Estuary General Fishery

Environmental Impact Statement

Public Consultation Document

Published in November 2001 by
NSW Fisheries
Cronulla Fisheries Centre
PO Box 21 Cronulla NSW 2230

Details of the public consultation process and contact information are included on page A–17 in Chapter A (Volume 1)

Estuary General Fishery Ennvironmental Impact Statement

Public Consultation Document

NSW Fisheries, November 2001

ISBN 0 7310 9420 4

Cover images by J Matthews

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, B.Sc. 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 General 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:

C/o NSW Fisheries
Cronulla Fisheries Centre
PO Box 21
CRONULLA NSW 2230

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 3rd 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.

VOLUME TABLE OF CONTENTS

CONTENTS AT A GLANCE

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Acknowledgments

NSW Fisheries would like to thank the many people who contributed substantial amounts of time and effort towards preparing this EIS, often within short timeframes.

The management planning and environmental assessment teams within NSW Fisheries have put in a great deal of dedicated work over the past 12 months, and numerous other departmental staff have made useful comments and suggestions on the drafts.

The members of the various advisory bodies who have reviewed 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 General Management Advisory Committee in particular has spent several meetings and much of member's 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 (membership is detailed on the following page):

Advisory Council on Commercial Fishing

Advisory Council on Recreational Fishing

Advisory Council on Fisheries Conservation

Fisheries Resources 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 Limited, 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 Mark Fenton from James Cook University and Dr David Godden from the University of Sydney.

Staff from Environment Australia, Department of Urban Affairs and Planning, 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 Bodies

Estuary General Management Advisory Committee

Richard Stevens (Chair)	Les Cheers	Dr Gee Chapman
David Smith	Don Campbell	Katrina Zantiotis-Linton
Karl Tesar	Graeme Brynes	Frank Krasna
Edward Byrnes	Brian Clifford	Malcolm Poole*
		(*replaced Chris Baty from Aug 2001)

Advisory Council on Commercial Fishing

Ross Leader (Chair)	Megan Gallagher	Ron Firkin
Graeme Byrnes	Willis Sneesby	John Smythe
Paul Sullivan	George Baker	Shirley Massey
Bruce Korner	John Brierley	Barbara Radley
Ted Allan	Howie Davison	

Advisory Council on Recreational Fishing

Bruce Schumacher (Chair)	Anthony Moore	Lisa Terry
Mel Brown	Ann Lee	Mark Umbers
Peter Goadby	Elaine Garvey	Lionel Jones
Scott Mitchell	Terry Maloney	Graeme Moore
Tim Simpson	Margaret Dodson	Robert Cooper

Advisory Council on Fisheries Conservation

Prof. Alistair Gilmore (Chair)	Robert Toyer	Dennis Hicks
Dr Stuart Blanch	Dr Tim Anderson	Dr Jeff Leis
Dr Marcus Lincoln-Smith	Allan Lyons	Steve Dunn
Peggy Svoboda	Valerie Taylor	

Fisheries Resources Conservation and Assessment Council

Richard Stevens (Chair)	Doug Joyner	Assoc. Prof. Stephan Schnierer
Prof. Tony Underwood	John Smythe	Yolande Stone (DUAP)
Prof. Alistair Gilmore	Margaret Dodson	Angela Langdon (NPWS)
Bruce Schumacher	Kathy Ridge	Steve Dunn (NSWF)
Graeme Turk	Mark Everson	Paul Elton* (DLWC)
		(*replaced Grant Bywater from Oct 2001)

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
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
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. AN OVERVIEW

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 impacts of those fisheries.

The management strategy and environmental impact assessment for each fishery are joined together in a document termed the Environmental Impact Statement (EIS) for the fishery. Its structure is based on guidelines issued by the Department of Urban Affairs and Planning (DUAP).

This overview constitutes the first chapter (Chapter A) in the EIS. Chapters B, C and D respectively 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 strategy), and an outline of the alternative management approaches considered. 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 ecological, economic and social impacts of the management rules proposed for the fishery, and a justification for the strategy chosen.

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

The 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 fishery management strategy, and the findings of the environmental impact assessment for the Estuary General Fishery – the largest of the State's commercial fisheries.

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

Development of the Fishery Management Strategy

The draft strategy for the Estuary General Fishery contains all the management rules for 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 strategy, and requires annual reporting on performance in order to ensure the objectives set out in the strategy are met.

The management advisory committee (MAC) for the Estuary General Fishery provided significant input into the drafting of the strategy. The MAC, which includes the elected representatives of the commercial estuary fishers as well as representatives of recreational and Indigenous fishers and the Nature Conservation Council, has a key role in this process – one similar to a proponent in a land-based development application.

Input into the draft strategy was also sought from all fishers endorsed in the Estuary General 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 the NSW Department of Urban Affairs and Planning 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 Environmental Assessment Process

The EIS also incorporates an assessment of the likely environmental impacts if the draft strategy was to be implemented.

It is important to understand that the environmental impact assessment and the 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 has been designed to give early feedback to the MAC and allow the industry to respond to the predicted environmental impacts of their 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.

This is the first time in Australia that the widely accepted land-based impact assessment process has been applied to fisheries assessments.

While the principles are the same, there are distinct differences between assessing the impacts of an existing fishing industry and assessing, for example, a new building development. One difference is that the fishing industry being assessed already exists and, 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 the impacts of proposed changes are carefully assessed therefore and, where appropriate, time is allowed to adjust to any changes required.

The assessment of fishery impacts is also much more difficult than is the case with many other natural resources because, in comparison to our knowledge of terrestrial resources, less is known about aquatic ecosystems, and even less about estuarine ecosystems.

In reality, and with few exceptions, the population sizes or biomass of fish species are unknown. Fisheries science has to rely on relative measures to estimate changes in population sizes over time. These estimates are mostly made from recorded catches, fishing effort reported by commercial fishers and by extrapolations from surveys of recreational catches, and therefore have considerable uncertainty attached to them. Even when changes to fish abundance are detected, the precise reasons for the changes are often not known.

While the recent national survey of recreational and Indigenous angling catches in Australia is expected to provide much better estimates (when combined with estimates of commercial catches) of total catches than has previously been possible, particularly for species that are both commercially and recreationally important, considerable uncertainty will still exist.

The precautionary principle, a key component of the principles of ecologically sustainable development, provides guidance for dealing with this uncertainty. This principle says 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.

Similar uncertainty exists over the impacts of fishing methods on the environment, and there are strong and varying opinions from all sectors on this issue.

The EIS acknowledges these uncertainties but then uses the best available information to document:

- the likely impacts of the fishery on fish resources
- their likely impacts on the biophysical environment (including biodiversity and threatened species)
- the economic and social impacts of management proposals on existing estuary general fishers.

As well as satisfying the environmental assessment requirements of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), the EIS will also be submitted to the Commonwealth Government to meet assessment requirements for the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Wildlife Protection (Regulation of Exports and Imports) Act 1982* (WP Act).

Estuaries of NSW

The Estuary General Fishery operates within our estuaries. Estuaries represent a 'mixing zone' between completely sheltered freshwaters and the open ocean. The forces driving this mixing include tides, wind, waves and river run-off, although the relative importance of each of these varies according to estuary type and location within the estuary.

There are at least 950 such water bodies joining the Tasman Sea along the New South Wales seaboard. The vast majority of these are very small and only intermittently open to the sea. Only 130 have a water area greater than 0.05 km^2.

Most estuaries have been directly affected by works that have modified or reduced freshwater inflows, and most are surrounded by urban, industrial or agricultural developments that also impact on their ecosystems.

A wide range of competing activities take place in estuarine waters, and the Estuary General Fishery is just one of these. Other activities undertaken in estuaries include other commercial fisheries such as the estuary prawn trawl fishery, the recreational fishery and non-harvesting activities such as scuba diving and recreational boating.

The Estuary General Fishery

The Estuary General Fishery includes all forms of estuary fishing other than prawn trawling. Estuarine fishing has been undertaken in NSW since the mid-1800s and today is still best described as an "artisanal" (a small subsistence) fishery. It comprises small fishing boats that operate predominantly in just 24 of the State's 130 major estuaries.

About half of the State's commercial fishing businesses are entitled to operate in the Estuary General Fishery. Diverse ranges of species are harvested in estuaries and off ocean beaches, using more than 15 different types of fishing gear. In 1998/99 the value of the 5,426 tonnes of fish harvested in this fishery was approximately $20 million at first point of sale[1].

Up to 87 species are taken in the Estuary General Fishery with the main species targeted being sea mullet, luderick, bream and school prawns. The most used estuarine fishing methods are meshing and hauling nets. Other methods include trapping for crabs, eels and some other finfish, and a small amount of hand-lining and handgathering. Gathering of pipis and beachworms by hand on ocean beaches is included in the Estuary General Fishery for administrative reasons and because handgathering also occurs in estuaries.

NSW Fisheries has records of reported estuarine commercial fishing catches for the last 50 years. The overall amount of fish reported as taken in the fishery has remained relatively stable throughout this period. Fishing effort over the same period is more difficult to estimate, although it appears that the total amount of time spent fishing has also remained relatively constant. The available fishing effort data should be treated with caution, however, as they do not allow for increases in effort associated with improved technology, including the introduction of outboard motors, modern refrigeration techniques, motorised net haulers, or synthetic net materials. The associated risks are dealt with in the EIS.

Estuarine fishing was first regulated in NSW under the *Fisheries Act 1865*. By the end of the 19th century there were controls in place over the type, size and use of fishing nets, as well as fishing closures, and requirements for the licensing of fishers and boats. These types of controls are still in existence today, but have now been augmented by many other management arrangements.

Sharing the catch

Commercial estuary fishers operate alongside, and at times in competition with, recreational anglers, Indigenous fishers, charter fishing operators, recreational divers and a variety of other waterway users. There has been a tendency, in the past, for each harvesting sector to blame the other for perceived declines in fish stocks. Today, however, there is general agreement that resource use needs to be carefully regulated, and that poor land management practices have also had a significant impact on fish stocks and their habitats.

The demands on our estuarine resources by commercial, recreational and non-consumptive users have never been greater.

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

Whether estuarine fish stocks have declined in recent decades is ultimately unknown. There is a commonly held view amongst recreational fishers that individual angler catches have decreased, but this may just reflect increasing human population levels and hence the numbers of fishers involved. In many areas, recreational and commercial sectors are now thought to take approximately equivalent quantities of many of the popular species of fish.

Some members of the community dislike net fishing in estuaries and are quick to draw conclusions about the sustainability of such practices. Some commercial fishers on the other hand argue that the long history of relatively stable catches must mean that these fishing practices are sustainable but this may not necessarily be the case. Determining whether or not these practices are sustainable, is a major aim of the EIS.

There are a number of other initiatives currently underway that may affect existing allocation arrangements in estuaries, namely the recreational fishing area selection process, the establishment of a comprehensive, adequate and representative system of marine protected areas and the development of an Indigenous Fisheries Strategy.

- *Recreational fishing areas.* 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 the creation, after extensive community consultation, of recreational fishing areas. These recreational fishing areas aim to resolve long standing resource-sharing issues in areas popular with large groups of anglers, and can involve closing small or large areas to commercial fishing, or changing or stopping a commercial fishing practice (for example a particular fishing method) within a specific area. 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 acquired. At the time of writing, Lake Macquarie, Botany Bay, St Georges Basin, Tuross Lakes and eight smaller lakes on the south coast had been announced as recreational fishing areas. Announcements about recreational fishing areas in other coastal regions are expected over the next few months.
- *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 additional marine protected areas.
- *Indigenous Fisheries Strategy.* 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 practices. 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. In response to these concerns, the Government is preparing a NSW Indigenous Fisheries Strategy in consultation with Aboriginal people and fisheries stakeholder groups.

An Indigenous Fisheries Strategy would consider issues such as the subsistence fishing and ceremonial needs of Aboriginal peoples, and Aboriginal involvement in the commercial use of fisheries resources, including aquaculture. Aboriginal people agree that resource sustainability remains paramount and any strategy must take into account the impacts of such practices on biodiversity.

The (draft) Fishery Management Strategy

Input and output controls are the two broad categories of management tools that can be used to manage fisheries.

Input controls limit the amount of effort that can be applied to take fish 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 length and mesh size of a net and the times and places it can be used.

Output controls directly limit the amount and sizes of fish that can be harvested (usually of a particular species). Output control regimes can vary from setting a total allowable catch (TAC) for an entire fish stock with individually allocated and tradeable quotas, to setting a maximum daily limit on catches (trip limits) or prohibiting the taking of a particular species all together.

Given its multi-species, multi-method nature, the Estuary General Fishery has historically been managed through a series of input and output controls, including a limit on the number of commercial fishers, limits on the size and type of gear used, and fishing closures in some areas or at certain times.

Output controls, in particular minimum legal lengths for many of the primary species, have also applied for many years. Some fish such as estuary cod, blue grouper, estuary perch and Australian bass that occur in estuaries have also been completely protected from commercial fishing.

This mix of input and output controls has provided a fair level of protection for fish stocks during the past 100 or so years that the fishery has been in operation, and overall, reported catches have been relatively stable. The environmental assessment process has, however, revealed a number of areas that could be considered high environmental risk if the fishery were to continue operating without any change. These include excess fishing effort and the risk of major effort shifts, bycatch issues, threatened and protected species management and protection of key fish habitats.

To address these and other issues, the draft strategy lists seven major long term goals for the management of the fishery:

- to manage the Estuary General Fishery in a manner that promotes the conservation of biological diversity in the estuarine environment
- to maintain fish populations harvested by the Estuary General Fishery at sustainable levels

- to promote the conservation of threatened species, populations and ecological communities associated with the operation of the Estuary General Fishery
- to appropriately share the resource and carry out fishing in a manner that minimises impacts on others
- to promote a viable commercial fishery (consistent with ecological sustainability)
- to ensure cost-effective and efficient estuary general management and compliance programs
- to improve knowledge of the Estuary General Fishery and the resources upon which the fishery depends.

These management goals are underpinned by 34 specific objectives and 97 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:

- significant changes in the use of gear in the fishery to minimise the impact of the fishery on bycatch (non-retained fish) and fish habitat, including;
  - increasing minimum mesh sizes in set mesh nets and flathead nets
  - reducing the maximum length of fish hauling nets in some waters from 1,000 metres and 750 metres, to 500 metres
  - prohibiting all hauling over beds of the strapweed seagrass (*Posidonia australis*)
  - defining designated landing sites for fish hauling nets where there may be interference with seagrass
  - prohibiting prawn hauling and prawn seining methods over all seagrass areas
- the introduction of a scientific observer program to collect actual data on the amount and type of bycatch taken in fishing operations and any occurrences of threatened or protected species captures
- a proposal to commence fishery-independent surveys to provide estimates of relative abundance of estuarine fishery resources and biological information
- the implementation of a regionally based zoning scheme for the fishery
- the issue of 15 year tradeable shares to estuary general fishers in accordance with the category two share management fishery provisions of the *Fisheries Management Act 1994*
- the use of share management, and minimum shareholdings, to ensure that the level of fishing effort in the fishery does not exceed historical and sustainable levels
- removing the ability for the owners of fishing businesses to nominate third parties to operate the businesses
- in accordance with agreed guidelines and after community consultation, identification of recognised fishing grounds over historical hauling and set pocket net sites – within which commercial fishers will have priority over other waterway users, but not exclusive use

- the development of a code of conduct for the fishery that sets standards for the manner in which fishers operate, to minimise disturbance of terrestrial habitats/species and to promote harmony with other resource users and surrounding communities
- the promotion of 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
- the development of a system for conducting formal stock assessments of the primary species taken in the fishery, as well as ongoing monitoring of commercial landings of other retained species
- 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
- 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
- establish local joint industry/government working groups as needed to provide advice to NSW Fisheries on local management needs and arrangements.

In addition to these proposed changes, the draft strategy incorporates a comprehensive performance monitoring system that will assess whether the stated management goals are being met. 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.

Assessment of the Environmental Impacts

The assessment of the environmental impacts of the management rules and risk mitigation measures contained in the draft fisheries management strategy are summarised in the table and text that follow.

Environmental Impact Assessment Summary Table

Environmental Impact Assessment Summary Table					
Issue	**Component**	**Impact / Hazard**	**Environmental Risk**	**Programs Proposed in the FMS for Mitigation**	**FMS Reduces Risk?**
Impact of the fishery on fish resources	Retained species	Potential for overfishing	High for 1 species	Development of recovery plan	Yes, but would be improved by setting a minimum legal size
			Medium for 26 species	Zoning of fishing effort, reduction of effort by proposed fishery restructure and significant changes to gear and area closures	Yes
			Low for 2 species	Not required	-
	Bycatch	Direct capture	High - hauling and flathead mesh net; medium - meshing and passive prawning; low - trapping, handlining and gathering by hand	Significant gear, time and area changes especially for the high risk methods and an observer survey	Yes
		Contact without capture	Low for all methods	Not required	-
		Ghost fishing	Low for all methods	Not required	-
	Bait	Potential for overfishing of bait stock	Low	Not required	-
		Introduction of disease	Low	Not required	-
Impact on the biophysical environment	Biodiversity	Change in ecosystem function or reduced diversity	Medium	Observer survey, bycatch reduction strategies and code of conduct	Yes
	Habitat damage	Change in ecosystem function or reduced diversity	High	Increased protection of seagrass, designated net landing sites, code of conduct and significant gear changes	Yes for vegetated habitats, much less so and indrectly for unvegetated habitats

Environmental Impact Assessment Summary Table (cont)

Issue	Component	Impact / Hazard	Environmental Risk	Programs Proposed in the FMS for Mitigation	FMS Reduces Risk?
Impact on the biophysical environment (cont)	Threatened and protected species	Capture and mortality; habitat damage	Low for most species - medium for estuary perch and Australian bass	Observer survey, bycatch reduction strategies, changes to catch returns, gear controls and area closures	Yes
	Trophic structure	Change in the abundance and distribution of organisms	Poorly known but thought to be low for most trophic levels	Monitor commercial landings	No
	Translocation of organisms	Spread of pest or disease organisms	Low for most organisms	Implementation of measures in accordance with Australian Emergency Marine Pest Plan or equivalent	Yes
			Medium for *Caulerpa taxifolia*	Location and gear closures, prohibition on removal of equipment from affected estuaries, and education campaign	Yes
	Fish health and disease	Transmission of disease	Low	Adopting AQIS guidelines, when developed, re imported products	Yes
	Water quality	Increase pollutant levels of estuaries	Low	Not required	-
	Noise	Disturbance	Low	Not required	-
	Light	Disturbance	Low	Not required	-
	Air quality	Engine emissions	Low	Not required	-
	Energy	Petrol or diesel use	Low	Not required	-
	Greenhouse	Engine emissions	Low	Not required	-
	External factors	Decrease operational area, time or species of the fishery	High	Catchment management, habitat protection and rehabilitation policies	Yes, to the extent that the FMS can impact other Government policies

Environmental Impact Assessment Summary Table (cont)

Issue	Component	Impact / Hazard	Environmental Risk	Programs Proposed in the FMS for Mitigation	FMS Reduces Risk?
Economic impacts of the FMS	Economic viability	Poor economic viability	High	A restructure of the fishery is proposed by setting minimum shareholdings	Yes
Social impacts of the FMS	Employment and community values	Reduction in number of fishers	Medium	The proposed industry funded restructure will allow fishers exiting the industry to reestablish themselves	Yes
	Health and safety	Fishers' well being	Low	Not required	-
		Provision of high quality seafood	Low	Adopting Safefood Production NSW guidelines, when developed, and continuing the pipi biotoxin management scheme	Yes
	European heritage	Damage of sites	Low	Not required	-
	Indigenous heritage and issues	Damage to cultural sites, resource allocation	Low to medium	Development of the Indigenous Fisheries Strategy	Yes

Impact on the fish resources

The draft strategy contains a series of measures that tackle the issue of harvest sustainability for the estuarine fish and invertebrate resources of estuaries, including reducing the risk of overfishing, reducing fishing mortality and bycatch, controlling fishing effort and protecting nursery habitats.

The draft strategy proposes a comprehensive fish resource management regime based on a combination of fishing gear and effort controls, minimum legal harvest sizes and area-based restrictions. The draft strategy does not treat each species in isolation, nor does it treat each species from the point of view of the Estuary General Fishery alone. Rather, it is based on the interactions between species, the impacts of fishing methods on habitats, and the cumulative effects of other fisheries or fishing sectors, including recreational fisheries.

Many of the measures aimed at ensuring sustainable harvest (e.g. size limits) and protection of key habitats (e.g. restrictions on activities liable to harm marine vegetation) apply across all relevant fisheries and, in some cases, across other waterway users.

Based on the available data, the assessment of the draft strategy suggests the proposed harvest strategies will maintain stock sustainability. Where uncertainty is highest, the draft strategy takes a conservative (precautionary) approach to future harvesting arrangements and places increased emphasis on performance measures, monitoring and research programs.

The issue of bycatch in the fishery is addressed by:

- improving the knowledge of the quantity and composition of non-retained species
- introducing changes to gear specifications that will reduce bycatch rates, including the adoption of bycatch reduction devices (BRDs)
- ensuring the use of best-practice techniques for handling bycatch, including banning the use of fish spikes and other such implements
- protecting habitat areas known to support large numbers of juvenile fish
- developing a code of conduct covering operations on or near sensitive habitats.

These measures are strongly supported by the management arrangements in other fisheries and sectors which might impact on fish harvest. On the basis of the information provided, the assessment concludes that the proposed measures relating to bycatch described in the draft strategy are acceptable and will minimise adverse impacts from the Estuary General Fishery.

Impact on the environment

It is clear from the assessment that much is known about the biodiversity and habitats found in those estuaries within which the fishery operates, but little is known about the magnitude, extent, or even type of impacts that may occur as a result of fishing activities. Most of the uncertainty in relation to biodiversity and habitat impacts lies not with current practices, but with past practices within the fishery.

Fishing effort and area closure information is available, however, and when compared to the distribution of fauna and habitats, suggests that the impact of the fishery on biodiversity and habitats as a whole is likely to be limited.

Notwithstanding the limited available data, there is an acceptance that the fishery is even now probably having some as yet unknown impacts on biodiversity and habitats, and for this reason, the draft strategy has taken a precautionary approach to such issues. This is reflected in several of the management responses, which allow fishing to continue, but establish routine monitoring programs and set benchmarks that, if reached, will result in fishing practices being modified.

The establishment of marine and estuarine protected areas also presents an opportunity to monitor the impacts of fishing practices. By monitoring a protected area on numerous occasions before and after a protected area is declared, it should be possible to detect any changes attributable to the cessation of a fishing activity. This also has the advantage of providing an estimate of the resilience of habitats to fishing methods (that is their rate of recovery after the fishing method stops), and may provide information about sizes or features of reserves that are important for protecting ecosystem function and biodiversity.

The Estuary General Fishery also has the potential to affect numerous threatened species listed under the *Fisheries Management Act 1994*, *Threatened Species Conservation Act 1995* and the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*. At this stage, however, there appears to be little or no substantive data that suggests the fishery has any adverse impact (directly or indirectly) on any of these species or their habitats.

In accordance with section 5A of the *Environmental Planning and Assessment Act 1979*, however, an eight part test has been carried out in order to assess 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, on published literature and on information held by individuals but not yet published. The assessment concluded that the Estuary General Fishery would not have a significant effect on any threatened species, populations or ecological communities or their habitats and, as such, a species impact statement was not required.

The observer programs proposed by the draft strategy, however, plan to obtain information about effects due to disturbance, not just direct capture, as this appears to be the most likely form of impact on the majority of threatened species and species of international significance listed.

It is possible that disruptions to trophic structure caused by the fishery's operation could cause long term changes in community structure (the loss/replacement of particular species). On the other hand, changes to fishing practices aimed at reducing bycatch could adversely affect certain bird species (e.g. pelicans) that may have come to depend on existing handling practices, or cause long term changes in estuarine communities as a result of the varying abilities of fish and invertebrates to survive the rigours of being caught, sorted and discarded. Further impacts may also be caused by the fact that fishing effort is normally directed at predators.

At the same time, it is not known whether the wastage (and increased food supplies) associated with certain fishing operations actually result in increased populations of the attracted species (e.g. pelicans), or just locally increased abundance. Nor is it known whether fishing operations may result in populations of these species actually being reduced as a result of being concentrated in areas, and hence more prone to capture.

In the end, however, it appears that the risks of significant or irreversible trophic effects are low for most estuarine biota with the possible exception of some sea birds. Even where localised effects occur, the dispersed nature of the fishing effort within the Estuary General Fishery needs to be

taken into account, and wide scale impacts seem very unlikely. The available research suggests that many marine trophic relationships are weak, and that environmental influences are normally paramount.

The fishing methods used in the Estuary General Fishery, and the limited movement of fishers between management zones, limit the risk of spreading marine pests or diseases. The one exception may be the spread of the invasive marine alga, *Caulerpa taxifolia*, (which has been found in mainland NSW only in the last few years), through its becoming entangled in fishing equipment. Restrictions on certain fishing methods have been put in place to overcome this possibility.

There are no current proposals for the artificial enhancement of populations of fish and invertebrate species targeted in this fishery. Any such proposals would at any rate be subject to the normal planning requirements, and to the provisions of any relevant fishery management strategy created under the *Fisheries Management Act 1994.*

Pollutants generated by estuary general fishing are likely to be low in magnitude and of low to moderate frequency. The number of vessels used in the Estuary General Fishery represent less than 0.5% of the more than 180,000 vessels registered by the Waterways Authority in NSW, and the vessels used in the fishery are almost invariably small, at between 3 and 6 metres in length. The collective potential for pollution from these vessels is only a small fraction of that associated with boating generally. On the basis of the above, it is assumed that the risk to water quality associated with fishing operations in the Estuary General Fishery is very small, and does not require any further management given existing controls as administered by the Waterways Authority and the Environment Protection Authority.

The Estuary General Fishery is primarily a daytime fishery, which uses a variety of small boats which average 5.1 meters in length and are propelled by oars or small outboard motors averaging 25HP. The direct noise, light, air quality, energy and greenhouse emission issues associated with the fishery were all assessed as low.

In contrast, the impacts of external factors (particularly land-based catchment uses, pollution and habitat degradation) on the Estuary General Fishery are significant. These pose major challenges for state and local government, and require measures that go well beyond those within the parameters of the draft strategy. Useful options available to the fishery for helping to mitigate these external impacts, however, include:

- the closure of badly affected areas (eg. Homebush Bay) to fishing activities
- the development of seafood safety protocols to reduce risks to consumers (this could result, as happened with pipis, in temporary closures triggered by particular disease outbreaks or adverse environmental conditions)
- assisting commercial fishers to recognise, and avoid harvesting in, adverse conditions
- increased fisher and fishery agency representation on boards and committees that regulate catchment activities and/or land uses liable to affect fish or fish habitats.

Economic impacts

This is the first formal assessment of the economic and social impacts of commercial fisheries in NSW. It has been compiled from the already available information augmented by new economic and social surveys.

This information indicates that the Estuary General Fishery is based predominantly north of Sydney (80% of estuary general endorsements) and incorporates a diverse range of businesses with endorsements in several managed fisheries. The Estuary General Fishery is seasonal, with a low period in June to August, and comprises predominantly one-person businesses with some joint operations between fishers and limited corporate involvement.

Economic information on fishers is limited. Trends in licence values show no significant rise in estuary general endorsement values 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 and few nets, while others have significant investment in the fishery.

Economic surplus is thought to exist in 20% of all businesses examined, being greatest in the higher grossing multi-fishery businesses. The businesses currently operating below short-term and long-term viability levels are effectively subsidised by foregoing returns on capital and particularly labour, presumably to accommodate lifestyle. For these operators, increased charges and requirements to purchase shares are likely to impact on operational viability. There is, however, probably a large range of levels of "operator viability" given numerous part time fishers, multiple fishing interests, and fishers with involvement in industries outside fishing.

The management measures contained in the draft strategy have been ranked on the basis of their potential for larger scale economic impacts, and the following assessments made:

- the implementation of zoning means that operators will be constrained to one region of operation. In the first stage, the impact will be varying degrees of economic and operational dislocation impacting up to 17 - 41 fishers in a range of regions
- the change from 1,000 m and 725 m hauling nets to a maximum length of 500 m (with a further restriction of one shot per crew per day) will possibly impact 20-30 fishers dependent on hauling, but may benefit fish stocks and improve the public perception of such fishing
- the proposal in the draft strategy to use shares to cap fishing effort to historical levels within the fishery, is likely to cause some businesses to exit the industry at the same rate as under the previous Registered Fishing Operation policy with 188 businesses retiring in five years. Those most likely to exit are elderly fishers of pension age, latent effort holders and those businesses grossing below $10,000 per year. The shares made available by this process are likely to be readily purchased by the 20% of businesses in economic surplus
- the costs and benefits of the major elements of the draft strategy are appraised through an environmental account of the management of the fishery. Under the draft strategy, the fishery will move towards economic viability by 2006 and towards full cost recovery of those management costs attributable to industry by 2008. The economic achievement of the objectives of the draft strategy depends on the category two shareholding proposal being as effective as envisaged in the plan.

There may be an incentive for some businesses to increase effort to cover the new costs of fishing. For these reasons, it is essential to monitor latent effort and contain active effort levels within historical guidelines as stated in the draft strategy. The economic impacts of the move to management of capacity by minimum shareholding can be mitigated in the setting of rates of minimum shareholding. Too high a rate of change in minimum shareholding levels would risk greater rises in effort to pay for adjustment.

Social impacts

In the social survey, the location of fishers was identified and shown to be predominantly focused around key estuaries and towns, although a significant number of fishers were found to reside in smaller communities.

Employment in businesses with an estuary general endorsement could be as high as 1,569 persons (full time and part time), though those directly associated with the Estuary General Fishery would be fewer. Some of the employees are probably engaged in processing and there is no measure of the extent of part time involvement.

A demographic profile shows estuary general fishers are an older, highly resident population, with substantial fishing experience and strong family involvement with fishing. 53% of fishers had more than two generations of family in the fishing industry. Fishers over 60 years of age comprise 20% of all estuary general fishers, but fishers of all ages are evident in the fishery.

The skill sets of fishers were examined through the social survey and approximately 70% were insistent on their identity as fishers and most were unable or unwilling to consider retraining. Regional unemployment in NSW is relatively high on the north coast of NSW (14%) and in areas outside Sydney generally, and this is a significant issue for older fishers considering alternative employment to fishing.

The social assessment ranked the draft strategy management responses into three sets of issues. The most socially impacting are changes to zoning, hauling net lengths and to minimum shareholdings discussed in the economic assessment. Each of these has the capacity to impact families, local communities and regions, with the assessment being able to examine regional and predicted family impacts from available data.

The major social changes in the plan involve the displacement of fishers through cost increases for management and the implementation of minimum shareholdings. This may impact part time and elderly fishers, and a diverse range of people who are either latent endorsement holders or fishing businesses grossing less than $10,000 per year. Predictions of social impact assume a 20% displacement of business numbers over five years and may have differential impact in different zones. These effects may be mitigated by the rate at which adjustment of minimum shareholdings occurs.

Health impacts

The proposed seafood safety scheme is based on the premise that some species and/or activities present a potentially higher food safety risk than others. The highest food safety risk is associated with bivalve molluscs (shellfish) because they can readily accumulate harmful contaminants (bacteria, viruses, algal toxins and heavy metals) from their environment and transmit these to the consumer. Within the context of the Estuary General Fishery, only those engaged in the harvesting of bivalve molluscs need special arrangements as outlined in the draft strategy.

Heritage impacts

The activities associated with the Estuary General Fishery are limited to the use of a variety of netting styles, traps, hand-lining and hand gathering. 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 fishing will have no impact on 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. It is considered that there is a low risk that estuary general fishing activities will impact on European heritage sites.

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.

Indigenous issues

There are several other concurrent policy initiatives being developed by the NSW Government that will affect the interaction of Aboriginal fishers with the Estuary General Fishery. In particular, as highlighted earlier, NSW Fisheries is currently working with the Aboriginal community to develop an Indigenous Fisheries Strategy that aims to provide a new framework for the management of Indigenous fishing within NSW.

Many of the concerns of Aboriginal communities about the impact of current commercial fishery regulations on their livelihoods and lifestyles are being addressed through the development of the Indigenous Fisheries Strategy. However, this process will require further consultation with stakeholders and will take some time to implement.

Justification for the Draft Strategy

The EIS highlighted the importance of the Estuary General Fishery to the community in terms of employment, supply of seafood to the community and economic benefits. There are approximately 1,500 people employed in association with the fishery, many of whom would not readily obtain employment outside of fishing. The fishery contributes approximately 5,000 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 fish. The annual landed value of the fishery is approximately $18.1 million, with 70% of the first sale value staying within local communities.

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

Consulting the Community

You are invited to comment on the environmental impact statement for the Estuary General Fishery which is on public exhibition until 18 January 2002. The full environmental impact statement consists of four volumes, however, volumes three and four consist of appendices only. It can be viewed at NSW Fisheries offices, the head office and regional offices of the Department of Urban Affairs and Planning, NSW Government Information Service, local Sydney and coastal councils and the Sydney office of the Environment Centre (NSW) during normal business hours. A paper or CD copy can be purchased for $25.

It is also available on the NSW Fisheries web site at www.fisheries.nsw.gov.au.

Need more information?

For enquiries relating to the Estuary General Fishery, please phone (02) 4297 6077.

For enquiries relating to the environmental impact statement, please phone (02) 9527 8512.

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

Want to comment?

Write to: Environmental Impact Statement
Estuary General Fishery
PO Box 21
CRONULLA NSW 2230

Fax: 02 9527 8576

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

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

Comments must be received by 18 January 2002.

CHAPTER B. REVIEW OF THE EXISTING OPERATION OF THE FISHERY

The Estuary General Fishery has been operating in NSW for over 100 years and is subject to a range of reasonably comprehensive management controls. This chapter describes the existing fishery and 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.

1. The Fish Stocks

a) Extent of the fishery

The Estuary General Fishery currently involves the taking of all finfish and shellfish for sale from the estuarine waters of NSW using lawful commercial fishing gear, and the taking of selected species by hand from ocean beaches. The fishery does not, however, include the taking of abalone and rock lobster as they are subject to separate management plans and require separate fishing entitlements. Additionally, the fishery does not operate in estuarine areas where fishing closures apply.

b) Species of the Estuary General Fishery

The Estuary General Fishery takes a wide and diverse range of species. A summary of the ten most prominent species taken in the Estuary General Fishery by weight is presented in Appendix B1. The summary presents information on life cycle, habitat preference, catches by fishery and method, seasonal catch trends and average market values for each of these species. The following is a list of the species that constituted 99% of the landed weight recorded by commercial fishers in the Estuary General Fishery during 1998/99.

≥99%

Sea mullet	Squid	Yellowtail
School prawn	Greasyback prawn	Leatherjacket spp.
Pipi	Mulloway	Octopus spp.
Luderick	Trumpeter whiting	Sand flathead
Yellowfin & black bream	Silver trevally	Black tip shark
Dusky flathead	River garfish	Whitebait spp.
Blue swimmer crab	Cockle spp.	Pilchard
Sand mullet*	Shortfin river eel	Sea garfish
Sand whiting	Estuary catfish	Sandy sprat
Silver biddy	Tailor	Tiger prawn
Longfin river eel	Old maid	Pike eel
Mud crab	Beachworms	Pike spp.
Flat-tail mullet	Tarwhine	Australian Salmon
Eastern king prawn	Hairtail	

* Examination of catch returns has indicated that the reported level of sand mullet landings may be inaccurate, by including a significant proportion of misreported catches of sea mullet.

