There are two types of licensed skippers that can operate in the Estuary Prawn Trawl Fishery; general skippers and employee skippers. Skipper endorsements are held by:

- licensed persons who were part owners of a fishing business in 1996 and held entitlements in the Estuary Prawn Trawl Fishery or other boat based fisheries
- licensed persons who were operating as employed skippers for other fishing business owners in 1996.

xi) Provision for unlicensed crew

The holder of a commercial fishing licence or fishing boat licence endorsed in the Estuary Prawn Trawl Fishery may apply for an authorisation to employ unlicensed crew (commonly referred to as a "block licence") or may employ a person who themselves are registered as crew. A fee for each applies.

A licensed fisher employing crew must maintain records about her/his crew. Information relating to crew must be recorded on the mandatory catch and effort return submitted each month by the licence holder.

xii) Trainee fishing licences

Licences are available to eligible persons for the purposes of training a new entrant to the commercial fishing industry. There are two types of training licences are available.

Trainer's licence: The seller of a fishing business may apply to continue to hold his/her fishing licence for up to one year to work with the purchaser of the fishing business for the purpose of training the new entrant. Licence conditions apply and the trainer must surrender his/her licence at the end of the one year period unless a further recognised fishing operation (RFO) is acquired.

Trainee's licence: Within six months of acquiring an RFO a new entrant may request that the RFO be placed in abeyance whilst they gain skills working with an experienced fisher. This arrangement may apply for a period of up to two years. The methods and areas that the new entrant may work are limited to those of the new entrant's RFO.

i) Administration

i) Renewal of licences and permits

Commercial fishing licences and fishing boat licences must currently be renewed annually. Fishers are sent renewal application forms approximately one month before the expiry date on the licence. If a commercial fishing licence is not renewed within 60 days of the expiry date on the

licence, the renewal application is taken to be an application for a new licence. Additional fees apply to late renewal applications (see below).

Abeyance period for fishing boat licences

Fishing boat licences can be held in abeyance for a period of up to two years from the date of expiry of the licence or when advised in writing by the owner. Fishing boat licence fees are not payable during the period of abeyance, but the full amount due is payable if the licence is reinstated within the two years specified.

ii) Fees

A number of fees are payable in the Estuary Prawn Trawl Fishery. An outline of the cost recovery policy and a summary of the fees follows:

Cost recovery policy

NSW Fisheries recoups costs that are attributable to industry through a cost recovery policy. Cost recovery is a common principle among Australian commercial fisheries, and an important component of ecological sustainable development.

NSW Fisheries is in the process of implementing cost recovery in a progressive manner, so that all charges are not passed on to industry immediately. The FM Act requires that in a share management fishery, the fees payable must be paid in proportion to the shareholdings in the fishery.

In November 2000, the Government announced a new cost recovery policy. As part of the second reading speech for the *Fisheries Management and Environmental Assessment Legislation Amendment Act 2000*, the Minister for Fisheries, the Hon. Eddie Obeid, gave the following commitment for the fisheries that were moving to category 2 share management fisheries:

"Over the next five years the Government will develop and implement a cost recovery framework for category 2 share management fisheries. This framework will be subject to extensive industry consultation"

"During this period, the total amount of money collected for NSW Fisheries, for its existing management services, will not increase without the support of the relevant management advisory committee"

"After five years, the costs that have been identified as attributable to the industry will be progressively introduced over a further three-year period".

It is important to note that the new services required to be implemented under the FMS or as a result of the environment assessment process will need to be fully funded by the fishery participants. The preliminary estimate of the additional cost to implement the draft FMS varies between estuaries of the Estuary Prawn Trawl Fishery but ranges between $850 and $2,600 per fishing business per year. The main cost incurred is that to do with research to monitor the target species of the Estuary Prawn Trawl Fishery. This includes:

- analysis of the commercial fishers monthly catch data against byproduct limits and performance monitoring requirements
- an observer-based monitoring program of the fishery

- fishery independent surveys to provide information on the abundance of species, sex and age composition of individuals in populations, species interaction and the occurrence of threatened species.

An exact estimate is not known because the number of endorsed fishing businesses will change, there will be opportunities for contestable service delivery and the cost of the final FMS approved by the Minister for Fisheries is unknown at this stage.

This draft FMS includes an outline of the charges that apply in the fishery at the time of the FMS preparation. The FMS does not, itself, set the charges, or limit or other govern the way charges are changed. It is not necessary to amend the FMS in order to effect changes to any particular charge described here.

Commercial fishing licences

The following fees are payable on application for issue or renewal of a licence:

New Licence application:

Fee……...$416

Contribution to industry costs…….$208

FRDC research levy……$115

Licence renewal received within 30 days of expiry:

Fee……...$208

Contribution to industry costs…….$208

FRDC research levy……....$115

Licence renewal received more than 30 days after expiry:

Fee……..….$312

Contribution to industry costs…….$208

FRDC research levy……....$115

Fishing boat licences

The following fees are payable on application for renewal of a fishing boat licence:

Renewal application lodged within 30 days after licence expiry:

Boats not greater than 3 metres in length……...$42

Boats in excess of 3 metres in length according to the scale hereunder:

Boats over 3 metres but not over 4 metres……..$63

Boats over 4 metres but not over 5 metres……..$84

Boats over 5 metres but not over 6 metres……..$105

Boats over 6 metres but not over 7 metres……..$126

Boats over 7 metres but not over 8 metres……..$147

Boats over 8 metres but not over 9 metres……..$168

etc… for each additional metre or part thereof, add an additional $21

Renewal application received over 30 days after licence expiry:

Boats not greater than 3 metres in length……$145

Boats in excess of 3 metres in length according to the scale hereunder:

Boats over 3 metres but not over 4 metres……..$166

Boats over 4 metres but not over 5 metres……..$187

Boats over 5 metres but not over 6 metres……..$208

Boats over 6 metres but not over 7 metres……..$229

Boats over 7 metres but not over 8 metres……..$250

Boats over 8 metres but not over 9 metres……..$271

etc… for each additional metre or part thereof, add an additional $21

The fee to replace an existing licensed boat with a new boat is $104, plus the cost of the new boat licence fee which depends on the length of the boat.

Share management fishery rental charge

The *Fisheries Management Act 1994* provides that a rental charge of $100 applies to shareholders in a category 2 share management fishery (irrespective of the number or type of shares held). This charge has applied from the commencement of category 2 share management fisheries on 23 March 2001 and will continue under the draft FMS.

This charge will be adjusted annually in accordance with inflation.

Environmental impact assessment charges

Arrangements have been made under Part 5 of the *Environmental Planning and Assessment Act 1979* for recovery of the costs associated with the preparation of the environmental impact statements (EIS). The EIS charge is payable annually commencing from 1 July 2001. For each fishery in which the person is eligible to hold shares there is a charge of $150 for the first two fisheries, then $100 for each fishery thereafter.

A charge of $80 is also payable to contribute to the costs incurred in arranging for the Fisheries Resource Conservation and Assessment Council (FRCAC) to perform its functions in relation to the EIS, commencing from 1 July 2001.

Fishers have the option of paying these charges and the share management fishery rental charge in one or in four instalments over the course of each year.

These charges will be adjusted annually in accordance with inflation.

Research levy

The annual fee of $115 collected upon commercial fishing licence renewal is paid directly to the Fisheries Research and Development Corporation (FRDC) to support funding of research programs. The FRDC support a number of research programs relating to the Estuary Prawn Trawl Fishery in NSW. Further details on these programs can be found in the research section of this draft FMS.

This charge will be adjusted annually in accordance with inflation.

Other transaction fees

There are several other fees payable in the fishery to cover the costs of individual licensing transactions, however, these only apply to the persons utilising these services. An example of this type of fee is the $260 fee payable for the transfer of a fishing boat licence.

These charges will be adjusted annually in accordance with inflation.

iii) Appeal mechanisms

Fishers may lodge an appeal to the Administrative Decisions Tribunal (ADT) against a decision to refuse to issue or renew, suspend, cancel or place conditions on a commercial fishing licence (or an endorsement on that licence) or a fishing boat licence.

The main role of the ADT is to review administrative decisions of New South Wales government agencies. To lodge an appeal with the ADT, a request must first be made to NSW Fisheries for an internal review of the decision, then a written application should be lodged with the ADT no more than 28 days after the internal review was finalised.

The ADT can make various orders concerning an appeal application including:

- upholding the original decision
- reversing the decision completely or in part
- substituting a new decision for the original decision
- ordering the agency to reconsider the decision in light of the ruling.

For further information, refer to the *Administrative Decisions Tribunal Act 1997* or the following website: http://www.lawlink.nsw.gov.au/

j) Research

Discussions among staff of the department led to the development of the following basic areas of research for the Estuary Prawn Trawl Fishery that can be categorised into seven broad areas:

(i) stock assessments of target species

(ii) quantification and reduction of the incidental catch

(iii) effects of fishing methods on habitats

(iv) importance of habitats to shellfish an finfish populations

(v) importance of ecological processes to shellfish and finfish populations

(vi) impacts of fishing on trophic interactions and ecosystems

(vii) impacts of fishing on threatened species.

Outlined below are those strategies by which research into these areas ideally should proceed.

i) Stock assessment of target species

Previous assessments on eastern king prawns in NSW have been done by Glaister *et al.* (1990), Montgomery *et al*. (1993), and Gordon *et al*. (1995). However, none of the studies developed a stochastic, length-based model. Data is available to do this research and the development of such a model is part of the existing prawn research project.

Despite the extensive studies done on the school prawn fisheries of the Hunter River (Ruello, 1969, 1971, 1973a,b, 1977) and the Clarence River (Glaister, 1977, 1978a,b), there is little information on the dynamics of school prawn populations and none that is of a quality that could be used in a stock assessment of the resource. Notwithstanding, Montgomery and McDonall (1988) used available information to do yield per recruit analysis to determine optimum times to open estuaries to prawn trawling. In addition, Montgomery (2000) used this data to determine optimal sizes at first capture for eastern king prawns and school prawns. A much needed, four year study funded by the Fisheries Research and Development Corporation (FRDC) to obtain estimates of the parameters to do a full stock assessment of this very important resource will begin in July 2002.

Further, past research has suggested that the level of landings of school prawns (particularly from the oceans), is determined by the level of river discharge. This association needs to be updated and will be done as part of the existing prawn research project.

Until recently, no research had been done on the squid stocks of the Estuary Prawn Trawl Fishery in NSW. The University of Sydney is currently doing a project to study the broad squid in the Hawkesbury River, the main commercial species. The study will investigate the distribution of the population, the size and/or age of first breeding, fecundity, rates of growth and mortality and, migration. The information collected will be used in yield per recruit analyses to determine an optimal legal minimum length for the broad squid. This study will provide information that is essential to the review of the status of squid populations proposed in management response 2.1c in section 4(b) of this chapter, and together with the response of the review will determine the need for future research on the squid stocks of the Estuary Prawn Trawl Fishery.

The annual stock assessments proposed in this draft FMS will be based upon estimates of population parameters provided from the studies mentioned above, from fishery independent surveys to provide information about the abundances and sizes of individuals in the populations and from observer surveys to provide information about what is being caught in commercial and recreational fishing gear. Fishery dependent data will be used to provide information on the level of catch and level of fishing effort that is being expended.

In the past, catch and effort information has been used to monitor the relative abundance of prawn species in the Estuary Prawn Trawl Fishery. However, this draft FMS will also require reliable information on the size and species composition of the target and incidental species taken in the fishery. Fishery dependent data provide none of this information. Further, fishery dependent data provides no information about the spatial distribution of fishing effort and therefore the effort expended upon different habitat types, nor information about the spatial distribution of species within

the estuary. Also, fishery dependent data would be biased under this draft FMS by the introduction of BRDs into the trawl nets and incidental catch ratios and prawn counts into the fishery.

Because of these problems with fishery dependent data, stock assessments for the Estuary Prawn Trawl Fishery will be based upon fishery independent methods involving stratified randomised surveys of relative abundances and size and age structures of wild populations. Such data will provide more robust and rigorous assessments of natural populations than that solely relying on data from the fishery.

The first step in implementing such a major change in focus is to do the necessary pilot studies that will develop appropriate fishing gears for such surveys, and to do cost-benefit analyses of information from pilot surveys to determine the most appropriate sampling regimes. This pilot work will then be followed by two years of sampling to test the developed survey design and allow the preparation of a final design for subsequent surveys that will continue into the future.

Such a fishery independent survey will also have significant side-benefits by providing samples of target and incidental species for studies on age determination and reproductive biology, stock assessments and also samples for diet analyses which will provide some information toward preliminary examinations of trophic interactions. These may also include some sampling to collect information about threatened and protected species.

ii) Quantification and reduction of incidental catch

It is well accepted that the most reliable and accurate way one can assess incidental catch and discarding is to use observer-based surveys. Observer surveys will be done in each year.

Observer surveys were done between 1989 and 1992 on the estuary prawn trawl fisheries of the Clarence River, Hawkesbury River, Port Jackson and Botany Bay (Gray and McDonall, 1993; Liggins and Kennelly, 1996; Liggins *et al*., 1996). Data from these surveys will provide the baseline information from which to determine whether the incidental catch in prawn trawls is being reduced. However, there have been no observer surveys done of the prawn trawl fleet in the Hunter River. The level of sampling will provide estimates of mean abundances with levels of precision of around 30%.

Observer surveys will be done in each year to collect information on what is being caught when the strategy is first introduced and to determine whether bycatch reduction devices have been effective in reducing bycatch. On randomly chosen days during the trawl season observers with go on randomly chosen trawlers and, count, measure and weigh individuals of each species caught during each trawl shot that day.

Bycatch reduction in the Estuary Prawn Trawl Fishery has been much studied (e.g. Broadhurst and Kennelly, 1994; Broadhurst and Kennelly, 1996; Broadhurst *et al*., 1996; Broadhurst *et al.*, 1997) and based upon this work BRDs are now mandatory in the Estuary Prawn Trawl Fishery. It is proposed that when specific bycatch and discarding problems are identified, targeted research will be directed at ameliorating the identified problems. This will include the development and testing of alternative gears and fishing practices as well as assessments of the utility of spatial and temporal fishing closures that are designed to reduce any identified problems. This research will be done through externally funded grants. For example, NSW Fisheries currently has a study funded by FRDC to investigate methods for reducing the capture of small prawns in prawn fishing gear, including the trawl net used in the Estuary Prawn Trawl Fishery and the practice of riddling.

iii) Effects of fishing methods on habitats

It is proposed to address the significant gaps in our knowledge about the physical impacts of trawling on habitats via targeted projects involving manipulative field experiments on specific problems. Specific issues will be prioritised and funding from external sources sought. If problems of physical damage on habitats are identified, it is proposed to undertake targeted projects on ways to reduce such effects through gear and/or operational modifications and/or spatial and temporal closures in sensitive areas.

iv) Importance of habitats to shellfish and finfish populations

Some research has been done on the associations between estuarine shellfish and the habitats on which they depend (e.g. Young and Carpenter, 1977; Young, 1981; Coles and Greenwood, 1983; Bell and Pollard, 1989; Ferrell and Bell, 1991; Gray *et al.* 1996). It is important that the role different habitats play in supporting fisheries resources continue to be studied and that the effects of the degradation of such habitats be fully understood. Current research includes a project investigating the impacts of acid sulphate soils on fisheries resources.

The extent and distribution of key estuarine habitats (e.g. seagrasses, mangroves, saltmarsh, etc.) have been recorded previously (West *et al*., 1985) and this work is currently being repeated. It is planned to continue and, in fact expand, the monitoring and assessment of changes in the state's estuarine habitats.

Research on specific interactions between particular populations and particular habitats would involve targeted research projects directed at specific problems, which would include field-based manipulative experiments and mensurative studies. Specific issues will be prioritised and funding from external sources sought.

v) Importance of ecological processes to fish populations

The structure and functioning of ecosystems and the myriad of ecological processes that occur in them underpin the sustainability of most of those shellfish and finfish that are exploited from estuarine systems. It is therefore important for the fisheries that target species in these systems to understand the complex ecological processes in those systems, whether these processes directly involve target species or not.