The following list of species constitutes the remaining 1% of landed weight recorded by commercial fishers in the Estuary General Fishery during 1998/99. The large diversity within this 1% may be in part due to incorrect species identification and suspected misreporting

≤1%

Flounder spp.	Eel unspecified	Snook
Snapper	Hammerhead shark	Cod unspecified
Catfish unspecified	Mackerel tuna	Short-finned conger eel
Nipper spp.	Mantis shrimp	Shells
Forktailed catfish	Red mullet	Coral crab
Garfish unspecified	Sand crab	Red gurnard
Shark unspecified	Golden trevally	Milkfish
Longtom	Krill	Hermit crab
Fiddler shark	Shovelnose shark	Zebra fish
Cuttlefish spp.	School whiting	Dory unspecified
Stingray spp.	Bronze whaler	Sweetlip unspecified
Shortbill garfish	Drummer	Endeavour prawn
Black trevally	Flathead unspecified	Old wife
Scallop	Red morwong	Morwong unspecified
Anchovy	Conger eel	Wirrah
Blue mussel	Mangrove jack	Blue whaler shark
Arrow squid	Spotted mackerel	Chinaman leatherjacket
Hardyhead	Mado	Port Jackson shark,
Blue mackerel	Whiting unspecified	Teraglin
Bonito	John dory	Batfish
Sole mixed	Latchet	Gurnard unspecified
Southern calamari	Yellowtail kingfish	Saucer Scallop
Queenfish	Mackerel unspecified	Stargazer
Trumpeter unspecified	Dart	Sweep
Black sole		

The species authorised to be taken on ocean beaches or in the estuaries by hand are limited to pipis, beachworms, cockles, yabbies and mussels.

c) Bycatch species

Bycatch consists of those animals that are discarded from the catch or retained for scientific purposes, and that part of the "catch" that is not landed but is killed as a result of interaction with fishing gear. Fish that are landed are sometimes discarded because there is no market for that type (or size) of fish, or because the regulations prevent the fish from being retained (eg. if it is smaller than the minimum legal length or is a species protected from commercial fishing).

Bycatch species in the Estuary General Fishery can generally be classified into fish that are juveniles of species that are of commercial or recreational importance, those that are of particular conservation significance and others which are neither a commercial or recreational species nor of specific conservation importance.

Juveniles of species that are considered to be of high commercial and recreational importance which are commonly caught in the estuary fishery include sand whiting, yellowfin bream, dusky flathead, tarwhine, snapper, leatherjackets, tailor and luderick.

Other species caught as bycatch which are of conservation significance or lesser commercial value include;

Stingarees and stingrays
Estuary catfish
Striped catfish
Bullrout
Perchlets
Bar-tail goatfish
Blue-lined goatfish
Gobies
Common toadfish
Weeping toadfish
Fiddler rays
Hardyheads
Fortesque
Cobbler scorpionfish
Little rock whiting
Weedfish
Blennies
Gudgeons
Smooth toadfish
Threebar porcupinefish

2. Existing Operational Areas

a) Normal areas of operation

The Estuary General Fishery currently operates in a large number of estuaries along the NSW coast where a range of fishing nets and traps permitted in the fishery may be used subject to closures or other restrictions. The method of handgathering also occurs along numerous ocean beaches.

Estuarine waters are defined under the Act as waters other than ocean waters that are ordinarily subject to tidal influence. Where an estuary meets ocean waters, estuarine waters are 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 to a line identified as the tidal limit.

There are a number of flowing fresh water streams east of the Great Dividing Range which lead into catchments and rivers that form some of the estuaries along the NSW coast, however these fresh water tributaries do not form part of the Estuary General Fishery.

There are 690 water bodies along the NSW coast, many of which are small and unnamed (Williams and Watford, 1996; Williams *et al*., 1998). Of these, 135 were considered by West *et al*. (1985) to be major estuaries.

Many of these estuaries are subject to complete or partial closures to commercial fishing. Some of these closures relate to specific areas whilst others relate to the use of specific gear types within these estuaries. Additionally, restrictions or concessions apply to certain types of fishing gear used within individual estuaries.

As of October 2001, the following 113 estuaries were open to commercial estuary fishing.

Estuaries available to the Estuary General Fishery

Tweed River	Khappinghat Creek	Moruya River
Cudgen Lake	Wallis Lake	Congo Creek
Cudgera Creek	Smiths Lake	Meringo River
Mooball Creek	Myall Lakes	Coila Lake
Brunswick River	Myall River	Tuross Lake
Belongil Creek	Lake Booloombayt	Lake Brunderee
Tallow Creek	Port Stephens	Lake Brou
Broken Head Creek	Karuah River	Dalmeny
Richmond River	Hunter River	Kianga Lake
Evans River	Lake Macquarie	Nangudga Lake
Jerusalem Creek.	Tuggerah Lakes	Corunna Lake
Clarence River	Hawkesbury River	Tilba Tilba Lake
Sandon River	Pittwater	Little Lake
Wooli Wooli River	Sydney Harbour	Wallaga Lake
Station Creek	Botany Bay	Bermagui River
Corindi River	Towradgie Creek	Barragoot Lake
Arrawarra Creek	Port Kembla Harbour	Cuttagee Lake
Darkum Creek	Lake Illawarra	Murrah Lake
Woolgoolga Lake	Minnamurra River	Bunga Lagoon
Hearns Lake	Wrights Creek	Wapengo Lake
Moonee Creek	Werri Lagoon	Middle Lake (Bega)
Coffs Harbour Creek	Crooked River	Nelson Lake
Boambee Creek	Shoalhaven River	Bega River
Bonville Creek	Lake Wollumboola	Wallagoot Lake
Bellinger River	Jervis Bay	Bournda Lagoon
Dalhousie Creek	St Georges Basin	Back Lake (Merimbula)
Oyster Creek	Swan Lake	Merimbula Lake
Deep Creek	Berrara Creek	Pambula River and Lake
Nambucca River	Nerrindilah Creek	Curalo Lake
Macleay River	Lake Conjola	Nullica River
South West Rocks Creek	Narrawallee Inlet	Towamba River
Saltwater Creek	Burrill Lake	Wonboyn River
Korogoro Creek	Toubouree Lake	Merrica River
Killick River	Termeil Lake	Nadgee River
Hastings River	Meroo Lake	Nadgee Lake
Lake Innes	Willinga Lake	
Lake Cathie	Durras Lake	
Camden Haven River	Batemans Bay	
Manning River	Tomaga River	

The highest producing 24 estuaries account for approximately 95% of the catch taken in the fishery (average of landed weight from 1997/98 and 1998/99) (see Table B1). Only seven of these major 24 estuaries are located south of Sydney with the majority of catch taken from the larger coastal lakes and rivers on the northern and central regions of the NSW coast. The Clarence River on the far north coast has consistently produced the highest catch of both finfish and prawns in recent years.

Table B1. Average production (from 1997/98 and 1998/99) in the estuaries that produce 95% of estuary general catch (Source: NSW Fisheries catch statistics database).

Estuary	Production (kg)
Clarence River	979,373
Myall Lakes / Port Stephens	520,205
Wallis Lake	443,152
Lake Macquarie	278,441
Tuggerah Lakes	270,471
Hawkesbury River	221,853
Richmond River	219,065
Tweed River	178,184
Camden Haven River	165,101
Lake Illawarra	164,666
Manning River	164,244
Hunter River	153,355
Botany Bay	122,030
Shoalhaven River	107,151
St Georges Basin	100,562
Port Jackson	86,739
Macleay River	86,605
Hastings River	78,828
Nambucca River	69,845
Turros Lake	41,419
Jervis Bay	28,973
Smiths Lake	27,031
Bellinger River	26,386
Coila Lake	20,752

3. Methods of Harvesting

a) Gear used in the fishery

Over 15 different types of fishing gear are used in the fishery with methods ranging from handgathering to the motorised winching of hauling nets. While most of the gear types catch a wide range of species, some gear types are designed to target particular species (eg. eel traps).

While there are standard minimum and maximum net lengths, mesh sizes and restrictions on overall dimensions that apply to most gear types used in the fishery, many of these regulations have been developed over a long time period and on a regional basis and reflect the extensive variation of the physical and biological characteristics of the State's estuaries. While this regional development of rules has addressed many local issues, it has also resulted in a very complex management scheme with large variations in fishing gear permitted between estuaries.

b) Types of boats used

The boats used in the fishery are generally small 'run-about' or 'punt' style vessels. The same boats are often used in the ocean hauling fishery, and sometimes in the ocean trap and line fishery by fishers also authorised to fish in those fisheries.

Typical 'run-about' style vessels are generally between 3 and 6 metres in length and vessels of this size constitute approximately 70% of the commercial fishing fleet in NSW (NSW Fisheries licensing database). The most common construction material is aluminium. Boats in this fishery are occasionally equipped with two motors, one of which is generally of a small capacity to enable the boat to be navigated easily at low speed to assist in setting and tending fishing gear.

c) Operation of fishing gear in the fishery

The following descriptions of each gear type permitted in the fishery outline the construction of gear, how it works, some of the controls that apply, the main species taken, some of the bycatch and the seasonal patterns of use.

i) Fish trap

Fish traps are generally made from wire mesh supported by a timber frame. They are set on the bed of the estuary and are baited to attract fish inside. Entrances to the trap are tapering funnels that make it hard for fish to leave the trap once they have entered. Recent video footage from a camera placed in baited traps has shown however, that some species move relatively unimpeded in and out of fish traps whilst they are set (Ferrell, D. pers comm, 2001).

Fishers attach a rope and float to identify the location of the trap and facilitate lifting it to the surface to remove the catch. The standard dimensions for a fish trap used in estuaries are a maximum of 2 metres in length, 1.5 metres in width and 1 metre in height. To minimise the capture of juvenile fish, the mesh in the trap must not be less than 50 mm.

Commercial fishers generally check fish traps in the morning on a daily basis or, occasionally, every two or three days. Any unwanted catch is returned to the water at the time the trap is lifted.

Yellowfin bream normally comprise about 40-50% of the catch retained from estuary fish traps, with blue swimmer crabs and silver trevally also being taken in significant proportions (NSW Fisheries catch statistics database). Bycatch predominantly comprises juvenile bream and snapper which are generally in good condition upon release.

The levels of use of fish traps is highest in the northern area of NSW with the winter months providing the peak of activity. This pattern is not reflected in other parts of the State with patterns of use being more sporadic.

ii) Eel trap

Eel traps are designed to catch longfinned eels (*Anguilla reinhardtii*) and shortfinned eels (*A. australis*). There are a few different designs of eel trap used in NSW waters, some with solid frames and some that are collapsible to facilitate easier transportation and handling on small boats. Eel traps are smaller than fish traps, but are similar in that they contain tapered funnels through which eels travel to get to bait placed within the trap. The standard dimensions for an eel trap are either a maximum of 2 metres in length, 0.5 metres in width and 0.5 metre in depth, or 1 metre in length, 1 metre in width and 0.5 metre in depth. The mesh in the trap must be between 20 mm and 40 mm and the entrance funnel must not be more than 100 mm in diameter.

A mesh pocket similar to a “cod-end” in a fishing net is attached to the rear of most traps. Eels generally remain in the codend until removed by a commercial fisher. Eels may damage themselves by rubbing against the rigid mesh in the traps, but are less prone to this damage in the softer mesh of the cod-end.

Eel traps are set throughout estuaries and can be set in shallow water in the upper reaches of estuaries, or relatively deeper water in the lower parts. Eel trapping occurs in most NSW estuaries, with a higher level of activity on the north coast. The Clarence River on the far north coast produces the highest commercial eel catch. The use of eel traps peaks during winter in the northern part of the state, and during the warmer months in the central and southern estuaries.

Eel fishers with permits may use eel traps in farm dams and some of the larger freshwater impoundments. In these areas the cod end must be long enough to reach the surface of the water to provide an air space for air breathing animals such as freshwater turtles which may enter the trap. Eel traps in these areas must also be checked and cleared daily. Research is currently being conducted to evaluate the effectiveness of a rigid ring in the entrance funnel of eel traps to exclude freshwater turtles from entering eel traps.

In estuarine waters, commercial fishers generally check eel traps daily, but may occasionally leave them for two to three days. Longfinned and shortfinned eels comprise approximately 95% of the total catch in eel traps. Bycatch in estuarine waters mostly consists of mud crabs and juvenile bream and snapper.

iii) Crab trap

Crab traps are generally made from wire mesh supported by a solid frame, and are weighted so they remain stationary on the bed of the estuary. Crabs are attracted to the trap by bait placed in the centre of the trap. They enter the trap through tapered funnels on the walls of the trap, or funnels that rise on an angle when entering the framework of the trap.

The standard dimensions for a crab trap are a maximum of 1.2 metres in length, 1 metre in width (or a diameter of no more than 1.6 metres if round) and 0.5 metres in height. To avoid the capture of juvenile fish in the trap, the mesh must not be less than 50 mm, and the trap must have no more than four entrance funnels.

Trapping for mud crabs generally occurs in the middle to lower reaches of estuaries, particularly around mangrove areas. Commercial fishers generally check crab traps in the morning on a daily basis or, occasionally, every two or three days. Unwanted catch is returned to the water at the time the trap is lifted.

Mud crabs comprise the majority of the catch retained from crab traps. Bycatch in these traps includes prohibited size mud crabs and blue swimmer crabs, as well as bream and luderick. There is a higher level of use of crab traps in the summer months throughout the State, though the overall use is highest in estuaries in the northern area of the state.

iv) Hoop or lift net

A hoop or lift net (also known as a "witches hat") can take a number of forms but generally consists of one (and no more than two) hoops or rings to which loose netting is attached. The net must not extend more than 1 metre from the hoop or hoops. In some designs, the hoop sits on the seabed and the net is held away from the hoop by use of a small float forming a conical shape. A piece of bait is placed on the inner side of the net so that fish, and particularly crabs, become entangled in the net whilst attempting to get to the bait.

Another method by which these nets are used is by placing the net held open by the hoop on the seabed with a piece of bait placed in the centre of the hoop. The lifting of the hoop and net forms an inverted cone shape. Crabs can be entangled in the net when it is lifted from the estuary bed.

Occasionally finfish become entangled in the net while feeding on the bait, and they can be retained if caught. Commercial fishers generally check these nets on a daily basis, or sometimes numerous times in the one day. Blue swimmer crabs and mud crabs constitute the majority of the catch taken in these nets.

v) Mesh net

A mesh net consists of a length of mesh secured to a headline (or "cork line") on the top, and a footline (or "lead line") on the bottom. The headline is designed to be buoyant by using a series of floats attached along the length of the net and the footline is weighted to keep the net vertically suspended in the water. The mesh in the net acts to entangle fish that encounter the net as they move through an estuary.

A mesh net is operated by one end being secured to the shoreline or attached to a float and anchor in water away from the shore. The net is then set out of a small boat travelling away from that point. When the entire length of the net has been set a float is attached to the top of the second end of the net and an anchor to the footline. Fish travelling through a path where the net is set will normally encounter the mesh of the net unless they swim over or underneath the net.

The size of mesh used in a mesh net determines the size of fish that will either pass through the mesh of the net without being caught, become entangled in the mesh of the net, or be large enough to "bounce off" the net. Upon retrieval of the net into the boat, marketable fish are removed from the net

and placed into plastic tubs or ice bins while prohibited sized and unwanted fish are returned to the water.

A mesh net can be used in two ways; either by setting or by splashing. A 'set mesh net' is positioned in the water column and left unattended for period of time, and catches fish that swim into the net whilst it is left or set in the water. A 'splashing net' is used by positioning the net in the water, then splashing the surrounding water to encourage the fish in the vicinity to swim into the net. Splashing nets are retrieved from the water immediately and the fish removed.

A set mesh net can either be 'top set' so that it is positively buoyant and targets fish which swim near the water surface such as mullet, or 'bottom set' so that it is negatively buoyant and targets demersal species such as flathead which swim near the bed of the estuary. A mesh net is limited to a maximum length of 725 metres and a mesh size of not less than 80 mm.

The reported use of mesh nets is greatest in winter when overnight setting is permitted, although levels of use in other months of the year are relatively constant. Sea mullet is the predominant catch taken in mesh nets with significant quantities of luderick, bream, flathead and blue swimmer crabs also captured. The estuaries and large coastal lakes in central NSW support the highest levels of mesh net activity.

vi) Hauling nets

A hauling net consists of a length of mesh secured to a headline (or "cork line") on the top, and a footline (or "lead line") on the bottom. Attached to each end of the net is a set of long rope hauling lines that are used to pull the net through the water.

A hauling net is generally made up of two "wings" which are the pieces of netting located closest to the hauling lines, a "bunt" section and a "cod-end" which is the bag in the centre used to hold most of the fish during the haul. The mesh size in hauling nets is normally considerably smaller than in a meshing net because hauling acts to herd fish rather than entangle them in the mesh.

When hauling, one end of the net or hauling line is attached to a fixed point. The net is then layed out (or "shot") from a boat that travels in a circular direction so as to encircle the target patch of fish or prawns before returning close to the original fixed point. The net is then retrieved to the shore or to a boat, either by being pulled by hand or with the aid of motorised line haulers. Once the shooting of the net has commenced the hauling operation must continue uninterrupted until completed.

Any fish caught in a hauling net must be removed from the net immediately on completion of the hauling operation or before removal of that part of the net from the water, whichever occurs first.

The levels of use of finfish hauling nets throughout the State is relatively constant throughout the year except for peaks of activity in the northern region during the winter months. The estuaries and coastal lakes in the central region of the State generally support the highest levels of hauling net activity.

There are many different types of hauling nets with variations in overall length and mesh size. Some nets are positively buoyant and designed to target fish that swim near the water surface (eg. mullet), whilst others are negatively buoyant and are used to target fish that swim near the floor of the estuary (eg. sand whiting and prawns). Some hauling nets are designed specifically to target prawns rather than finfish.

Hauling nets are generally non-selective and therefore catch a wide size range of many species of fish. The types and quantities of bycatch in hauling nets varies greatly amongst estuaries. Bycatch often comprises undersized individuals of the target species, including bream and sand whiting, as well as several species of little economic importance (eg. pufferfish). The mortality rates of bycatch can be low when catches are sorted in a reasonable depth of water and when little or no jellyfish is caught during the haul.

Following is a description of the specific types of hauling nets used in the Estuary General Fishery.

General purpose hauling net

This is the most common type of hauling net. Relatively large mesh is used and species such as mullet, bream, tarwhine and silver biddies are usually targeted. This net is commonly used to catch sea mullet as they congregate in the lower reaches of estuaries in early autumn and winter in preparation for their annual northerly spawning migration.

A standard dimension hauling net must not exceed 375 metres in headline length. The following dimensions must also be complied with:

Part of net	Length restrictions	Mesh size restrictions
Wings of net	375 m less the length of the bunt	Not less than 80 mm
Bunt: in full	Not more than 90 m or _ of the total length of the net (whichever is lesser)	[see below]
Bunt: centre piece	Between 25 and 50 m	Between 30 and 50 mm
Bunt: remainder of	Not more than 50 m	50 mm*

* Fishers may increase the mesh in the bunt (centre piece) of a general purpose haul net, by permit, from a maximum of 50mm to a maximum of 57mm to reduce the incidence of prohibited size sand whiting being caught in these nets. This is particularly an issue in some north coast rivers, as well as some of the larger coastal lagoons such as Wallis Lake. The effectiveness of the net operated under such a permit will be monitored by NSW Fisheries and consideration given to recommending a change to regulation.

The maximum length of the net (headline length) on hauling nets is greater than the standard 375 metres in a limited number of the larger estuaries and coastal lagoons. Six estuaries currently have a 1,000 metre maximum net length, seven estuaries have a 725 metre maximum, and 15 estuaries have a 450 metre maximum length (see below). This increased maximum length is in some cases only applicable in parts of these estuaries.

1,000 metre hauling nets may currently be used in:

Wallis Lake, Watson Taylor's Lake, Queens Lake, Lake Macquarie, Tuggerah Lakes and St Georges Basin

725 metre hauling nets may currently be used in:

Clarence River, Lake Innes, Smiths Lake, Myall Lakes, Lake Booloombayt, Lake Illawarra and Wallaga Lake

450 metre hauling nets may currently be used in:

Tweed River, Clarence River, Hastings River, LakeWollumboola, Lake Conjola, Coila Lake, Turross Lake, Dalmeny Lake, Cuttagee Lake, Murrah Lake, Wapengo Lake, Nelson Lake, Curola Lake, Merimbula Lake and Wallagoot Lake

Prawn hauling net

This net has a much smaller mesh size throughout than a general purpose hauling net and is specifically designed for catching prawns in estuarine waters. The standard dimensions of a prawn hauling net must not exceed a maximum length of 40 metres with mesh of between 30 and 36 mm, and each hauling line not exceeding 130 metres in length.

A modified version of the standard prawn hauling net has been permitted in the Manning River and parts of Wallis Lake. The net used in the Manning River has a relatively long hauling line attached to the shore and a shorter hauling line attached to a boat that is used to shoot (or set) the net. The net used in parts of Wallis Lake is operated in a similar manner, however the longer hauling line is attached to an anchored boat so the net may be used away from the shore.

Prawn hauling nets are used throughout the upper and lower reaches of estuaries. Peak levels of use of these nets occurs in summer with minimal use during the winter months. This trend occurs throughout the State and is directly related to the seasonal nature of the estuarine prawn fishery.

Even though fish caught by this method can be retained for sale, school prawns constitute approximately 96% by weight of the total landings from this gear type. Bycatch primarily consists of small species including perchlets and siphonfish *(Siphamia sp.)* which are of little recognised value to commercial or recreational fishers. Bycatch levels are generally very low when the net is retrieved to a boat mid-stream as opposed to being hauled to shore. When operated as a mid-stream net, the majority of bycatch is in good condition when it is released.

Pilchard, anchovy and bait net

This type of hauling net is designed for taking small species of fish and it is used predominantly in ocean waters in the ocean hauling fishery. Port Jackson is the only estuary in which the use of this net is permitted under Regulation in the Estuary General Fishery, however permits have been historically issued to allow the net to be used in parts of Pittwater and the Hawkesbury River.

The net has a central bunt or 'codend' in which the fish are collected during the hauling operation. The mesh decreases in size as the net tapers into the cod-end. The permitted dimensions for this net when used in estuarine waters are that it must not have an overall length exceeding 250 metres, and the following dimensions relating to the construction of the net must be complied with:

Part of net	Length restrictions	Mesh size restrictions
Wings of net	Each wing not more than 90 m	Not greater than 80 mm
Bunt	Not more than 60 m	Between 50 and 65 mm
Bag	Not more than 12 m	Not more than 30 mm
Cod-end	Not more than 6 m	Not more than 25 mm
Hauling lines	Each line not more than 125 m	-

The pilchard, anchovy and bait net is used to catch schools of anchovy and whitebait which travel between ocean and estuary waters, with the peak levels of activity occurring in spring and autumn.

The primary catch taken in the net consists of approximately 40% anchovy and 40% whitebait by weight, along with a range of other small species.

Trumpeter whiting net

A trumpeter whiting net is a hauling net used to target trumpeter whiting (*Sillago maculata*) in Port Stephens. The net is a negatively buoyant hauling net with floats attached to the headline and a weighted footline. The only catch permitted to be taken in trumpeter whiting nets is trumpeter whiting.

Part of net	Length restrictions	Mesh size restrictions
Wings of net	Not more than 50 meshes deep	Between 50 and 65mm
Bunt of net	50 metres	Between 30 and 40mm
Overall length	Up to 275 metres	-
Hauling lines	Between 100 and 225 metres	-

Garfish hauling net

A garfish hauling net is operated as a conventional hauling net and is positively buoyant to target surface schooling garfish. This net is predominantly used in the ocean hauling fishery and, in the Estuary General Fishery, may only be used in parts of Port Jackson, Broken Bay, Botany Bay, Port Stephens and Jervis Bay. The net has relatively small mesh of between 28mm and 36mm.

Fish that are not subject to legal size requirements may also be retained in this net when it is being used for taking garfish. Sea garfish and river garfish constitute over 90% of the catch taken in garfish hauling nets.

Garfish bullringing net

A garfish bullringing net is a net specifically designed to catch garfish in estuarine waters. The net is a surrounding net and is positively buoyant. The headline has floats attached and the footline is weighted so that the net sits vertically in water. The net is set by attaching one end to a fixed point with the headline being attached to a float and the footline being attached to an anchor. Then net is then 'shot' or layed out in a circular motion until a school of garfish is encircled.

The first end of the net to be shot or laid out is normally deeper in meshes than the last end to be set. The last end of the net to be set is then retrieved to create a diminishing circle around the school of garfish. As the first end of the net is deeper, the hauling in of the second end of the net in effect closes the net around and underneath the garfish. Through this process the fish are either captured in the end of the net or by becoming caught in the mesh of the net.

Standard garfish nets consist of mesh between 28mm and 36mm with a standard maximum length of 275 metres, however a longer maximum length of 550 metres applies in Tuggerah Lakes. In the Clarence River, the maximum length of the net is 375 metres, and the mesh is larger than standard (28mm to 45mm) to enable fishers to target river garfish as well as the slightly larger species of snub-nosed garfish *(Arrhamphus sclerolepis)*.

River garfish constitute approximately 80% of the total catch taken in garfish bullringing nets. Sea mullet and other garfish species are also taken by this method.

Prawn seine net

Prawn seining ("snigging") nets were historically introduced into some NSW estuaries as an alternative to the use of board trawl nets. The net is set by a boat attaching a float to one end of a hauling line and then travelling in a circular motion to set the remainder of that hauling line, the net, and then the second hauling line. The net and lines are set in a teardrop shape, with the net being at

the broader section of the teardrop and the two hauling lines meeting at a point where they are attached to the boat.

The net is negatively buoyant with the headline of the net lined with floats and the footline weighted with lead or other weights. This results in the net sitting vertically in the water and maintaining contact with the bed of the estuary when it is set. The net is then retrieved through a combination of towing the hauling lines to close the net, and hauling of the hauling lines to return the net to the boat.

Greasyback prawns and school prawns constitute approximately 90% of the total catch in prawn seining nets. The composition of bycatch in these nets varies depending on where the net is used. Bycatch is generally greater over seagrass where it often comprises juveniles of species that are of both commercial and recreational importance, including bream, luderick and leatherjackets. Bycatch also often includes species of little recognised importance to commercial or recreational fishers including stinkfish *(Foetorepus calauropomus)* and frogfish *(Batrachomoeus dubius)*. Some commercial fishers are trialing different bycatch reduction devices in an attempt to reduce the discard rates.

Permits have historically been issued to a small number of fishers (20 in Lake Macquarie and 24 in Wallis Lake) authorising the net to be used in a manner known as 'clover leafing'. The technique is an additional method of operation of this net, and is designed to use the net to catch prawns in deeper water.

Clover leafing can occur in either of two main methods of operation. Firstly, it may involve using the net in a manner where the prawns are removed from the cod end of the net without the net being fully removed from the water. This involves the net being re-opened once closed, with the boat travelling around to the back of the net and the crew removing the prawns whilst the hauling lines and majority of the net remain in the water. The second main method is where a number of sets and tows are made before the catch is removed from the water. In this method of operation, the net is set and then the hauling lines towed to close the net, followed by the wings of the net being opened out again and the process repeated, possibly a number of times before the catch is removed from the net.

vii) Prawn net (set pocket)

This type of net is operated by being staked in estuaries and must not have any hauling lines attached. The net consists of a tapered conical shape funnel of mesh that ends in a cod-end or pocket. The net can be either set to target school prawns, which travel along the bottom of an estuary, or king prawns which travel nearer the water surface.

The net targets prawns travelling or being swept through an estuary by the movement of water, normally on an outgoing tide. The movement of the water leads the prawns along the mesh of the net until they reach the pocket where they remain until the net is picked up and the catch removed.

Set pocket nets are only permitted to be used in parts of the Clarence River, Lake Cathie, Hastings River, Queens Lake, Watson Taylor Lake, Smiths Lake, Wallis Lake, Myall River, Tuggerah Lakes, Lake Illawarra, and Sussex Inlet. Set pocket nets must not be left unattended, and are usually set for the period of the outgoing tide. The catch in the pocket of the net is landed onto a boat and discarded catch must be released prior to the sorting of prawns.

In the Clarence River, a set pocket prawn net may also be used in conjunction with a moored fishing boat that has its engine running. This enables the fisher to use the propeller to create a current

in order to assist the motion of the tide through the net. To ensure that these fishing operations caused minimal disturbance to local residents, a code of conduct was developed by the Northern Professional Fisherman's Association and the NSW Waterways Authority. This code of conduct restricts noise levels including noise from engines, radios and prawn cookers.

School prawns are the major catch in set pocket nets constituting approximately 60% of the total landed catch across the estuaries in which set pocket nets are used. The months of October and November have greater levels of use of this method, with estuaries in northern NSW having the highest levels of activity. Bycatch often contains small species of fish including perchlets and juveniles of important species including bream and tailor. Bycatch levels are generally low but can be affected by higher levels of river discharge.

viii) Prawn running net

This type of prawn net can be used in two main methods of operation. The net may either be staked, or set, then the whole of the net retrieved in a manner known as running the net. A prawn running net is negatively buoyant with the headline being attached to floats and the footline being weighted so that the net sits vertically in water when set.

When the net is staked it is placed at an angle across an area of water which has a current or tide running through it. Prawns travelling with the current come into contact with the mesh. The movement of water guides the prawns along the net until it reaches a point where the net ends.

The net can also be used by attaching one end of the net to the shoreline and shooting or setting the net from a boat across a channel or body of water so that tidal current passes through the mesh of the net. Prawns swimming with the current come in contact with the mesh and those that are not small enough to pass through the net are held upstream of the mesh by the current. The net does not have a pocket or bunt in which prawns are caught, but the movement pattern of prawns in an estuary during an ebb tide result in them being collected on the upcurrent side of the net.

The net is then retrieved back toward the shoreline at a point near where the other end of the net is attached. In retrieving the net the fisher shakes and collects the net in a manner that herds the prawns toward the shoreline. Once the whole of the net has been returned to the shoreline the prawns are gathered. The mesh of these nets is relatively fine and is not designed for entangling fish. However, fish that are not subject to a minimum or maximum size limit may be taken if caught in a prawn running net operation.

Eastern king prawns constitute approximately 75% of the total catch taken in prawn running nets, with a smaller quantity of school prawns also taken. Prawn running nets are used more frequently in the central and southern estuaries on the NSW coast. The peak times for the use of these nets are November and December in estuaries in the central areas with peak activity in southern estuaries occurring about one month later. Bycatch levels are generally low and dominated by small garfish and herrings. Bycatch is generally in good condition when it is released.

ix) Push or scissor prawn net

A push or scissor prawn net is operated by one person with the net attached to a scissor shaped frame. The act of pushing the net through estuary waters whilst maintaining contact with the seabed leads prawns into the pocket of the net. The net can be easily removed from the water at any time by the fisher and unwanted catch returned to the water.

The net length of bottom line at the lower ends of the poles must not exceed 2.75 metres and the mesh size must be between 30mm and 36mm. This net is used predominantly by recreational fishers, with minimal use by commercial fishers.

School prawns are the predominant catch taken in push or scissor nets.

x) Hand-hauled prawn net

A hand-hauled prawn net is a net that is pulled through the water by two people, one on either end of the net. The net is relatively short (6 metres maximum) and only suitable for use in shallow water. The mesh size of the net must be between 30mm and 36mm.

The net has a weighted footline and a floated headline with stakes or poles at each end to hold the net open. The movement of the net through the water leads prawns into the pocket of the net. At the completion of a haul the net is brought ashore where the catch is sorted. The predominant catch taken in hand-hauled prawn nets is school prawns.

This net is often used by recreational fishers.

xi) Handgathering

The method of handgathering occurs regularly on ocean beaches and is occasionally undertaken in estuaries. It is a highly selective method targeting few species, including beach worms, pipis, cockles, mussels and yabbies. Handgathering may also include collecting fish or shellfish by hand while diving in estuary waters.

Since 2000, the handgathering of pipis has been restricted to fishers who operate under an approved biotoxin management plan. Pipi biotoxin management plans are managed under strict guidelines developed by NSW Fisheries and Safe Food Production NSW, and food safety consultants carry out regular audits of the scheme. All fishers operating under these management plans are required to hold public liability insurance.

The majority of handgathering occurs on ocean beaches throughout the summer months with pipis constituting 97% of the catch by weight taken by this method. Beachworms are also a significant catch in the handgathering sector, however due to a significant weight difference between an individual beachworm and an individual pipi, the reported landings (by weight only) do not reflect this.

xii) Handlining

The term handlining refers to the use of a spool of fishing line, or a reel of fishing line used in conjunction with a rod. Hooks attached to the line are baited and fish are hooked when they attempt to feed on the bait. Artificial lures may be used instead of bait. Fishers in the Estuary General Fishery may also use set lines which are commonly used to target some species of sharks in estuarine waters.

Handlines rigged with baited hooks and a sinker generally remain motionless within the water or on the bed of the estuary. The predominant species taken by handlining are high value larger fish such as mulloway and hairtail. These species each constitute about 30% of the total landed catch taken by this method.

Handlining activity peaks during the autumn months in the central region estuaries. In contrast, higher levels of handlining occurs in the northern region estuaries towards the end of winter

and beginning of spring. There is only a relatively small level of handlining activity in estuaries on the southern NSW coast.

d) Maintenance of fishing gear

Most commercial fishing gear used in this fishery is used on a seasonal basis and requires periodical maintenance when not being used. Nets can deteriorate through continued use in water, or they may become torn or entangled during their use, particularly when caught on snags or accidentally run over by boats. Mesh can often shrink over time when exposed to sunlight and needs to be periodically replaced.

Traps are usually made with a wooden or steel frame covered with wire, and some traps are entirely constructed with metal weld mesh. Because of these construction materials and the fact that traps are left in water for extended periods, traps deteriorate over time. Boats occasionally run over the floats used to mark the position of the traps and this results in the traps becoming difficult to retrieve. For example, crab traps typically have an operational life of approximately two years (or seasons), and replacement cost is approximately $60 per trap.

Blue swimmer crabs often become entangled in mesh nets and hoop or lift nets (witches hats) and quite often part of the net becomes damaged or unusable. Fishers generally re-use the leadlines and the float lines on nets and replace the portion of damaged net when needed.

Most prawn nets require little maintenance as they are usually used over soft substrate with fewer potential snags to damage the net.

4. Catch Information

a) Catch levels and value

The Estuary General Fishery supplies many species of finfish and shellfish to the domestic market as fresh local seafood and also has a developing export market.

The total commercial estuary catch has remained relatively stable over the past 50 years except for slightly higher catches during the late 1980s and early 1990s. Total landings have generally been stable between 1993/94 and 1998/99 (see Table B2). The total reported landed catch of 5,426 tonnes for the 1998/99 fiscal year was worth an estimated $20 million, though the value figures do not take into account export, interstate or local markets where higher prices may be obtained.

Table B2. Catch and value for the Estuary General Fishery.

Period	Catch (t)	Value ($)**
1993/94	5,774	21,390,000
1994/95	5,805	20,044,000
1995/96	5,664	19,941,000
1996/97	5,294	19,488,000
1997/98	5,668	19,366,000
1998/99*	5,426	20,054,168

*Information for the 1998/99 period sourced from NSW Fisheries catch statistics database during August 2001.
** Value calculated using the average Sydney Fish Market prices.

In 1998/99, 52% of active estuary general endorsement holders also held endorsements in other commercial fisheries, with estuary fishing forming only a part of their overall fishing operation (NSW Fisheries licensing database). Some fishers also participate in the fishery on a part time basis whilst maintaining other 'non-fishing' forms of employment.

It is easier to operate on a part time manner in this fishery compared with many other fisheries because of the relatively small levels of capital investment required. The fishery has historically had a sizeable lifestyle component and many fishers have operated at fairly low levels of participation. The catch information from this fishery, when multiplied by average Sydney Fish Market prices, shows that:

- 50% of fishers take 90% of the fishery revenue
- the top 10% take 38% of fishery revenue
- the top 20% take 57% of fishery revenue
- the top 30% take 72% of fishery revenue.

5. Existing Management Strategy

a) History 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 good set 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 B3 below provides an insight into the historical development of fisheries management in NSW.

Table B3. Chronology of major fisheries management events in NSW.

Year	Management event
mid 1800's	Commercial fishing commenced in NSW estuaries
1865	Fisheries Act 1865 commenced in response to concerns of overfishing, enabling the declaration of 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 developed into 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, estuary prawn trawl, estuary general. Purse seining was incorporated into the ocean hauling fishery. (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

The *Fisheries Management Act 1994* provides several broad frameworks for managing commercial fisheries including category 1 and category 2 share management fisheries and restricted fisheries. Each framework provides a different level of access right along with different levels of cost and responsibility for industry. Table B4 provides a comparison between the three management frameworks.

Table B4. Comparison of the restricted fishery and share management fishery frameworks.