The techniques and methodologies for examining such interactions involve quite complex field experimentation and there exists a substantial body of literature on the subject, though not often involving the estuaries of NSW that are exploited by the Estuary Prawn Trawl Fishery.

Directed, detailed experimental and mensurative programs need to be undertaken so that management decisions about exploited shellfish and finfish can be made in the light of entire ecosystem processes. Such information will, of course, also provide vital information to other non-fisheries agencies that manage other aspects of such systems under the principles of ecological sustainable development. Specific issues will be prioritised and funding from external sources sought.

vi) Impacts of fishing on trophic interactions and ecosystems

Little research has been done anywhere to assess the impacts that fishing has on the structure of estuarine ecosystems. In general, such work is very much in its infancy throughout the world but, where work has been done, it is invariably characterised by being complex, expensive, of a long

duration and usually shows that fishing can significantly affect the structure and function of ecosystems (Hall, 1999; Kaiser and de Groot, 2000). Currently there is a three year study being done to investigate the effects of fishing upon the benthos in the Clarence River. Once this research is completed the need for future studies will be assessed. It is proposed to examine the impact of fishing upon biodiversity by doing targeted projects on specific impacts via manipulative experimentation in the field. Samples from fishery independent surveys will provide data that can be used to determine species richness and dietary information that perhaps can be used in trophic level analyses. External funding will be sought to conduct studies to investigate the impacts of trawling upon biodiversity.

Before this ecosystem research commences however, it is proposed to undertake a risk assessment as proposed by the Sustainability Indicators Working Group of the Standing Committee on Fisheries and Aquaculture. The Working Group is in the process of developing a national reporting framework for ESD for Australian fisheries and has completed some work on identifying the main ecosystem components that may be subject to impacts from fishing. Acknowledging that research resources are limited, the working group is recommending that Australian fisheries management agencies undertake a risk assessment for each fishery to determine the level of management (including research) necessary for each component of the ecosystem. The working group recommends that this be done through a workshop so that the outcome is a combined judgement of a group of people who have considerable expertise in the areas being examined.

vi) Impacts of fishing on threatened species

Little is known about the biology and ecology of those species listed as endangered and threatened, and potential impacts of commercial fishing on these species is even less understood. Because of the rare occurrence of threatened and endangered species in any fishery, it is appropriate to study the effects of all fisheries on a particular species. It is proposed that research on such issues should involve specific research projects targeted at particular species and the many influences that affect such organisms. Such studies would involve examining the biology and ecology of certain species to assess potential impacts of many factors (only one of which would be the Estuary Prawn Trawl Fishery). Specific issues and species will be prioritised and funding sourced.

k) Compliance

NSW Fisheries has approximately 94 positions for fisheries officers who are responsible for coordinating and implementing compliance strategies in NSW. These strategies include:

- maximising voluntary compliance
- providing effective deterrence
- providing effective support services.

Sixteen of these fisheries officers are located in areas along the NSW coast where the Estuary Prawn Trawl Fishery occurs. Part of their duties include conducting patrols, inspecting commercial fisher's catch and gear and recording rates of compliance. During the period from July 2000 to February 2001 the rate of compliance of commercial fishers in the Estuary Prawn Trawl Fishery was 91%.

Once an offence has been detected officers have a range of responses available to them. Matters are dealt with depending upon severity by the use of a verbal caution, the issue of a written caution or penalty notice or by referring the matter to a court where a determination is made and

penalty issued. Records are kept by NSW Fisheries of all convictions and a record of any previous convictions is handed to the court with the brief of evidence for any matters raised. Previous convictions are taken into account by the courts when fines are issued.

Briefs of evidence are prepared by the investigating officer. Briefs include a summary of the events which took place, a full statement including a description of the events, interviews with the offender/s and any witnesses, details of the offence/s and maximum penalties and any additional information such as video footage, photographs, records, maps, copies of any closures, supporting statements, summary of any fishing gear and catch seized and any other information relevant to the matter.

Any fishing equipment used to commit an offence is seized and held as evidence. If the gear is of legal dimensions the fisher can make application to NSW Fisheries for the return of the gear. Provided the fisher has no prior convictions and there are no extenuating circumstances, e.g. obstruction charges, the return of the gear is usually approved. An undertaking to produce the gear in court if necessary must be signed by the fisher before it is returned. Fishing gear forfeited to the crown by the court is disposed of by being destroyed or auctioned. Catch seized is disposed of by selling through a market if practical, donation to a charity, hospital or similar establishment or destroyed if not suitable for human consumption.

In addition to the traditional penalties handed out to fishers the draft FMS proposes a penalty points system. Fishers upon payment of a penalty notice or conviction in court of an Estuary Prawn Trawl Fishery related offence will be allocated penalty points (see section K(i)).

NSW Fisheries manages compliance service delivery for each significant fishing or target program through a district compliance planning process that is administered within the Fisheries Services Division. Each district fisheries office is responsible for compliance service delivery within a geographical area, and develops a district plan based upon the particular priorities associated with that area.

Officers have in the past, at the request of fishers, checked trawl nets at private residences and on-board vessels when not working to assist fishers in maintaining gear at legal dimensions. Requests have been most common immediately prior to the commencement of the trawling season in each estuary. It is proposed under this strategy to formalise this activity by implementing a compliance audit scheme into the Estuary Prawn Trawl Fishery. The compliance audit will be carried out by Fisheries Officers on board trawlers in the fishery prior to the commencement of each prawn trawling season, and in the case of Hawkesbury River operators each September.

The purpose of the audit is to check prawn trawl nets and associated fishing gear for compliance with mesh size and other legal requirements, and to give operators an opportunity to replace or modify illegal gear without penalty before commencing operations for the season. Quality inspections will be done at random throughout the season to ensure compliance with the rules applicable to the Estuary Prawn Trawl Fishery. Non compliance by fishers may result in the prosecution of the offender and in penalty points being placed upon that fishers' licences.

i) A penalty points system

A penalty points scheme with share forfeiture provisions will be introduced under this strategy and will be developed as part of the share management fishery management plan for the Estuary Prawn Trawl Fishery.

The Estuary Prawn Trawl Fishery generally has a high compliance rate, however, despite the relatively large number of potential offences and the maximum penalties specified in the FM Act and Regulation, there are still a small number of fishers who regularly operate beyond the rules. These few people continue to breach the law partly because the courts are often unwilling to uphold hefty fines for fisheries offences (which are often viewed as minor compared to criminal offences) and reluctant to uphold administrative decisions to suspend or cancel a fisher's entitlements. The penalty points system is a way of providing a clear deterrent to fishers who are considering breaching the provisions of the FMS or associated rules.

Similar to how the motor vehicle licensing scheme works (administered by the Roads and Traffic Authority), the proposed system would see a list of penalty points assigned to serious or repeated offences. If a fisher accrued a certain level of penalty points by breaching the management rules, the endorsement or licence would be subject to predetermined periods of suspension or cancellation through provisions in the share management plan for the fishery.

The offences deemed as "serious" and the definition of a "repeated offence" would need to be included in the share management plan, as would the points attributable to each offence.

l) Consultation

There are a range of consultative bodies established in NSW to assist and advise the Minister and NSW Fisheries on fisheries issues. There are committees that are established to provide advice on specific issues as well as bodies to advise on matters which cut across different fisheries or sectors.

i) The Management Advisory Committee

Share management and restricted fisheries in NSW each have a management advisory committee (MAC) that provides advice to the Minister for Fisheries on:

- the preparation of any management plan, strategy or regulations for the fishery
- monitoring whether the objectives of the management plan, strategy or those regulations are being attained
- reviews in connection with any new management plan, strategy or regulation
- any other matter relating to the fishery.

Table C20 details the membership on the Estuary Prawn Trawl MAC. The industry members of the MAC comprise representatives that are elected by endorsement holders in the fishery (or shareholders in the share management fishery). There is an industry representative from each of the estuaries included in the Estuary Prawn Trawl Fishery. The members hold office for a term of three years, however the terms of office are staggered and the terms of half of the industry members expire every 18 months.