	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 whithin a 15 year term
Statutory management plan required?	No	Yes, 5 year plan	Yes, 5 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	Small rental payment

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

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

b) Controls on fishing activity

No formal management plan currently exists for the Estuary General Fishery, however, there are numerous management controls that apply to the fishery.

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 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 General Fishery in NSW is predominantly managed by input controls. The controls in place are almost as diverse and complex as the fishery itself. The following section sets out in broad terms the controls that apply to activities in the fishery.

i) Licences required in the fishery

A commercial fishing licence is required by an individual before s/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 with a minimum level of validated catch history or an appropriately endorsed vessel (eg. an estuary prawn trawl vessel). The RFO policy was introduced via the Licensing Policy issued by NSW Fisheries in June 1994.

The common objectives of the 1994 Licensing Policy and its replacement in 1996 (which is still current) 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.

The RFO policy has been effective at restructuring and consolidating fishing businesses at the lower end of the income range and has been delivering on the objective of promoting a viable commercial fishing industry (Murphy, 1999).

In addition to each fisher having to be licensed, every fishing boat used in connection with estuary general fishing must also be licensed. There has been a cap on the total number of boat licences since 1984.

ii) Limited entry

Access to the Estuary General Fishery has been limited to eligible fishers since the restricted fishery regime commenced on 1 March 1997. Prior to that date, nearly every NSW fisher with a general commercial fishing licence could operate in the Estuary General Fishery.

Entry to the restricted fishery for most methods was defined by having a minimum level of catch history showing that the methods sought in the application had been actively used over past years. An extensive statutory appeals process followed.

Following changes to the *Fisheries Management Act 1994* in December 2000 the Estuary General Fishery, along with most other major marine 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) Fishing endorsements

In determining the number of fishers in the Estuary General 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 licences of individuals and authorise the use of the

specific gear or taking of specific species. Further information on entitlements and endorsements is provided in section 5b(iii).

Some fishing businesses can be owned and held in the names of more than one individual (including company or partnership names) and therefore an entitlement associated with a business may entitle more than one person's licence to be endorsed to operate in the fishery.

Nine classes of entitlements and endorsements currently exist in the fishery and are shown in Table B5 below, along with the number of entitlements issued for each endorsement type.

Table B5. Entitlements and endorsements in the Estuary General Fishery (as of July 2001).

Endorsement types	Endorsement description	Number of entitlements
Meshing	This endorsement authorises the commercial fisher to use a meshing net and a flathead net to take fish for sale from estuary waters	755
Prawning	This endorsement authorises the commercial fisher to use a prawn hauling net, prawn seine net, prawn set pocket net, prawn running net, hand-hauled prawn net, push or scissors net and a dip or scoop net to take prawns for sale from estuary waters	566
Category 1 hauling	This endorsement authorises the commercial fisher to take fish for sale from estuary waters using any of the following nets: general purpose hauling net, trumpeter whiting net, pilchard, anchovy and bait net, garfish hauling net, garfish bullringing net, bait net	203
Category 2 hauling	This endorsement authorises the commercial fisher to take fish for sale from estuary waters using any of the following nets: garfish hauling net, garfish bullringing net, bait net	210
Trapping	This endorsement authorises the commercial fisher to use a fish trap and a hoop or lift net to take fish (other than eels or mud crabs) for sale from estuary waters	260
Eel trapping	This endorsement authorises the commercial fisher to use an eel trap to take eels for sale from estuary waters	226
Mud crab trapping	This endorsement authorises the commercial fisher to use a crab trap to take mud crabs for sale from estuary waters	296
Hand gathering	This endorsement authorises the commercial fisher to take beachworms, pipis, cockles, yabbies, mussels and nippers for sale from estuaries and ocean beaches by hand picking	124
Handlining & hauling crew	This endorsement authorises the commercial fisher to take fish for sale from estuaries using a hand line or by assisting another commercial fisher with a category one or a category two hauling endorsement (using hauling methods only)	853
	Total number of endorsed fishing businesses	944*

* Fishing businesses can hold multiple entitlements

iv) Controls on fishing gear and boats

Detailed restrictions relating to the dimensions and type of fishing gear are set out in the *Fisheries Management (General) Regulation 1995*. The Regulation provides for the use of 'standard' gear in most estuaries, but variations to the standard gear are often applicable to particular estuaries or parts of estuaries. The Regulation also stipulates in many cases how the gear must be operated.

The regulations which currently apply to the size, dimensions and use of each gear type in the Estuary General Fishery are included in Appendix B2 in Volume 3.

Net registration

Commercial fishing nets used in the Estuary General Fishery (with the exception of the hoop and lift net) are required to be registered. Net registration certificates are issued for individual nets and are valid for the life of the net. The certificates stipulate the length and mesh sizes of individual nets.

Net registrations are not transferable and are only issued for new nets that are replacing existing nets of the same specifications that are no longer serviceable. New (ie. additional) commercial fishing net registrations have not been issued since a freeze was placed on the registration of new nets in July 1989.

Where nets are acquired as part of the transfer of a fishing business, only the nets authorised for use by the new owner's entitlements are registered.

Boat replacement policy

To prevent any increase in size and therefore efficiency of vessels in the fishery, a strict boat replacement policy applies. Boats 6 metres in length or less may be replaced with boats up to 6 metres. Boats that are greater than 6 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 boat length over time.

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 only become available to a new entrant if a fishing business with the required level of validated catch history is acquired (ie. a RFO).

Under the current Licensing Policy, fishing businesses must be sold as an entire package (ie. the catch history or endorsements cannot be split). Proposals regarded as licence splitting, or contrary to the intention of the Licensing Policy are not approved.

The Licensing Policy currently provides that the estuary general endorsements of a fishing business only become available to the first new owner of the business. If the business is transferred for a second time, the offer to retain the endorsements lapses. This part of the policy is known as the "interim transfer policy".

The interim transfer policy came about as result of the relatively low entry criteria that were set during the implementation of restricted fisheries in 1997. The criteria were purposely set at a low level to ensure that the process was inclusive rather than exclusive and to allow both diversified and long term fishers to continue, even if their historic catch level had been relatively low. This was consistent with the policy objective at the time, which was simply to identify the participants in each fishery.

While the Minister at the time agreed to set the initial entry criteria at a low level, there was significant concern that too many endorsements would be issued and that licences previously operated at a low level could be transferred to fishers who could operate at much greater levels of effort. Consequently, the purpose of the interim transfer policy is to allow for the limited transferability of fishing businesses whilst longer term criteria for transferability are developed.

vii) Transfer of licensed fishing boats

The majority of licensed fishing boats used in the Estuary General Fishery are small and are classified as "general purpose" boats. Boats in this category do not carry validated catch history and can be transferred separate to the other entitlements of the fishing business. In general, boats have been categorised as general purpose vessels where the fisher, rather than the boat, was considered to be the predominant unit of fishing effort.

On the other hand, boats that are categorised as "boat history" vessels cannot be transferred separate to the fishing business. The Licensing Branch can advise a fishing boat owner whether a boat has been classed as a boat history or general purpose vessel. Any transfer of a fishing boat licence must first be approved by the Director of 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 businesses to be nominated to a person. This was necessary due to fishing businesses being held in company or partnership names and because fishing licences can only be issued to natural persons. This issue is more relevant in the more capital intensive ocean fisheries. Only 6.4% of fishing businesses with endorsements in the Estuary General Fishery are held in company or partnership names, many of which are also endorsed in the larger boat based fisheries (NSW Fisheries Licensing Database – 6 April 2001).

Under the current nomination policy, if the owner of a fishing business is eligible for an endorsement in the Estuary General 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 his or her right to fish (under all endorsements) while the nomination is active.

ix) Time and area closures

The *Fisheries Management Act 1994* provides for the use of fishing closures in the Estuary General Fishery to, among other things:

- protect and conserve areas of key habitat;
- manage the amount of fishing effort in an estuary;
- to manage conflicts between stakeholders over the use of the resource and to ensure it is equitably shared; and

- minimise bycatch and the impacts of the fishery on threatened and protected species.

Fishing closures can be established on a seasonal, time, area, operator or gear specific basis. There are numerous fishing closures in place in NSW which limit commercial fishing in estuaries.

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 *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 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 purpose intended by their issuing and are often used to limit the extent of the permitted activity. The permits that are currently issued are outlined in Table B6.

Permits issued under section 37 are valid only insofar as 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) 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 may apply to continue to hold his/her fishing licence for up to one year from the next fishing licence renewal date, to work with the purchaser of the fishing business for training purposes (but the business must qualify as a RFO), subject to the entitlements of the fishing business, on the understanding that the licence is surrendered at the end of the one year period unless a further RFO is acquired which is not the original business.

Trainee's licence: Within six months of acquiring an RFO a new entrant may request that the RFO be placed into abeyance whilst they gain the skills working with an experienced fisher. This arrangement may apply for a period of up to two years. Fishing methods which the new entrant can use are restricted to the entitlements held by his or her fishing business. Areas which can be worked by the new entrant are limited to areas included in the purchased RFO and areas of historic operation of the experienced fisher.

Table B6. Permits issued in the Estuary General Fishery.

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 a legal framework for the possible development of more selective or passive fishing methods. Permits may be issued to facilitate industry in developing alternate fishing practices in line with the goals of the Estuary General Fishery management strategy.
Manning River prawn hauling	The permit provides for fishers to prawn haul mid stream as opposed to the traditional method, detailed in clause 30 of the Regulation, that requires prawn haul nets to be retrieved to the bank, often over sea grass beds. Permits have been issued to all estuary fishers with a prawning endorsement who have been identified as operating in the Manning River. The use of this method will be monitored by NSW Fisheries to decide whether a regulation amendment is required.
Clover leafing of prawn seine nets	Permits have been issued to a small number of fishers in past years to operate prawn seine nets in a manner known as clover leafing. This allows the net to be effectively operated in 2 estuaries that have areas of relatively deep water compared to other estuaries where prawn seine nets are used.
Glass eel harvesting	As no successful method of reproducing eels in captivity has been developed, permits to harvest limited quantities of glass eels (which would otherwise be prohibited size eels) are issued to provide stock for growing out in aquaculture production.
Harvest of eels from farm dams and impoundments	Permits are issued to a small number of eel endorsement holders to harvest eels from freshwater farm dams and impoundments.
Marking of fishing gear	Permits are issued to allow an alternate method of marking fish traps. The Regulation prescribes that fish traps must be attached to a floating buoy. This buoy identifies the fisher who is using the trap and the immediate location of the trap, however in estuaries where there is substantial boating traffic in the areas where these traps are set, these buoys may prove to be a hazard to other users of the estuary. Permits authorising the use of fish trap tags attached to the trap as opposed to floating buoys addresses this issue in Botany Bay and Port Jackson.
Sandon River fishing	A permit is issued to 1 commercial fisher to allow the fisher to operate nets in the Sandon River. There is a sunset clause on this permit and it may only be reissued to this fisher whilst he holds an endorsement in the Estuary General Fishery.
Prawn seine net in Smiths Lake	Permits have been issued to allow local fishers to use prawn seine nets in Smiths Lake where they are not currently permitted by Regulation. These permits are only issued to fishers holding a prawning endorsement.
Whitebait species net	Permits are issued to approximately 14 fishers enabling the use a hauling net with small (13mm) minimum mesh size to target whitebait. Managing the use of this gear type through permits rather than by Regulation provides a control on the overall number of fishers able to use the net. Strict conditions on the permit govern when and where permit holders can operate.
Pilchard, anchovy and bait net	Permits are issued to allow some fishers with the appropriate endorsement to use pilchard, anchovy and bait nets in parts of the Hawkesbury River and Pittwater.
Hauling lines	Permits are issued allowing the use of extended hailing lines in some estuaries. These are introduced to allow fishers to target fish that gather in deeper holes away from the shore in particular months of the year.
Use unlicensed crew	A permit has been issued to allow 1 endorsed fisher with disabilities to engage the assistance of another person without an endorsement, to assist in physical fishing operations. This has been necessary as otherwise there is no legal framework for unlicensed crew members in the Estuary General Fishery.

xii) Size limits and protected fish

Size limits apply to a number of key species taken in the estuary general commercial fishery. Size limits are designed to allow a sufficient proportion of the population to survive to maturity and thereby breed at a rate necessary to sustain the population in the long term. The size limits for fish are prescribed in the regulation and apply to both commercial and recreational fishers. Size limits that apply to species recorded as being taken in the Estuary General Fishery are listed in Table B7.

Table B7. Minimum legal sizes on species taken in the Estuary General Fishery.

SPECIES Common name	SIZE LIMIT Total length (cm)
Sea mullet	30
Luderick	25
Beam	25
Dusky flathead	36*
Sand whiting	27
Eels	30
Mud crab	8.5 (carapace length)
Blue swimmer crab	6 (carapace length)
Mulloway	45
Tailor	30
Tarwhine	20
Snapper	30**
Red morwong	25
Yellowtail kingfish	60
School shark	91
Tiger flathead	33
Teraglin	38

* increased from 33 cm on 1 July 2001
**increased from 28 cm on 1 July 2001

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
Eastern blue devil fish
Elegant wrasse
Estuary cod
Giant Queensland groper
Grey nurse shark
Herbst nurse shark
Black rock cod
Weedy sea dragon
Australian grayling
Eastern freshwater cod
Trout cod
Macquarie perch

Fish protected from commercial fishing include:

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

xiii) Catch limits or quotas

A daily bycatch limit applies to Australian salmon north of Barrenjoey Headland and tailor in all NSW waters taken by commercial fishing nets as follows:

Commercial fishing activity	Daily possession limit per species
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 General 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 Safe Food Production NSW. For the Estuary General Fishery the food safety program encompasses the already established biotoxin monitoring program for pipis. This program was established in 1998 in response to several food poisoning events traced to the consumption of pipis harvested from Ballina and Stockton beaches. Fishers operating under the biotoxin management plans are limited to operating on beaches that are regularly monitored for environmental conditions, algal concentrations and, when necessary, shellfish toxicity testing. Under the plans, harvesting ceases if the monitoring detects unacceptable concentrations of algae and only recommences after repeated tests show that it is safe to harvest.

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 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 General Fishery. The following is an outline of the cost recovery policy applying to catergory 2 share management fisheries and a summary of the fees that currently apply.

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 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

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.

Net registration

Net registration certificates are issued at local NSW Fisheries Offices. The fee for registration of a net is $21.

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.

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 Statemens (EIS). The EIS charge is payable annually commencing from 1 July 2001 for three years. 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.

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 support a number of research programs relating to the Estuary General Fishery in NSW. Further details on these programs can be found in the following section on research.

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.

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; or
- 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

Table B8 provides a brief description of the primary research programs being conducted at present by NSW Fisheries that relate to the Estuary General Fishery. This is not a comprehensive list of all research relevant to the fishery, as many other research groups and universities conduct programs that provide valuable information for use in fisheries management. Table B9 lists priority areas for research previously identified by the Estuary General MAC and NSW Fisheries.

Table B8. Research programs underway by NSW Fisheries relating to the Estuary General Fishery.

Funding	Project objectives
This project is funded by NSW Fisheries and is ongoing.	• Assess the size composition of estuarine and ocean commercial catches of yellowfin bream in NSW. • Derive an age composition of the commercially harvested bream stock in NSW. • Develop a conceptual model and a preliminary simulation model of the bream stock in NSW. •Assess catch and effort trends from available data.
This project is funded by NSW Fisheries and is due to be completed in December 2003.	• Assess the size composition of estuarine and ocean commercial catches of sand whiting in NSW. • Derive the age composition of commercially harvested sand whiting in NSW. • Develop a conceptual model of the sand whiting stock in NSW. • Assess catch and effort trends from available data.
This project is funded by NSW Fisheries and is due to be completed in December 2003.	•Assess the size composition of estuarine and ocean commercial catches of dusky flathead in NSW. • Derive the age composition of commercially harvested dusky flathead in NSW. • Develop a conceptual model of the dusky flathead stock in NSW. • Assess catch and effort trends from available data. • Determine the reproductive cycle and the size and age at first maturity of dusky flathead in NSW.
This project is funded by NSW Fisheries and is ongoing.	• To provide annual estimates of the size and age composition of sea mullet landings by the NSW estuary general and ocean hauling fisheries. • To complete annual analysis of catch and effort data from the NSW commercial sea mullet fisheries. • To incorporate the biological and fishery data available for sea mullet into a dynamic population model which can be used to determine the requirements for the sustainable utilisation of the resource.
This project is funded by NSW Fisheries and is due to complete in December 2003.	•To validate and document aging methods for sea mullet. • Describe growth patterns of male and female sea mullet within NSW waters. • To describe the spawning period and estimate fecundity for northern, central and southern NSW regions.
This collaborative project is jointly funded by NSW Fisheries, the Marine and Freshwater Research Institute – Victoria and the FRDC. The project is due to be completed in December 2001.	• To characterise migrations and assess stocks of glass eels in coastal catchments of southern Queensland, NSW, Victoria and Tasmania to enable evaluation of the potential of seedstock supply for Australian aquaculture. • Develop pond and tank culture technology for commercial Australian eel production, with an emphasis on the use of eastern drainage Australian glass eel seedstock. • To contribute to the development of eel aquaculture industry development plans and fisheries management plans through the provision of relevant information in the form of reports, publications, seminars, newsletters and workshops.

Table B8 (cont)

Funding	Project objectives
This project is jointly funded by NSW Fisheries, the FRDC and the University of Technology – Sydney. The project is due to be completed in December 2001.	• Conduct a literature review of fishery-dependent techniques for assessing adult anguillid eel stocks. •Compile all available survey data on longfinned eels in NSW to provide a quantitative summary of their distribution and relative abundance in coastal catchments. • Compile and cross-check all available historic catch and effort data for the commercial fishery on longfinned eels in NSW from all sources (monthly catch returns, permit logs, and export records) into a database of catch and effort information. • Describe the size, age, reproductive status and stock structure of the commercial catch of longfinned eels and their populations in representative fished and unfished catchments of NSW. • Assess the magnitude of the recreational fishery and the magnitude and cultural significance of the traditional fishery for freshwater eels in NSW. •Develop a preliminary fishery dependent model for stock assessment of longfinned eels which incorporates relevant catch, effort, recruitment and growth information. • Develop a strategy for monitoring the commercial fishery for longfinned eels and associated impacts related to glass eel harvest in the future. • Provide advice to fishery managers on the status of the stocks of longfinned eels in NSW, along with an assessment of the adequacy of existing management restrictions. • Provide advice to the Australia - New Zealand Eel Reference Group about the development and implementation of fishery dependent techniques for assessing other anguillid eel stocks of eastern Australia.
This project is jointly funded by NSW Fisheries and the FRDC and is due to be completed in 2001/2002.	• To identify and quantify the by-catch, discards and landed catches from prawn and fish hauling at a variety of locations throughout NSW using a stratified, randomised observer-based survey; these data will be used to determine key gears, methods, areas and times of discarding that will be addressed in Objective 2. •To develop, test and implement modifications to current hauling gears and fishing practices that will decrease the identified problematic discards.
This project is jointly funded by NSW Fisheries and the FRDC and is due to be completed in February 2002.	•Identify and quantify the rates of retained and discarded catches from the different types of gill nets used in the NSW estuarine commercial finfish fishery. • Determine the selectivities of the gill nets currently used by commercial fishers.

Table B9. Priority areas for research previously identified by the Estuary General MAC and NSW Fisheries.

Research Area
Provide robust biomass estimates of the key species taken by commercial fishers in the NSW estuary general fishery
Determine the impacts and ways to reduce agents of degradation of estuarine habitats like: flood mitigation; invasive species like Caulerpa; blue green algae; reduced oxygen levels during flood events
Independent assessment of the economic value of the NSW commercial fishing industry and undertake extension and promotion activities to increase the public awareness of commercial fishing (including its value) and the results of relevant research to reduce conflict
Evaluate the performance indicators and trigger points in the Estuary General Fishery Management Strategy in order to develop more robust and appropriate indicators that are sensitive to the goals and objectives of the strategy
Investigate the effects of estuarine recreational fishing areas on stocks of key recreational and commercially targeted species of fish & shellfish
Investigate strategies to enhance product and add value to the estuary general fishery
Conduct stock assessment and biological studies on blue swimmer and mud crabs in NSW
Observer program to monitor discarded and retained catches across all net and trap methods (not hand gathering)
Stock assessments of all important species in the EG fishery
Develop fishery independent surveys to complement fishery dependent stock assessment studies & to assess populations between estuaries open and closed to different fishing regimes (including recreational only)
Studies of estuarine ecosystem relationships and functions

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 fish stocks.

Fishers in the Estuary General 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

There is a high level of compliance by fishers in the Estuary General Fishery. During the period from 1 July 1999 to 30 June 2000, 3885 inspections of estuary general fishers or fishing gear were conducted, with a 92% rate of compliance.

NSW Fisheries has approximately 90 fisheries officers responsible for coordinating and implementing compliance strategies in NSW. These strategies include:

- maximising voluntary compliance;
- providing effective deterrence for offences; and
- providing effective support services.

Approximately 65 of these fisheries officers are located in areas along the NSW coast where the Estuary General Fishery occurs. Their general duties include conducting patrols, inspecting commercial fishers and fishing gear, and recording rates of compliance.

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 developed by fisheries agencies throughout Australia in 1999, 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 important 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 General 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 Act and Regulation also provide a number of offences relating to fishing activities that encompass the methods used, and species taken in the Estuary General Fishery. These offences and the maximum penalties are summarised in Table B10. The table is not a comprehensive list of offences under the Act or its regulations, but highlights the offences that are most relevant in the Estuary General Fishery.

The *Fisheries Management (General) Regulation 1995* 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 a forfeiture offence.

Forfeiture offences include:

- Offences under the *Fisheries Management Act 1994*

  Section 8 Waters closed to fishing

  Section 17 Bag limits – taking of fish – (recreational fishers)

  Section 18 Bag limits – possession of fish – (recreational fishers)

  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 B10. Current offences and penalties under the *Fisheries Management Act 1994* specifically relevant to the Estuary General Fishery.

Please note that these offences and penalties are the current offences and penalties under the *Fisheries Management Act 1994* and its Regulation (as at April 2001), and apply to both commercial and recreational fishers.

Section	Short title	Maximum penalty
14(1)	Take fish contrary to fishing closure	$22,000 and/or 6 months imprisonment
14(2)	Possess fish taken contrary to fishing closure	$11,000 and/or 3 months imprisonment
16(1)	Possess prohibited size fish	$11,000 and/or 3 months imprisonment
16(2)	Sell prohibited size fish	$11,000 and/or 3 months imprisonment
19(2)	Take protected fish	$11,000 and/or 3 months imprisonment
19(3)	Possess protected fish	$11,000 and/or 3 months imprisonment
20(2)	Take commercially protected fish for sale	$11,000 and/or 3 months imprisonment
20(3)	Sell commercially protected fish	$11,000 and/or 3 months imprisonment
22(2)	Use unregistered fishing gear	$2,750
24(1)	Unlawful use of net or trap	$22,000 and/or 6 months imprisonment
25(1)	Possess fishing gear in / on / adjacent to closed waters when use of that gear or taking of fish is prohibited.	$22,000 and/or 6 months imprisonment
35(1)	Possess fish illegally taken	$11,000 and/or 3 months imprisonment
102(1)	Take fish for sale when unlicensed	$11,000
104(7)	Contravene condition of a commercial fishing licence	$11,000
107(1)	Use unlicensed boat to take fish / land fish for sale	$11,000
108(7)	Contravene condition of boat licence	$11,000
110(9)	Carry unregistered crew	$5,500
121	Fail to make catch record	$22,000
122	Fail to send catch record to Director	$1,100
219(1)	Obstruct fish in bay / inlet / river / creek / flat	$11,000
247(1)	Resist or obstruct a fisheries officer	$22,000 and/or 6 months imprisonment
248(4)	Fail to assist in boarding and search of boat	$5,500
249(3)	Fail to comply with requirement to remove gear from water	$5,500
256(4)	Fail to comply with requirement to produce records or answer questions	$5,500
257(4)	Fail to comply with requirement to produce authority	$2,750

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.

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; and
- any other matter relating to the fishery.

Table B11 details the membership on the Estuary General MAC. The industry members of the MAC comprise representatives that are elected by endorsement holders in the fishery. There is an industry representative from each of the seven coastal regions in the fishery, although there are two representatives from region 4, to assist in addressing the diversity of issues that occur in that region. 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 three years The MAC is chaired by an independent chairperson to ensure that all issues discussed by the committee are fairly represented.

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 B11. Membership on the Estuary General MAC.

Position	Northern boundary	Southern boundary
Independent chairperson	-	-
Region 1 – Upper north coast	NSW / Queensland border	29°15'S
Jerusalem Creek – south of Evans Head in the Bundjalung National Park		
Region 2 – Clarence	29°15'S	29°45'S
Sandon River – south of Yamba in the Yuragir National Park		
Region 3 – North coast	29°45'S	31°44'S
Diamond Head – south of Camden Haven in Crowdy Bay National Park		
Region 4 – Central	31°44'S	33°25'S
Wamberal Point – the entrance to Wamberal Lagoon north of Terrigal		
Region 4 – (additional rep*)	(see note below this table)	
Region 5 – Metropolitan	33°25'S	34°20'S
Bulli Point at Bulli		
Region 6 – Upper south coast	34°20'S	35°25S
Lagoon Head, Burrill Lake south of Ulladulla		
Region 7 – Lower south coast	35°25S	NSW / Victorian border
Recreational fishing	All areas	
Indigenous fishing	All areas	
Conservation	All areas	
NSW Fisheries	All areas	

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
- Advisory Council on Recreational Fishing
- Advisory Council on Fisheries Conservation
- Advisory Council on Aquaculture

The Estuary General Fishery and each of the other major share management and restricted fisheries have representatives on the Advisory Council for Commercial Fishing. 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 Advisory Council on Fisheries Conservation.

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 General 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 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 Statement 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 Ministerial Advisory Council on Commercial Fishing are consultative bodies that facilitate cross-sectoral and cross-fishery consultation, respectively.

6. Interaction With Other Fisheries and the Environment

a) Dealing with the relationships between fisheries

The fisheries of NSW are intrinsically complex due to the large diversity of species occurring and the wide range of areas fished and gear types used. Many species taken in the Estuary General Fishery are also taken in other commercial fisheries, by other sector groups such as recreational and charter boat fisheries, and by fisheries managed under the jurisdiction of the Commonwealth or other States. Indeed, over 50% of the total commercial harvest (including aquaculture) from NSW waters is comprised of species that are estuarine dependent (Pollard, 1976: In Pease, 1999).

To avoid over-exploitation of fish stocks targeted by the Estuary General Fishery, it is necessary to consider all potential sources of mortality. For this reason, fisheries science aims to develop stock assessments for individual species rather than just fishery based assessments. Studies on the ecological effects of fisheries are also underway to ensure that the Government's responsibilities to conserve biodiversity and ecological processes are met.

Results from stock assessment studies provide the information needed to put in place appropriate controls on the capture of particular species. Some of these controls, such as minimum legal lengths, apply to more than one user group.

As discussed in the preceding section, the *Fisheries Management Act 1994* establishes a system of advisory councils who advise the Minister for Fisheries on issues that cross fishery management arrangements. It is through the advice of these councils (eg. the Advisory Council on Commercial Fishing) that the Department can appropriately manage among fisheries. The same sorts of structures do not always exist where management issues cross jurisdictions (e.g. across state borders).

b) Fishery interactions

i) Commercial fisheries

Of the 750 fishers actively participating in the Estuary General Fishery during 1998/1999, 52% also participated in other NSW commercial fisheries. When they did so, the other fisheries involved were mainly the ocean trap and line, ocean hauling and estuary prawn trawl fishery. The number of estuary general fishers who participated in multiple fisheries is as follows:

- 48% participated in the Estuary General Fishery only
- 34% participated in two fisheries
- 14% participated in three fisheries
- 4% participated in four fisheries

Although there is some conflict between commercial fishing sectors in NSW, the interaction of fishers participating in more than one fishery possibly reduces the level of conflict that may be expected if each fisher participated in one fishery only. The diverse nature of commercial fishers in NSW means that most fishers have an understanding of the issues affecting each other and the industry as a whole.

Ocean trap and line fishery

Approximately 21% of fishers operating in the Estuary General Fishery also fished in the ocean trap and line fishery during 1998/99. Estuary fishers who have used fish traps in estuary waters often also set some traps in ocean waters around the headlands of estuaries.

Ocean hauling fishery

Approximately 19% of fishers operating in the Estuary General Fishery also fished in the ocean hauling fishery during 1998/99. This trend is related to the annual migration of species such as sea mullet out of estuarine waters during the autumn and winter period and along the ocean water beaches where the ocean hauling fishery operates. The beach based sector of the ocean hauling fishery uses similar gear and boats to the Estuary General Fishery. Indeed, 78% of fishing businesses with entitlements in the ocean hauling fishery also hold entitlements in the Estuary General Fishery (NSW Fisheries licensing database).

There are management rules in the ocean hauling fishery that impact on fishing activities in this fishery. In 1995, a restrictive zoning scheme was introduced into the ocean hauling fishery preventing fishers from travelling beyond a single ocean hauling region. Ocean haulers who are also endorsed in the Estuary General Fishery are not authorised to catch mullet in estuaries beyond their ocean hauling region during the March to July spawning period each year.

This regime is in place to prevent dual endorsed fishers undermining the ocean hauling zoning scheme by travelling to catch schools of mullet that congregate in the mouths of estuaries before moving into ocean waters. The regime, which is implemented as a condition on all ocean hauling endorsements, will become less relevant as zoning is progressively introduced in the Estuary General Fishery (see section 6(i)(xiii) in Chapter C).

The Estuary General Fishery operates on a number of ocean beaches for the purpose of handgathering. As the name suggests, the method of handgathering involves limited hand operated gear to gather relatively small species such as pipis and beachworms. There is very little interaction between the ocean hauling and estuary general fishers over this common use of ocean beach areas for commercial fishing.

Estuary prawn trawl fishery

The estuary prawn trawl fishery currently operates in five estuaries that are also used in the Estuary General Fishery. These estuaries include the Clarence, Hunter and Hawkesbury Rivers, Port Jackson and Botany Bay (although Botany Bay will become a Recreational Fishing Area in May 2002). The operation of the estuary prawn trawl fishery in these estuaries is limited through restrictions on areas and times that the boats (trawlers) may operate within.

Prawn trawlers operate in the same areas and often at the same times as the Estuary General Fishery. While there is potential for competition between these methods, estuary general fishers are generally aware of the main trawling grounds and tend not to compete over the areas during these times.

Approximately 15% of fishers operating in the Estuary General Fishery also fished in the estuary prawn trawl fishery during 1998/99. Estuary prawn trawl operators who are also appropriately endorsed in the Estuary General Fishery can use estuary general methods, such as handlines and mesh nets from their trawling vessels.

ii) Recreational fishery

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 to resolve long standing conflict issues.

The Government has recently initiated a program that will provide a mechanism for introducing more equity between recreational and commercial fishers. Under the program, revenue from the new general recreational fishing fee is being used to create recreational fishing areas, and fair compensation will be paid to commercial fishers in exchange for their fishing entitlements.

To obtain more reliable estimates relating to non-commercial fishing patterns and levels of harvest, a National Recreational and Indigenous Fishing Survey was conducted in 2000 and 2001. Preliminary data provided from the survey in October 2001 shows a strong interaction between recreational fishing and the Estuary General Fishery and indicates that approximately 16% of the NSW population (approx. 1 million people) go recreational fishing at least once a year.

With recreational fishing in estuaries being safe and convenient for a large number of people, the major proportion of recreational fishing effort is exerted in estuaries. Almost 40% of recreational fishing occurs in estuaries as opposed to 30% in ocean waters and 14% in freshwater rivers and streams. These preliminary figures appear to be consistent with the levels of catch (by numbers) with 42% of total recreational catch coming from estuaries, 37% from ocean waters and 8% from freshwater rivers and streams.

The national survey plans to translate these number and percentage figures into estimated catch weights during the later part of 2001 and early 2002.

The preliminary figures also indicate that the main species of finfish taken by recreational fishers are bream, flathead, whiting, luderick and tailor. Prawns and blue swimmer crabs are also taken in substantial numbers by recreational fishers. All of these species with the exception of tailor, are listed as either primary or key secondary species in this management strategy.

Other interactions with recreational fishing in estuaries include captures of target recreational species in commercial fishing gear as bycatch.. This is a concern especially in the case of Australian bass, a highly regarded recreational fishing species that migrates from freshwater into the upper reaches of estuaries during certain times of the year to spawn. Many fishing closures are in place in the Estuary General Fishery specifically to prevent captures of Australian bass in meshing nets.

iii) Aquaculture

The aquaculture industry in NSW is currently dominated by oyster farming, 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 $14 million/year).

There are few direct interactions between aquaculture operations and the Estuary General Fishery. Competition in the marketplace and competition for space within the estuary are the two main interactions.

Oyster farming

Oyster cultivation occurs in many estuaries in NSW and can interact with estuary general fishing by occupying areas within estuaries. In March 2001, there were a total of 3253 oyster leases in

NSW located in 32 estuaries along the coast. The leases covered an area of around 4300 hectares. Current initiatives underway by the NSW Government will see a constriction of areas under oyster lease. A program is underway to clean up derelict oyster lease areas in Port Stephens and the Georges River.

Whilst oyster leases do not confer exclusive use of areas by the oyster farmer, commercial fishing practices may be significantly restricted. For example, the use of hauling or meshing nets in areas under oyster leases would pose difficulties to commercial fishers. This interaction is not new though, as oyster culture has been a component of the NSW estuarine environment since the late 1800s. Commercial fishing and oyster farming in NSW have operated in relative harmony.

Apart from potential visual and navigational impacts, oyster racks, sticks, trays and rafts may have several effects on estuarine habitat, both positive and negative. Structures used for oyster cultivation act as fish aggregating devices (FADs) by providing cover and food. Many estuarine fish species are known to utilise this habitat. It is thought that estuarine productivity may be enhanced due to this increased habitat.

Oyster leases may affect the flow patterns within estuaries, leading to increased siltation. However, the placement of oyster leases is usually confined to intertidal margins where deposition rates are naturally high (due to low flow velocities). Siltation and other potential interactions of oyster leases (eg. reduction in turbidity, effects on nutrient levels, and interaction with the rest of the food chain) with the estuary has not been fully evaluated in any scientific study to date.

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 adjacent to either the Clarence or Richmond River. The total production of prawns in aquaculture is comparable to the wild catch taken in the Estuary General Fishery each year.

Black tiger prawn (*Penaeus monodon*) are used as broodstock in aquaculture, and 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.

Most prawn farms in NSW discharge effluent into adjacent estuaries. The discharge of effluent is strictly regulated by the Environment Protection Authority (EPA). 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 land based aquaculture enterprises in 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.

Eels

Eel aquaculture is a relatively new industry in NSW and has grown in recent years due to the high prices received from exports to China and Europe. No one in Australia has successfully bred eels in captivity. This means that the supply of product for aquaculture must be drawn from the natural stock.

Aquaculturalists rely on supplies of glass eels (juvenile eels that are not fully pigmented) harvested from estuaries to stock their facilities and grow them to marketable size. NSW Fisheries gives commercial fishers and aquaculturists the opportunity to apply for permits each year to catch a predetermined quantity of glass eels to supply the aquaculture facilities. This is done via a formal tender process.

The interaction between eel aquaculture and the Estuary General Fishery centres around the fact that both sectors rely on the same natural stock of eels. This has been a source of contention in the past and the Estuary General MAC has made clear its opposition to the collection of glass eels. The MAC is concerned that the harvest of glass eels from the wild may affect recruitment of eels into the estuary general eel fishery. Since 2000, the collection of eels for aquaculture has been prohibited in the Clarence and Hawkesbury Rivers and Port Stephens, which are in the three major commercial eel harvesting catchments in NSW.

c) Species interactions

A number of the species taken in the Estuary General Fishery are of significant importance in other commercial and recreational fisheries. Species such as sea mullet and school prawns constitute a large percentage of the catch in other commercial fisheries. The 'ten most prominent species' descriptions in Appendix B1 detail the level of catch of these species in other commercial fisheries in NSW.

The Estuary General Fishery targets prawns, specifically school prawns that are also targeted by the estuary prawn trawl fishery and ocean prawn trawl fisheries, which operate in the same or adjacent waters.