The non-industry members on the MAC are appointed by the Minister for Fisheries and also hold terms of office for up to three years. To ensure that all issues discussed by the committee are fairly represented the MAC is chaired by a person who is not engaged in the administration of the FM Act and is not engaged in commercial fishing.

Although the MAC receives advice from NSW Fisheries observers on research, compliance and administrative issues relating to the fishery, only members of the MAC have voting rights on the decisions of the MAC.

The actual composition and role of the MAC is set by the FM Act and its regulations and may be altered from time to time.

There are many references in this draft FMS to consultation with the Estuary Prawn Trawling MAC. Consultation involves seeking the advice of the MAC on their views. The MAC generally meets at least twice a year but many issues may require resolution urgently, and it may not be practicable to defer consultation to a face-to-face meeting of the MAC. For this reason, references to consultation with the Estuary Prawn Trawl MAC in this draft FMS may include the distribution of document to individual members by a specific date. NSW Fisheries may then compile the comments received into a single document recording the views of the MAC members. This document may then be used as a basis for further decision making by NSW Fisheries and/or the Minister for Fisheries.

Table C20. Membership on the Estuary Prawn Trawl MAC

Position	Group represented
Independent chairperson	Independent
Clarence River	Clarence River prawn trawl fishing business owners and endorsement holders
Hunter River	Hunter River prawn trawl fishing business owners and endorsement holders
Hawkesbury River	Hawkesbury River prawn trawl fishing business owners and endorsement holders
Port Jackson	Port Jackson prawn trawl fishing business owners and endorsement holders
Botany Bay	Botany Bay prawn trawl fishing business owners and endorsement holders
Recreational fishing	Recreational fishing interests across all estuaries
Indigenous fishing	Indigenous interests across all estuaries
Conservation	Conservation interests across all estuaries
NSW Fisheries	Government interests across all estuaries

ii) Ministerial advisory councils

Four Ministerial advisory councils are currently established under the *Fisheries Management Act 1994*. The councils provide advice on matters referred to them by the Minister for Fisheries, or on any other matters the councils consider relevant. They report directly to the Minister.

The Ministerial advisory councils currently established are:

- Advisory Council on Commercial Fishing (ACCF)
- Advisory Council on Recreational Fishing (ACoRF)
- Advisory Council on Fisheries Conservation (ACFC)
- Advisory Council on Aquaculture (ACoA).

The Estuary Prawn Trawl Fishery and each of the other share management and restricted fisheries have representatives on the ACCF. These representatives are nominated by each of the respective MAC's and appointed by the Minister.

Representatives from the commercial fishing industry in NSW, or people who in the opinion of the Minister have expertise in commercial fishing are also represented on the ACFC.

The name and composition of the Ministerial advisory councils are determined by regulations under the FM Act and may be altered from time to time.

iii) The Fisheries Resource Conservation and Assessment Council

The Fisheries Resource Conservation and Assessment Council (FRCAC) has been established to play a key role in advising the Government on fisheries conservation and assessment throughout the State. The members on the council represent a wide range of interests and includes representatives from commercial fishing, recreational fishing, fish marketing, the fishing tackle industry, charter boat fishing, regional tourism, academic expertise, conservation, aquaculture and Indigenous peoples.

The FRCAC advises the Minister for Fisheries on the preparation and revision of Fishery Management Strategies for fishing activities, including this draft FMS for the Estuary Prawn Trawl Fishery.

The legislated role of the FRCAC includes providing advice on:

- the preparation or revision of a fishery management strategy (and for that purpose to review the environmental impact statement prepared in connection with a draft strategy)
- other matters as may be referred to it by the Minister.

In summary, the FRCAC's duties involve:

- fostering relationships between community groups, recreational fishing interests, commercial fishing interests and government agencies
- advising on the preparation and revision of fishery management strategies
- reviewing environmental impact statements prepared in connection with draft strategies
- providing an opportunity for key stakeholder groups to have input into issues papers prepared for recreational fishing areas selection processes
- reviewing community consultation reports that arise from the recreational fishing areas selection process.

Both the FRCAC and the ACCF are consultative bodies that facilitate cross-sectoral and cross-fishery consultation, respectively.

The composition and role of the FRCAC are set by the FM Act and it regulations and decisions by the Minister for Fisheries. These arrangements may change from time to time.

iv) Prawn Resource Forum and Total Allowable Catch Setting and Review Committee

A prawn resource forum will be formed in line with this strategy that provides a process for cross fishery consultation regarding commonly shared prawn stocks. Other fisheries proposed to be represented in the forum will include the Estuary General Fishery, the Ocean Prawn Trawl Fishery and recreational fishers.

The process for assessing the status of and pressure on prawn stocks would ultimately include the Total Allowable Catch Setting and Review Committee (TAC Committee). This committee would, as required by the share management plan, make determinations about the total level of fishing effort to apply in the capture of prawns. The TAC Committee consists of at least four members, including:

(a) a person appointed by the Minister as the Chairperson of the TAC Committee, being a person who is neither engaged in the administration of the *Fisheries Management Act 1994* nor engaged in commercial fishing

(b) a person appointed by the Minister who is a natural resource economist not employed by the Government

(c) a person appointed by the Minister who is a fishery scientist not employed by the Government

(d) persons appointed by the Minister who have appropriate fisheries management qualifications.

The composition and role of the TAC Committee are set by the FM Act and its regulations and decisions by the Minister for Fisheries. These arrangements may change from time to time.

m) Share Management Plan

A share management plan for the Estuary Prawn Trawl Fishery will be prepared as part of the transition of the fishery to a full share management regime. The share management plan for the fishery will be consistent with the goals and objectives of this management strategy. Section 1 of this chapter discusses the relationship between a share management plan and this draft FMS, and section 6(a) of provides information relating to the transition of the Estuary Prawn Trawl Fishery to full share management.

CHAPTER D. CONSIDERATION OF ALTERNATIVE MANAGEMENT REGIMES

1. Outline of Feasible Alternative Management Regimes

This chapter highlights a range of high-level alternates to the proposed harvest strategy described in the previous chapter. There are two significant alternatives however, that are not presented in this chapter. The first of these is the option of not changing the management of the fishery from its' present set of arrangements. This management structure is presented in Chapter B. The final section of Chapter B also presents a review of the fishery and a discussion of the issues where improved management is warranted. A second major alternate to the proposed harvest strategy is the "no fishery" option where all activities of the Estuary Prawn Trawl Fishery would cease. The discussion of this option is best understood in the context of the justification of the proposed harvest strategy and appears in Chapter I.

a) The alternative management regime paradigm

The draft Estuary Prawn Trawl Fishery Management Strategy (FMS) contains eight goals, each with several objectives and many more management responses. There are also more than a dozen types of management tools which could be used (see Table D1). All of these may be used in different combinations to control the impacts of fishing activities. With this large array of management responses and tools, there are many alternative management options.

With this in mind, alternatives to the proposed draft FMS can only meaningfully be considered at the higher policy level rather than the level of individual management responses. It should be noted that as the goals and objectives of the proposed draft FMS address the major issues in the fishery irrespective of the management measures applied, they are left unchanged for the discussion that follows.

Consequently, this chapter discusses alternative holistic approaches to managing the fishery and then broad alternatives for managing each of the issues that have arisen from the review of the existing operation of the fishery in Chapter B. For further discussion on the proposals in the draft FMS for addressing each management issue refer to section 3 of Chapter C.

b) Managing Estuary Prawn Trawling Under A Different Fishery Definition

The *Fisheries Management Act 1994* (FM Act) defines six category 2 share management fisheries. These fisheries have historically been managed, and are currently defined, on the basis of the fishing methods used, the species targeted and/or the waters fished. Three of these fisheries are the Estuary Prawn Trawl Fishery, the Estuary General Fishery and the Ocean Prawn Trawl Fishery which all target prawns. One alternative is to manage the Estuary Prawn Trawl Fishery as part of the Estuary General or Ocean Prawn Trawl fisheries given that all three target the same species.

The Estuary General Fishery targets the same stocks of prawns within the same ecosystems as the Estuary Prawn Trawl Fishery. If included in the Estuary General Fishery, all targeted commercial fishing for prawns in estuaries would come under the one FMS. Approximately 57% of fishers with an endorsement in the Estuary Prawn Trawl Fishery also have an endorsement in the Estuary General Fishery. However, most of these fishers fish in the Clarence River (77% of estuary prawn trawl fishers) and the Hawkesbury River (60% of estuary prawn trawl fishers). Few fishers in the other estuaries have endorsements in both the Estuary Prawn Trawl Fishery and Estuary General Fishery.

The Estuary Prawn Trawl Fishery has had an identity as a single method fishery for over 50 years and its management has evolved down this path. It has been managed as a restricted fishery since 1986 and has undergone some restructuring. It uses one gear type on specialised vessels that are generally not suited to the methods of the Estuary General Fishery. Also, with the exception of the Clarence and Hawkesbury Rivers, the fishery involves a quite distinct group of fishers to those in the Estuary General Fishery.

If included within the Ocean Prawn Trawl Fishery then the one FMS would cover the method of trawling for prawns. Whilst the method is the same, many of the participants in the Ocean Prawn Trawl are different to those in the Estuary Prawn Trawl Fishery with only 27% of estuary prawn trawl fishers also holding ocean prawn trawl endorsements. These are mostly made up of Clarence River fishers (49% of estuary prawn trawl fishers) and Hunter River fishers (41% of estuary prawn trawl fishers). Also, the fisheries for the most part exploit different species of prawns. Overall, school prawns predominate in the landings of the Estuary Prawn Trawl Fishery whilst eastern king prawns predominate in the landings of the Ocean Prawn Trawl Fishery. Further, these fisheries operate in different ecosystems.

Irrespective of the new fishery structure, the impacts of trawling as a method would need to be managed separate to other estuary methods. This could be done by creating a separate type of endorsement within the new fishery authorising a limited number of trawlers, and introducing sufficient management controls to limit harvest levels and the impacts of trawling on the general environment.

Given that the draft FMS provides several mechanisms for holistic species based management (ie. TAC Committee process, the Prawn Resource Forum, species based performance indicators, etc.) the key outcome that could be expected from a new management structure is purely administrative. It would allow for the formal establishment of regional (or estuary) based advisory committees rather than separate MACs for trawling and estuary general fishing, however, the added value of such a consultation structure must be questioned.

The present MAC structure enables fisheries managers to consult over proposed changes to estuary trawling with a group of key stakeholders who are specialised and have an intimate understanding of the activity, how it is undertaken, and its impacts. Such consultations are likely to be far more efficient than those with a MAC that was made up of predominantly estuary general fishers representatives present (some of who may not even harvest prawns) and only one or two prawn trawling representatives.

c) Managing the Estuary Prawn Trawl Fishery using a higher proportion of closures and/or reserves

The management of the Estuary Prawn Trawl Fishery includes many existing and proposed closures, including temporal closures (e.g. seasons) and spatial closures (e.g. key habitat areas).

This section considers an alternate to the use of closures as currently proposed in the harvesting strategy, where closures are used to a much greater extent and may be used in place of other management measures.

This alternate way of meeting the fishery objectives would involve closing larger representative areas of the main ecosystems within each of the estuaries where prawn trawling takes place, with reduced levels of controls on fishing effort and gear. Such closures would be most effective if they were closed to all types of extractive activities, however, these broader protection measures are examined as part of the marine protected area process..

It is arguable that closures of sufficient size already exist to minimise the impact of the Estuary Prawn Trawl Fishery because trawling will only be permitted in four of the 130 coastal estuaries of NSW (Botany Bay will be closed to trawling from 1 May 2002), and within these four estuaries trawling is restricted to between 40 and 50% of the area of the estuary. However, the area where trawling is permitted in each of these estuaries (with the exception of the Hawkesbury River where several large lower estuary closures are in place) is in the downstream reaches of the estuary and it is possible that trawling is occurring over a major proportion of one or several types of habitat essential to the ecosystems within each of these estuaries.

The level of success the large spatial closures would have in conserving species affected by prawn trawling would vary between species. These closures are likely to be most successful with species that have a life history contained within the estuary. But, many of the species caught in the prawn trawl net migrate into, move within, and emigrate from the estuary. In such cases the level of protection afforded to the species will depend upon the relationship between the patterns of movement of the species and the placement and area of the closures. Little is known about the types of aquatic habitats or life history of many of the species that occur in NSW. Much research would be needed to define habitats and to collect information about the life history and distribution of species before effective large spatial closures could be put in place.

It is not obvious which management programs in the Estuary Prawn Trawl Fishery could be reduced or dropped if replaced with a system of large spatial closures. The need would remain to provide assessments of target species and other appropriate scientific advice to fisheries managers and it is unlikely that management controls on effort, gear etc. could be substantially reduced or lifted. Large spatial closures would, however, provide a great degree of certainty that the risks of impacts upon the ecosystem from the fishery were greatly reduced.

The proposal for large spatial closures would have application as alternative strategies for:

- ensuring sustainability of stocks (section 1(e)(i) in this chapter
- protecting key habitat (section 1(e)(ii) in this chapter)
- minimising the effects of trawling (section 1(e)(vii) in this chapter)
- conserving threatened species (section 1(e)(viii) in this chapter).

Table D1. Types of management tools available to control fishing activity.

(Source: adapted from DUAP, 2001, now Planning NSW)

Type of Control	Management Tool
Limiting who has access	***Limited access regimes*** can be used to limit entry to participants in a particular fishery or part of a fishery. They usually include eligibility rules and rules relating to the transfer of entitlements
	Restructuring programs can provide a concentrated or focused change in management procedures to achieve an accelerated change in expected outcomes . These may include minimum entitlement holdings, buy back schemes and restructuring through transferability programs
Limiting where and when the fishing can occur	Fishing closures which restrict commercial and/or recreational fishing for a specified period of time, any fishing or fishing for certain classes of fish in any waters or from specified waters
	Marine protected areas in estuarine or oceanic areas managed to conserve biodiversity and habitat. These include aquatic reserves, marine parks and marine components of national parks and nature reserves (Note: fishing restrictions may only apply in certain zones in marine parks and aquatic reserves)
	Recognised fishing grounds are areas used regularly or intermittently for net fishing by commercial fisheries and which have been mapped and approved by the Minister for Fisheries and where commercial net fishers are given priority under clause 105 of the *Fisheries Management (General) Regulation 1995*
	Planning controls in Environmental Planning Instruments (eg LEPs) under the *Environmental Planning and Assessment Act 1979* that could limit where fishing could occur, but only upon the approval of the Minister for Fisheries
Input controls limiting the equipment used to take fish	***Gear restrictions*** limit the size and type of gear (in possession or that can be used to take fish) such as: • size and number of nets/traps/lines/etc • mesh or size configurations, • gear design, and • marking of gear
	Boat controls limit the size and engine capacity of boats
Output controls limiting the amount and type of fish able to be landed	***Total allowable catch*** (TAC) is a specified total catch for a fishery determined by an independent Total Allowable Catch Setting and Review Committee, fished on a competitive basis or by people holding individual quotas
	Species size limit restricts the minimum size, maximum sizes or range of sizes specified for fish of a particular species that can be landed (by measurement or weight)
	Bag limit is the maximum quantity of fish of a specified species or of a specified class that a person may take on any one day – daily limit
	Possession limit is the maximum quantity of fish of a specified species or specified class that a person may have in possession in any specified circumstances
	Protected fish are certain species of fish completely prohibited from being in a person's possession.
	Protected fish from commercial fishing are certain species of fish completely prohibited from commercial fishing and from being taken for sale
	Quality assurance controls are the controls on the harvest of shellfish such as mussels and pipis to protect health

d) Managing the Estuary Prawn Trawl Fishery by Output Controls

To properly consider the use of output controls as an alternative in the Estuary Prawn Trawl Fishery, it is important to understand the fundamental differences between input and output controls.

Input controls limit the amount of effort fishers are able to apply to take shellfish and finfish in the fishery, thereby indirectly controlling the catch. Input controls can be as broad as limiting the number of people that can fish, or as specific as prescribing the allowable length and mesh size of a net. Input controls aim to reduce fishing "capacity" which has been described by Greboval and Munro (1999) as the ability, or power, of a vessel or a fleet to generate fishing effort per period of time.