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. Snapper is one example of this interaction, with large populations of snapper residing in estuaries as juveniles, being taken as adults in small numbers by estuary general fishers, and forming the basis of a significant commercial and recreational fishery around inshore and offshore rocky reefs in ocean waters.

The Estuary General Fishery also harvests a number of 'bait' species such as anchovy and pilchard that may form part of the food source of species taken in other commercial fisheries.

There is no overlap of species taken in this fishery with the abalone and lobster share management fisheries. Abalone and lobsters are only permitted to be taken commercially by fishers endorsed in those fisheries. The lobster fishery does however, use a number of fish species as bait in inshore lobster traps. These fish baits are usually fresh, frozen or salted, and may compromise whole or part fish. Mullet and luderick are the most commonly used baits in the lobster fishery and it is likely that most of these fish are supplied by the estuary general and ocean haul fisheries, with a small proportion being imported from other states.

d) Ecosystem and habitat management

This section provides only a brief overview of the description of estuarine and beach habitats and their ecological importance, as well as NSW coastal climatic patterns. A comprehensive review of the habitat types important for the long term sustainability of the Estuary General Fishery is included in section F1 of this EIS.

i) Estuarine habitats

Estuaries are partially enclosed bodies of water connected to the ocean. They are characterised by brackish water derived from the mixing of oceanic and fresh waters. Estuaries along the NSW coast are generally complex systems compromising a number of interrelated habitats, including saltmarshes, mangroves, seagrasses, reedbeds, shallow sand and mud flats, rocky shores and reefs, and deeper zones of fine sediments (NSW Fisheries, 1999b).

The composition of estuarine habitats varies according to physical, biological and anthropogenic factors. Some habitats may show large variability in space and time and other habitats may be either relatively stable or particularly vulnerable (NSW Fisheries, 1999b)

Many of the State's estuaries have become a focus for recreation and urban development, with 60% of Australia's population living in cities and towns located on estuaries (Yapp, 1986; Fairweather, 1990). Some of the larger estuaries near major urban areas (eg. Hunter River, Sydney Harbour and Botany Bay) also support large amounts of shipping, along with associated port facilities and industry.

Estuaries are attractive to a wide range of user-groups for reasons primarily relating to shelter, accessibility and scenery.

The complex mixture of activities affecting many estuaries leads to a multitude of user-conflicts and environmental issues. For example, port operations may impact on recreational boating, scenic values and foreshore access, whilst also posing a risk of a major pollution incident such as an oil spill. Also, residential development and land clearing within the catchment lead to increased volumes of stormwater runoff (and associated pollutants) entering an estuary; not only affecting water quality and aquatic habitats, but also many of the values that would have made the estuary attractive to nearby residents in the first place.

ii) 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; Pease *et al*., 1981a, 1981b and 1981c; 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 (Pease *et al.,* 1981c).

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 she-oak 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.

iii) Ocean beach habitats

The eastern Australian coastline is comprised of long barrier type beaches interrupted by rocky headlands and estuaries. The habitat profile is fairly consistent for all ocean beaches. These beaches are formed from marine sands and are dynamic in their structure; prevailing winds, currents and climatic events are constantly sculpturing their profile.

Common benthic inhabitants of beaches are beachworms, pipis, crabs and numerous isopods and amphipods. The structure of an ocean beach ranges from extensive sandflats, deep gutters to offshore sand bars. Inhabitants of these areas rely on sand erosion caused by waves to uncover their food source. Marine vegetation along the majority of these beaches is virtually non-existent.

The majority of fish found on ocean sea beaches with the exception of mullet are jointly targeted by both the commercial and recreational sectors. Tailor, Australian salmon whiting, mulloway and yellowfin bream are all commonly caught on ocean beaches. Unfortunately there is very little scientific data concerning the ecology of fish in these habitats (West, 1993).

iv) 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.

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 or cooler in summer and winter respectively. 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 General 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 (Max-Planck-Institut fur Meteorologie; www.ipcc.ch and United Nations Environmental Programme World Meteorological Organisation; www.gcrio.org). 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 southeast 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 (www.gcrio.org). 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 (www.gcrio.org). 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 Chapter F section 10(b)(iv)).

v) Habitat management

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

Proper management of land-based catchment activities is essential to the long term survival of fish habitat and fish stocks.

The *Fisheries Management Act 1994* provides for the protection of fish habitats. These provisions can be found in Part 7 of the Act. The primary habitat related provisions of the Act are:

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

Aquatic reserves – which allow for the creation and management of aquatic reserves (see section 6d(vi) of this chapter).

Dredging and reclamation – which allows for the control and regulation of dredging and reclamation activities which may be harmful to fish and fish 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 fish and noxious marine vegetation – which allows for the declaration of undesirable fish and marine vegetation as noxious. Once declared noxious these fish or vegetation may be liable to be seized and destroyed.

Release or importation of fish – which allows for the control of the release, import, sale or possession of fish 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 fish into, or release fish in, NSW waters.

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.

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 fish or fish habitat are referred to NSW Fisheries for comment or recommendations.

In 1999, NSW Fisheries published an updated version of *Policy and Guidelines for Aquatic Habitat Management and Fish Conservation*. This 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 is 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:

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

vi) Marine protected areas

NSW is committed under international, national and state agreements to conserve marine biodiversity and manage the ecologically sustainable use of fish 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. They allow areas for fish to breed 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. It is important to note that some marine protected areas allow for a range of activities to occur. The activities permitted depend on the particular area and may include the collection of bait, harvesting of lobsters or abalone by hand and recreational angling.

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, fish 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. 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 and estuarine 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 are 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 (IPAs)

Intertidal protected areas were created at 14 locations around Sydney in July 1993. They extend from the mean high water mark 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 invertebrates (except crayfsih and abalone) from within those areas. These invertebrates include crabs, gastropods, 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 act as reservoirs to assist in re-populating other areas. Recreational and commercial fishing is permitted within IPAs, however bait must not be gathered from within the designated areas.

Marine or estuarine extensions 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.

e) Stakeholders

There are a significant number of stakeholders in the Estuary General Fishery. This is due to the substantial number of commercial fishers involved, the large physical area covered by the fishery, the number of species taken, and the fact that it operates in estuary waters and ocean beaches which are accessible and visible.

i) Commercial fishers

The primary stakeholders in the Estuary General Fishery are the 944 fishing business owners who are entitled to operate in the fishery. 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. A well-managed sustainable fishery will provide ongoing financial benefits to commercial fishers, their families and the community well into the future.

Commercial estuary fishers provide an important service to that part of the community who enjoy eating seafood but are either unable or unwilling to venture out and catch fish themselves. Seafood provided by estuary general fishers is often fresh because it is landed daily and the fishing activity is generally carried out close to population centres. The fishery also harvests a number of species which are generally more affordable than some premium priced seafood products targeted in some of the other fisheries.

Estuary general fishers also supply significant quantities of bait, including species such as prawns, mullet and pipis, which are bought and used by recreational fishers.

ii) Recreational fishers

Recreational fishing in estuaries is a popular pastime and a large number of anglers use the same estuarine areas used by estuary general fishers. This inevitably results in some conflict and competition over the fishing resources and areas within estuaries.

Preliminary data from the National Recreational and Indigenous Fishing Survey conducted in 2000 and 2001 indicated that approximately 16% of the NSW population (approximately 1 million people) go recreational fishing at least once a year. This preliminary data also suggests that approximately 40% of these people fish in estuarine waters. Other studies conducted on recreational fishing activities in specific areas have concluded that the recreational catch of some species is equivalent to, or may exceed, the commercial catch (see West and Gordon, 1994).

Recreational fishers target many of the same species as fishers in the Estuary General Fishery. The national survey preliminary results indicate the key species targeted by recreational fishers are species that are also considered as primary or key secondary estuary general species.

A number of recreational fishers use bait, in particular school prawns and beachworms that are harvested in the Estuary General Fishery. A large number of recreational fishers are also consumers of seafood harvested in the Estuary General Fishery.

As stakeholders in the Estuary General Fishery, the recreational fishing sector is represented on the key advisory body to the Government with respect to this fishery, the Estuary General MAC. The recreational representative on each commercial fishery MAC has full voting power and equal participation to the commercial fishing, conservation and Indigenous representatives.

Further discussion relating to recreational fishing appears earlier in section 6B(ii).

iii) Indigenous people

Indigenous people are also stakeholders in the Estuary General Fishery. There are Aboriginal people who are directly involved in the fishery as commercial fishers. There are Indigenous people who have traditionally caught and continue to catch primary fish species in this fishery and/or the recreational fishery for consumption, trade or barter within their communities. There are also Indigenous people who have lodged native title claims seeking exclusive use over estuarine areas where commercial fishing currently takes place.

It is important for NSW Fisheries to work with Aboriginal people to take a collaborative approach to fisheries management. 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 peoples 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 *Fisheries Management Act 1994* that authorises Aboriginal people to meet specific cultural obligations with respect to traditional fishing.

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

iv) Conservationists

Conservation groups and individuals have a significant stakeholding in the resource harvested by the Estuary General Fishery through their interest in ensuring the conservation and protection of natural resources and ecological systems.

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 General MAC with full voting privileges.

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 conservation interest in the Estuary General Fishery may extend from concerns over threatened species, bycatch and the impact of the gear used on habitat, to simply knowing that the fishery is being managed in a manner that will ensure the conservation of marine resources for future generations. Conservationists place a significant value on non-consumptive uses of the resource.

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

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. Another community group recognised as stakeholders in the fishery are 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 fresh 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 located at Ballina, Bermagui, Brunswick-Byron, Clarence River, Coffs Harbour, Crowdy Head, Evans Head, Hastings River, Hawkesbury River, Laurieton, Macleay River, Mannering Park, Newcastle, Taree, Twofold bay, Ulladulla, Wallis Lake, Wollongong and Wooli.

The co-operative system is an important way for fishers to distribute and sell their catch taken in the fishery, and 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) Markets

The *Fisheries Management Act 1994* places restrictions on the sale of fish. Fish taken by a commercial fisher when using a commercial fishing boat or commercial fishing gear are deemed by the 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 the catch to a Certificate of Exemption (COE) holder, or direct to the public if the fisher held a consent under the Act. Consents were issued to fishers who were able to show they resided beyond a certain distance from a recognised market, or that the market did not cater for their product (eg. 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. Co-operatives and COE holders were granted Registered Fish Receiver (RFR) certificates while consent holders were granted Restricted Registered Fish Receiver (RRFR) certificates.

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 success of the new deregulated regime.

The Estuary General Fishery harvests a number of species that are exported either whole or after processing. Accurate figures on the level of exports taken in this fishery are not currently available, however, the financial return on the export of eels and sea mullet roe is known to be significantly greater than the prices achieved on domestic markets.

f) Hazard issues

There are a number of hazard issues affecting the use of ports or locations where estuary general fishers operate. There are two broad categories of hazard, those that are external to commercial fishing and those that relate to commercial fishing.

Hazard issues external to commercial fishing include the position of jetties, pontoons, moorings, snags, submerged logs, bridges, non-lit navigational markers, waterway craft such as ferries and barges, and ferry wires. Other hazards may include fast running water currents in some areas and turbulent waters around entrances to estuaries, including near breakwalls and sand bars.

Hazard issues related to commercial fishing include the times and locations that fishers set their fishing gear. For instance, poor lighting at night increases the risk of boating accidents including possible collisions with other watercraft or objects. Similarly, water currents and submerged hazards can result in fishing gear becoming entangled and may increase the risk of injury to the fisher operating the gear.

Boats used in this fishery often contain heavy equipment such as large amounts of net, traps, or moving parts such as winches and small derricks. There is the potential of injury to fishers while operating these equipment types, or generally moving about on the relatively small boats in which they are located.

7. Outcomes of Review

The purpose of this section is to summarise the review of the current operation of the Estuary General Fishery into the key issues that need to be addressed in the FMS. A description of each of those issues appears below in the context of how the fishery currently operates. An outline of the changes to the fishery that are proposed by this draft FMS to address each issue can be found in section 3 of Chapter C.

a) Ensuring stock sustainability

It is important that the fishery operates at a level where the harvesting of fish is conducted in a manner that minimises the risk of overfishing the stocks. The Estuary General Fishery as a whole has maintained very stable catch rates over a long period. The biology of most of the principal species captured reflects a fishery based on fish that are generally fast growing, highly fecund and with variable growth rates. The stocks of the main species are therefore less vulnerable to recruitment overfishing than the target species in many other fisheries.

Although there are a number of natural buffers to overfishing the principal species in this fishery, excess fishing pressure can have the effect of reducing stock levels to a point below optimum levels. As the Estuary General Fishery is managed by input controls, the key issue with respect to controlling the level of harvest is controlling the amount of fishing pressure (or fishing effort) that is applied to the stock.

The current levels of effort applied by this fishery to the stocks of most of the principal species is not considered to be excessive. However, there are a large number of fishing businesses that hold entitlements in the fishery that operate either at a fairly low level of participation or do not participate at all. As presented in earlier in this chapter, only a relatively small number of estuary general fishers take the majority of the revenue from the fishery, with 90% of the revenue being taken by only 50% of the fishers. NSW Fisheries catch statistics and licensing databases also show that approximately 30% of fishing businesses endorsed to operate in the fishery did not actively fish during 1999/2000. This demonstrates that there is a sizeable component of latent (unused or seldom used) effort in the fishery.

The fact that dormant entitlements are not currently being utilised is not a problem while it remains that way, but there is a potential risk to the environment because there are presently few controls preventing the re-activation or expansion of their use.

If for whatever reason the latent effort became activated, there would be a significant increase in pressure placed on the stocks, consequently jeopardising the sustainability of the fishery.

Silver trevally is one species harvested in the Estuary General Fishery that has been determined as being growth overfished[2]. Silver trevally is primarily taken in the NSW ocean fish trawl fishery, but is also taken in much smaller quantities in the ocean trap and line, ocean hauling and estuary general fisheries. The commonwealth managed south east trawl fishery which operates in waters adjacent to NSW, also takes a significant quantity of silver trevally. The significant recreational catch of silver trevally is also recognised. Presently, there is no defined course of action prescribed to address the silver trevally growth overfishing problem.

To effectively manage the recovery of any overfished species, there needs to be a mechanism to allow for recovery plans to be developed in consultation with all relevant harvesting groups. This

[2] 'Growth overfishing' occurs when fishing activities lead to a reduction in the size of the individuals of a species, as a consequence of which few specimens grow to the size for optimum yield.

recovery plan must be conducted at the species level, rather than through a fragmented approach at the individual fishery level.

b) Reducing bycatch

As evidenced by the preceding discussion in this chapter, there is a wide range of fishing gear types that may be used in this fishery, with the specifications for use often varying between estuaries. Whilst some of the gear types are very selective towards the species they catch (such as eel traps or handgathering), others are relatively non-selective (such as fish hauling nets). Although most of the landed species in the fishery are marketable and therefore retained, there are a number of species that are not retained either because they are not saleable, or there are regulations preventing them from being retained.

Bycatch in fisheries has been acknowledged as a problem by agencies throughout Australia, and this is evident by the development of the 1999 National Policy on Fisheries Bycatch, which was an expression of concern by all fisheries ministers. Both state and federal environmental assessment processes for fisheries require that the issue of bycatch be addressed in proposals for future management.

There are significant quantities of non-retained catch in some estuary general gear types, especially some hauling and seine nets (and in some cases these are measured). Research programs have been completed and new ones are underway to see how gear can be modified to reduce the level of bycatch. Commercial fishers have shown strong support and are actively participating in this research.

With the diverse nature of the Estuary General Fishery, there are still levels of uncertainty about bycatch associated with some of the fishing methods used, and about the impacts of bycatch on the broader ecosystem. To properly address the issue, fishing should be undertaken in a way to reduce bycatch as far as possible and further data is required to quantify the level of bycatch from fishing methods and its overall impact on the ecosystem.

c) Protecting key fish habitat

The Estuary General Fishery operates in over 100 estuaries along the NSW coast. While it is recognised that the environmental quality and value of these estuaries varies considerably, many of them provide a range of important habitats for fish and crustaceans. Habitat types like saltmarsh, seagrass and mangroves are vital for the long term survival of many fish species, including most of the species landed in the Estuary General Fishery. They provide shelter for juvenile fish and provide habitat for many small organisms that serve as a valuable food source for fish species.

Bare substrata such as sand and mud also play a valuable role in estuarine ecological processes as they are inhabited by species such as sand whiting and are often used as foraging sites by some species that spend the majority of the time in seagrass beds.

There are many fishing and non-fishing activities in estuaries that have the potential to adversely impact on key fish habitats, including the use of gear types that move across the substratum.

The Estuary General Fishery uses a range of fishing gear types, some of which are passive, while others are actively pulled through the water and across the bottom of estuaries to catch fish. As general purpose hauling nets are drawn across the bottom of estuaries, they have the potential to affect seagrass habitats and surrounding fish communities. Worldwide reviews of the impact of active fishing gear which physically disturbs the sea floor through direct net contact show that impact occurs

on both the substrate and the associated plant and animal communities (Hall, 1999; Kaiser & de Groot, 2000)[3].

A research study was conducted during 1996 and 1997 on the physical effects of hauling on *Zostera* seagrass beds in NSW estuaries (Otway & Macbeth, 1999). The study found that hauling nets generally had minimal impacts on the physical seagrass bed structure, with some hauled sites showing a reduction in leaf length but a corresponding increase in shoot and leaf densities. In terms of their habitat values, the overall effects of this possible change to seagrass beds are not known.

It is important to acknowledge that hauling is not the only activity that can impact on seagrass habitats and the associated aquatic communities. General boating and recreational fishing activities can also damage seagrass through physical contact with boats, propellers, anchor ropes and chains. Natural events such as storms can also modify seagrass systems when sand covers or is swept away from seagrass beds. Some bird species such as black swans are also known to disturb seagrass while feeding in coastal rivers and lagoons.

The numerous fishing closures that currently limit estuary general fishing to specific estuaries or parts of estuaries already provide some level of protection for fish habitats.

Although this draft FMS cannot directly control the impacts of other activities on key habitats, promoting habitat conservation or rehabilitation are important initiatives.

d) Conserving threatened species, populations and ecological communities

Activities that impact on species, populations or ecological communities that are listed as being threatened must, under several pieces of state and federal legislation, be modified or phased out so as to mitigate those impacts. Protected animals must also receive a higher conservation status. This includes threatened mammals, birds, and reptiles, as well as fish species, and could include habitats that are critical to the survival of such animals.

While there are no firm data, it is thought that the impact of the Estuary General Fishery on threatened species, populations and ecological communities is small. Nevertheless, 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.

e) Promoting ecosystem management

The United Nations convention on biological diversity held in Malawi (Africa) in 1998 discussed the use of an ecosystem approach to managing biodiversity at a broad environmental level. The convention considered a number of aspects of ecosystem management, including humans as being an integral component of ecosystems. This is one aspect of ecosystem management that is specifically relevant to marine ecosystems.

The convention considered that because sectoral interests such as agriculture, environment, forestry, fisheries and planning are rarely managed in an integrated or coordinated way, an ecosystem approach should be used *inter alia* for the following reasons:

- people frequently move among ecosystems, and often use different ecosystems to satisfy their needs

[3] Though caution must be used in applying those results to the Estuary General Fishery as the studies were based mainly on trawling and dredging methods.

- humans are frequently seen as external to ecosystems even when they are residents within them
- the ecosystem approach allows the use of both Indigenous and local knowledge, innovations and practices including traditional management systems and scientific thinking.

Ecosystem management has been defined as "management of ecosystem values and uses recognising the interactions with the environment, and responding to signals from the ecosystem to control anthropogenic activities and uses". This recognises that humans are central players in ocean ecosystems, but that management can realistically control primarily only the human activities, not the ecosystems (Ward *et al*., 1997; after Sainsbury *et al*., 1997 and Harden Jones, 1994). Ecosystem management should take into account the following ten attributes (Ward et al, 1997; after Grumbine, 1994):

(1) Interactions between ecological levels:

Management ensures that connections between and across all levels (species, populations, habitats, and regions) are taken into account in resolving issues - focus on any one level is inadequate.

(2) Ecosystem boundaries:

Management acts within ecological boundaries and across administrative, political and jurisdictional boundaries.

(3) Maintenance of ecosystem integrity:

Management's focus includes the maintenance of ecological integrity. It has the stewardship of total national biological diversity (genes, species, communities, habitats) and the ecological processes that maintain that diversity, rather than a narrower focus on the benefits to particular sectors or areas.

(4) Data collection:

Management collects information beyond that required to manage individual sectors. It includes an inventory of biodiversity assets, baseline assessments of ecosystem functions, measurements of the interactions of sectors and improved management and use of existing data.

(5) Monitoring of management:

Management uses measurable performance indicators to assess the success or failure of its actions. Monitoring provides feedback that is critical to evaluating and refining management approaches.

(6) Adaptive and precautionary management:

Management acknowledges that, as scientific and other information is necessarily incomplete, actions with poorly understood or difficult to reverse consequences are to be avoided. Adaptive management regards management as a learning process, where incorporating the experience from previous actions and improved knowledge of the system enables managers to adapt to changing levels of uncertainty and to improve progressively.

(7) Inter-agency cooperation:

Management improves inter-agency cooperation because ecological boundaries cross traditional agency and administrative divides and Commonwealth, State and local government jurisdictions. Managers work together across such boundaries to integrate conflicting legal mandates, management practices and priorities.

(8) Organisational change:

Management recognises that the orientation, structure and modus operandi of agencies that manage ocean uses will be different from sector-based agencies. The differences may be relatively simple arrangements for inter-agency coordination, or more fundamental shifts in lines of accountability, responsibility, organisational orientation, decision-making processes, priorities and operations.

(9) Management of human activities:

Management recognises that human activities are fundamental influences on many marine ecological patterns and processes and are in turn affected by them. Although human activities are the focus of most management actions, they are recognised as being embedded in marine ecosystem functioning.

(10) Values:

Management recognises, accepts and incorporates biodiversity values into all resource allocation processes that could affect the ocean ecosystems, even when scientific and technical knowledge may be insufficient for a full definition of values. Management recognises, however, that human values will play a dominant role in decisions on ocean uses.

Whilst these attributes are suitable for a broader oceans based management framework, the elements of a fisheries ecosystem management approach have been summarised by Leadbitter *et al.* (1999) into four key aspects:

- data collection and research on fish stocks and environmental factors to enhance management on an ecosystem basis
- steps to resolve cross-sectoral issues between coastal management, total catchment management and fisheries management
- awareness and education campaigns for both users and the general public
- development of strategic management plans, framed within the principles of ESD, in conjunction with rationalisation of fishing capacity and over-exploited fisheries.

The existing operation of the Estuary General Fishery has the potential to impact on the ecosystem by, for instance, reducing the stock abundance of retained and bycatch species, modifying the physical estuarine environment (eg. habitat), and the provision and translocation of biological material (eg. discards, movement of gear between estuaries). The extent to which each ecosystem component may be affected, if at all, would vary depending on the area, the method(s) used and the intensity of use.

There is a growing recognition in fisheries management of the need to expand the historical focus on management of the main target species to consider and manage the impacts of fishing activities on the general environment. This need is particularly relevant to the Estuary General Fishery because it:

- Operates in many different estuaries and habitat types
- Catches varying quantities of a wide range of retained species, many of which are targeted in other commercial and recreational fisheries
- Involves the use of many different gear types, each of which may have differing levels of impact on the environment
- Involves a significant number of operators.

f) Improving economic viability

A review of the existing economic environment (undertaken in section 1 of Chapter G) has indicated that there is a significant lifestyle component in the Estuary General Fishery with only a small proportion of fishers who are in economic surplus. The relatively small levels of capital investment required to operate in the fishery, as opposed to the larger boats needed for most ocean based fisheries, means that fishers can operate on a part time basis, whilst sometimes maintaining other non-fishing forms of employment.

Management charges payable by estuary general fishers have increased slightly recently with additional costs being for the category 2 share management fishery rental charge, as well as contributions to the cost of preparing the environmental assessment for the fishery. The environmental assessment levy will only apply for a three year period, however, current government policy is to phase in full cost recovery over the three year period from 2005 to 2008.

Estuary general fishers will need to be in a position to afford higher management costs during the term of the FMS. Having more viable participants also provides a higher incentive to address sustainable management needs of the fishery and to carry out fishing activities with a higher level of stewardship, as fishers could afford to make changes and fishing entitlements would become more valuable.

g) Interaction with other resource users and the community

The Estuary General Fishery operates in areas that are visible and easily accessible to the broader community. The commercial fishing grounds in the Estuary General Fishery are frequently the same grounds used by recreational fishers, charter boat fishers and occasionally by estuary prawn trawl fishers, and the species targeted are often the same. Often the fishing grounds are located in close proximity to residential housing or popular tourist areas (such as caravan parks).

The location of estuary general fishing and the competition for limited fishery resources between commercial and recreational fishers has stimulated a long standing discord between resource users. A significant amount of the discord that has occurred between estuary general fishers and other resource users has resulted from the ability of estuary general fishers to travel to any estuary in the state that is open to commercial fishing. An example of the problems that occur when fishers travel to distant estuaries to fish is the disregard given to the many ‘gentlemans’ agreements that are established by local fishers to work in a manner acceptable to the surrounding community, to conserve resident fish stocks, or to achieve improved prices by allowing fish to grow before harvesting. Implementation of a zoning scheme has commenced in an attempt to improve industry and public relations.

Other aspects of the existing operation of the fishery that create concern amongst the community include the use of large length hauling nets in some estuaries. On occasions, 1,000 metre fish hauling nets are nets are used along with two 1,000 metre hauling lines, making the overall length of the fishing gear up to three kilometres. The size of this gear, when coupled with perceptions (albeit incorrect) that hauling in estuaries takes all fish in the path of the net, creates significant community concern about the sustainability of commercial net fishing in estuaries. There is also significant community concern about the use of hauling nets (prawn and fish) over areas of sensitive habitat.

There are of course significant benefits to the community from this fishery through the provision of fresh local seafood, and especially more affordable seafood products. This provision of seafood to people who are not able to obtain fish for themselves needs to be considered in conjunction with any negative community perceptions.

h) Information needs and research

The need for more information relating to fish stocks has been identified by both state and commonwealth environmental assessment requirements as essential for the management of fisheries. There is a general lack of knowledge about many species in the Estuary General Fishery, the impacts of fishing on stocks and impacts on the surrounding environment. Although stock assessments are underway, there are only a small number of species taken in the fishery currently being formally assessed. Species including bream, sea mullet, sand whiting and dusky flathead have ongoing stock assessments and monitoring of the size composition, effort trends and age composition of catches.

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 a range of factors such as weather conditions 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, and identifying the impacts of fishing on threatened species, habitats, trophic interactions and ecosystems.

The study of fish 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 General Fishery

a) Brief fishery description

The Estuary General Fishery is the most diverse commercial fishery in NSW. Approximately 99% of the catch by total landed weight is comprised of 45 species (NSW Fisheries catch statistics database 1998/99), and these species are taken from approximately 100 estuaries along the NSW coast using 17 types of fishing gear. The gear ranges from large hauling nets to relatively small traps and gathering by hand.

The Estuary General Fishery has a large number of participants, with 944 fishing businesses endorsed to operate in the fishery (as of July 2001). There is also large variation in the levels of participation of fishers with some fishers operating on a full time professional basis, while others operate on a part time basis and maintain other non-fishing forms of employment. Of the full time fishers, there are people who operate solely in the Estuary General Fishery, and people who operate in a number of different commercial fisheries in NSW. Table C1 below shows a comparison between the Estuary General Fishery and other commercial fisheries in NSW.

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 general	Ocean trap and line	Ocean prawn trawl	Ocean fish trawl	Ocean hauling	Lobster	Abalone	Estuary prawn trawl
Methods	Handline, Trap, Hauling net, Mesh/gill net, Hand collecting	Demersal trap, Handline, Setline, Dropline	Otter trawl net	Otter trawl net	Beach seine net, Purse seine net	Trap/pot	Diving (hookah)	Otter trawl net
Species	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	School prawn, King prawn
Total catch in 1998/99 (t)	4,943	1,995	3,429	413	2,463	110	323	495
Est. value in 1998/99 (A$m)	17.5	9.6	22.7	1.5	4.1	4.2	12.6	3.2
No. of authorised fishing businesses	944	630	330	102	374	170	37	294
Standard boat length (m)	5	6-8	14	14	4	6-8	6	9
General no. of unlicensed crew	0*	0-1	2	2-3	0**	0-1	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* 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 objects of the Act include:

(a) to conserve fish stocks and key fish habitats, and

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

(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, and

(e) to promote quality recreational fishing opportunities, and

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

i) Ecological 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[4]:

- 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 FMS outlines the rules, regulations and programs that are in place to manage the taking of fish by estuary general fishers. Outlining the proposed rules in the draft FMS allows an

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

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.

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.

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 all 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 Wildlife Protection (Regulation of Exports and Imports) Act

In 2000, the federal government amended Schedule 4 of the *Wildlife Protection (Regulation of Exports and Imports) Act 1982* (the WP Act) 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 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) under the *Environmental Protection and Biodiversity Conservation Amendment (Wildlife Protection) Act 2001*. 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 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. As with the WP Act, this draft FMS details the controls proposed to manage the impacts of the Estuary General Fishery on such matters.

iv) 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 primary 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, and

(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 General 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 *Fisheries Management Act 1994* requires that a share management plan be developed and implemented for all 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 share management fishery. A draft share management plan is prepared for a fishery after shares in the fishery have been issued on a provisional basis. Further information on the transition of the Estuary General Fishery to full share management can be found in section 6(a) later in this chapter.

The share management plan may also bring into operation a number of aspects of the fishery that are described in this draft FMS. This includes the fish that may be taken, the areas for taking fish,

the times or periods for operating the fishery, the protection of fish habitats, the use of boats and fishing gear and the use of bait in the fishery.

A share management plan must include objectives and performance indicators which, for the Estuary General Fishery, will be consistent with those outlined in section 5 of this draft FMS.

e) Issues within the Estuary General Fishery

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

- Ensuring stock sustainability
- Reducing bycatch
- Protecting key fish habitat
- Conserving threatened species, populations and ecological communities
- Promoting ecosystem management
- Improving economic viability
- Interaction 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 them.

2. Vision and Goals for the Fishery

a) Fishery vision

The long term vision for the Estuary General Fishery is:

To have a more profitable Estuary General Fishery with a smaller number of operators which provides the community with fresh local seafood and uses fishing gear in an ecologically sustainable manner.

b) Fishery goals

The goals that are proposed for the fishery to assist in achieving this vision are:

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

3. Proposed Changes to the Operation of the Fishery

Section 7 of Chapter B describes the key management issues arising from the existing operation of the fishery that need to be addressed by the FMS. These issues are listed below along with a description of the actions or changes to management of the fishery proposed to address them. Please refer to Chapter B for a full description of how the Estuary General Fishery currently operates and in particular, section 7 for a further discussion of the management issues that have been identified.

a) 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. Other key issues that need addressing are the overfished status of silver trevally stocks and the need to promote stewardship over the fishery resources.

To address these issues, this draft FMS proposes:

- Introduction of a zoning scheme to restrict movements of fishing effort between the seven coastal regions
- A new share-based restructuring program to operate at the regional level to cap the number of fishers with access to the fishery (and in each part of the fishery) at historically active levels
- That the total amount of fishing effort level applied to prawn stocks be determined by an independent expert committee (called the 'Total Allowable Catch Setting and Review Committee'[5]) and subsequently allocated between fisheries (by the Minister) after stakeholder input
- Implementation of a policy that prevents fishing business owners from nominating another person to operate their business on their behalf (thus activating inactive entitlements)
- Undertaking scientific assessments of the status of the stocks of primary species
- Introducing, as a precautionary measure, minimum legal lengths for the primary species at a size where at least 50% of the individuals have a high probability of spawning prior to capture

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

- Consultation with key stakeholder groups over the introduction of an appropriate minimum legal length for silver trevally to address the problem of growth overfishing[6]
- Implementing stronger compliance programs, including a penalty points scheme and share forfeiture scheme for serious and or habitual offenders.

b) Reducing bycatch

Commercial fishery bycatch includes fish and other living organisms that get caught during the act of fishing but are not retained for sale. Estuaries are extremely dynamic environments with a high diversity of species, and bycatch occurs as other species become inadvertently caught in the gear while it is being used to catch marketable fish. When handled properly, much of the bycatch that is taken and returned to the water can survive.

Several research programs have been conducted in the NSW Estuary General Fishery to quantify the level of bycatch taken in hauling and meshing nets and to examine techniques for reducing bycatch, with some success. Uncertainties still exist however, over the quantity of bycatch in some of the more passive methods (eg. trapping) and the effect of bycatch on the broader ecosystem.

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

- Commencement of an observer-based survey which would assist in quantifying the bycatch taken in actual estuary general fishing operations
- Banning the use of fish spikes, clubs and any other such implement that could unduly harm bycatch
- Reducing the maximum length of fish hauling nets to 500 metres in the estuaries where 725 metre and 1,000 metre nets have historically been permitted
- Increasing the minimum mesh size in flathead nets to minimise the capture of dusky flathead that are below the minimum legal length
- Increasing the minimum mesh size in overnight set meshing nets (set during the winter months) to reduce the catch of unwanted fish and/or fish below the minimum legal length
- Prohibiting the use of prawn seining and prawn hauling nets over seagrass areas, including changing the length of hauling lines on the Manning River prawn hauling net in order that the net is landed to a boat in the channel of the estuary and not hauled ashore
- Identifying designated landing sites for fish hauling nets in estuaries where seagrass exists around shoreline areas
- Using fishing closures to temporarily suspend hauling in specific areas when there are high abundances of juvenile fish or jellyfish in those areas
- Being adaptive and able to modify fishing gear or the use of gear when necessary to reduce impacts on non-retained organisms.

[6] 'Growth overfishing' occurs when fishing activities lead to a reduction in the size of the individuals of a species, as a consequence of which few specimens grow to the size for optimum yield.

c) Protecting key fish habitat

Healthy fish habitats are essential for the ongoing sustainability of fish populations. Many areas within estuaries act as nursery areas for juvenile fish. 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 fish 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:

- Prohibiting the use of all hauling nets over beds of strapweed seagrass (*Posidonia australis*) which has a very low recovery rate if damaged
- Prohibiting the use of prawn seining and prawn hauling nets over seagrass areas
- Identifying designated landing sites for fish hauling nets in estuaries where seagrass exists around shoreline areas
- Reducing the maximum length of fish hauling nets to 500 metres in the estuaries where 725 metre and 1,000 metre nets have historically been permitted
- Developing a code of conduct for the fishery with respect to operating on or near river banks, mangroves, seagrasses or saltmarsh habitats
- Involvement of the Estuary General MAC in the development of habitat management policies and habitat rehabilitation works
- Being adaptive and able to modify the use of fishing gear when necessary to reduce impacts on fish habitats.

d) Conserving threatened 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 General Fishery on threatened species is small.

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

- Gathering information on threatened species interactions by requiring endorsement holders to record interactions or sightings on the mandatory monthly catch and effort returns
- Using fishing closures to avoid direct interactions with threatened species, populations or ecological communities
- 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
- Developing a code of conduct for the fishery, which provides guidance for estuary general fishers when operating in the vicinity of listed Ramsar wetlands or known JAMBA & CAMBA migratory bird habitat, to minimise any disturbance.

e) Promoting ecosystem management

Ecosystem management has been defined as "management of ecosystem values and uses recognising the interactions with the environment, and responding to signals from the ecosystem to control anthropogenic activities and uses" (Ward *et al.*, 1997; after Sainsbury *et al.*, 1997 and Harden Jones, 1994). It involves having a dynamic and adaptive framework that is capable of responding to environmental needs.