Output controls on the other hand directly limit the amount of shellfish and finfish that can be harvested (usually of a particular species). Output control regimes can vary from setting a TAC for an entire shellfish or finfish stock with individually allocated and tradeable quotas, to setting a maximum daily limit on catches which applies equally to all operators in a fishery.

Assessment of feasibility of a total allowable catch for the fishery

There are a number of factors that should be considered when determining the applicability of a fishery or a species to an output control regime. Each of these factors is discussed below and particular reference is made to the conditions of the Estuary Prawn Trawl Fishery in relation to each factor.

Jurisdictional issues

Quota management of species managed by more than one jurisdiction is most successful if there is an arrangement to coordinate management, perhaps with an overarching TAC. While TACs can be successfully set across jurisdictions, the allocation of the TAC between parties can sometimes result in conflict. For example, the recent disputes between Canada and the US over the allocation of Fraser River salmon stocks is indicative of cross-jurisdictional management issues in fisheries (Christy, 2000).

Ideally, quota management of species taken by multiple jurisdictions requires coordinated management between agencies and fisheries. This points to the need for complementary management arrangements for these species. While the management of a fishery by input control is most effective when management arrangements are coordinated across jurisdictions, there is still a need to monitor global catches if the total resource is to be protected.

With one exception, the Estuary Prawn Trawl Fishery would, if managed by output controls, not suffer from such jurisdictional concerns. The fishery primarily targets two species of prawns, and in each estuary can be considered as harvesting a unit stock that is also in some areas fished by the Estuary General, Ocean Prawn Trawl and recreational fisheries. The exception is the fishery in Port Jackson which targets only eastern king prawns which are part of a unit stock found along the east coast of Australia. Although the Estuary Prawn Trawl Fishery is not a significant harvester of eastern king prawns from a unit stock point of view, the management of the resource by output controls would require cross jurisdictional arrangements involving the governments and operators of NSW, Queensland, Victoria and the Commonwealth.

Target species and gear types

Output controls are ideally suited to fisheries that target few species and where the targeting of the species can be clearly defined. Fisheries that target more than one species are generally more difficult to manage under a quota control system because of the difficulties in administering the level of quota. Any mismatch between quota levels among species targeted by the same gear can lead to discarding, due to high-grading or over-quota catches. High-grading is the practice of discarding lower value fish of a particular species when a premium price is paid for higher grades (e.g. different sizes) of that species. Over-quota catch is when fishers continue to harvest a particular species when their quota for that species is exhausted. The fisher is then faced with either having to purchase or lease additional quota or discard catch if he or she intends to continue fishing. The availability of quota on the quota market and its price are critical factors which influence the decisions of fishers whether to trade or discard those species (Kaufmann *et al*., 1999).

As the target species in this fishery are quite limited, problems of high-grading and over-quota are not seen as major issues.

Level of catch, value and management costs

High value fisheries with low production volumes are more suited to quota management than low value and higher volume fisheries, due largely to the increased costs of administration and compliance in a quota managed fishery.

The financial costs associated with quota management regimes varies from fishery to fishery, however, evidence to date suggests that management costs under quota management schemes might be higher than alternative management strategies (Kaufmann *et al*., 1999). The Estuary Prawn Trawl Fishery is a high value, high volume fishery that targets small animals. Apart from the higher costs associated with the catch reporting and administration needed in quota management than in an input control management regime, the Estuary Prawn Trawl Fishery under management by output controls would also require a higher level of compliance. The fishery targets small sized animals that are easily concealed and disposed of on the "black market" (see the discussion below under "enforcement issues"). It is unlikely that the costs associated with administering a quota would be able to be absorbed by the commercial prawn fishers of NSW. Furthermore, the increased cost of compliance needed to ensure the integrity of the scheme would be prohibitive for estuary prawn trawl fishers.

Number of participants

A quota management scheme is more easily applied to fisheries with a small number of participants. This enables the catch to be more easily monitored and reduces the cost of administration and compliance.

The application of quota management to the prawn resources of NSW would be complex. There are many fishing businesses apart from those in the Estuary Prawn Trawl Fishery with endorsements in other fisheries to catch prawns in NSW. In addition, preliminary results from the National Recreational and Indigenous Fishing Survey undertaken in 2000 and 2001 suggested that approximately 30,000 people in NSW went recreational fishing for prawns at least once per year. Considering this level of participation, the costs for administration and compliance are likely to be high.

Number of ports of landing

The enforcement of a catch quota system is likely to be easier in fisheries where a limited number of ports or places of landing are used to land the catch. The Estuary Prawn Trawl Fishery will be restricted to four estuaries as of May 2002, but the number of locations within each estuary where catch can be unloaded relatively out of sight are numerous. In addition, although recreational fishing is not substantial in the estuaries of the Estuary Prawn Trawl Fishery, consideration needs to be given to the number of sites of landing for ocean prawn trawl, estuary general and recreational fishers who may also be subject to the same or similar quota controls.

Scientific understanding

The greater the level of scientific understanding of a species, the higher the level of confidence that can be attributed to any management regime designed to ensure sustainable harvest levels. To be able to confidently estimate a biological sustainable harvest for any fishery, a good knowledge of the biology and population dynamics of the species is required. Quota management can also place extra demands on research and monitoring of stock and catch composition. The quality of the information on the population parameters for school prawns and squid is currently not sufficient to have a robust quota management regime. Research is being undertaken or is pending to address our needs for knowledge on these stocks.

Species with biological characteristics that lead to dramatic changes in abundance will have different information needs under quota management compared to a species with more stable population dynamics. This is because the process of changing the TAC to adapt to changes in abundance needs to have timely information so that the adjusted TAC can efficiently reflect the changes in abundance. The catch of prawn species is highly variable between years because there is an association between catch and the level of river discharge. Catches are greater in the months around periods of high rainfall and therefore greater river discharge. To consider such an external factor in an output control management regime so that yield was not underestimated during years of high river discharge would be very difficult.

Enforcement issues

Compliance in a management regime based upon output controls relies upon an effective plan to check catches at sites where vessels unload and then to have a "paper trail" to audit the landings. These types of enforcement schemes may include complex weighing requirements, tagging, logbook schemes and regular compliance audits of processing plants, seafood wholesalers and retailers. Any effective compliance scheme should include focus on both the commercial and recreational sectors.

The prawn fisheries in NSW, including the Estuary Prawn Trawl Fishery, targets species of high value and take high volumes of product which is easily concealed and disposed of through "black markets". For these reasons the cost of an effective compliance scheme would be prohibitive to any management regime based upon output controls.

Management issues

Management and administration of quota systems involves significantly more resources than input controls. In particular, there is a need to maintain accurate records of quota transactions that are of a quality that satisfies audit procedures, and for monitoring of the quota system paper trail. For example, there is significant administration associated with the annual distribution of around 180,000 lobster tags in the quota managed NSW Lobster Fishery.

Level of industry support

In order for quota management to be successful, the support of participants is important. There has been a mixed reaction to the application of quota management by commercial fishers in different fisheries. In some fisheries, such as abalone, there has been strong support by fishers for quota management.

The current level of support for a quota management scheme in the Estuary Prawn Trawl Fishery is unknown. However it is unlikely to differ substantially from the recommendation of the Estuary Prawn Trawl Management Advisory Committee (MAC) in April 1998 that was made in accordance with Division 1A of Part 8 of the *Fisheries Management (General) Regulation 1995*, which sought to retain input controls as the primary management mechanism in the fishery.

e) Alternatives to addressing key management issues within the fishery

Apart from the higher order alternatives to managing the Estuary Prawn Trawl Fishery discussed above, the following discussion examines alternatives for addressing each of the issues that were identified from the review of the existing operation in the fishery, in Chapter B.

i) Alternate regimes to ensure sustainability of stocks

The draft FMS proposes various input controls and other measures to ensure stock sustainability. The controls primarily restrict the number of fishers able to operate in the fishery, where, when and with what gear they may operate, as well as size and landing limits. Other measures in the draft FMS include gathering further information to improve assessments of shellfish stocks and stronger compliance programs. A more comprehensive discussion on these proposals can be found in Chapter C section 3.

Apart from the discussion above in section 1(c) of this chapter about implementing large spatial closures, another alternative approach to the management responses in the draft FMS for ensuring sustainability of target and incidental stocks is to significantly reduce the number of participants and/or the area or time the fishing gear is able to be used in the fishery through fishing closures. This alternative is similar to the approach being adopted in the creation of recreational fishing areas in NSW, except that process is aimed primarily at promoting recreational fishing opportunities (rather than ensuring stock sustainability), and compensation is therefore being offered to commercial fishers for entitlements that are surrendered as a result of declaring such areas.

To examine the likely economic impacts of substantially reducing fisher numbers, it is useful to consider the relationship between the numbers of operators and fishing capacity. If the number of estuary prawn trawl fishers reduced from current levels, it would be expected that the potential for increased individual fishing business profitability would initially expand because of the shellfish stocks becoming available to a smaller number of fishers.

However, the relationship between the number of fishers and catchability is not likely to be linear. There is a point (yet undefined) where, even with a surplus of available stocks, fishing businesses operating at full capacity would be unable to increase their individual catches due to the range of controls on the gear used and the area and time able to be fished. If fisher numbers were reduced below this point, individual profitability is likely to decrease, as the management costs for the fishery would be shared amongst fewer businesses.

There is also a risk that substantially reducing the number of fishers could affect the viability of regional support structures, such as small fishing depots or cooperatives, registered fish receivers, cold storage facilities and transport arrangements. Creating a lesser need for these services may adversely affect the infrastructure needed by remaining fishers to supply shellfish and finfish to the community.

ii) Alternative regime for protecting key habitat

Apart from the discussion in section 1(c) of this chapter about implementing large spatial closures, another alternative management approach to the proposed management responses in the draft FMS to protect key areas of habitat, is to compensate for damaging such habitat by building an equivalent area of the same habitat in an area that cannot be fished. This approach has been trialed in the United States of America and is known as 'mitigation banking'. However, no environmental factor operates in isolation and the quality of habitat is the summation of a range of factors, processes and conditions (Fronseca *et al*., 1985). If the habitat is restored, created or enhanced then the functional equivalence of the modified habitat must be considered (Thorhaug, 1990; Simenstad and Thom, 1996). Few projects of this nature have been successful in the long term and this approach runs the risk that perhaps the simulated habitat will not continue to exist once constructed, or that species will not recruit to the area because the environment is not suitable.

If key habitat areas are not protected then it is likely that nursery areas will be reduced. A possible outcome from a reduction in nursery areas is that the number of recruits to populations that rely upon these habitats will be reduced causing greater pressure upon the populations to maintain the appropriate level of spawning biomass needed to replenish the population.

In considering the impact on key areas of habitat, it is important to recognise that the fishery is only one of the many environmental and anthropogenic factors that impact on areas of key habitat in the estuaries of NSW.

iii) Alternative regime for reducing incidental catch

An alternative to the proposals in the draft FMS for reducing incidental catch may be to focus solely on a substantial increase in the use of fishing closures to reduce levels of bycatch. The closures would be put in place in areas where and at times of the year when the incidental species were known to be most abundant. However, the fishery would be likely to incur significant, increased economic and social costs because the diverse range and distribution of species within estuaries would mean less area of fishing ground and reduced periods of time for fishing.

Another alternate proposal is to stop trawling and to use the passive methods of fishing described for the Estuary General Fishery. This management alternative is discussed in section 1(e)(vii) of this chapter.

Fishers in the Estuary Prawn Trawl Fishery are committed to reducing the incidental catch of their fishing operation. The draft FMS proposes a number of management responses to address the need for improved management of the incidental catch in the fishery and these are presented in Chapter C section 6. There are no other alternatives to reducing levels of incidental catch that are considered to be feasible.

iv) Alternative regimes for minimising the multi-species character of the Estuary Prawn Trawl Fishery

The alternative proposal described above to reduce incidental catch would also assist to minimise the multi-species character of the Estuary Prawn Trawl Fishery.

Another alternative would be to allow no byproduct species to be landed. This would cause economic loss to the fishers through the loss of sales of byproduct that has traditionally formed part of their catch and income from the Estuary Prawn Trawl Fishery. Such a management response is likely to create a "black market" for byproduct species which would be costly to police. This alternative to land no byproduct could also lead to a waste of resource as not all of the incidental catch may survive when returned to the water. At least part of that proportion of the incidental catch that died when returned to the water could have been sold.

v) Alternative regimes for controlling the activation of latent effort and major effort shifts

The draft FMS presents a number of options for controlling effort in the fishery. These include an owner operator scheme and minimum entry requirements for new entrants as mechanisms to address latent effort. A number of options are also presented for controlling active effort, and these include either controlling the number of days fished, or a restructure of the fishery through the use of minimum shareholdings. Although minimum shareholdings would provide a control on the number of endorsements that may be available in the fishery, they require a significant adjustment time for share trading to occur and do not limit the effort able to be applied by fishers who hold the required shareholding. On the other hand, controlling fisher days is a more direct control on effort and can be adjusted over a shorter period of time in response to influences such as variations in stock abundance.

Industry representatives on the Estuary Prawn Trawl MAC have recommended an alternative strategy for addressing latent effort. They propose that a minimum shareholding threshold be established for all Recognised Fishing Operations (RFOs) that have achieved a required level of participation based on average days worked over the past three years. Fishing businesses that have a number of fishing days below this minimum level would receive half the number of shares but be allowed to continue to operate in the fishery at any level. However, fishers in this latter category would need to reach the minimum shareholding level before they could transfer their business.

This alternative has merit as a mechanism for distributing shares within the fishery but it does not adequately address the issue of reducing latent fishing effort because it relies upon RFOs being transferred. It is more than likely that the transfer of RFOs will not occur at a rate to satisfactorily reduce the level of latent fishing effort in the short term.

vi) Alternative regimes for allocating target species

The prawn resources targeted by this fishery are also targeted by other fisheries. The draft FMS proposes a specific process for allocating the targeted prawns and squid taken in the fishery. There is concern about the impact of the capture of incidental species in this fishery on other resource users (see section 1(j) of this chapter). The process for resource allocation of the target species proposed in the draft FMS is through the setting of fishing effort controls by the independent Total Allowable Catch Setting and Review Committee (TAC Committee), on the advice of a Prawn Resource Forum and relevant management advisory committees. This process provides for an independent assessment of the status of the resources and an allocation of resource once submissions

from interested parties have been considered. Further discussion on these interactions can be found in the draft FMS.

The industry members on the Estuary Prawn Trawl MAC do not agree with the use of the TAC Committee to set levels of fishing effort for these resources. Industry representatives on the MAC believe that fishing days cannot be effectively used as a control on fishing mortality rates because the abundances of prawns varies greatly between years. They also believe that the TAC Committee is not independent of Government and may not have the knowledge to reliably review assessments of the stocks of prawns fished by the Estuary Prawn Trawl Fishery.

The alternative proposed by industry representatives on Estuary Prawn Trawl MAC is to use area and time closures to control fishing effort and to use a Prawn Resource Forum to recommend controls on the level of harvest across fisheries. In the opinion of industry representatives, a Prawn Resource Forum would be comprised of representative from all stakeholder groups and its composition is likely to be more qualified to make recommendations to the Minister than the statutory TAC Committee.

vii) Alternative regimes for minimising the effects of trawling

The draft FMS takes a precautionary approach to the issue of the effects of trawling upon the river bed and it's flora and fauna by proposing to close key habitat areas and areas of environmental sensitivity, use incidental catch ratios to avoid areas with a high presence of incidental species, modify fishing gear and limit the landings of byproduct species. Another alternative management option to the management response to close key habitat areas is that proposed in section 1(c) of this chapter, to implement large spatial closures.

Another alternative management option to minimise the effects of trawling is to prohibit trawling all together and to catch prawns with more passive forms of fishing such as those already used in the Estuary General Fishery. This alternative would maintain the value of harvesting prawns whilst minimising levels of incidental catch and any impacts on fish habitat. For instance, set pocket nets are currently used to catch school prawns in the Clarence River estuary of the fishery. Set pocket nets, prawn running nets, prawn hauling nets, prawn seine nets, and hand hauled prawn nets are all used as part of the Estuary General Fishery to target eastern king prawns and school prawns in estuaries throughout the state with local closures restricting methods and area of use within individual estuaries.