The draft FMS embraces the ecosystem management concept and proposes changes to the operation and management of the fishery by:

- Undertaking a risk assessment with respect to the impact of the fishery on each component of the ecosystem through a workshop-type forum, and initiating appropriate management programs based on the outcome of that process
- Encouraging collaborative research between scientific research institutions to improve our understanding of ecosystem functioning and how it is affected by fishing practices
- Collecting information on the level of harvest of the primary species by all sectors, not just catches originating from the Estuary General Fishery
- Participating in the management of marine protected areas that are being declared along the NSW coast
- Establishing local joint industry/departmental working groups as needed to provide accurate and timely advice on local management needs and arrangements
- Being actively involved in the management of activities that are external to the fishery, but which have the potential to adversely impact on fish or fish habitat
- Having a management regime that is adaptive and can respond to environmental needs and/or related management programs such as marine pests and diseases threatened species marine parks; aquatic reserves; biodiversity conservation; pollution events; fish kills; and seafood safety
- Enhancing awareness and education of the resource users and the general public;
- Taking precautionary action to limit the landing of fish hauling nets to designated landing sites and prohibiting prawn hauling and seining methods over seagrass areas, thus reducing bycatch and habitat impacts
- Reducing the likelihood of the fishery modifying species, populations and ecological communities such that ecosystem integrity (ie. composition and function) is threatened.

f) Improving economic viability

In terms of gross value of production, the Estuary General Fishery is worth approximately $20 million annually (not including revenue received from the export market which generally yields higher prices for fish exported). A recent economic survey of the Estuary General Fishery has shown that only a small proportion of the respondents are making an economic surplus (20%). With the progressive phase in of full cost recovery of attributable costs between year 2005 and 2008, estuary general fishers need to be in a position to fund a fairer share of management costs.

The draft FMS aims to improve the economic viability of the Estuary General Fishery by:

- Implementing the category 2 share management fishery provisions of the *Fisheries Management Act 1994*
- Incorporating a restructuring scheme at both the fishing business level and endorsement level that requires a minimum number of shares to be held before an endorsement to fish becomes available
- Harvesting fish at a size that maximises the economic return to the industry, consistent with the need to take a precautionary approach to the conservation of fish stocks
- Encouraging the use of value-adding techniques to maximise the market value of product taken
- Investigating the feasibility of implementing a tradeable crab trap entitlement regime to improve the catching efficiency for crab fishing
- Preventing domination by a small number of operators in the fishery through a limit on the maximum allowable shareholding permitted (at 5%)
- Appropriately managing food safety risks in the harvesting of fish in the fishery by cooperating with Safe Food Production NSW in the development and implementation of food safety programs.

g) Interaction with other resource users and the community

The Estuary General Fishery operates in close proximity to many residential areas, popular tourism destinations and other general users of the State's waterways. It also harvests species of fish 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 general 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 general fishers and other stakeholders by:

- Introducing a zoning scheme which will assist in promoting a stronger level of stewardship over the harvesting of resources by estuary general fishers in each of the seven coastal regions
- Monitoring the relative catch levels of each harvest sector and undertaking reviews where appropriate
- Providing for recognised fishing grounds (applicable to some fishing methods only) within which commercial fishers have priority over other waterway users
- Being adaptive and able to accommodate the provisions of an Indigenous Fisheries Strategy
- Developing a code of conduct for the fishery with respect to use of gear and behaviour of fishers.

h) 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 General 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 key 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 general fishers through the mandatory monthly catch and effort returns submitted to NSW Fisheries
- Increasing the level of monitoring, analysis and reporting of commercial landings data at both a species level and at the individual estuary level
- Developing fishery-independent methods of data collection for stock assessment purposes
- Commencing observer-based surveys to collect bycatch and discarding information for methods in the fishery where little information is known, and periodically (every 5 to 10 years) repeating those surveys
- Conducting targeted, short-term research projects to address the significant gaps in knowledge about the physical impacts of various fishing methods on habitats and about the effects of fishing on trophic interactions and ecosystems
- 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 General Fishery).

b) Objects of the Fisheries Management Act 1994

The *Fisheries Management Act 1994* 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 objects of the Act include:

(a) to conserve fish stocks and key fish habitats, and

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

(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, and

(e) to promote quality recreational fishing opportunities, and

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

i) Ecological 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 FMS outlines the rules, regulations and programs that are in place to manage the taking of fish by estuary general 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.

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.

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.

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

After thorough consultation with all 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 Wildlife Protection (Regulation of Exports and Imports) Act

In 2000, the federal government amended Schedule 4 of the *Wildlife Protection (Regulation of Exports and Imports) Act 1982* (the WP Act) 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 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) under the *Environmental Protection and Biodiversity Conservation Amendment (Wildlife Protection) Act 2001*. 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 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. As with the WP Act, this draft FMS details the controls proposed to manage the impacts of the Estuary General Fishery on such matters.

iv) 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 primary 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, and

(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 General 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 *Fisheries Management Act 1994* requires that a share management plan be developed and implemented for all 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 share management fishery. A draft share management plan is prepared for a fishery after shares in the fishery have been issued on a provisional basis. Further information on the transition of the Estuary General Fishery to full share management can be found in section 6(a) later in this chapter.

The share management plan may also bring into operation a number of aspects of the fishery that are described in this draft FMS. This includes the fish that may be taken, the areas for taking fish, the times or periods for operating the fishery, the protection of fish habitats, the use of boats and fishing gear and the use of bait in the fishery.

A share management plan must include objectives and performance indicators which, for the Estuary General Fishery, will be consistent with those outlined in section 5 of this draft FMS.

e) Issues within the Estuary General Fishery

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

- Ensuring stock sustainability
- Reducing bycatch
- Protecting key fish habitat
- Conserving threatened species, populations and ecological communities
- Promoting ecosystem management
- Improving economic viability
- Interaction 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 them.

2. Vision and Goals for the Fishery

a) Fishery vision

The long term vision for the Estuary General Fishery is:

To have a more profitable Estuary General Fishery with a smaller number of operators which provides the community with fresh local seafood and uses fishing gear in an ecologically sustainable manner.

b) Fishery goals

The goals that are proposed for the fishery to assist in achieving this vision are:

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

3. Proposed Changes to the Operation of the Fishery

Section 7 of Chapter B describes the key management issues arising from the existing operation of the fishery that need to be addressed by the FMS. These issues are listed below along with a description of the actions or changes to management of the fishery proposed to address them. Please refer to Chapter B for a full description of how the Estuary General Fishery currently operates and in particular, section 7 for a further discussion of the management issues that have been identified.

a) 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. Other key issues that need addressing are the overfished status of silver trevally stocks and the need to promote stewardship over the fishery resources.

To address these issues, this draft FMS proposes:

- Introduction of a zoning scheme to restrict movements of fishing effort between the seven coastal regions
- A new share-based restructuring program to operate at the regional level to cap the number of fishers with access to the fishery (and in each part of the fishery) at historically active levels
- That the total amount of fishing effort level applied to prawn stocks be determined by an independent expert committee (called the 'Total Allowable Catch Setting and Review Committee'[8]) and subsequently allocated between fisheries (by the Minister) after stakeholder input
- Implementation of a policy that prevents fishing business owners from nominating another person to operate their business on their behalf (thus activating inactive entitlements)
- Undertaking scientific assessments of the status of the stocks of primary species
- Introducing, as a precautionary measure, minimum legal lengths for the primary species at a size where at least 50% of the individuals have a high probability of spawning prior to capture

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

- Consultation with key stakeholder groups over the introduction of an appropriate minimum legal length for silver trevally to address the problem of growth overfishing[9]
- Implementing stronger compliance programs, including a penalty points scheme and share forfeiture scheme for serious and or habitual offenders.

b) Reducing bycatch

Commercial fishery bycatch includes fish and other living organisms that get caught during the act of fishing but are not retained for sale. Estuaries are extremely dynamic environments with a high diversity of species, and bycatch occurs as other species become inadvertently caught in the gear while it is being used to catch marketable fish. When handled properly, much of the bycatch that is taken and returned to the water can survive.

Several research programs have been conducted in the NSW Estuary General Fishery to quantify the level of bycatch taken in hauling and meshing nets and to examine techniques for reducing bycatch, with some success. Uncertainties still exist however, over the quantity of bycatch in some of the more passive methods (eg. trapping) and the effect of bycatch on the broader ecosystem.

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

- Commencement of an observer-based survey which would assist in quantifying the bycatch taken in actual estuary general fishing operations
- Banning the use of fish spikes, clubs and any other such implement that could unduly harm bycatch
- Reducing the maximum length of fish hauling nets to 500 metres in the estuaries where 725 metre and 1,000 metre nets have historically been permitted
- Increasing the minimum mesh size in flathead nets to minimise the capture of dusky flathead that are below the minimum legal length
- Increasing the minimum mesh size in overnight set meshing nets (set during the winter months) to reduce the catch of unwanted fish and/or fish below the minimum legal length
- Prohibiting the use of prawn seining and prawn hauling nets over seagrass areas, including changing the length of hauling lines on the Manning River prawn hauling net in order that the net is landed to a boat in the channel of the estuary and not hauled ashore
- Identifying designated landing sites for fish hauling nets in estuaries where seagrass exists around shoreline areas
- Using fishing closures to temporarily suspend hauling in specific areas when there are high abundances of juvenile fish or jellyfish in those areas
- Being adaptive and able to modify fishing gear or the use of gear when necessary to reduce impacts on non-retained organisms.

[9] 'Growth overfishing' occurs when fishing activities lead to a reduction in the size of the individuals of a species, as a consequence of which few specimens grow to the size for optimum yield.

c) Protecting key fish habitat

Healthy fish habitats are essential for the ongoing sustainability of fish populations. Many areas within estuaries act as nursery areas for juvenile fish. 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 fish 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:

- Prohibiting the use of all hauling nets over beds of strapweed seagrass (*Posidonia australis*) which has a very low recovery rate if damaged
- Prohibiting the use of prawn seining and prawn hauling nets over seagrass areas
- Identifying designated landing sites for fish hauling nets in estuaries where seagrass exists around shoreline areas
- Reducing the maximum length of fish hauling nets to 500 metres in the estuaries where 725 metre and 1,000 metre nets have historically been permitted
- Developing a code of conduct for the fishery with respect to operating on or near river banks, mangroves, seagrasses or saltmarsh habitats
- Involvement of the Estuary General MAC in the development of habitat management policies and habitat rehabilitation works
- Being adaptive and able to modify the use of fishing gear when necessary to reduce impacts on fish habitats.

d) Conserving threatened 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 General Fishery on threatened species is small.

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

- Gathering information on threatened species interactions by requiring endorsement holders to record interactions or sightings on the mandatory monthly catch and effort returns
- Using fishing closures to avoid direct interactions with threatened species, populations or ecological communities
- 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
- Developing a code of conduct for the fishery, which provides guidance for estuary general fishers when operating in the vicinity of listed Ramsar wetlands or known JAMBA & CAMBA migratory bird habitat, to minimise any disturbance.

e) Promoting ecosystem management

Ecosystem management has been defined as "management of ecosystem values and uses recognising the interactions with the environment, and responding to signals from the ecosystem to control anthropogenic activities and uses" (Ward *et al.*, 1997; after Sainsbury *et al.*, 1997 and Harden Jones, 1994). It involves having a dynamic and adaptive framework that is capable of responding to environmental needs.

The draft FMS embraces the ecosystem management concept and proposes changes to the operation and management of the fishery by:

- Undertaking a risk assessment with respect to the impact of the fishery on each component of the ecosystem through a workshop-type forum, and initiating appropriate management programs based on the outcome of that process
- Encouraging collaborative research between scientific research institutions to improve our understanding of ecosystem functioning and how it is affected by fishing practices
- Collecting information on the level of harvest of the primary species by all sectors, not just catches originating from the Estuary General Fishery
- Participating in the management of marine protected areas that are being declared along the NSW coast
- Establishing local joint industry/departmental working groups as needed to provide accurate and timely advice on local management needs and arrangements
- Being actively involved in the management of activities that are external to the fishery, but which have the potential to adversely impact on fish or fish habitat
- Having a management regime that is adaptive and can respond to environmental needs and/or related management programs such as marine pests and diseases threatened species marine parks; aquatic reserves; biodiversity conservation; pollution events; fish kills; and seafood safety
- Enhancing awareness and education of the resource users and the general public;
- Taking precautionary action to limit the landing of fish hauling nets to designated landing sites and prohibiting prawn hauling and seining methods over seagrass areas, thus reducing bycatch and habitat impacts
- Reducing the likelihood of the fishery modifying species, populations and ecological communities such that ecosystem integrity (ie. composition and function) is threatened.

f) Improving economic viability

In terms of gross value of production, the Estuary General Fishery is worth approximately $20 million annually (not including revenue received from the export market which generally yields higher prices for fish exported). A recent economic survey of the Estuary General Fishery has shown that only a small proportion of the respondents are making an economic surplus (20%). With the progressive phase in of full cost recovery of attributable costs between year 2005 and 2008, estuary general fishers need to be in a position to fund a fairer share of management costs.

The draft FMS aims to improve the economic viability of the Estuary General Fishery by:

- Implementing the category 2 share management fishery provisions of the *Fisheries Management Act 1994*
- Incorporating a restructuring scheme at both the fishing business level and endorsement level that requires a minimum number of shares to be held before an endorsement to fish becomes available
- Harvesting fish at a size that maximises the economic return to the industry, consistent with the need to take a precautionary approach to the conservation of fish stocks
- Encouraging the use of value-adding techniques to maximise the market value of product taken
- Investigating the feasibility of implementing a tradeable crab trap entitlement regime to improve the catching efficiency for crab fishing
- Preventing domination by a small number of operators in the fishery through a limit on the maximum allowable shareholding permitted (at 5%)
- Appropriately managing food safety risks in the harvesting of fish in the fishery by cooperating with Safe Food Production NSW in the development and implementation of food safety programs.

g) Interaction with other resource users and the community

The Estuary General Fishery operates in close proximity to many residential areas, popular tourism destinations and other general users of the State's waterways. It also harvests species of fish 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 general 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 general fishers and other stakeholders by:

- Introducing a zoning scheme which will assist in promoting a stronger level of stewardship over the harvesting of resources by estuary general fishers in each of the seven coastal regions
- Monitoring the relative catch levels of each harvest sector and undertaking reviews where appropriate
- Providing for recognised fishing grounds (applicable to some fishing methods only) within which commercial fishers have priority over other waterway users
- Being adaptive and able to accommodate the provisions of an Indigenous Fisheries Strategy
- Developing a code of conduct for the fishery with respect to use of gear and behaviour of fishers.

h) 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 General 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 key 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 general fishers through the mandatory monthly catch and effort returns submitted to NSW Fisheries
- Increasing the level of monitoring, analysis and reporting of commercial landings data at both a species level and at the individual estuary level
- Developing fishery-independent methods of data collection for stock assessment purposes
- Commencing observer-based surveys to collect bycatch and discarding information for methods in the fishery where little information is known, and periodically (every 5 to 10 years) repeating those surveys
- Conducting targeted, short-term research projects to address the significant gaps in knowledge about the physical impacts of various fishing methods on habitats and about the effects of fishing on trophic interactions and ecosystems
- 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 General Fishery).

4. Goals, Objectives and Management Responses

This section sets out the goals, objectives and management responses for the Estuary General Fishery.

a) A model framework

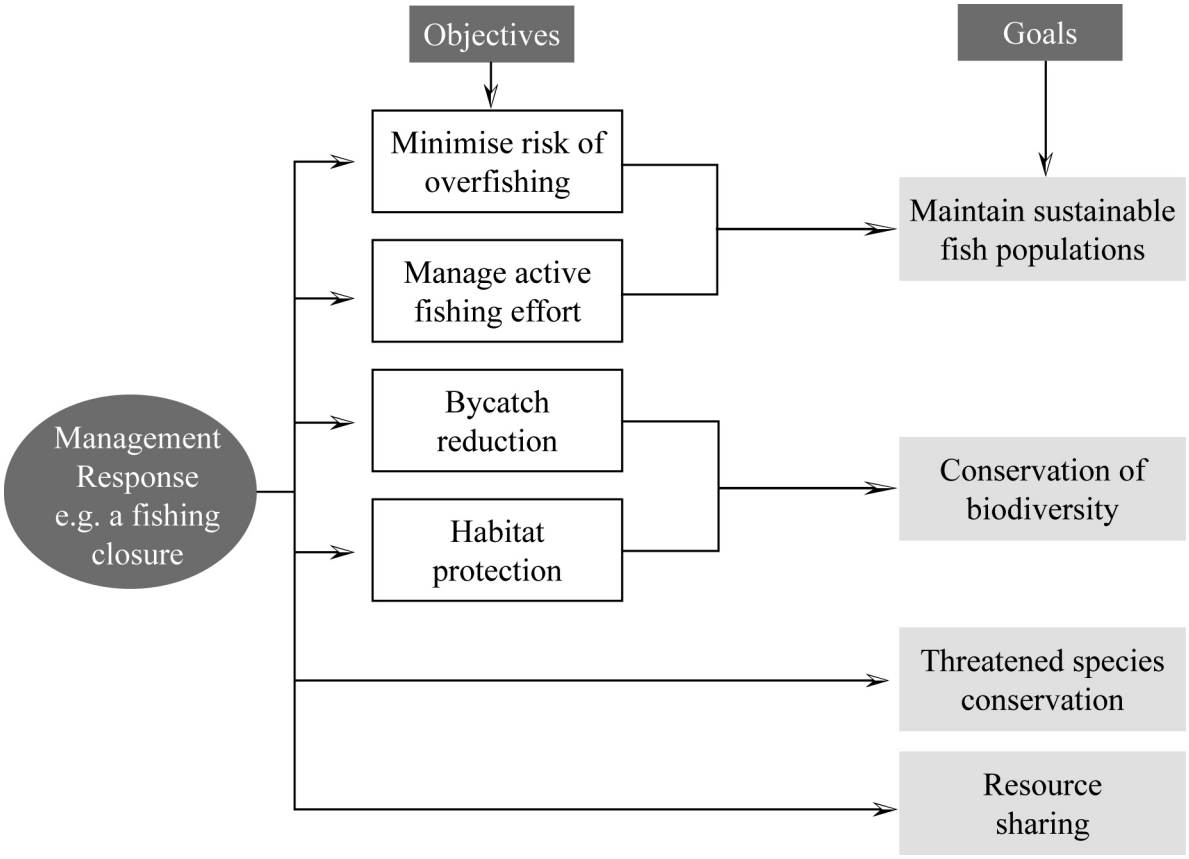
Figure C1. A model of the framework for a FMS.

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

An estuarine fishing closure is one example of the complex relationships that exist in a multi-method multi-species fishery. Some closures were originally put in place to more fairly share access between recreational and commercial fishers. A closure to reduce conflict appears to fit into the "resource sharing" goal, however, it can have other benefits, and assist the fishery to meet other objectives.

For example, a closure can also reduce the level of fishing pressure in that area and provide greater protection to habitat and biodiversity. This outcome provides a range of benefits for the fishery over and above reducing conflict (see Figure C2).

Figure C2. 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. There are cross references between each response and the other goals and objectives 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 (ie. the "Other important responses" must be taken into account).

Information under each response is also provided detailing the timeframes by which the action will be undertaken, the agency or group responsible for implementation and the authority under which the action will be implemented.

b) Goals, objectives and management responses

GOAL 1. To manage the Estuary General 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 fish (including prohibited size, unwanted fish and fish protected from commercial fishing)

Other important responses: 1.1f,g,h; 1.2a,b; 1.3c; 2.1f; 2.1.2c; 2.1.3b; 2.2b,c; 2.3a,b,c; 6.2a; 6.3c

(a) increase the minimum mesh size (and other dimensions if needed) of flathead nets from 70 mm following the 2001 research program into mesh net selectivity

Background: Following an increase in the minimum legal length of dusky flathead from 33 to 36 cm, NSW Fisheries and the Estuary General MAC agreed to phase out the use of 70mm mesh size flathead nets after the 2001 season. Recommendations on a replacement for the 70mm net in terms of mesh size, dimensions and other controls will be made with the benefit of data from the 2001 mesh selectivity research program. For further information, refer to section 5 in Chapter B.

Contributing to Goals	Timeframe	Responsibility	Authority
2,5	By February 2002	NSW Fisheries	Regulatory

(b) using the best available knowledge and appropriate technology, modify fishing practices (such as by adopting bycatch reduction devices) to reduce the impacts of the fishery on non-retained fish, invertebrates, reptiles, mammals and birds; and in particular implement the use of discard chutes by June 2003 to facilitate the return of fish removed from mesh nets

Background: The National Policy on Fisheries Bycatch provides a national framework for coordinating efforts to reduce bycatch. It provides options by which each jurisdiction can manage bycatch according to its situation in a nationally coherent and consistent manner. Any changes to fishing practice that transpire under this management response could be implemented through conditions on the relevant fishing endorsement, through a code of conduct or other regulatory control, depending on the nature of the change.

Contributing to Goals	Timeframe	Responsibility	Authority
2,4	Ongoing	NSW Fisheries EG fishers	Various

(c) use best-practice handling techniques, including the prohibition by June 2002 on the use of fish spikes, clubs or any other such implement that could unduly harm incidentally captured organisms

Background: Some techniques used to return unwanted animals to the water unduly injure animals. Such techniques are used to hasten the sorting process or to avoid handling dangerous animals. Fishers should adopt alternative techniques for returning animals to the water which avoid injuring those animals. In 1999, Oceanwatch (a non-profit company sponsored by the NSW seafood industry) produced a publication outlining bycatch solutions for non-trawl fisheries proposing better handling techniques. The prohibition of spikes and clubs by June 2002 is a specific action, however, the use of best handling techniques is an ongoing aim for the fishery.

Contributing to Goals	Timeframe	Responsibility	Authority
4	Ongoing	EG fishers NSW Fisheries	Regulatory

(d) phase out the setting of mesh nets with a mesh size less than 95 mm between sunset and sunrise over winter

Background: A research program conducted in 1999 found that overnight set mesh nets with a mesh size of 89 mm (3.5 inch) often catch a high proportion of juvenile fish. The survival rate was high for some species such as bream, but was low for some other species. NSW Fisheries and the Estuary General MAC support an increase in the minimum mesh size to 95mm (3.75 inches) for which bycatch was significantly less.

Contributing to Goals	Timeframe	Responsibility	Authority
2	By 1 June 2002	NSW Fisheries	Regulatory

(e) reduce the maximum allowable length of general purpose 'fish' hauling nets to 500 metres in estuaries where 725 metre and 1,000 metre nets are currently permitted, and implement a restriction on the number of shots per day to ensure an overall reduction in area swept by the net

Note: This response has been proposed by NSW Fisheries, and its implementation without a period of evaluation is not supported by the Estuary General MAC or the NSW Advisory Council on Commercial Fishing. The MAC does not consider the reduction in net length and restriction on the number of shots per day as effective means of effort reduction and believes that there will be no environmental benefits.

Background: There are a number of the larger coastal rivers and lagoons in NSW where large length hauling nets (1,000 m, 725 m & 450 m) have historically been authorised (see section 3(c)(xi) in Chapter B for further details). These nets are usually operated with hauling lines, each of which may be as long as the net itself. The area swept during the hauling of this type of net is significant.

This proposed response would act to reduce the swept area hauled to assist in reducing the impacts of fish hauling on bycatch, and any effects on habitat. It is not proposed to reduce the length of the hauling lines associated with these nets because fishers still need to be able to work the gear in the deeper water. This response may also assist in promoting harmony between commercial estuary fishers and other resource users.

Due to its size, the current 1,000 metre hauling net requires a lengthy time to lay out and haul the net, which normally limits its use to one shot per hauling crew per day. The proposal to

limit the number of shots per day of the 500 metre replacement net would prevent the hauling of the net multiple times per day and thereby negating the intention of the proposal.

Contributing to Goals	Timeframe	Responsibility	Authority
2,4	By June 2002	NSW Fisheries	Regulatory

(f) introduce an industry funded scientific observer program to collect information on the quantity and composition of non-retained species for methods where little or no information is known, and periodically (every 5 to 10 years) repeat that program for all methods used in the fishery

Note: This program will be an important way of monitoring the impacts of the fishery on bycatch species, as well as consequentially recording any interactions with threatened species and occurrences of lost fishing gear. The program will commence by collecting information on bycatch from gear types where little is currently known (eg trapping), and it would be periodically repeated for all methods every 5 to 10 years. Further information on the scientific observer program is presented in section 6(g) of this draft FMS. Bycatch monitoring is an important requirement under the Commonwealth environmental assessment guidelines. The sampling design will be developed in consultation with the Estuary General MAC.

Contributing to Goals	Timeframe	Responsibility	Authority
2,3,7	By July 2002	NSW Fisheries EG fishers	–

(g) 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 unless otherwise described by this fishery management strategy

Contributing to Goals	Timeframe	Responsibility	Authority
2,3,4,5	Current and ongoing	NSW Fisheries	Regulatory

(h) continue the prohibition on using firearms, explosives or electrical devices to take fish in the fishery

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 terrestrial habitat

Other important responses: 1.1e,g,h; 1.3c,d; 1.5a-f; 2.1a,f; 2.2b,c; 2.3b,c; 2.4c; 6.2a

(a) [continue to] use fishing closures to control the area and time fished to:

(i) protect key fish habitat, specifically prohibit the use of all hauling nets over beds of strapweed seagrass (*Posidonia australis*)

(ii) protect key fish habitat and reduce bycatch by defining, in consultation with the Estuary General MAC and other key stakeholders identified by NSW Fisheries,

designated landing sites for fish hauling nets in estuaries where seagrass exists around shoreline areas

(iii) reduce bycatch by identifying areas of seagrass which should be closed to prawn hauling and prawn seining methods

(iv) reduce bycatch in areas and at times of high abundances of jellyfish or juvenile fish

(v) harvest fish at a size that maximises the economic return

(vi) avoid direct interactions with marine and terrestrial threatened species, populations or ecological communities

(vii) equitably share the resource between estuary general fishers and other stakeholders

(viii) minimise impact on nesting and/or feeding areas of migratory shorebirds

(ix) minimise impact on sensitive shoreline habitat.

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.

Numerous fishing closures already exist in the Estuary General Fishery for a range of reasons. Each closure generally has benefits to numerous aspects of the resource and the fishery. Recommendations for many short term area restrictions to protect fish could be made by local joint industry/Departmental working groups, eg. to avoid bycatch of juvenile fish or during periods following fish kills.

Fishing closures can be gear specific, so that only the relevant gear type/s are affected by such a closure. Closures are periodically reviewed and modified to take account of changing fishing patterns and/or environmental conditions.

As an outcome of the Juvenile Prawn Summit held in June 2000, commercial fishers agreed to prohibit prawn hauling and prawn seining over areas of seagrass, and this concept has been generally supported by fishers. District Fisheries Officers and local fishers will identify these seagrass areas and the relevant closures will be declared as part of this strategy.

Contributing to Goals	**Timeframe**	**Responsibility**	**Authority**
2,3,4,5,7	(i),(ii)&(iv): By July 2003 (iii): By December 2003 (v)&(vi): Ongoing (vii): Current & Ongoing	NSW Fisheries EG MAC	Regulatory

(b) modify the use of fishing methods that have a detrimental impact on fish habitat, or threatened species, populations or ecological communities

Background: Where fishing methods are known or believed to be having detrimental impacts on fish habitat or threatened species, their use should be modified so as to avoid or minimise those impacts. These impacts may be identified through research programs proposed in this draft FMS or through consultation with the Estuary General MAC or Ministerial advisory councils. This response allows the modification of gear use where new information about fishing methods, habitats, threatened species, populations or ecological communities has been obtained, for example through the outcomes of a research program. Other than the specific changes to fishing gear as set out in this strategy, this management response does not propose any immediate actions.

Contributing to Goals	Timeframe	Responsibility	Authority
3,4	Ongoing	NSW Fisheries	Various

(c) develop a code of conduct for the fishery with respect to:

(i) guidelines for operating on or 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 & CAMBA migratory bird habitat in a manner that minimises disturbance

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

(iv) the use of gear and behaviour of fishers, enforceable by conditions on licences and endorsements or by use of other regulatory controls

(v) encouraging the use of effective icing and value-adding techniques to maximise the market price of product taken

Background: A code of conduct will be developed similar to that used in the ocean hauling fishery which sets standards for the manner in which fishers operate. A code of conduct which has the support of surrounding communities can go a long way to improving the relations between the commercial fishing industry and other stakeholders. Ramsar wetlands are wetlands of international importance identified through a treaty first signed by 18 countries in the small Iranian town of Ramsar in 1971.

Contributing to Goals	Timeframe	Responsibility	Authority
3,4,5,6,7	By December 2002	EG MAC NSW Fisheries	Voluntary & Regulatory

(d) continue the prohibition on wilfully damaging marine vegetation

Contributing to Goals	Timeframe	Responsibility	Authority
4	Current and ongoing	NSW Fisheries	FM Act

Objective 1.3 To reduce the likelihood of this fishery changing species, populations and ecological communities in a manner which threatens ecosystem integrity (ie. composition and function)

Other important responses: 1.1a-h; 1.2a-d; 1.4b; 1.5a-f; 2.1a,c,e,f; 2.1.1b,c; 2.1.2b,c; 2.1.4a,b; 2.2a-c; 2.3a-c; 2.4c; 2.5a-c; 2.5.2a; 4.2b; 6.2a; 7.4a,b

(a) collaborate with other institutions to improve our understanding of ecosystem functioning and how it is affected by fishing practices

Background: There is a general lack of knowledge about the way in which biodiversity in marine ecosystems is affected by fish harvesting nor how to meaningfully measure these effects. This is especially true for diverse and complex systems like the environment in which the Estuary General Fishery operates.

Contributing to Goals	Timeframe	Responsibility	Authority
6,7	Ongoing	NSW Fisheries	–

(b) contribute to relevant biodiversity monitoring programs and develop a performance measure of biodiversity impacts at the species, community and ecosystem levels

Background: There is no simple performance measure currently available to give an accurate representation of the impacts of the Estuary General Fishery on biodiversity. 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 may require some preliminary research to determine the best approach.

Research that contributes to our understanding of biodiversity is carried out by a number of institutions and a coordinated program is likely to be a key strategy within the aquatic biodiversity strategy currently being developed for NSW.

Contributing to Goals	Timeframe	Responsibility	Authority
3,6,7	Current and ongoing	NSW Fisheries	–

(c) through a workshop involving key stakeholders and experts, conduct a risk assessment of the impacts of the fishery on the ecosystem, and initiate appropriate management programs (eg. monitoring) based on the outcomes of that process

Background: The Estuary General Fishery is a large and diverse fishery which is likely to have some level of impact on different components of the ecosystem. The Sustainability Indicators Working Group of the Standing Committee on Fisheries and Aquaculture is in the process of developing a national reporting framework for ESD in fisheries and has completed some work on identifying the main ecosystem components that may be subject to impacts from fishing. Acknowledging that 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 or reporting necessary for each component of the ecosystem. The working group recommends that this be undertaken through a workshop in order that the outcome is a combined judgement of a group of people who have considerable expertise in the areas being examined.

Contributing to Goals	Timeframe	Responsibility	Authority
3,6,7	By December 2002	NSW Fisheries EG MAC	–

(d) the Estuary General 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 (ie. marine parks and aquatic reserves) is being declared in each marine "bioregion" along the NSW coast to protect and enhance marine and estuarine biodiversity. The bioregions were determined by the Interim Marine and Coastal Regionalisation for Australia (IMCRA) report.

Contributing to Goals	Timeframe	Responsibility	Authority
2,3,4,6,7	Current and ongoing	EG MAC	–

Objective 1.4 To prevent the introduction and translocation of marine pests and diseases

Other important responses: 2.2a; 2.4a,b; 6.4a

(a) implement, in consultation with the Estuary General MAC, measures required in accordance with any marine pest or disease management plans

Contributing to Goals	Timeframe	Responsibility	Authority
2,6	Current and ongoing	NSW Fisheries EG MAC	To be determined

(b) continue the prohibition on taking or selling declared 'noxious fish'

Contributing to Goals	Timeframe	Responsibility	Authority
–	Current and ongoing	NSW Fisheries	Act

Objective 1.5 To facilitate the rehabilitation of priority areas of estuarine fish habitat to assist in the long term sustainable management of the fishery

Other important responses: 1.2a-d; 2.4a-c; 6.3c

(a) the Estuary General MAC will provide advice to NSW Fisheries to assist in the mapping of key habitat areas for the fishery that require rehabilitation and will provide information concerning the historical significance of these habitats and the species which once used them

Background: Commercial fishers often know where the key habitat areas for fishery production occurred within an estuary prior to changes to land and water uses (e.g. wetlands, backswamps, creek systems). This knowledge can assist NSW Fisheries Office of Conservation to identify and prioritise sites for rehabilitation to provide the most benefit to increase fishery production. This knowledge may include identifying the location and original extent of the habitat area, the types of sizes of fish that occupied the area, and the vegetation/habitat values that attracted the fish to these areas. This information could be updated in consultation with the Office of Conservation on a five yearly basis.

Contributing to Goals	Timeframe	Responsibility	Authority
2,5,6,7	2002 and reviewed every 5 years	EG MAC	–

(b) the Estuary General MAC will review NSW Fisheries' habitat rehabilitation and conservation research programs annually to provide advice on priority issues and habitat areas for the fishery

Background: The NSW Fisheries Office of Conservation has program plans which outline the priorities for habitat rehabilitation and conservation research in NSW. The plans aim to target funding bids and staff activities towards achieving the defined priorities. These plans should be reviewed annually by the Estuary General MAC to provide advice and input on the priority issues and habitat areas which should be addressed to benefit the fishery and associated fish habitat.

Contributing to Goals	Timeframe	Responsibility	Authority
2,5,6,7	Annually	EG MAC	–

(c) the Estuary General MAC will review and provide advice on the development of estuarine habitat management and rehabilitation strategies developed by NSW Fisheries and other agencies; in particular through reviewing estuary management plans, floodplain management plans, floodgate management plans, wetland management plans, habitat protection plans, water and catchment management plans, aquatic reserve and marine protected area strategies

Background: The NSW Government has a range of natural resource management planning processes underway which affect the management of estuaries within NSW. While several of these forums have commercial fishery representation, there is limited direct consultation and input from the Estuary General Fishery on their development and implementation. A process will be developed in consultation with NSW Fisheries Office of Conservation and the Estuary General MAC to allow for input into these processes. This process can also be used to allow fishers to provide advice to NSW Fisheries Office of Conservation staff on development applications which may potentially impact on estuarine fish habitat or fishing activities.

Contributing to Goals	Timeframe	Responsibility	Authority
2,5,6,7	Ongoing	EG MAC	–

(d) the Estuary General MAC will review habitat rehabilitation and research applications developed by NSW Fisheries to provide advice as to whether they provide benefit for the fishery and focus on priority issues and key habitat areas

Contributing to Goals	Timeframe	Responsibility	Authority
2,5,6	Annually	EG MAC	–

(e) the Estuary General MAC will advise NSW Fisheries to assist in nominating priority habitat areas for the fishery for protection and management, including fishing closures, aquatic reserves and marine protected areas

Contributing to Goals	Timeframe	Responsibility	Authority
2,5,6	Annually	EG MAC	–

(f) the Estuary General MAC will provide advice to NSW Fisheries to assist in reviewing the role, responsibilities and membership of the habitat monitor program to ensure the program includes a focus on habitat issues of importance to the fishery

Background: The Habitat Monitors program was established to provide an important communication link between the department and commercial fishers on habitat management issues. The program requires review to ensure that the role, responsibilities and membership reflect the current requirements of the fishery and the department in ensuring that habitat management issues are being communicated and addressed.

Contributing to Goals	Timeframe	Responsibility	Authority
2,5,6,7	Ongoing	EG MAC	–

GOAL 2. To maintain fish populations harvested by the Estuary General Fishery at sustainable levels

Objective 2.1 **To ensure that the quantity and composition (eg. size, age, sex) of harvested fish of each species does not result in overfishing**

Other important responses: 1.1a,b,d-h; 1.2a; 1.3d; 2.1a; 2.2a-c; 2.3a-c; 2.5a-c; 2.5.2a; 4.1a,b; 4.2a-c; 5.2a; 5.4b; 6.1a,b,e; 6.2a,b; 6.3c; 7.4a,b

(a) limit the size and dimensions of gear permitted to be used in each estuary to the specifications provided in the estuary based controls section of this fishery management strategy (see Appendix C1)

Contributing to Goals	Timeframe	Responsibility	Authority
1,3,4,5	By June 2002	NSW Fisheries	Regulatory

(b) monitor landings of each species by estuary, and evaluate catches by other sectors where available

Contributing to Goals	Timeframe	Responsibility	Authority
4,7	Annually	NSW Fisheries	–

(c) promote research that contributes to more robust and reliable fish stock assessments and continue to involve the Estuary General MAC in prioritising research programs

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

(d) continue to use size limits on selected species to prevent the exploitation of juvenile, sub-adult and, where appropriate, mature fish

Background: Minimum legal lengths apply to many of the species in the Estuary General Fishery. To address a growth overfishing problem with respect to snapper, the minimum legal length for that species increased on 1 July 2001 from 28 cm to 30 cm.

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

(e) continue the prohibition on the taking of all female crabs carrying ova

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

(f) continue the prohibition on the use of unregistered fishing nets in the fishery (with the exception of hoop or lift nets and dip or scoop nets)

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,6	Current and ongoing	NSW Fisheries	Regulatory

Objective 2.1.1 To maintain the stock of the primary species (yellowfin bream, sand whiting, dusky flathead, sea (bully) mullet, luderick, eels, mud crabs, school prawns, king prawns and pipis) at or above a level that minimises the risk of overfishing

(a) introduce, within five years, minimum legal lengths for the primary finfish species to give a high probability that at least 50% of the fish of each particular species landed have reached reproductive maturity (unless alternative strategies apply to individual species)

Background: It is a generally accepted principle that the minimum legal length for finfish should be set such that at least 50% of the individuals of the species have spawned prior to capture. It is important however, to maintain the natural sex ratio in the population. As noted in the proposed response, there may be exceptions for some species.

Size limits are already in place for all primary finfish species. A periodic review of all size limits, involving community consultation, is conducted. If in the interim, additional information becomes available indicating that a size limit needs to be introduced or changed prior to the periodic review, the appropriate action is taken

Contributing to Goals	Timeframe	Responsibility	Authority
4	By March 2007	NSW Fisheries	Regulatory

(b) develop a system for and conduct a formal stock assessment of the primary species within 5 years and review the assessment at least every 3 years thereafter

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,5,7	By March 2007	NSW Fisheries	–

(c) the Minister for Fisheries will require the Total Allowable Catch Setting and Review Committee to make determinations relating to the maximum level of effort that may be applied to prawn stocks, after receiving advice from the Estuary General MAC and other stakeholders

Note: Under the Fisheries Management Act 1994, the TAC Committee can recommend total catch levels and/or total ***effort*** *levels. Section 6(i) of this draft FMS outline the process by which the total allowable effort would be determined and allocated between fishing sectors.*

Contributing to Goals	Timeframe	Responsibility	Authority
1,4	Annually from 2003	NSW Fisheries EG MAC Prawn Resource Forum	Section 28(4) of the FM Act

Objective 2.1.2 To maintain local (catchment based) populations of glass eels and adult eels

(a) monitor commercial catch levels of adult longfin and shortfin eels in each catchment

Contributing to Goals	Timeframe	Responsibility	Authority
7	Annually	NSW Fisheries	–

(b) each year, allocate a maximum quantity of glass eels that can be taken for aquaculture purposes ensuring that the allowable catch is allocated across a number of catchments, and monitor the annual catches in each catchment

Background: Last season 85kg of glass eels were allocated to permit holders (from a 300kg total allowable catch) and there were limits on the quantity that could be taken from each catchment area. No glass eels are permitted to be taken from the three highest commercial producing catchments (ie. the Clarence River, Hawkesbury River and Port Stephens).

Contributing to Goals	Timeframe	Responsibility	Authority
1,4	Annually	NSW Fisheries	Regulatory

(c) finalise the current review of eel harvesting and implement the outcomes

Background: A review is underway examining issues of trap design, bycatch reduction (specifically to exclude mammals and freshwater turtles), appropriateness of the current minimum legal size, eel fishing in farm dams, impoundments and aquaculture facilities, and glass eel harvesting.

Contributing to Goals	Timeframe	Responsibility	Authority
1,3,4	By December 2002	NSW Fisheries	To be determined

Objective 2.1.3 To contribute to the sustainability of the mud crab stock and to prevent localised depletion of mud crab populations in NSW waters

(a) monitor catch levels of mud crabs in each estuary

Contributing to Goals	Timeframe	Responsibility	Authority
4,7	Annually	NSW Fisheries	–

(b) implement the outcomes of the review by NSW Fisheries and the Estuary General MAC in relation to fish and crab trapping

Background: A review was conducted in 1999/00 relating to the use of excessive numbers of crab traps in estuaries and the appropriateness of the endorsement structure in the fishery. The review considered changes to the size and marking requirements of traps to improve compliance capabilities, and that a general 'trapping endorsement' allowing the use of both crab traps and fish traps would be a better alternative to the current separate 'fish trap' and 'mud crab trap' endorsement structure. The review recommended that fishers who hold either endorsement would be permitted to use ten traps, while fishers who hold both endorsements would be permitted to use 20 traps.

Contributing to Goals	Timeframe	Responsibility	Authority
1,6	By February 2003	NSW Fisheries EG MAC	Regulatory

(c) consider the feasibility of implementing a tradeable crab trap regime based on shareholdings

Background: The Estuary General MAC has previously discussed the development of a tradeable trap management regime for the crab fishery (including mud crabs and blue swimmer crabs), and the share management fishery regime may provide an efficient way of administering such a scheme. The implementation of a tradeable trap regime would need to take into consideration any implications from the review of fish and crab trapping outlined in response 2.1.3(b).

Contributing to Goals	Timeframe	Responsibility	Authority
5,6	By July 2003	NSW Fisheries EG MAC	–

Objective 2.1.4 To detect fluctuations in commercial catches of the following key secondary species, and other secondary species, beyond reference points: mulloway, silver biddy, flat tail mullet, river garfish, trumpeter whiting, blue swimmer crabs, greasyback prawn, cockles and beachworms

(a) monitor the total commercial catch of each key secondary species annually for comparison against reference levels

Background: A number of secondary species have been selected as "key secondary species" because they are subject to more rigorous performance monitoring requirements than other secondary species.

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,7	Annually	NSW Fisheries	–

(b) monitor the catch level of all other secondary species taken in the fishery annually for comparison against reference levels

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,7	Annually	NSW Fisheries	–

Objective 2.2 To conserve fish stocks by managing levels of active effort in the fishery

Other important responses: 1.1e,g,h; 1.2a; 1.3d; 2.1a,f; 2.1.1c; 2.1.2b; 2.1.3b; 2.5a-c; 2.5.2a; 4.1b; 5.2a; 6.1a,b,e; 6.2a,b

(a) implement a zoning scheme in the Estuary General Fishery

Background: A zoning scheme has been approved by the Minister for Fisheries and is currently being implemented.

Contributing to Goals	Timeframe	Responsibility	Authority
1,4	By December 2002	NSW Fisheries	Various

(b) identify the level of active effort (as opposed to latent effort) in each endorsement type and region, and implement minimum shareholdings over set time periods to ensure that the level of active effort does not exceed historical levels (provided that those levels are sustainable)

Background: The fishery management strategy must address the potential for existing operators to increase their activity in endorsement types they have had little involvement in. 'Active effort' and 'historical levels' will be determined using data on historic effort levels and current endorsement numbers.

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,5	By July 2003	NSW Fisheries	Regulatory

(c) continue the licensing arrangements described in the proposed management strategy (see section 6(i) of this fishery management strategy)

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,5,6,7	Current and ongoing	NSW Fisheries	Various

Objective 2.3 To prevent the activation of latent (unused) fishing effort by new entrants

Other important responses: 2.1.1c; 2.2b,c

(a) implement an owner-operator rule for estuary general fishing businesses (ie. no new nominations & sunset existing nominations), except in cases of short term illness

Background: There have been notable instances where fishers who have worked their entitlements very little in recent years have used the existing nomination provisions to 'pass' their entitlements to new entrants who work at significantly greater levels than the owner had been, thus substantially increasing the level of effort in the fishery.

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,5,6	By July 2003	NSW Fisheries	Regulatory

(b) establish minimum entry requirements for new entrants at the fishing business level (ie. taking into account entitlements held in other fisheries) to prevent increases in effort by small businesses

Background: Similar to how the Recognised Fishing Operation policy works (see section 5 in Chapter B), safeguards are needed to ensure that new entrants to the fishery replace active fishing businesses before they can operate. This response also provides a mechanism for structural adjustment in the fishery to improve the economic viability of fishing.

The best available information suggests that about 50% of the endorsement holders take only 10% of the fishery revenue. 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.

The Estuary General Fishery has for many years involved some component of lifestyle. A number of fishing businesses operate on a 'part time' basis, with fishers only working during times of peak catches or often when commitments in other fields of employment allow. NSW has a large residential coastal population and a significant recreational fishery. The community has made it clear in the past that commercial style netting in estuaries, particularly

for reasons of lifestyle or recreation, is not favoured. It is the Government's intention to create a full time professional fishing industry, and this response will assist in achieving that.

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,5	By July 2003	NSW Fisheries	Regulatory

(c) continue the prohibition on unlicensed crew from operating in the fishery (with the current exception that applies to prawn seining to a boat)

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,5	Current and ongoing	NSW Fisheries	FM Act

Objective 2.4 To minimise the impact of activities external to the Estuary General Fishery on the resources harvested by the fishery and on fishery related habitats

Other important responses: 1.3d 1.4a; 1.5a-f; 2.1.1a,c; 2.5a,b; 4.2c; 6.3c

(a) NSW Fisheries will continue to review and where necessary 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

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. The Department can provide comment on the proposal and, in some circumstances, recommend conditions to be attached to the approval of the activity.*

Contributing to Goals	Timeframe	Responsibility	Authority
1,7	Current and ongoing	NSW Fisheries	EP&A Act

(b) the Estuary General MAC will consider the impacts on the resource of activities external to the fishery and bring any detrimental impacts to the attention of NSW Fisheries and/or the relevant managing agency

Contributing to Goals	Timeframe	Responsibility	Authority
1,5,6,7	Current and ongoing	EG MAC	–

(c) NSW Fisheries and commercial fishers will contribute to the development of policies or legislation established by the NSW Government to ensure that fish stock and habitat issues (including beach habitat) are properly considered in other environmental planning regimes

Background: NSW Fisheries and fisheries stakeholders are already represented on many natural resource management committees that operate across the State (eg. Catchment Management Boards, Healthy Rivers Commission, Coastal Council of NSW, etc.)

Contributing to Goals	Timeframe	Responsibility	Authority
1,6,7	Current and ongoing	NSW Fisheries EG fishers	–

Objective 2.5 To promote the recovery of overfished species

Other important responses: 1.1g; 1.5a-f; 2.1a,c,d; 2.1.1a; 2.1.4b; 2.2a-c; 2.3a-c; 4.2c

(a) where the fishery is a major harvester of an overfished species, develop and implement a recovery plan for the species within a specified timeframe

Contributing to Goals	Timeframe	Responsibility	Authority
1,4,5,6	Recovery plan drafted for consultation within 6 months	NSW Fisheries EG MAC	To be determined

(b) where the fishery is a minor harvester of an overfished species, contribute to the development of a recovery plan 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 EG MAC	To be determined

(c) during the period of development of a recovery plan 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.

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 plan.

Contributing to Goals	Timeframe	Responsibility	Authority
1,6	As required	NSW Fisheries	Various

Objective 2.5.1 To assist in the development of a recovery plan for silver trevally

(a) commence consultation with all harvest sectors of silver trevally over the development of a recovery plan for that species, in particular consider the introduction of an appropriate size limit to address the growth overfishing problem

Background: Data available for both commercial and recreational catches since the late 1980s strongly suggest a significant reduction in the mean size of silver trevally. Yield modelling indicates silver trevally are being caught well below the optimum size, and the analyses suggest that the silver trevally stock is growth overfished. Significant increases in yield (per recruit) would be expected to result from increasing the size at first capture, at current exploitation rates.

Contributing to Goals	Timeframe	Responsibility	Authority
6	Immediate	NSW Fisheries EG MAC	–

Objective 2.5.2 To assist in the development of a recovery plan for sea garfish

(a) prevent the capture of sea garfish in the fishery whilst a recovery plan for the species is being developed through the ocean hauling fishery

Background: Sea garfish are found in ocean waters throughout NSW and are also found in the lower reaches of estuaries. The life history is poorly understood. Juveniles are known to occur in estuaries and spawning most likely occurs in coastal waters. Sea garfish are predominantly taken in the ocean hauling fishery, and comprise less than 0.1% of the estuary general commercial catch. The draft FMS for the ocean hauling fishery has identified sea garfish as most likely to have been recruitment overfished and that the species is being caught at levels generally lowest on record. There is an urgent need to improve biological knowledge of and the assessment for this species to ensure appropriate management settings. The development of a recovery plan for sea garfish commenced with the preparation of a draft FMS for the ocean hauling fishery. Note that river garfish which are taken in much greater quantities in estuaries should not be confused with sea garfish.

Contributing to Goals	Timeframe	Responsibility	Authority
1,6	Immediate	NSW Fisheries	Regulatory

GOAL 3. To promote the conservation of threatened species, populations and ecological communities associated with the operation of the Estuary General Fishery

Objective 3.1 **To eliminate and/or minimise any impact of fishing activities in the fishery on threatened species, populations and ecological communities (including mammals, birds, reptiles, amphibians, fish, invertebrates and vegetation), and where possible promote their recovery**

Other important responses: 1.1f,g; 1.2a-c; 1.3b-d; 2.1a; 2.1.2c; 6.4a

(a) modify the catch and effort returns, in consultation with the Estuary General MAC, to collect and monitor information on sightings or captures of threatened or protected species

Background: The guidelines for a "ecologically sustainable" fishery approved by the Commonwealth under the Wildlife Protection (Regulation of Exports and Imports) Act 1982 *include a requirement to collect information on interactions with endangered, threatened or protected species and threatened ecological communities.*

Contributing to Goals	Timeframe	Responsibility	Authority
6	Immediate	NSW Fisheries EG MAC	–

(b) implement, in consultation with the Estuary General MAC, the provisions of any relevant threatened species recovery plans or threat abatement plans

Note: The recovery plans referred to in this response could include those being developed under the Fisheries Management Act 1994 *or the* Threatened Species Conservation Act 1995. *The response recognises that the provisions of a threatened species recovery plan must be implemented and take precedence over any conflicting provisions contained in this FMS.*

Contributing to Goals	Timeframe	Responsibility	Authority
6	As required	NSW Fisheries EG MAC	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.

At the commencement of this 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, grey nurse shark, herbst nurse 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	FM Act

GOAL 4. To appropriately share the resource and carry out fishing in a manner that minimises impacts on others

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 fish**

Other important responses: 1.1e,g; 1.2a; 2.1a,b,d,f; 2.1.1a-c; 2.1.2b; 2.1.4a,b; 2.2a-c; 2.3a-c; 2.5a,b; 4.2a; 4.5a; 6.2a,b; 6.3c

(a) estimate, as far as practicable, the size of the non-commercial catch, and the relative impact of such harvesting on the resource, taking into account the results of the National Recreational and Indigenous Fishing Survey

Note: Final results from this survey were not available at the time of drafting the FMS, but are expected to be available in early 2002. Illegal catch includes any 'black market' catch sold by both licensed and unlicensed fishers.

Contributing to Goals	Timeframe	Responsibility	Authority
2,7	By June 2003	NSW Fisheries	–

(b) continue the requirement that species landed in this fishery are not landed in contravention of any maximum daily catch or 'trip' limit that may apply to particular species

Background: At the commencement of this FMS, a daily bycatch limit applied to two species taken in the Estuary General Fishery. A limit of 100 kg per hauling crew, 50 kg per meshing crew (or individual) and 50 kg for any other licensed commercial fishing vessel containing a commercial fishing net applies for Australian salmon north of Barrenjoey Headland and tailor taken in all NSW waters

Contributing to Goals	Timeframe	Responsibility	Authority
2	Current and ongoing	NSW Fisheries	Various

Objective 4.2 **To monitor and manage a fair and equitable sharing of the fisheries resource *among commercial fisheries***

Other important responses: 1.1e,g; 1.2a; 2.1a,b,d,f; 2.1.1a-c; 2.1.4b; 2.2b,c; 2.3a,c; 2.5a,b; 4.1b; 4.2a; 6.2a,b; 6.3c

(a) monitor the catch of the primary estuary general species that are also taken in other commercial fisheries (ie. ocean trap and line, estuary prawn trawl, etc)

Contributing to Goals	Timeframe	Responsibility	Authority
2,7	Annually	NSW Fisheries	–

(b) through the prawn resource forum, determine on an annual basis an appropriate size at first capture for king prawn and school prawn species. Once an appropriate size has been determined, the use of prawn gear in the Estuary General Fishery (such as times of operation) should be modified appropriately

Background: See section 6(i)(xviii) of this draft FMS for a discussion on the Prawn Resource Forum.

Contributing to Goals	Timeframe	Responsibility	Authority
1,2,5	Annually from 2002	NSW Fisheries	Various

(c) review, in consultation with the Estuary General MAC and Ocean Hauling MAC, the use of the garfish hauling and garfish bullringing nets in the estuary general and ocean hauling fisheries

Contributing to Goals	Timeframe	Responsibility	Authority
2,6	By July 2003	NSW Fisheries EG MAC	–

Objective 4.3 To monitor and manage a fair and equitable sharing of the fisheries resource *within the Estuary General Fishery*

Other important responses: 1.1e,g; 1.2a; 2.1a,d,f; 2.1.1a,b,d; 2.1.2c; 2.1.3a,c; 2.2a-c; 2.3a,c; 2.5a,b; 5.2a; 6.1d; 6.2a,b; 6.3c

(a) monitor the relative catch of the primary and key secondary species taken by meshing, hauling, trapping, handlining and handgathering methods

Contributing to Goals	Timeframe	Responsibility	Authority
7	Annually	NSW Fisheries	–

(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
5	By July 2003	NSW Fisheries	Regulatory

Objective 4.4 To minimise any impacts of the Estuary General Fishery on Aboriginal cultural heritage

Other important response: 4.1a; 6.4a

(a) participate in the development of and subsequent reviews of the Indigenous Fisheries Strategy

Background: The NSW Government is currently developing an Indigenous Fisheries Strategy for NSW, and the Estuary General MAC has already examined and provided comments on an working paper.

Contributing to Goals	Timeframe	Responsibility	Authority
6	Current and ongoing	EG MAC	To be determined

(b) consult the Aboriginal Sites Register administered by the National Parks and Wildlife Service and coastal Aboriginal Land Councils when identifying designated landing sites [see management response 1.2a(ii*)*], and wherever practicable avoid hauling over known Aboriginal sites

Contributing to Goals	Timeframe	Responsibility	Authority
6	Current and ongoing	EG MAC	To be determined

Objective 4.5 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: 1.1b,c,e,g,h; 1.2a-d; 1.3d; 2.1a,d; 2.1.1a,c; 2.1.2c; 2.2a-d; 2.3a-c; 3.1c; 4.1a,b; 4.2b; 4.3b; 4.4a,b; 6.1b; 6.3b,c; 6.4a; 7.1a-c; 7.2a; 7.4a

(a) consult with the comunity on proposals for recognised fishing grounds made, in accordance with the guidelines approved by the Minister from time-to-time, over historical fish hauling, prawn hauling, prawn running and prawn set pocket net sites.

Background: Recognised fishing grounds determine the rights of priority for certain methods between commercial fishers and other waterway users in specified areas. They do not prevent local Councils from approving applications for development in or over those areas, but they can be useful in highlighting areas of importance for commercial fishing. Draft guidelines for declaring recognised fishing grounds in the Estuary General Fishery are provided in section 6(i)(xvii) of this chapter.

Contributing to Goals	Timeframe	Responsibility	Authority
5,6	Ongoing	NSW Fisheries EG MAC	FM Act and Regulations

(b) continue to administer the code of conduct in the Clarence River relating to the modification of prawn set pocket net operations to reduce the impact of noise on the surrounding community

Background: Fishers from the Clarence River operate under a code of conduct which limits the level of noise made by prawn set pocket net boats during their operation, specifically noise emanating from boats using their engines and propellers to stimulate water flow through the nets, from marine radios and from gas fired prawn cookers.

Contributing to Goals	Timeframe	Responsibility	Authority
6,7	Current and ongoing	EG fishers	Voluntary

GOAL 5. To promote a viable commercial fishery (consistent with ecological sustainability)

Objective 5.1 To optimise the biological yield of fish taken within the fishery where appropriate to maximise economic return

Other important responses: 1.1a,g; 1.2a; 2.1a,d; 2.1.1a,b; 2.5a,b; 4.2b; 6.3c

Objective 5.2 To promote the long term economic viability of estuary general fishing

Other important responses: 1.1a; 1.2a,c; 1.5a-f; 2.1.3c; 2.2b,c,d; 2.3a-c; 2.5a,b; 4.2b; 4.3b; 5.3a; 6.1d

(a) use minimum shareholding provisions, either as a trigger point response or in accordance with the share management plan, to adjust the number of estuary general fishing businesses to a level which improves the economic viability of the fishery and its participants

Background: As stated earlier in this section, it is the Government's intention to create a full time professional fishing industry.

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.

This management response provides a mechanism within the FMS to reduce the number of estuary general fishing businesses in order to improve the fishery-wide average economic return and expand the potential for greater individual profitability.

Contributing to Goals	Timeframe	Responsibility	Authority
2,4	By July 2003	NSW Fisheries	Regulatory

(b) NSW Fisheries will develop, in consultation with the Estuary General MAC, a performance measure for economic viability at the individual fishing business level

Background: A performance indicator is already proposed under goal 5 in section 5 of this chapter 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
4,7	By December 2005	NSW Fisheries EG MAC	

(c) 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 suceeding 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 for NSW Fisheries for it's existing management services, will not increase without the support of the relevant MAC. Each estuary general fisher currently pays the same commercial fishing licence fees for the Estuary General 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 ACCF	Ministerial determination

Objective 5.3 To provide secure fishing entitlements for estuary general fishers

Other important responses: 2.1.1b; 2.2c; 2.3b,c; 4.5a; 6.1d

(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

Objective 5.4 To appropriately manage food safety risks in the harvesting of fish in the fishery

Other important responses: 1.2c; 2.2c; 2.4b; 6.1f; 6.4a

(a) co-operate with Safefood Production NSW in the development and implementation of food safety programs relevant to the fishery, including the pipi biotoxin management scheme

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	EG fishers	FP Act

(b) continue the prohibition on the processing or mutilation of fish taken in this fishery on or adjacent to water

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

GOAL 6. To ensure cost-effective and efficient estuary general management and compliance programs

Objective 6.1 **To maximise compliance with the Estuary General Fishery Management Strategy**

Other important responses: 1.2c; 2.1f; 2.1.3b; 2.2c; 2.3a; 4.5a; 5.3a; 6.2a-c; 6.3a,c; 7.1a-c; 7.4a,b

(a) develop, in consultation with the Estuary General MAC, a compliance strategic plan to provide the direction for education, advisory and enforcement services provided by NSW Fisheries for the Estuary General Fishery

Background: NSW Fisheries already develops and implements operational plans for compliance.

Contributing to Goals	Timeframe	Responsibility	Authority
2	By December 2002	NSW Fisheries EG MAC	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" will be defined in the share management plan and could include offences such as interfering with fishing gear, offences carrying serious consequences, etc. It should be noted that the Estuary General MAC supports a penalty points scheme with suspension or cancellation provisions for endorsements, but does not support a forfeiture scheme for shares issued in the fishery.

Contributing to Goals	Timeframe	Responsibility	Authority
2,4	By July 2003	NSW Fisheries	Regulation 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	Ongoing from 2003	NSW Fisheries	–

(d) continue the prohibition on fishers using or interfering with fishing gear set by other fishers

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

(e) continue the requirement that all fishing gear in the fishery be marked in accordance with the requirements set out in the Regulation

Contributing to Goals	Timeframe	Responsibility	Authority
2	Current and ongoing	NSW Fisheries	FM Act

(f) continue the requirement that fish taken in this fishery are marketed through a Registered Fish Receiver or a Restricted Registered Fish Receiver as outlined in the Regulation

Contributing to Goals	Timeframe	Responsibility	Authority
5,7	Current and ongoing	NSW Fisheries	Regulatory

Objective 6.2 To encourage cooperation between fishers and compliance officers in detecting offences and to promote stewardship of the resource

Other important responses: 1.2c; 2.1.3c; 2.2c; 2.3a; 4.5b; 5.3a; 6.1a,d; 6.3a,c; 7.1a-c

(a) continue the use of regulatory controls, 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 this strategy

Contributing to Goals	Timeframe	Responsibility	Authority
1,2,4	Current and ongoing	NSW Fisheries	Various

(b) continue the requirement for fishers to adhere to determinations made by local fisheries officers with respect to the use of prawn nets

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

(c) 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

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 General Fishery

Other important responses: 1.3a,c,d; 1.5a-f; 2.2c; 2.4b,c; 2.5.1a; 4.2b,c; 4.4a,b; 5.2c; 5.4a; 2.5a,b; 6.1a,c; 6.3c; 7.1a-c; 7.2a; 7.3a; 7.4a,b

(a) continue to utilise the Estuary General MAC as the primary consultative body for issues affecting the fishery

Contributing to Goals	Timeframe	Responsibility	Authority
–	Current and ongoing	NSW Fisheries	–

(b) continue to utilise the services of a chair in the Estuary General 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

(c) establish local joint industry/Departmental working groups as needed to provide advice to NSW Fisheries on local management needs and arrangements

Contributing to Goals	Timeframe	Responsibility	Authority
1,2,4,5,6	By December 2002	NSW Fisheries EG fishers	–

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 ecologically sustainable development

Other important responses: 1.3b-d; 1.4a; 2.2c; 2.5c; 2.5.2a; 3.1a,b; 4.4a,b

(a) manage the Estuary General 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 strategy will be operating alongside other programs relating to the management of marine resources, and must be consistent with those programs. The strategy must be adaptive if inconsistencies between the programs become apparent. This response enables a whole-of-government approach to management of the estuarine ecosystem.

Contributing to Goals	Timeframe	Responsibility	Authority
1,3,4,5	Current and ongoing	NSW Fisheries	–

(b) 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 purposes consistent with the vision and goals of this fishery management strategy

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

GOAL 7. To improve knowledge of the Estuary General Fishery and the resources upon which the fishery relies

Objective 7.1 To improve the community's understanding and public perception of commercial estuary general fishing

Other important responses: 1.1f; 1.2a,c; 1.3d; 1.4a; 2.1.1b; 2.1.2a; 2.1.3a; 2.1.4a,b; 2.4a-c; 4.5b; 5.2b; 6.1c; 7.2a; 7.3a; 7.4b

(a) make the Fishery Management Strategy, Environmental Impact Statement and other relevant documentation widely available to the public by:

- placing them on the NSW Fisheries website
- providing copies at Fisheries Offices throughout the State
- targeted mail outs to key stakeholders.

Contributing to Goals	Timeframe	Responsibility	Authority
4,6	Ongoing	NSW Fisheries	–

(b) produce or contribute to the production of brochures, newsletters, signs and undertake targeted advisory and educational programs as considered appropriate by NSW Fisheries

Contributing to Goals	Timeframe	Responsibility	Authority
4,6	Current and ongoing	NSW Fisheries	–

(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	Current and ongoing	NSW Fisheries	–

Objective 7.2 To promote community awareness as to the importance of fish habitat to fish stocks

Other important responses: 1.5f; 2.1.1b; 2.4a-c

(a) publish educational information concerning the protection of fish habitat (including the benefits of aquatic reserves) on the NSW Fisheries website and in other publications and media that NSW Fisheries consider relevant

Contributing to Goals	Timeframe	Responsibility	Authority
4,6	Current and ongoing	NSW Fisheries	–

Objective 7.3 To promote appropriate scientific research and monitoring to gain knowledge of target species, bycatch species and the impacts of fishing on the general environment

Other important responses: 1.1f; 1.3a-c; 1.5b; 2.1b,c; 2.1.1b; 2.1.4a,b; 3.1a; 4.1a; 4.2a; 4.3a; 6.4b; 7.4a,b

(a) 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 General Fishery. This process will need to incorporate feedback from the stakeholder groups on the research needs identified in this strategy. The priority setting process will identify the research priorities for the Estuary General Fishery by June 2002.

Contributing to Goals	Timeframe	Responsibility	Authority
4,6	Current and ongoing	NSW Fisheries	–

(b) 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 7.3a

Background: Research into the Estuary General 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 June 2002	NSW Fisheries	–

Objective 7.4 To improve the quality of the catch and effort information collected from endorsement holders

Other important responses: 1.1f; 1.3b; 2.1.1b; 2.2c; 3.1a; 6.1f

(a) periodically review, in consultation with the Estuary General MAC, the mandatory catch and effort return forms submitted by estuary general fishers and implement changes if:

- the data collected is perceived to be of poor quality or insufficient for the purpose of conducting an environmental assessment
- the forms are found to be exceedingly complex for fishers to complete, ensuring an emphasis on the quality rather than quantity of information collected.

Contributing to Goals	Timeframe	Responsibility	Authority
1,2,4,6	Current and ongoing	NSW Fisheries EG MAC	–

Background: A working group involving input from commercial fishers and NSW Fisheries staff has been established to review the current mandatory catch and effort returns used by fishers. The working group will make recommendations for change to the current returns that

are considered necessary to improve the quality of data collected. Any recommendations of the working group will be discussed with the Estuary General 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 performance of this strategy. Most species in the fishery are clearly and easily identified and accurately reported, however, there are some species for which correct identification or reporting can be difficult (eg. the different species of leatherjackets).

Contributing to Goals	Timeframe	Responsibility	Authority
1,2,4,6	By 2004	NSW Fisheries EG MAC	–

5. Performance Monitoring and Review

a) Performance monitoring

The complex nature of the Estuary General Fishery means that 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 seven goals (ie. the major objectives). An annual report will, however, be prepared (as outlined later in this section) detailing the progress made in implementing 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 are to be used to gather information to measure performance indicators. These monitoring programs are detailed later in this section in Table C10.

With the implementation of the new research proposals for the fishery outlined in section 6(g) 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.

Table C2 to Table C9 establish 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 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 and the ongoing operation of the FMS is not affected by any specified timeframe in the FMS not being met or by the review processes required in the event of performance indicators being triggered.

c) Reviews arising from triggered performance indicators

i) The review process

If a performance indicator reaches the corresponding trigger point, the Minister will firstly consult with the relevant fishery's MAC 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 catch levels 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, 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 the performance monitoring provisions are inappropriate and need to be modified, the FMS itself may need to be amended by the Minister for Fisheries. If the reasons are considered to be due to 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 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. Any price fluctuations can result in fishers adjusting their activities.

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 General MAC. In the case of the former, the Minister must consult the Estuary General 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, however, the Minister for Fisheries may 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 may need to be 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.

Table C2. Performance indicators and trigger points for Goal 1 of the draft FMS.

	Performance indicator	Trigger point	Comments
1	[A performance indicator will be developed to monitor biodiversity impacts at the species, community and ecosystem levels. — see management response 1.3b]	[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 will be used (below) until a suitable indicator is developed. This is likely to include the monitoring of species composition and abundance
2	Number of estuaries totally closed to estuary general fishing (through regulatory controls, marine parks and/or aquatic reserves)	The number of estuaries open to estuary general fishing increases after the commencement of the FMS or any estuary that was previously closed to commercial fishing is opened	Significant closed areas prevent any impacts of the fishery on biodiversity on those areas, thus minimising the total impact on biodiversity at the regional or state-wide scale
3	Estimate of total quantity of bycatch by method	Total bycatch for any method increases between repeated observer surveys	This has been estimated for some methods through previous research programs, but will not be possible for all methods until the observer program commences. Baseline information relating to seasonal changes will be obtained through the observer program
4	Ratio of bycatch compared with total landings by method	No trigger point set at this stage. To be set one year after the commencement of the observer program	The scientific observer program will provide benchmarks for the ongoing monitoring of bycatch
5	Response of the fishery to marine pest and disease incursions	The fishery does not respond appropriately to marine pest and disease management programs that recommend that estuary general 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 C3. Performance indicators and trigger points for Goal 2 of the draft FMS.

	Performance indicator*	Trigger point*	Comments
1	Total annual commercial landings or other available indications of stock size of each primary species	See table C9	The selection of species trigger points is discussed later in this section
2	Total annual commercial landings or other available estimates of stock size of each key secondary species	See table C9	Species trigger points are discussed later in this section
3	Commercial landings of each eel species in each catchment contributing greater than 10% of total eel landings	Landings in any one of these catchments change by at least 45% from the reference year 1998/99	
4	Commercial landings of sea mullet in estuary and ocean waters	Landings in estuary or ocean waters change in the same direction by at least 10% per year in each of two consecutive years	
5	Total commercial landings of each primary and key secondary species from each estuary fished	Landings in any one estuary changes by at least 50% between any two consecutive years	There is normally significant variation between estuaries
6	Ratio of prohibited size fish of primary and key secondary species	Ratio of prohibited size fish of primary and key secondary species increases between consecutive observer surveys	This information will come from the scientific observer program
7	Total estuary general annual landings of each secondary species (other than key secondary species)	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 catch level is considered outside the range even if there have been years where no catch was recorded
8	Number of each endorsement type in each region	Number of available endorsements exceed historically active levels after four years	This indicator measures potential fishing effort at the broad scale. If the target number of endorsements is not achieved by the timeframe stipulated, the minimum shareholding must immediately increase to ensure that historical levels are maintained

Table C4. Performance indicators and trigger points for Goal 3 of the draft FMS.

	Performance indicator	Trigger point	Comments
1	Number of incidental captures relating to threatened species, populations or ecological communites	The number of captures increases between consecutive years by 25% or more	Data will be sourced from the scientific observer program and catch return records. If the observer progrm indicates that it would be appropriate to monitor this indicator on a regional basis, the indicator will be modified appropriately
2	Response of the fishery to threatened species declarations	A threatened species recovery plan or threat abatement plan requires a modification to estuary general 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 C5. Performance indicators and trigger points for Goal 4 of the draft FMS.

	Performance indicator	Trigger point	Comments
1	Estimates by NSW Fisheries of the catch of primary and key secondary 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	Catch levels (incl. estimates) from the commercial, recreational and Indigenous sectors (excluding catches attributable to recreational fishing areas).	After estimates become available, relative catch levels between sectors shifts by 25% over each five year period	This relates primarily to the objective of monitoring and managing equitable allocations between fishing sector groups
3	Catch levels of species taken in the estuary general fishery relative to other commercial fisheries	Relative catch levels between commercial fisheries shifts by 25% over each five year period	This relates primarily to the objective of monitoring and managing equitable allocations between commercial fisheries
4	Catch of primary and key secondary species by endorsement type	Relative catch levels between endorsement types shifts by 25% over each five year period	This relates primarily to the objective of monitoring and managing equitable allocations within the fishery
5	Total annual commercial landings taken in each region	Catch levels between any two regions shifts by 25% over each five year period	This relates primarily to the objective of monitoring and managing equitable allocations within the fishery

Table C6. Performance indicators and trigger points for Goal 5 of the draft FMS.

	Performance indicator	Trigger point	Comments
1	Median fishery-wide gross return of estuary general fishers derived from commercial fishing in NSW	Median fishery-wide gross return has not increased by at least 20% four years after the commencement of the share management plan	This relates to the fishery-wide median and will indicate if there is a greater number of economically viable fishing businesses involved in the estuary general fishery over time. This should not be interpreted as the gross return of individuals increasing by that amount
2	Average market value of estuary general 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, once the trading period with increased minimum shareholdings has ceased, average share value may be a good indicator of economic health of the fishery

Table C7. Performance indicators and trigger points for Goal 6 of the draft FMS.

	Performance indicator	Trigger point	Comments
1	Rate of compliance relating to the estuary general fishery as indicated by quality inspections conducted by NSW Fisheries	Overall rate of compliance with quality inspections is less than 80%	The reported estuary general compliance rate during the 1999/00 financial year was 92%. As quality inspections are a more comprehensive evaluation of compliance by fishers than the previous measure used, it is possible that the 92% level may decrease
2	Number of Estuary General MAC meetings held each year	Less than two meetings held in a calender year, unless otherwise agreed by the MAC	This trigger point is currently a requirement of the regulation
3	Occasions when this FMS is in direct conflict with other approved Commonwealth or State programs	Any occasion when the Director, NSW Fisheries determines that this 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 C8. Performance indicators and trigger points for Goal 7 of the draft FMS.