If trawling was prohibited in estuaries there would be significant socio-economic consequences. First of all, fishers would lose the income they make from trawling each year and although this could be compensated for to some degree by the alternative methods made available, there would be an unknown learning period for fishers with the passive gear. Further, it is unlikely fishers would be as profitable using passive gear because sites where the gear could be used and the times when the gear is efficient are more limited.

Trawling is extremely important to the infrastructure of some small towns. The loss of a trawl fishery could be felt in the wider community. Employment may be lost because processing facilities may not receive the same volume of catch, and families of fishers in the Estuary Prawn Trawl Fishery may not have the same level of disposable income.

viii) Alternative regimes for conserving threatened species

The draft FMS proposes to conserve threatened species through a coordinated species management approach using threatened species recovery plans and threat abatement plans and through dedicated research into issues on a case by case basis. An alternative to these is the large spatial closures proposed as an alternative management approach in section 1(c) of this chapter.

Another alternative to the coordinated species management approach proposed in the draft FMS is to implement actions in the fishery that are independent of other users of the areas where the threatened species or ecological communities may occur. For instance in the case of the green sawfish if management action is only related to ocean waters then any captures of the species by the Estuary Prawn Trawl or Estuary General fisheries (although unlikely) could undo measures to protect that species. This type of uncoordinated approach runs the risk of introducing measures that are contradictory to those adopted by other users, or measures that offer little or no protection for threatened species.

These fishery-based alternatives to conserving threatened species, populations and ecological communities are not consistent with an ecosystem based approach to the management of biological diversity in NSW estuaries, and are not considered suitable alternatives.

A further, albeit much broader alternative to that proposed in the draft FMS, is to control all human activities that interact with the general environment to conserve those species (ie. the "ecosystem management" concept). However, this broader approach surpasses the legislative purpose of the draft Estuary Prawn Trawl FMS, and, other than that stated above, there are no apparent alternatives to the proposals in the draft FMS which effectively propose a species/community based approach to threatened species management.

ix) Alternative regimes for information needed for management regimes

The alternative to the research proposed in the draft FMS is to continue to rely, but increasingly heavily, upon fishery dependent data. Fishery dependent data can be biased by the very nature of the data source and by the self interest of stakeholder groups. Commercial and recreational fishers are likely to fish where the abundance of a species is greatest, and to also target areas where certain sizes of individuals are found or indeed certain species are found. Consequently, the essential ingredients to assessing the status of stocks including information about sizes of individuals in a population, species composition and abundances of species, may be biased if taken solely from fishery dependent surveys.

The need for fishery independent research to collect the information needed for the assessment of shellfish and finfish stocks is a widely held view. Whether to rely upon observer-based surveys to collect this information or to do truly fishery independent surveys frequently is a matter of cost. Observer-based surveys still rely upon the commercial fisher for information and so in many ways are subject to the same vagaries as fishery dependent data. These surveys do however, provide information about what is being caught by commercial fishing gear which is free from the interpretation or recording bias that may come from fishers recording their own data.

Whilst more expensive to conduct than fishery dependent surveys, fishery independent surveys provide the least biased information about the abundances and size composition of populations. Fishery independent surveys also provide a source of material for small scale projects studying various aspects on the biology of species. For instance, studies on the age determination or diet of a species

are important for stock assessment and trophic level analyses respectively. Neither fishery dependent nor observer-based surveys provide the same opportunity for this material.

For these reasons, continuing to rely upon fishery dependent data is not considered a feasible alternative to the proposals in the draft FMS.

x) Alternative regimes for minimising conflict with other resource users and with the community

Minimising conflict between the Estuary Prawn Trawl Fishery and other users of the estuaries is being addressed in this draft FMS through the use of fishing closures and by increasing public awareness of trawling operations and the benefits of the Estuary Prawn Trawl Fishery. Other users of estuaries where prawn trawling occurs includes recreational and commercial fishing, water orientated sports including boating and numerous shore-based activities. Industry has voluntarily limited trawling times and areas to share the estuaries with other users. However, the question of trawlers operating on the State's estuaries continues to be a contentious issue.

The industry members on the Estuary Prawn Trawl MAC do not agree with the implementation of further closures for the purposes of reducing conflict with other users of the waterways and the community. They propose no alternative management response other than that no further closures should be introduced for the reason of sharing the estuaries. Industry believes that it has voluntarily limited the time and area for this purpose in the past, and with environmental conditions dictating when they can operate, any further reduction in available fishing time would lead to a reduction in income and viability.

2. Assessing the Effectiveness of Alternative Management Strategies

As presented in the previous discussions in this chapter, the most significant and high level policy alternatives to the suite of input controls are to merge estuary prawn trawling into another fishery, to use large spatial closures or to use output controls, specifically total allowable catches. Table D2 below presents the merits of using these alternative strategies against the proposals in the draft FMS, with all considered against a range of sustainability considerations.

The comparison shows that the use of an alternative fishery definition for estuary prawn trawling provides no advantages in terms of ecologically sustainable development over the purposed draft FMS. While output controls can be a very effective way of guarding against over-exploitation of quota species, without further controls on gear use or areas fished, they fail to address broader sustainability issues such as reducing incidental catch or protecting key habitat. In addition, the high cost of an effective management regime based upon output controls in the prawn fisheries of NSW would render this management less cost effective than an input control regime. Large spatial closures provide very effective protection for key habitat and effective maintenance of ecologically viable stock levels for at least some species, but would still need to be complemented by a suite of input controls.

Table D2. Effectiveness of alternate management regimes in addressing sustainability considerations.

Sustainability Considerations	Alternative: Different Fishery Definition	Alternative: Closures	Alternative: Output Controls	Proposed Draft FMS
Maintenance of ecologically viable stock levels	Effective for target species. Effectiveness for species in the incidental catch will depend upon the efficacy of the management controls on other types of fishing gear	Effectiveness will vary with species life history	Questionable effectiveness for target species given the difficulty in predicting annual recruitment levels	Effective for target species. Effectiveness for species in the incidental catch will depend upon the efficacy of the management regimes in other fisheries
Rebuild stocks to viable levels within nominated timeframes where overfished	Very effective provided the same fishing controls as proposed in the draft FMS also apply to the 'amalgamated' fishery	May vary between species but generally effective without further controls	Very effective for nominated species	Very effective as draft FMS has measures in place to address and guard against overfishing concerns. Should recruitment overfishing occur, there is provision for species specific recovery programs, fishery restructuring and targeted gear changes
Conservation of biological diversity in the ecosystem and the protected or threatened species, populations or communities and their habitats	Moderately effective provided similar monitoring programs to those proposed in the draft FMS are in place	Very effective	Ineffective without further controls	Moderately effective, with proposals for monitoring incidental catch and threatened species and changes to fishing in areas of key habitat
Protection of the ecosystem in particular key habitat areas	Very effective provided the same fishing controls as proposed in the draft FMS also apply to the 'amalgamated' fishery	Very effective for the closed areas, but would be ineffective in open areas unless tighter controls are proposed	Ineffective without further controls	Very effective, particularly the proposal to protect areas of key habitat and environmental sensitivity
Fishing operations not being a threatening process to bycatch species	Very effective provided the same fishing controls as proposed in the draft FMS also apply to the 'amalgamated' fishery	Very effective for the closed areas, but would be ineffective in open areas unless tighter controls are proposed	Ineffective without further controls	Very effective, through proposed changes to gear, incidental catch ratios and monitoring regimes
Responsible stewardship in the management and harvesting of fishing resources, including the accountable management of latent effort and bycatch reduction	Moderately effective, although could reduce stewardship levels if prawn trawl operators perceived that the consultation would become less effective	Ineffective without further controls	Promotes stewardship and addresses latent effort on nominated species, although does not address reduction of the incidental catch without further controls	Shares should promote stewardship, and draft FMS effectively address effort levels and incidental catch issues