	Performance indicator	Trigger point	Comments
1	Scientific observer program is established and providing quality data	The scientific observer program has not commenced by December 2002	Funding for this new program will be sourced from the fishery participants
2	Total level of funding committed to research projects that the Director, NSW Fisheries determines provide a flow of benefits to the Estuary General Fishery of 25% or more	To be determined	
3	Number of research grant applications submitted to external funding agencies annually relating to the Estuary General Fishery	There are less than two such applications submitted annually	The outcome of such grant applications can not be guaranteed
4	Rate of successful external research funding applications relating to the Estuary General Fishery, measured as a percentage	To be determined	
5	Accuracy of catch return data measured every two years	Accuracy of data is at or below 80%	Accuracy will be measured by undertaking comparisons with market records using a sample of endorsement holders

f) Setting trigger points for monitoring changes in commercial landings

A system to detect undesirable changes in landings will be used while stock assessments are being developed for primary species. This primary monitoring tool is also likely to be in place for an extended period for the many species of low value (and/or catch) that do not have better estimates of stock status. As biological reference points become available from stock assessments, monitoring based solely on landings will be phased out.

Systems for monitoring based on landings only are rarely formalised, as proposed in this draft FMS, and published examples of such systems could not be found. However, the large number of species caught in most NSW fisheries means that some species must remain a relatively low priority for stock assessment. For these species, monitoring landings is the only practical choice.

A more sophisticated treatment of catch data often used in stock assessments is catch per unit effort (or CPUE) analysis. However, caution must be taken in analysing CPUE information for the reasons described in the box below.

Note on the use of catch per unit effort as an indicator of relative abundance

It is tempting to consider that there is a simple relationship between fish stock abundance and catch which has been scaled by units of fishing effort (known as catch per unit of effort or CPUE). 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 target aggregations of fish, which can mean that CPUE stays high, even as total abundance drops because the remaining fish continue to aggregate.

The correct use of fishing effort data requires a good knowledge of 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.

An index of relative abundance based on CPUE is likely to be biased when applied to a range of species, even when caught by the same gear (Richards and Schnute, 1986). This means the application of CPUE information from commercial catch records would need to be adjusted for each species.

Finally, CPUE series need to take account of changes in reporting (see Pease and Grinberg, 1995) or other changes that may have changed catchability. The difficulties as they relate to the NSW Estuary General Fishery are discussed in Scandol and Forrester (2001). For these reasons, CPUE has not been used in the development of initial performance indicators and trigger points in this draft FMS.

The aim of trigger points based on changes in catch is to force a review of a species' circumstance when landings 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 relative to known levels of variation in annual catch levels. That is, trigger levels will be set to be within the known range of past landings variation, leading to the expectation of "false alarms". 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:

- level of variation in recorded historic landings
- lanagement changes over time that may affect landings levels
- changes in the catch recording system that limit interpretation of landings 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 catch can be interpreted.

The landings-based trigger points are designed to measure different types of changes in catch of the primary and key secondary species.

Firstly, a review should commence when landings change dramatically from one year to 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 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 landings level from the previous year.

The second type of trigger point is designed to detect patterns in landings that are of sufficient concern to require a review (eg. a downward or upward trend over several years). Time series of landings for any commercial species are likely to be correlated from one year to the next (ie. the level of landings one year is related to the level of landings in one or more previous years.) This type of data structure will complicate the analysis of trends in landings. It is not a trivial exercise to devise an objective system to force a review when catch data exhibit certain patterns. For example, downward trends in landings 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 (eg. does the species come from a group that is known to be relatively long- or short-lived?)

An objective system for defining trigger points that detect concerning trends in landings will be developed and tested during the first nine months of the FMS and applied to all primary and key secondary species at the first annual review. The assistance of a statistical expert will be sought to develop this system. The system may involve several different measures, including the steepness of the trend and the period over which the trend occurs.

g) How trigger points based on landings will work

The single year trigger is explained in the examples shown in Figure C3. These examples below explain how the single year trigger points will work with a hypothetical starting point (five years ago), trigger levels and existing catch data.

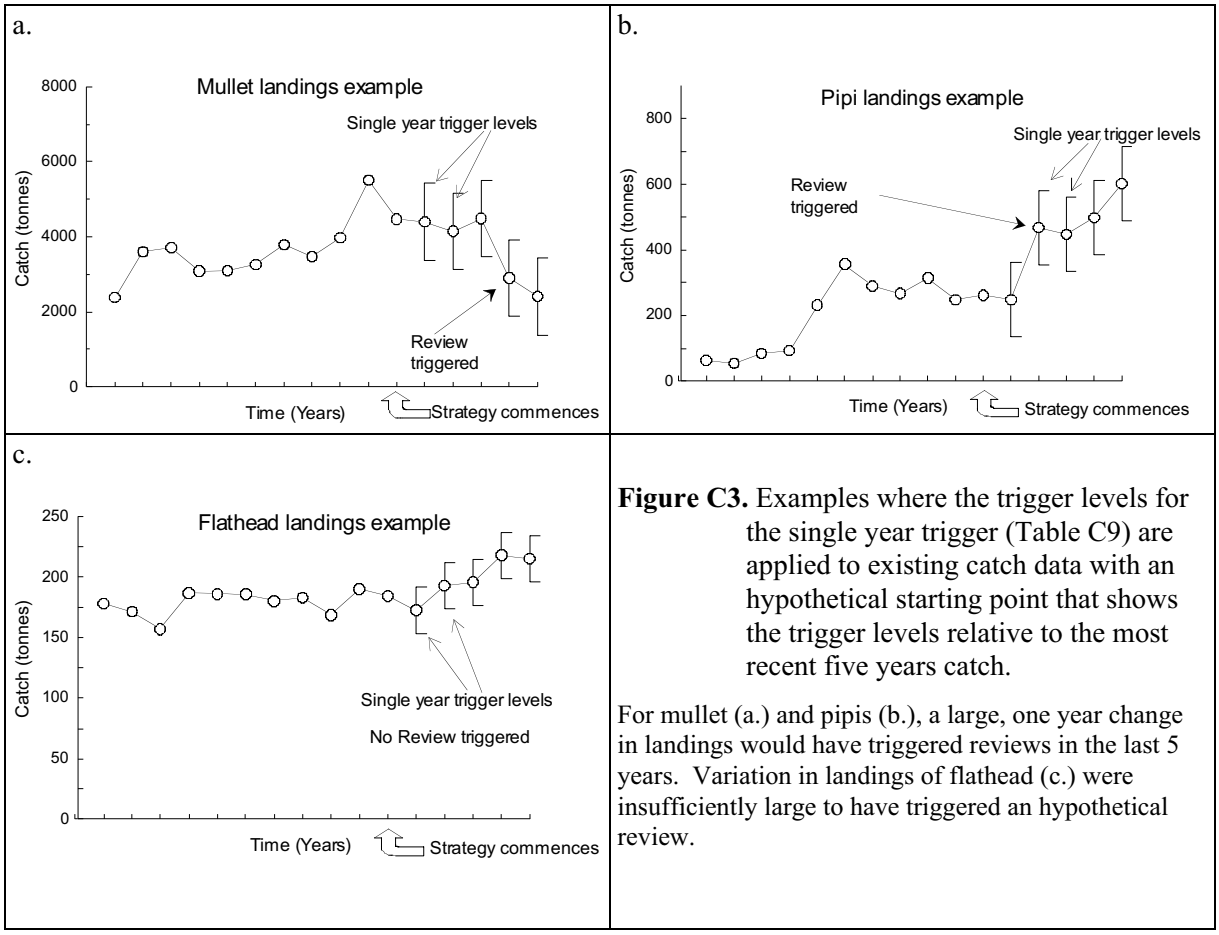


Figure C3. Examples where the trigger levels for the single year trigger (Table C9) are applied to existing catch data with an hypothetical starting point that shows the trigger levels relative to the most recent five years catch.

For mullet (a.) and pipis (b.), a large, one year change in landings would have triggered reviews in the last 5 years. Variation in landings of flathead (c.) were insufficiently large to have triggered an hypothetical review.

Table C9. Levels of trigger points for single year trigger to detect large change from one year to the next.

Note: These levels will apply for the first year of the FMS only. 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 16 years commencing in 1984/85 except for river eels, where records commenced in 1990/91. All values are in tonnes.

	Reference level (99/00 catch)	**Average annual change (+ 80% CI)**	**Upper trigger point**	**Lower trigger point**
Primary species				
Sea mullet	2412.9	1022	3434.9	1390.9
Luderick	489.6	102.9	592.5	386.7
Yellowfin bream	281.5	101.7	383.2	179.8
School prawns	909.2	373.5	1282.7	535.7
Dusky flathead	215.4	18.7	234.1	196.7
Eastern king prawn	891.5	179.4	1070.9	712.1
Sand whiting	128.2	38.7	166.9	89.5
Mud crab	137.2	40.2	177.4	97
River eels	134.5	64.7	199.2	69.8
Pipis	602.2	113.3	715.5	488.9
Key secondary species				
Blue swimmer crab	181.2	68.5	249.7	112.7
Greasyback prawns	27.3	28.9	56.2	0
Mulloway	70	30	100	40
Cockles	42	27.3	69.3	14.7
Beachworms	19.9	14.7	34.6	5.2
River garfish	44	12.7	56.7	31.3
Silver biddy	121.6	43.8	165.4	77.8
Flat tail mullet	68.8	29.6	98.4	39.2
Trumpeter whiting	64.6	16.1	80.7	48.5

i) Monitoring programs

Table C10 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 the monitoring the performance of the draft FMS.

Table C10. Monitoring programs in place or planned to measure the performance indicators.

Goal	Performance indicator	Monitoring program	Time frame
1	Number of estuaries totally closed to estuary general fishing (through regulatory controls, marine parks and/or aquatic reserves)	Review number of estuaries totally closed to estuary general fishing every two years	Begin 2002 and review every two years
	Estimate of total quantity of bycatch by method	Observer-based program that provides a predetermined cover of all fishing methods in a predetermined number of key estuaries stratified throughout the regions	Begin January 2003 and ongoing subject to annual review
	Ratio of bycatch compared with total landings by method	Observer-based program that provides a predetermined cover of all fishing methods in a predetermined number of key estuaries stratified throughout the regions	Begin January 2003 and ongoing subject to annual review
	Response of the fishery to marine pest and disease incursions	Reports will be provided to the Estuary General MAC through the marine pest management program on results of monitoring marine pests and diseases	Ongoing
2	Total annual commercial landings or other available indications of stock size of each primary species	Annual analysis by NSW Fisheries scientists, in consultation with the Estuary General MAC, of commercial catch returns Reports scrutinised in March/April and final report made available in June of each year.	Begin 2002 and ongoing subject to annual review
	Total annual commercial landings or other available estimates of stock size of each key secondary species	Annual analysis by NSW Fisheries scientists, in consultation with the Estuary General MAC, of commercial catch returns Reports scrutinised in March/April and final report made available in June of each year.	Begin 2002 and ongoing subject to annual review
	Total commercial landings of primary and key secondary species from each estuary fished	Annual analysis by NSW Fisheries scientists, in consultation with the Estuary General MAC, of commercial catch returns Reports scrutinised in March/April and final report made available in June of each year.	Begin 2002 and ongoing subject to annual review
	Total estuary general annual landings of each secondary species (other than key secondary species)	Annual analysis by NSW Fisheries scientists, in consultation with the Estuary General MAC, of commercial catch returns Reports scrutinised in March/April and final report made available in June of each year.	Begin 2002 and ongoing subject to annual review
3	Number of incidental captures relating to threatened species, population or ecological communities	Annual analysis by NSW Fisheries scientists, in consultation with the Estuary General MAC, of commercial catch returns Reports scrutinised in March/April and final report made available in June of each year. Analysis of annual report from observer-based program	Begin 2002 and ongoing subject to annual review
	Response of the fishery to threatened species declarations	Reports will be provided to the Estuary General 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, populations and ecological communities	Ongoing

Table C10 (cont).

Goal	Performance indicator	Monitoring program	Time frame
4	Estimates by NSW Fisheries of the catch of primary and key secondary species for all sectors (including recreational and Indigenous)	Stratified recreational creel surveys and compliance reports	Ongoing
	Catch levels (incl. estimates) from the commercial, recreational and Indigenous sectors (excluding catches attributable to recreational fishing areas)	Annual analysis by NSW Fisheries scientists, in consultation with the Estuary General MAC, of commercial catch returns and available data on catches by other sectors. Reports scrutinised in March/April and final report made available in June of each year.	Begin 2002 and ongoing subject to annual review
	Catch levels of species taken in the estuary general fishery relative to other commercial fisheries	Annual analysis by NSW Fisheries scientists, in consultation with the Estuary General MAC, of commercial catch returns Reports scrutinised in March/April and final report made available in June of each year.	Begin 2002 and ongoing subject to annual review
	Catch of primary and key secondary species by endorsement type	Annual analysis by NSW Fisheries scientists, in consultation with the Estuary General MAC, of commercial catch returns Reports scrutinised in March/April and final report made available in June of each year.	Begin 2002 and ongoing subject to annual review
	Total annual commercial landings taken in each region	Annual analysis by NSW Fisheries scientists, in consultation with the Estuary General MAC, of commercial catch returns Reports scrutinised in March/April and final report made available in June of each year.	Begin 2002 and ongoing subject to annual review
5	Median fishery-wide gross return of estuary general 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 general fishery, by multiplying their monthly catches with the respective average Sydney Fish Market price	Ongoing
	Average market value of estuary general 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
6	Rate of compliance relating to the estuary general fishery as indicated by quality inspections conducted by NSW Fisheries	The compliance rate will be calculated as part of the annual review using the Project Activities Reports (PARs) that are completed by the Field Services Branch	Ongoing
	Number of Estuary General MAC meetings held each year	The number of Estuary General MAC meetings held will be determined as part of the annual review based on the records held by NSW Fisheries	Ongoing
	Any occasion when the Director, NSW Fisheries determines that 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 reported to the Estuary General MAC on a case by case basis	Ongoing

Table C10 (cont).

Goal	Performance indicator	Monitoring program	Time frame
7	Scientific observer program is established and providing quality data	Implement a sampling strategy to adequately cover, via an observer survey, all estuarine commercial fishing methods across all regions (though the different methods may be staggered between years)	Begin January 2003 and ongoing subject to bi-annual review
	Total level of funding committed to research projects that the Director, NSW Fisheries determines provide a flow of benefits to the estuary general fishery of 25% or more	Annual review by the Director, NSW Fisheries of total research funding from consolidated and external funds that are being spent on the Estuary General Fishery	Begin 2002
	Number of research grant applications submitted to external funding agencies annually relating to the estuary general fishery	Via Estuary General MAC submit at least two grant applications that relate to the fishery to external funding agencies annually, and calculate the success rate	Begin 2002
	Accuracy of catch return data measured every two years	Analysis of comparisons of catch return records with Fish Receiver data and compliance data, and observer-based surveys, every two years	Begin by July 2002 and review every two years

6. Proposed Harvesting Strategy

a) Fishery status

i) Number of operators

In July 2001, NSW Fisheries licensing database showed that 944 fishing businesses held entitlements to operate in the Estuary General Fishery. This number however, constantly varies due to a number of factors including the transfer and amalgamation of fishing businesses and late payments on renewal of fishing licences.

ii) Implementation of share management

The Estuary General 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 is a staged implementation.

The fishery is first identified as a share management fishery by being included in Schedule 1 of the 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 in the fishery to be eligible to hold an endorsement. Throughout this stage, the fishery continues to operate under the regulations that applied to the restricted fishery (with any necessary modifications).

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 General Fishery is at the stage of consulting over the criteria for the allocation of shares. Later in the implementation process, a share management plan for the fishery will be prepared in accordance with the goals, objectives and management responses outlined in the final FMS.

b) Fishery description

As discussed in Chapter B and the introduction to Chapter C, the Estuary General Fishery is one of nine major commercial fisheries in New South Wales. It is a large and diverse fishery harvesting a wide range of finfish and shellfish for sale from estuarine waters using a range of commercial fishing gear. The fishery also includes the taking of invertebrates (such as beachworms and pipis) by hand from ocean beaches.

The fishery is categorised into a number of endorsement types that determine the type fishing that can take place. Table C11 below shows the endorsement types available in the fishery and details the activity that is authorised by each endorsement. For example, only fishers with a crab trap endorsement on their fishing licence are permitted to use crab traps, and only fishers with category 1 hauling endorsement on their fishing licence are permitted to use general purpose hauling nets. A

more detailed discussion of fishing licences and endorsements for the fishery appears in section 6(i) of this chapter.

Table C11. Endorsements in the Estuary General Fishery.

Endorsement types	Endorsement description
Meshing	This endorsement authorises the commercial fisher to use a meshing net and a flathead net to take fish for sale from estuary waters
Prawning	This endorsement authorises the commercial fisher to use a prawn hauling net, prawn seine net, prawn set pocket net, prawn running net, hand-hauled prawn net, push or scissors net and a dip or scoop net to take prawns for sale from estuary waters
Category 1 hauling	This endorsement authorises the commercial fisher to take fish for sale from estuary waters using any of the following nets: general purpose hauling net, trumpeter whiting net, pilchard, anchovy and bait net, garfish hauling net, garfish bullringing net, bait net
Category 2 hauling	This endorsement authorises the commercial fisher to take fish for sale from estuary waters using any of the following nets: garfish hauling net, garfish bullringing net, bait net
Trapping	This endorsement authorises the commercial fisher to use a fish trap and a hoop or lift net to take fish (other than eels or mud crabs) for sale from estuary waters
Eel trapping	This endorsement authorises the commercial fisher to use an eel trap to take eels for sale from estuary waters
Mud crab trapping	This endorsement authorises the commercial fisher to use a crab trap to take mud crabs for sale from estuary waters
Hand gathering	This endorsement authorises the commercial fisher to take beachworms, pipis, cockles, yabbies, mussels and nippers for sale from estuaries and ocean beaches by hand picking
Handlining & hauling crew	This endorsement authorises the commercial fisher to take fish for sale from estuaries using a hand line or by assisting another commercial fisher with a category one or a category two hauling endorsement (using hauling methods only)

c) Area

The Estuary General Fishery occurs in approximately 100 estuaries along the NSW coast, however parts of these estuaries are often closed to commercial fishing. Appendix C1 (estuary based controls) lists each of the estuaries the fishery is authorised to operate in and the fishing methods that may be used in those estuaries (or parts thereof). Appendix C1 forms an important part of the proposed management rules in this draft FMS.

Estuarine waters are defined under the Act as waters other than ocean waters that are ordinarily subject to tidal influence. Where an estuary meets ocean waters, estuarine waters are 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 to a line identified as the tidal limit.

There are a number of flowing fresh water streams east of the Great Dividing Range which lead into catchments and rivers that form some of the estuaries along the NSW coast, however, these fresh water tributaries do not form part of the Estuary General Fishery.

The fishery also includes the handgathering of fish such as beachworms and pipis from ocean beaches.

The list of available estuaries in Appendix C1 may change if areas are designated as recreational fishing areas, or sanctuary, habitat protection or special purpose zones are established or modified within marine protected areas.

d) Methods

Fishing gear used in the fishery consists mostly of a range of hauling and meshing nets used to target finfish, as well as a number of nets designed to specifically target prawns. Traps are also used in the fishery to target finfish, crabs and eels, and the fishery also includes handgathering and handlining. In all, there are 14 types of nets and three types of traps permitted in the fishery. Most of these fishing gear types are only able to be used by licensed commercial fishers, although recreational fishers are also able to use a number of the smaller nets including the hand-hauled prawn net, the push scissor prawn net, the hoop or lift net.

The sections following describe the fishing gear able to be used in the fishery and give details relating to the standard dimensions of that gear. Appendix C1 which lists the estuary based controls in the fishery identifies the fishing gear types that may be used in each of the estuaries. Further detail on the use of this gear can be found in section 3 of Chapter B.

The dimensions that apply to a number of the gear types differ between some of the estuaries. For example, the general purpose hauling nets able to be used in some of the larger coastal lakes have a longer overall length of net and longer hauling lines than the standard dimension hauling nets able to be used in most estuarine rivers and creeks.

It is important to note that this fishery does not include the activity of prawn trawling. Prawn trawling currently occurs in five estuaries in NSW (the Clarence River, Hunter River and Hawkesbury River, Port Jackson and Botany Bay) and is managed as a separate commercial fishery. A draft FMS is also being prepared for the Estuary Prawn Trawl fishery.

i) Traps

Fish trap

Fish traps are generally made from wire mesh supported by a timber frame. The standard dimensions for a fish trap are a maximum of 2 metres in length, 1.5 metres in width, 1 metre in height and with mesh not less than 50 mm.

Crab trap

Crab traps are generally made from wire mesh supported by a solid frame similar to that used in fish traps. The standard dimensions for a crab trap are a maximum of 1.2 metres in length, 1 metre in width (or a diameter of no more than 1.6 metres if round), 0.5 metres in height and with mesh not be less than 50 mm.

Eel trap

The standard dimensions for an eel trap are either a maximum of 2 metres in length, 0.5 metres in width and 0.5 metre in depth, or 1 metre in length, 1 metre in width and 0.5 metre in depth. The mesh in the trap must be between 20 mm and 40 mm and the entrance funnel must not be more than 100 mm in diameter.

ii) Meshing nets

Meshing net

A meshing net consists of a length of mesh secured between a headline (or "cork line") on the top, and a footline (or "lead line") on the bottom. A meshing net can be used in two ways, either by setting where the net is set in the water for a period (other than during daylight hours), or by splashing where the net is placed in the water and the surrounding water splashed to encourage fish to swim into the net. A standard length meshing net is a maximum length of 725 metres with mesh size of not less than 80 mm.

Flathead net

The flathead net is a variation on a standard meshing net, and is specifically designed to target dusky flathead. As a result of the increased minimum legal length of dusky flathead from 33 cm to 36 cm in June 2001, the dimensions of flathead nets are being reviewed. Data from a mesh selectivity research program being conducted during 2001 will be used to determine the most appropriate dimensions and controls for the re-designed flathead net. The previous mesh size restriction of between 70 and 80 mm will increase to minimise the capture of flathead less than the 36 cm minimum legal length.

Flathead nets may only be used by fishers with a meshing endorsement in Wallis Lake, Smiths Lake, Tuggerah Lakes, Lake Illawarra and St Georges Basin.

Hoop or lift net

A hoop or lift net, also known as a witches hat, is a relatively small net (less than 13 mm) and can take a number of forms. The net generally consists of one (and no more than two) hoops or rings to which loose netting is attached. The net is sometimes extended from the hoop by the use of a small float, however the net must not extend more than 1 metre from the hoop or hoops and the hoop must not exceed 1.25 metres in diameter (or at the greatest diagonal).

iii) Fish hauling nets

General purpose hauling net

The general purpose hauling net is the most common type of hauling net, and uses relatively large mesh to catch a range of finfish. A standard dimension hauling net must not exceed 375 metres in headline length. The following dimensions must also be complied with:

Part of net	Length restrictions	Mesh size restrictions
Wings of net	375 m less the length of the bunt	Not less than 80 mm
Bunt: in full	Not more than 90 m or one quarter of the total length of the net (whichever is lesser)	[see below]
Bunt: centre piece	Between 25 and 50 m	Between 30 and 50 mm
Bunt: remainder of	Not more than 50 m	50 mm

* Fishers may increase the mesh in the bunt (centre piece) of a general purpose haul net, by permit, from a maximum of 50mm to a maximum of 57mm to reduce the incidence of prohibited size sand whiting being caught in these nets. This is particularly an issue in some north coast rivers, as well as some of the larger coastal lagoons such as Wallis Lake. The effectiveness of the net operated under such a permit will be monitored by NSW Fisheries and consideration given to recommending a change to regulation.

Longer general purpose hauling nets of 1000, 750 and 450 metres may also be used in selected estuaries, however, nets over 500 metres in length will be prohibited from July 2002 and daily restrictions placed on the number of times the new 500 metre net can be employed (see management response 1.1e). Further information relating to where these longer nets may be used can be found in Appendix C1 which details estuary based controls.

Pilchard, anchovy and bait net

This net is a type of hauling net designed to target smaller species and is only used in parts of Port Jackson, Pittwater and the Hawkesbury River. When used in estuarine waters this net must not have an overall length exceeding 250 metres, and the following dimensions relating to the construction of the net must be complied with:

Part of net	Length restrictions	Mesh size restrictions
Wings of net	Each wing not more than 90 m	Not greater than 80 mm
Bunt	Not more than 60 m	Between 50 and 65 mm
Bag	Not more than 12 m	Not more than 30 mm
Cod-end	Not more than 6 m	Not more than 25 mm
Hauling lines	Each line not more than 125 m	-

Trumpeter whiting net

This net is a type of hauling net used in parts of Port Stephens to catch trumpeter whiting only. The standard dimensions of the net include an overall length of up to 275 metres with the following restrictions applying:

Part of net	Length restrictions	Mesh size restrictions
Wings of net	Not more than 50 meshes deep	Between 50 and 65mm
Bunt of net	50 metres	Between 30 and 40mm
Overall length	Up to 275 metres	-
Hauling lines	Between 100 and 225 metres	-

Garfish hauling net

This net may only be used in parts of Port Jackson, Broken Bay, Botany Bay, Port Stephens and Jervis Bay. The net has relatively small mesh of between 28 and 36 mm, although there is no overall maximum length applicable to this net.

Garfish bullringing net

Standard garfish bullringing nets consist of mesh between 28 and 36 mm with a standard maximum length of 275 metres, and hauling lines of 25 metres.

iv) Prawn nets

Prawn hauling net

The standard dimensions for a prawn hauling net is a maximum length of 40 metres with mesh of between 30 and 36 mm and each hauling line must not exceed 130 metres in length.

Prawn seine net

The standard dimensions for a prawn seine net is an overall length of 140m with the mesh throughout between 30 and 36 mm.

Prawn set pocket net

There is no standard length for this net and the total allowable headline length of the net may vary from 5 metres to 63 metres throughout different estuaries. The standard mesh restriction throughout is between 30 and 36 mm.

Prawn running net

The standard dimensions of a prawn running net include a mesh throughout of between 25 and 36 mm. The maximum total length of the net is either 75 metres or 140 metres, depending on the estuary in which the net is used.

Hand-hauled prawn net

A hand-hauled prawn net is a relatively short net with a maximum overall length of 6 metres and mesh size between 30 and 36 mm. The net is operated by hand and is only used in relatively shallow water.

Push or scissor prawn net

This is a relatively small hand operated net that is not often used by commercial fishers. The net length of bottom line at the lower ends of the poles must not exceed 2.75 metres and the mesh size must be between 30 and 36 mm.

v) Other methods

Handgathering

Handgathering includes the taking of fish by hand, or with the assistance of any of the following implements:

- a pump or similar device having a barrel or cylinder with a diameter of not more than 85mm
- a tube or cylinder (whether or not fitted with a cap at one end) with a length of not more than 250mm and a diameter of not more than 85mm
- a single blade knife with a blade longer than it is wide
- a spade or fork (except in a seagrass bed, mangrove or saltmarsh area or for the taking of pipis)
- pliers

Handlining

The term handlining refers to the use of a spool of fishing line, or a reel of fishing line used in conjunction with a rod. Fishers in the Estuary General Fishery may also use up to ten set lines with a restriction of no more than six hooks on each line.

e) Species

This strategy categorises the retained species taken into "primary species", "key secondary species" and "secondary species". A description of those categorisations is provided below.

This categorisation differs from the often used "target species versus by-product species" categorisation because the fishery uses a range of relatively non-selective fishing gear to take many different species that are retained for sale. It follows that all saleable fish that are caught in the fishery would otherwise be considered "target" species. Information on whether species are primary or key secondary can be found in Table C13 in this section.

i) Primary species

These are the species of major importance to the fishery, and consequently they receive a higher management and research priority within this draft FMS. Individual trigger points have been determined for these species to provide for a review of the fishery if catch rates fall outside predetermined reference points (see section 5 in this draft FMS for further information).

ii) Secondary species

Secondary species can be categorised as those that are retained by the fishery but which do not fall under the primary species category described above.

A number of secondary species have been selected as "key secondary species" (see objective 2.1.4 in section 4 of Chapter C) because they are subject to more rigorous performance monitoring requirements than the remaining secondary species.

iii) Species taken in the fishery

As previously mentioned, the Estuary General Fishery takes a wide and diverse range of species. The following is a list of the species permitted to be taken in the fishery.

Common	Scientific	Family
Sea mullet	*Mugil cephalus*	MUGILIDAE
School prawn	*Metapenaeus macleayi*	PENAEIDAE
Pipi	*Donax deltoides*	DONACIDAE
Luderick	*Girella tricuspidata*	GIRELLIDAE
Yellowfin bream	*Acanthopagrus australis*	SPARIDAE
Black bream	*Acanthopagrus butcheri*	SPARIDAE
Dusky flathead	*Platycephalus fuscus*	PLATYCEPHALIDAE
Blue swimmer crab	*Portunus pelagicus*	PORTUNIDAE
Sand mullet	*Myxus elongatus*	MUGILIDAE
Silver biddy	*Gerres subfasciatus*	GERREIDAE
Sand whiting	*Sillago ciliata*	SILLAGINIDAE
Longfin river eel	*Anguilla reinhardtii*	ANGUILLIDAE
Mud crab	*Scylla serrata*	PORTUNIDAE
Flat tail mullet	*Liza argentea*	MUGILIDAE
Eastern king prawn	*Penaeus plebejus*	PENAEIDAE
Greasyback prawn	*Metapenaeus bennettae*	PENAEIDAE
Mulloway	*Argyrosomus hololepidotus*	SCIAENIDAE
Trumpeter whiting	*Sillago maculata*	SILLAGINIDAE
Silver trevally	*Pseudocaranx dentex*	CARANGIDAE
River garfish	*Hyporhamphus regularis*	HERMIRAMPHIDAE
Cockle spp.	various	ARCIDAE/VENERIDAE
Shortfin river eel	*Anguilla australis*	ANGUILLIDAE
Estuary catfish	*Cnidoglanis macrocephalus*	PLOTOSIDAE
Tailor	*Pomatomus saltatrix*	POMATOMIDAE
Old maid	*Scatophagus multifasciatus*	SCATOPHAGIDAE
Beachworm spp.	various	Class: POLYCHAETA
Tarwhine	*Rhabdosargus sarba*	SPARIDAE
Hairtail	*Trichiurus lepturus*	TRICHIURIDAE
Yellowtail	*Trachurus novaezelandiae*	CARANGIDAE
Leatherjacket spp.	various	MONACANTHIDAE
Octopus spp.	various	OCTOPODIDAE
Sand flathead	*Platycephalus caeruleopunctatus*	PLATYCEPHALIDAE
Black tip shark	*Carcharhinus sp.*	CARCHARHINIDAE
Whitebait spp.	various	CLUPEIDAE/GALAXIIDAE
Pilchard	*Sardinops sagax*	CLUPEIDAE
Eastern sea garfish	*Hyporhamphus australis*	HEMIRAMPHIDAE
Tiger prawn	*Penaeus esculentus*	PENAEIDAE
Pike eel	*Muraenesox bagio*	MURAENESOCIDAE
Pink-eye mullet	*Myxus petardi*	MUGILIDAE
Striped trumpeter	*Pelates sexlineatus*	TERAPONTIDAE
Pike spp.	*Sphyraena spp.*	SPHYRAENIDAE
Australian salmon	*Arripis trutta*	ARRIPIDAE
Flounder spp.	various	PLEURONECTIDAE/BOTHIDAE

Common	Scientific	Family
Snapper	*Pagrus auratus*	SPARIDAE
Catfish spp.	various	ARIIDAE
Nipper spp.	*Callianassa spp.*	CALLIANASSIDAE
Longtom spp.	various	BELONIDAE
Cuttlefish spp.	various	SEPIIDAE
Stingray/stingaree spp.	various	DASYATIDAE/UROLOPHIDAE
Shortbill garfish	*Arrhamphus sclerolepis*	HEMIRAMPHIDAE
Black trevally	*Siganus nebulosus*	SIGANIDAE
Scallop	*Pecten fumatus*	PECTINIDAE
Anchovy	*Engraulis australis*	ENGRAULIDAE
Blue mussel	*Mytilus edulis*	MYTILIDAE
Squid spp.	various	Class: CEPHALOPODA
Hardyhead spp.	various	ATHERINIDAE
Blue mackerel	*Scomber australasicus*	SCOMBRIDAE
Bonito	*Sarda australis*	SCOMBRIDAE
Sole spp.	various	SOLEIDAE
Southern calamari	*Sepioteuthis australis*	LOLIGINIDAE
Black sole	*Synaptura nigra*	SOLEIDAE
Mackerel tuna	*Euthynnus affinis*	SCOMBRIDAE
Mantis shrimp	*Squilla sp.*	STOMATOPODA/SQUILLIDAE
Red mullet	*Upeneichthys lineatus*	MULLIDAE
Sand crab spp.	various	PORTUNIDAE
Golden trevally	*Gnathanodon speciosus*	CARANGIDAE
School whiting	*Sillago bassensis*	SILLAGINIDAE
Red morwong	*Cheilodactylus fuscus*	CHEILODACTYLIDAE
Conger eel	*Conger verreauxi*	CONGRIDAE
Mangrove jack	*Lutjanus argentimaculatus*	LUTJANIDAE
John dory	*Zeus faber*	ZEIDAE
Yellowtail kingfish	*Seriola lalandi*	CARANGIDAE
Short-finned conger eel	*Conger wilsoni*	CONGRIDAE
Shell spp.	various	Class: GASTROPODA/PELECYPODA
Red gurnard	*Chelidonichthys kumu*	TRIGLIDAE
Hermit crab spp.	various	PAGURIDAE
Sweetlip	*Lethrinus sp.*	LETHRINIDAE
Endeavour prawn	*Metapenaeus endeavouri*	PENAEIDAE
Old wife	*Enoplosus armatus*	ENOPLOSIDAE
Chinaman leatherjacket	*Nelusetta ayraudi*	MONACANTHIDAE
Gurnard spp.	various	TRIGLIDAE
Saucer scallop	*Amusium spp.*	PECTINIDAE
Sweep	*Scorpis lineolatus*	SCORPIDIDAE

iv) Status of species within the fishery

NSW Fisheries uses a standardised method of reporting on the exploitation status of fish stocks across all commercial fisheries. Where there are data, the impact of the recreational harvest is also taken into consideration in determining the status. This reporting method uses one of the following terms to describe the stock status:

Table C12. Criteria for determining the exploitation status of species.

Exploitation status	Definition
Under fished	The appraisal of a fish 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 optimal levels (the definition of which may vary between fisheries; eg catches are close to maximum sustainable yield, or fishing effort is close to some reference point). In a fully fished fishery, significant increases in fishing effort above current levels may lead to overfishing.
Overfished	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 the stock is long term fishery dependent catch data.

Table C13 shows the primary and key secondary species of the fishery. Table E1 in Chapter E provides information (where data is available) on the exploitation status of the species.

Table C13. Primary and key secondary species in the Estuary General Fishery.

Species	Primary, key secondary or bait	Other significant fisheries/sectors where the species is harvested
Sea mullet	Primary	NSW (ocean hauling), Queensland, Victoria
Luderick	Primary	NSW (ocean hauling & recreational), Queensland, Victoria
Yellowfin bream	Primary	NSW (ocean hauling, ocean trap and line, fish trawl & recreational), Queensland
School prawns	Primary	NSW (ocean prawn trawl, estuary prawn trawl), Queensland
Dusky flathead	Primary	NSW (recreational), Queensland
Eastern king prawn	Primary	NSW (estuary prawn trawl & ocean prawn trawl), Queensland
Sand whiting	Primary	NSW (recreational & ocean hauling), Queensland
Mud crab	Primary	NSW (recreational), Queensland
River eels	Primary	Victoria
Pipis	Primary	NSW (recreational)
Blue swimmer crab	Key secondary	NSW (recreational, estuary prawn trawl & ocean prawn trawl), Queensland
Greasyback prawns	Key secondary	NSW (estuary prawn trawl)
Mulloway	Key secondary	NSW (recreational & ocean trap and line)
Cockles	Key secondary and bait	NSW (recreational)
Beachworms	Key secondary and bait	NSW (recreational)
River garfish	Key secondary	NSW (recreational), Victoria
Silver biddy	Key secondary	NSW (estuary prawn trawl)
Flat tail mullet	Key secondary	
Trumpeter whiting	Key secondary	NSW (estuary prawn trawl & ocean fish trawl)

Only adjacent jurisdictions and other fisheries in NSW have been considered in Table C13.

v) Bycatch species

The species which are generally caught as bycatch in this fishery are discussed in section 1 of Chapter B. As bycatch was identified as one of the key issues in the fishery following the review of the current operation of the fishery, below is a summary of the proposals to reduce the impact of the fishery on bycatch:

- Implement a scientific observer program to gather data on the levels of bycatch from fishing methods used in the fishery
- Prohibit the use of fish spikes, clubs or other implements that, if used to handle discarded fish, may cause undue harm
- Reduce the overall length of fish hauling nets from 1000 metres and 725 metres in some of the larger estuaries to 500 metres
- Increase the mesh size in flathead nets to complement the increase in the minimum legal length of flathead
- Increase the minimum mesh size able to be used in set mesh nets
- Prohibit the use of prawn seining and prawn hauling nets over areas of seagrass
- Identify designated landing sites for fish hauling nets to minimise the use of these nets over areas of seagrass that occur around the shorelines of some estuaries
- Provide for the use of short term closures to prohibit some fishing methods when there are high numbers of jellyfish or juvenile fish in particular estuarine areas.

vi) 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 plan for that species (see objective 2.5 and related management responses in section 4 of this draft FMS). A recovery plan 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 plan will also set out a timeframe for that process and may specify further appropriate action should recovery targets not be met.

vii) 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.

viii) 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 (eg. 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 fish 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 remediation. 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 years in age compositions are all indicative of potential problems with recruitment.

When new information that is likely to change the present status of a fish species is received by NSW Fisheries, NSW Fisheries scientists will review the status determination for that species against the criteria specified in Table C12 and report on the updated status in the annual report "Status of Fisheries Resources". If a species is designated as overfished, a recovery plan involving all harvest sectors will be developed.

ix) 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 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 plans 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 plans 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.

x) Species in the Estuary General Fishery determined as being overfished

Silver Trevally (*Pseudocaranx dentex*)

Silver trevally were determined as being overfished in the 1999/2000 NSW Fisheries Status of Fisheries Resources report. There has been a significant decline in commercial landings of silver trevally since the mid 1980s, from about 1000 t per annum to around 300 t per annum. The Estuary General Fishery catches approximately 16% of the total NSW commercial catch of silver trevally (based on average landings 1997/98 and 1998/99). Other significant catches of silver trevally are taken in the ocean fish trawl and ocean trap and line fisheries in NSW and the south east trawl fishery managed by the Commonwealth. There is also a significant recreational catch of the species.

Whereas the Estuary General Fishery lands approximately 16%, the NSW ocean fish trawl fishery lands approximately 55% of the landed weight of the NSW commercial catch of silver trevally. As the ocean fish trawl fishery is the primary fishery in NSW in which silver trevally are taken, a recovery plan for the species will be developed under the ocean fish trawl FMS. The Estuary General Fishery will contribute to the development of the recovery plan, and will implement actions as needed under that plan.

Appendix C2 includes a summary of silver trevally, including general information on the biology of the species, habitats, catch and market information.

Sea garfish (*Hyporhamphus australis*)

Although no formal determination has been made of sea garfish being overfished, NSW Fisheries and the ocean hauling MAC are preparing a recovery plan for the species. The preparation of the recovery plan is a precautionary action in response to a severe decline in recorded landings of sea garfish in the ocean hauling fishery over recent years.

The Estuary General Fishery is a minor harvester of sea garfish landing approximately 10% of the total commercial catch in NSW during 1997 to 2000. Sea garfish comprises less than 0.1% of the total landings in the Estuary General Fishery (NSW Fisheries catch statistics database). The majority of the catch in the Estuary General Fishery is taken from Port Stephens, with the months March to June producing the highest landings.

xi) Specific actions in the strategy to address overfishing

Objective 2.5 in section 4 of this chapter 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 2.5 are:

(a) where the fishery is a major harvester of an overfished species, develop and implement a recovery plan 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 plan for the species and adopt any measures required by that plan

(c) during the period of development of a recovery plan 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.*

xii) Size limits and protected fish

Size limits apply to a number of species taken in the Estuary General Fishery. The following is a list of the minimum legal lengths that apply to species permitted to be taken in the fishery.

Table C14. Minimum legal sizes on estuary general species.

SPECIES	SIZE LIMIT
Common name	**Total length (cm)**
Primary	
Sea mullet	30
Luderick	25
Beam	25
Dusky flathead	36*
Sand whiting	27
Eels	30
Mud crab	8.5 (carapace length)
Key Secondary	
Blue swimmer crab	6 (carapace length)
Mulloway	45
Secondary	
Tailor	30
Tarwhine	20
Snapper	30**
Red morwong	25
Yellowtail kingfish	60

* increased from 33 cm on 1 July 2001
** increased from 28 cm on 1 July 2001

Protected fish

The *Fisheries Management (General) Regulation 1995* identifies a number of species that are protected, either from commercial fishing or fishing by all sectors.

Protected fish include:	Fish protected from commercial fishing include:
Ballina angelfish	Black, blue and striped marlin
Eastern blue devil fish	Atlantic salmon
Elegant wrasse	Australian bass
Estuary cod	Eel-tailed catfish
Giant Queensland groper	Estuary perch
Grey nurse shark	Blue groper
Herbst nurse shark	Silver perch
Black rock cod	Brook, brown and rainbow trout
Weedy sea dragon	Freshwater crayfish
Australian grayling	
Eastern freshwater cod	
Trout cod	
Macquarie perch	

Commercial fishers are not permitted to take either protected fish or fish protected from commercial fishing.

Of the species that appear in the lists above, fishers in the Estuary General Fishery are not likely to have any direct or indirect interaction with the majority of the species because a large percentage of them are freshwater species. Any interactions between the fishery and protected fish are more likely to involve the incidental capture of Australian bass, estuary perch or estuary cod. Further information on these species can be found in Appendix F4.

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 two direct measures to obtain data on any such interactions. The first of these measures is the implementation of an observer-based surveys which will *inter alia* collect data on occurrences of threatened species in catches. Secondly, a modification to the monthly catch return forms will incorporate mandatory reporting by fishers on interactions with threatened species during fishing operations.

A number of management responses also appear in section 4 of this draft FMS aimed at minimising impacts on threatened species. These measures include using fishing closures, modifying gear use and implementing the provisions of any threatened species recovery plans and threat abatement plans.

f) Catch and landings

i) Overall catch levels and value

The total commercial estuary catch has remained relatively stable over the past 50 years except for slightly higher catches during the late 1980s and early 1990s. Total landings have generally been stable between 1993/94 and 1998/99. The total reported landed catch of 5,426 tonnes for the 1998/99 fiscal year was worth approximately $20 million, though the value figures do not take into account export, interstate or local markets where higher prices may be obtained.

Table C15. Overall catch and value for the Estuary General Fishery.

Period	Catch (t)	Value ($)
1993/94	5,774	21,390,000
1994/95	5,805	20,044,000
1995/96	5,664	19,941,000
1996/97	5,294	19,488,000
1997/98	5,668	19,366,000
1998/99*	5,426	20,054,168

*Information for the 1998/99 period sourced from NSW Fisheries catch statistics database in August 2000.

ii) Catch and landings of the primary species in the fishery

Appendix B1 provides a number of graphs for the primary species in the fishery, which show:

- The total catch for each of these species for the period 1984/85 to 1999/00
- The average catch by month for the period 1997/98 (ie. seasonal trends)

- The distribution of the commercial catch between NSW commercial fisheries for the period 1997/98
- The relative catch by each gear type used to take each primary species in the Estuary General Fishery for the period 1997/98.

g) Research

The basic areas of research needed for the Estuary General Fishery can be categorised into seven broad areas: (i) stock assessments of primary species; (ii) quantification and reduction of the bycatch and discarding of untargeted species; (iii) effects of fishing methods on habitats; (iv) importance of habitats to fish populations; (v) importance of ecological processes to fish populations, (vi) impacts of fishing on trophic interactions and ecosystems; and (vii) impacts of fishing on threatened species.

Outlined below are those strategies by which research into these areas are proposed to proceed.

i) Stock assessments of key species

Fishery-dependent information

Previous assessments of fish stocks in estuaries have generally been inadequate and mostly reliant on fishery-dependent information. These assessments have made extensive use of reported catch and effort data supplied by commercial fishers and have included age-based assessments of commercial landings of key species (including sea mullet and bream since 1995 - Virgona *et al.*, 1998, Gray *et al*., 2000, sand whiting and luderick between 1995-97 - Gray *et al*., 2000 and dusky flathead between 1995-97 and 2000 - Gray *et al.,* submitted). Stocks of eels are also currently being assessed in a targeted Fisheries Research and Development Corporation (FRDC) funded project.

Fishery-dependent catch and effort information has been used in the past because: (i) it is easy to obtain; (ii) a large and long term data series exists; and (iii) it has been the best information available. These reasons do not, however, make up for the unreliable nature of such information – in terms of its accuracy, precision and consistency. Further, such information only concerns species (and sizes/ages of species) that are actually landed and therefore virtually no information is obtained on small, undersized individuals, bycatch species or other organisms involved in the affected ecosystems. Age-based sampling of commercial landings represents a significant advancement in stock assessments over that solely relying on catch and effort data, but its utility in assessing stocks, bycatch and ecosystem interactions remains minimal.

Nevertheless, because of the reasons listed above (fishery-dependent information is relatively easy to obtain, large, long-term and the best available), it is proposed to continue fishery-dependent age-based assessments of three key fish species in the Estuary General Fishery (sea mullet, bream and dusky flathead) until more robust methods for assessing stocks are developed and implemented (see below).

With the exception of some work on king prawns, few stock assessments of other invertebrates (like school prawns, blue swimmer crabs, mud crabs, pipis, beachworms, etc.) have been done (although a new four year project to assess school prawn stocks commences in 2002). Reported catch and effort data on such species have been (and will continue to be) monitored to assess any changes in relative abundance inferred by the data until better methods for stock assessments are established (see below). Where known, other sources of mortality will be considered in the stock assessment process.

Fishery-independent information

Because of the problems inherent with fishery-dependent information, it is intended that future stock assessments of estuarine species will involve fishery-independent methods based on 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 those based on fishery-dependent data.

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 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. A proposal will be submitted to the FRDC this year to fund the first four years of this work which includes all of the pilot and design work. It is intended that the pilot studies on alternative sampling tools and cost-benefit analyses will be done during 2002-2003 and a pilot sampling strategy will be implemented between 2004-2006. After this period, it is intended that the program will be continued using funds provided by all users that benefit from these resources.

Such a fishery-independent survey will also have other benefits including the provision of fish samples for age determination, information on reproductive biology (which will allow some review of appropriate size limits), recruitment indices and some preliminary examinations of trophic interactions. Information from the fishery-independent surveys will therefore contribute to several other priority areas of research and management whilst allowing quite robust modelling of populations for stock assessment purposes.

ii) Quantification and reduction of the bycatch and discarding of untargeted species

It is widely accepted that the most reliable and accurate way one can assess bycatch and discarding is to use observer-based surveys. Observer surveys of bycatch and discarding have been carried out for most methods used in the Estuary General Fishery. Such studies examined by-catches from the prawning methods of set pocket netting (Andrew *et al.*, 1995), snigging (Gray, in press and unpublished), hauling (Gray *et al.,* in preparation) and running nets (Hewitt, 2001; Gray *et al.,* in preparation), general-purpose fish hauls (Gray *et al*., 2001, in preparation) and mesh nets set overnight (Gray, in press). Discarding from all types of mesh nets is currently being assessed and is due to be completed by February 2002. Bycatch from fish traps has also been examined in Botany Bay only (Stewart and Ferrell submitted).

Research into the development of discard-reducing gears has also been undertaken for some methods used in the Estuary General Fishery, including fish haul nets (Gray *et al.*, 2000; Kennelly and Gray, 2001), fish traps (Stewart and Ferrell submitted) and eel traps (Pease *et al.,* unpublished data). Further research is currently being done to reduce the capture of small prawns in estuarine prawning gears and the survival rates of discards from general purpose haul nets have also been estimated (Kennelly and Gray, 2001; Gray *et al*., in preparation).

Major gaps in our knowledge about bycatch and discarding in the Estuary General Fishery mainly exist for a few relatively minor fishing methods including crab and eel traps and specific hauling gears like garfish haul and bullringing nets, trumpeter whiting haul nets and bait haul (e.g. lampara) nets.

It is proposed that future research concerning bycatch and discarding for the Estuary General Fishery will involve starting observer-based surveys on crab and eel trapping and specific haul nets in 2002/2003. It is then proposed to repeat observer surveys of all methods used in the fishery periodically (every 5 to 10 years) in order to maintain a "watching brief" on bycatch levels in the fishery. Of course, if specific changes to operations occur, this ideally would be followed by directed observer surveys to assess effects of such changes on catches and bycatch. For example, the introduction of a new flathead net to the fishery in 2002 should be accompanied by an observer survey during the ensuing fishing season.

The field component of the program will include observations of gear types used in a sample set of estuaries across the regions used in the fishery. Although the exact number of observer days is yet to be determined, the observer program will be stratified across factors of importance, for example regions or particular estuary types. The level of observer coverage will be sufficient within strata to detect differences among them. This will require pilot estimates of variation to be made early in the observer program.

Although the program will be conducted under the supervision of NSW Fisheries, the field observing component will be offered as a contract under a competitive tender process. This could result in a research institution (other then NSW Fisheries) undertaking the field observations and as such, it is not possible at this stage to estimate the number of observers that will be used to meet the requirements of the program.

It is proposed that when specific bycatch and discarding problems are identified, targeted research will be directed at ameliorating the identified problems. This could include the development and testing of alternative gears and fishing practices in addition to assessments of the utility of spatial and temporal fishing closures to reduce any identified problems.

iii) Effects of fishing methods on habitats

Whilst a study of the impacts of hauling over *Zostera* seagrass has been completed (Otway and Macbeth, 1999), the impacts on other habitats of other fishing gears have not been investigated and potential impacts have generally been inferred from studies undertaken elsewhere.

It is proposed to address the significant gaps in our knowledge about the physical impacts of various fishing methods on habitats via targeted projects involving manipulative field experiments on specific problems. Examples may include the effects of various mobile fishing methods like hauling on seagrass beds and sand flats. Specific issues will be prioritised and funding sought. As was the case above for identified bycatch problems, 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 fish populations

Some research has been done on the associations between estuarine fish and the habitats on which they depend (e.g. Young, 1981; Middleton *et al.*, 1984; Bell and Pollard, 1989; Ferrell and Bell, 1991; Gray *et al.*, 1996). It is important that the role of different habitats 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 (eg. 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 certain 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 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 fish and crustaceans 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 General Fishery.

Directed, detailed experimental and mensurative programs need to be undertaken so that management decisions about exploited fish and crustaceans 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.

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 and none has been undertaken in relation to the Estuary General Fishery. In general, such work is very much in its infancy throughout the world and, where such work has been done, it is invariably characterised by being complex, expensive, of a long duration. However, such work has shown that fishing can significantly affect the structure and function of ecosystems (Hall, 1999; Kaiser and de Groot, 2000).

As with the proposals to study the effects of different fishing methods on habitats, it is proposed to examine the issue of impacts of fishing on trophic interactions and ecosystems through targeted projects on specific impacts using quite elaborate manipulative and mensurative experiments. An example of such work is currently being undertaken in the Clarence River where the impacts of trawling on benthic systems is being examined.

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 (see management response 1.3c in section 4 of this draft FMS). 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.

vii) Impacts of fishing on threatened species

Little is known about the biology and ecology of many of those species listed as endangered or threatened, and the potential impacts of commercial fishing on these species is even less understood. It is proposed that research on such issues should involve specific projects targeted at particular species and the many factors that influence them, rather than studying particular fisheries for their impacts on certain species.

Such studies would involve examining the biology and ecology of certain species to assess potential impacts of a variety of "threats" (only one of which would be the Estuary General Fishery). Specific issues and species will be prioritised and funding sought.

viii) The Conservation Technology Unit

In March 2001 NSW Fisheries established a Conservation Technology Unit to examine conservation-based gear technology in commercial and recreational fisheries. This focussed research initiative will help address gaps in knowledge including the selectivity of fishing gear used in the Estuary General Fishery. The research will also assist in identifying the most appropriate gear to be used in the fishery and ensure that future changes to gear regulations can be based on accurate scientific information. The development of new and innovative fishing techniques will help minimise unwanted catches, discarding and environmental change.

h) Compliance

NSW Fisheries has approximately 90 fisheries officers responsible for coordinating and implementing compliance strategies in NSW. These strategies include:

- Maximising voluntary compliance
- Providing effective deterrence for offences
- Providing effective support services.

Approximately 65 of these fisheries officers are located in areas along the NSW coast where the Estuary General Fishery occurs. Their general duties include conducting patrols, inspecting commercial fishers and fishing gear, and recording rates of compliance.

A compliance strategic plan is to be developed that will provide the direction for education, advisory and enforcement services provided by NSW Fisheries for the Estuary General Fishery (see management response 6.1a in section 4 of this draft FMS).

To ensure that compliance service is delivered in a consistent manner, quality inspection guidelines will be developed as part of the operational plan for inspections within the Estuary General Fishery. These guidelines will set out a procedural approach to be adopted when undertaking inspections of fishers, fishing gear and other related matters to ensure that all issues requiring compliance by commercial fishers under the FMS are being adhered to.

i) A penalty points system

A penalty points scheme with endorsement suspension and share forfeiture provisions will be introduced under this draft FMS and will be developed as part of the share management plan for the Estuary General Fishery (see management response 6.1b in section 4 of this draft FMS).

The Estuary General Fishery generally has a high compliance rate, however, despite the relatively large number of potential offences and the maximum penalties specified in the Act and Regulation, there are still a small number of estuary general fishers who regularly operate beyond the rules. These few people continue to breach the law partly because the courts are sometimes unwilling to impose hefty fines for fisheries offences (which are often viewed as minor compared to other criminal offences) and are reluctant 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 strategy or associated rules.

Similar to the motor vehicle licence demerits points scheme (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 enough 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.

It should be noted that the Estuary General MAC does not support the introduction of a share forfeiture scheme in the fishery. The MAC supports an endorsement or licence suspension scheme based on penalty points, but not the forfeiture of shares.

i) Management controls

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 be continually modified in response to 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 General Fishery in NSW will be managed predominantly by input controls. The following sections set out in broad terms the controls that apply to activities in the fishery. The specific rules, such as the net length and mesh sizes applying in particular areas are detailed in section 6(d) of this Chapter and in the *Fisheries Management (General) Regulation 1995*.

i) Limited entry

The Estuary General Fishery was recently declared a category 2 share management fishery. Access to the fishery has been limited to eligible fishers since the restricted fishery regime commenced on 1 March 1997. Prior to that date, nearly every NSW fisher with a general commercial fishing licence could operate in the Estuary General Fishery.

Initial entry to the Estuary General Fishery under the restricted fishery regime for most methods was defined by having a minimum level of catch history showing that the methods sought in the application had been actively used over past years. An extensive statutory appeals process followed.

Following changes to the *Fisheries Management Act 1994* in December 2000, the Estuary General Fishery, along with the other major commercial fisheries, was selected to become a category 2 share management fishery. Section 6(a) of Chapter C outlines the process from 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 this FMS will apply to the fishery whether it has category 1 or category 2 share management status.

ii) Fishing licences

A commercial fishing licence is required by an individual before they 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 a recognised fishing operation (RFO).

This draft FMS proposes to retain the RFO concept under share management, and undertake a structural adjustment program at the fishing business level in order to manage fishing effort and improve the economic viability of fishers. Variations to the Licensing Policy will be made to allow for these changes as they are developed.

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 General Fishery moves to full category 2 share management.

iii) Fishing endorsements

Nine classes of endorsement will exist in the fishery at the commencement of the FMS, and Table C11 lists the endorsement types available and the gear eligible to be used with each endorsement type.

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 shareholdings may apply to each endorsement or each region in the fishery, or to 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 regional 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.

The introduction of minimum shareholdings will result in trading of shares within the fishery and will eventually result in each fisher in the Estuary General Fishery falling into one of three categories:

- Fishers who have acquired shares and continue to fish
- Fishers who have chosen to transfer all or some of their shares and leave particular fisheries or endorsement types within fisheries
- Fishers who retain their original shareholdings, cannot fish, but can re-enter the fishery later if they acquire sufficient shares.

iv) Fishing boat licensing

In addition to each fisher having to be licensed and nets having to be registered, every fishing boat used in connection with estuary general fishing must also be licensed. There has been a cap on the total number of boat licences since 1984 (includes boats used in all fisheries) and this restriction will remain for the duration of the FMS.

To prevent any increase in size and therefore efficiency of vessels in the fishery, a strict boat replacement policy exists. Boats 5.8 metres in length or less may be replaced with boats up to 5.8 metres. 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 boat length over time.

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 will not be approved unless all entitlements issued to the business by other jurisdictions are also transferred to the same buyer, 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.

This fundamental component of the Licensing Policy will be retained under this FMS.

vi) Transfer of licensed fishing boats

The majority of licensed fishing boats used in the Estuary General Fishery are small vessels that have been classified as "general purpose" boats. Boats in this category do not carry validated catch history and can be transferred separate to the other entitlements of the fishing business. In general, boats have been categorised as general purpose vessels where the fisher, rather than the boat, was considered to be the predominant unit of fishing effort.

On the other hand, boats that are categorised as "boat history" vessels cannot be transferred separate to the fishing business. The Licensing Branch can advise a fishing boat owner whether a boat

has been classed as a boat history or general purpose vessel. Any transfer of a fishing boat licence must first be approved by the Director of NSW Fisheries.

vii) 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 if a fishing business with the required level of validated catch history is acquired. This may change as share management is introduced and shareholdings become important for access arrangements (see management responses 2.2b and 2.3b in section 4 of this draft FMS).

Prior to final shares being issued, fishing businesses must be sold as an entire package (ie. the catch history, endorsements or shares cannot be split). During this period, proposals regarded as licence splitting will not be approved.

Prior to the commencement of the share management plan for the fishery, the estuary general endorsements of a fishing business will only become available to the first new owner of the business. If the business is transferred for a second time, the offer to retain the endorsements lapses. This is known as the "interim transfer policy".

The interim transfer policy will be superseded with the implementation of share management provisions and minimum shareholdings for the fishery upon the commencement of the share management plan.

viii) Nomination policy

Owner-operator provisions will be introduced into the Estuary General Fishery (see management response 2.3a in section 4 of this draft FMS). Existing nominations will continue until the arrangements between the parties expire, but no new nominations will be approved. These new arrangements will need to be reflected in the arrangements developed for the category 2 share management fishery.

ix) 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 from the next fishing licence renewal date, to work with the purchaser of the fishing business for training purposes (but the business must qualify as a RFO or meet the minimum requirements set within the share management plan), subject to the entitlements of the fishing business, on the understanding that the licence is surrendered at the end of the one year period unless a further RFO (which is not the original business) or minimum shareholding is acquired.

Trainee's licence: Within six months of acquiring an RFO, a new entrant may request that the RFO be placed into abeyance whilst they gain the skills working with an experienced fisher. This arrangement may apply for a period of up to two years. Fishing methods which the new entrant can use are restricted to the entitlements held by his or her fishing business.

x) Controls on fishing gear and boats

Detailed restrictions relating to the dimensions and type of fishing gear are set out in the *Fisheries Management (General) Regulation 1995*. The regulation provides for the use of 'standard' gear in most estuaries, but variations to the standard gear are often applicable to particular estuaries or parts of estuaries. The estuary based controls specified in Appendix C1 outlines the gear permitted to be used in each NSW estuary. The regulation also stipulates in many cases how the gear must be operated. The current regulations relevant to the Estuary General Fishery will continue, subject to any changes necessary to implement this draft FMS.

xi) Net registration

Commercial fishing nets used in the Estuary General Fishery (with the exception of the hoop and lift net) are required to be registered. Net registration certificates are issued for individual nets and are valid for the life of the net. The certificates stipulate the length and mesh sizes of individual nets.

New (ie. additional) commercial fishing net registrations have not been issued since a freeze was placed on the registration of new nets in July 1989 and will not be issued under this FMS.

Net registrations are not transferable and are only issued for new nets that are replacing existing nets of the same specifications that are no longer serviceable. Where nets are acquired as part of the transfer of a fishing business (or share transfers), only the nets authorised for use by the new owner's entitlements will be registered.

xii) Time and area closures

The FM Act provides for the use of fishing closures in the Estuary General Fishery to, among other things:

- Protect and conserve areas of key habitat
- Manage the amount of fishing effort in an estuary
- To manage conflicts between stakeholders over the use of the resource and to ensure it is equitably shared
- Minimise bycatch and the impacts of the fishery on threatened and protected species.

Fishing closures can be established on a seasonal, time, area, operator or gear specific basis. The existing fishing closures will remain until reviewed and new closures will be developed in accordance with the provisions in section 4 of this FMS.

Fishing closures will normally 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.

It is important to note that the Fisheries Management Amendment Bill 2001 also proposed to permit closures to be made by regulation. References to closures in this FMS include references to any such restrictions included in regulation.

The list of estuary based controls in Appendix C1 outlines the estuaries and gear types to which closures will apply at the beginning of the FMS. Details on fishing closures that affect the Estuary General Fishery can be found on the NSW Fisheries website at; www.fisheries.nsw.gov.au.

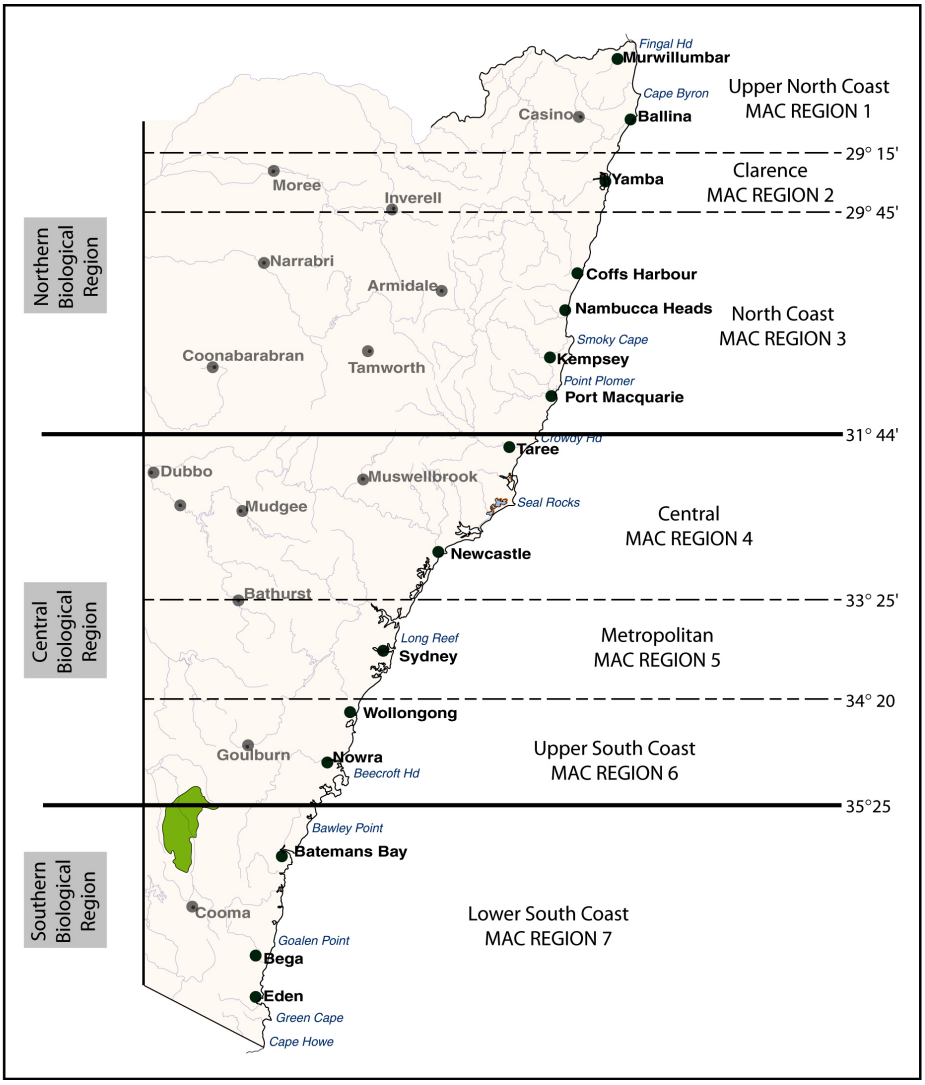
xiii) Zoning

Estuary general fishers have historically had access to all estuaries not closed to commercial fishing. Although this arrangement has allowed commercial fishers greater flexibility, it has also had difficulties. The major problem caused by this arrangement was conflict resulting from fishers travelling out of their local estuaries to fish in other regions and disregarding local conduct rules. This problem was the major reason for zoning the ocean hauling fishery in 1995.

In addition to promoting harmony within the fishery, zoning of the Estuary General Fishery focuses management and research on regional aspects of the biological, social and economic aspects of the fishery. Local management and research issues can then be addressed in a way that meets the requirements of local communities, within a statewide framework.

A zoning scheme for the fishery is being implemented in two stages. Stage one commenced in June 2001 and involves allocating each fisher to one of seven primary regions (see Figure C4) and, in some cases, issuing a permit to operate in individual estuaries that are beyond the fisher's primary region but within one of three larger estuarine specific regions as applicable (see Pease, 1999). Allocation of estuaries outside primary regions is based on fishers being able to demonstrate historical fishing participation in those estuaries. Stage two of the implementation involves finalising the zoning.

Figure C4. Map of the NSW coast showing the seven regions being used for zoning (which are also the MAC electoral regions) and the three larger estuarine biological regions as defined by Pease (1999).



The zoning scheme introduces substantial changes to the way the fishery operates and will influence the way that this draft FMS is implemented. Because the number of operators in each region is capped, programs for effort control will be developed regionally.

Based the outcomes of stage one of the zoning scheme, Table C16 below provides information on the number of endorsements in each endorsement class on a regional basis.

Table C16. Endorsement numbers by region in the Estuary General Fishery (as of July 2001).

Class of endorsement	Regions						
	1	2	3	4	5	6	7
Crab Trap	22	59	68	119	20	4	4
Eel Trap	8	46	36	66	20	28	22
Fish Trap	5	23	48	120	49	6	9
Hand gathering	29	4	29	40	2	15	5
Handlining & hauling crew	58	152	96	300	116	96	62
Hauling Cat 1	12	25	11	77	36	28	14
Hauling Cat 2	11	32	26	77	17	32	15
Meshing	54	119	81	264	95	89	53
Prawning	31	109	47	241	12	77	49

Note: fishers may hold more than one endorsement

xiv) Catch limits or quotas

Section 5 in this chapter lists the trigger points and allowable commercial catch levels for primary and key secondary species in this fishery. The upper catch trigger level for the commercial catch of each of these species has been determined using the upper trigger point range and recorded annual landings.

A daily bycatch limit applies to Australian salmon north of Barrenjoey Headland and tailor in all NSW waters taken by commercial fishing nets as follows:

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

Other species based catch controls, such as size limits and protected fish, are discussed in section 6(e) of this FMS.

xv) Seafood safety programs

Food safety programs relating to the Estuary General 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 Safe Food Production NSW.

For the Estuary General Fishery the food safety program will encompass the already established biotoxin monitoring program for pipis. This program was established in 1998 in response to several food poisoning events traced to the consumption of pipis harvested from Ballina and Stockton beaches. Fishers operating under the biotoxin management plans are limited to operating on beaches that are regularly monitored for environmental conditions, algal concentrations and, when necessary, shellfish toxicity testing.

xvi) Permits

Section 37 of 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 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 purpose intended by their issuing and are often used to limit the extent of the permitted activity.

Permits will be issued to authorise modified fishing practices to assist approved research programs or for purposes consistent with the vision and goals of this draft FMS (see management response 6.4b in section 4 of this draft FMS).

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 and are valid only insofar as they do not conflict with approved determinations of native title made under the Commonwealth *Native Title Act 1993*.

xvii) Recognised fishing grounds

Section 39 of the *Fisheries Management Act 1994* and clause 105 of the *Fisheries Management (General) Regulation 1995* provide for the declaration of waters used for net fishing by commercial fishers as recognised fishing grounds (RFGs). These areas may include areas of sea or estuaries that have been used historically for net fishing or are used regularly or intermittently for net fishing by commercial fishers.

Recognised fishing grounds aim to reduce conflict between user groups by clearly defining the specific areas that have traditionally been used by commercial fishers who take fish and prawns by specific methods, and giving priority to commercial fishers in those areas. Priority in areas that have not been declared an RFG will be based on whoever is present at the site first.

Recognised fishing grounds have two purposes:

1. Commercial fishers may request a person to remove anything that has been placed or left by the person, without lawful excuse, and which is obstructing the lawful use of the net fishing activities of the commercial fisher

2. Commercial fishers using nets have priority over recreational fishers in the waters defined as RFGs. Boats, surfcraft or similar equipment are not allowed to cause the dispersal of schooling fish or fish travelling in a school.

The implementation of RFGs does not mean commercial fishers will be excluded from areas that have not been declared an RFG nor does it provide an additional property right in the fishery. RFGs merely provide priority for access to particular areas. Additionally, just because and area has been declared an RFG, it does not prevent a lawful obstruction, such as a jetty or mooring being constructed. The declaration of an RFG however, will provide useful information for local Councils, and other State agencies when considering an application for construction and the impact of the obstruction on other user groups.

The process of declaring RFGs will involve broad stakeholder input. The initial step will be identification of possible sites by the Estuary General MAC, having regard to guidelines approved by the Minister. Once these sites have been identified, they will be presented to the other relevant advisory councils such as the Advisory Council on Recreational Fishing for consideration, prior to a period of public comment. The Estuary General MAC, prior to final recommendations being submitted to the Minister, will consider any comments made by the community.

There is currently only one declared recognised fishing ground in NSW, at Iluka in the Clarence River. However, the Estuary General MAC has already been consulted on the development of guidelines for the declaration of recognised fishing grounds for specific gear types in other areas. The draft guidelines are included below. This draft FMS proposes that consultation takes place with local stakeholder groups and the community in accordance with the draft guidelines.

Once the FMS is finalised, it will up to the Estuary General MAC to decide on the extent and scope of any implementation program for RFGs in their fishery. The implementation program will need to be financed by an industry contribution determined on advice from the MAC.

Draft guidelines for defining RFGs in the estuary general fishery

1. As they are quite specific and defined areas, RFGs will be identified in waters used for fish and prawn hauling, prawn running and set pocket netting methods only;
2. The area proposed for a RFG must be an area where there is historical evidence that the site has been fished using the relevant method at least 3 times a year and that there is a valid reason for its implementation (ie. there is a high level of ongoing user conflict);
3. The area proposed for a RFG must relate to areas that are not currently closed to commercial fishing;
4. The grounds should be proposed initially by agreement between NSW Fisheries officers and local commercial fishers, considered by the Estuary General MAC and referred to the Advisory Council on Recreational Fishing and (when relevant) the Advisory Council on Aquaculture for consideration prior to the public consultation specified in guideline (6);
5. In the light of comments made by the advisory councils, the Minister for Fisheries or NSW Fisheries may either: proceed to release the proposals for public consultation with or without modifications; ask the Estuary General MAC to further consider the proposals prior to any public consultation; or decline to release the proposals for public consultation.
6. Proposed RFGs must be displayed in the local NSW Fisheries office and NSW Fisheries Head Office for public comment for a period of at least 30 days, and an advertisement notifying of the exhibition placed in a newspaper circulating throughout the region;
7. Any objections to the proposed RFGs will be considered by the Minister prior to the grounds being declared as an RFG; and
8. Following the Minister's approval of an RFG, copies of maps with the approved RFG will be deposited at the Head Office of NSW Fisheries and at the relevant district office of NSW Fisheries located in the region of the RFG.

xviii) Administration

Renewal of licences

Commercial fishing licences and fishing boat licences must currently be renewed annually. Fishers are sent renewal application forms approximately 1 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.

Fees

A number of fees are payable in the Estuary General 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. The cost recovery policy applies to existing services traditionally provided by NSW Fisheries in administering and regulating commercial fishing. Cost recovery is a common principle among Australian commercial fisheries.

NSW Fisheries is in the process of implementing cost recovery in a progressive manner, so that all charges are not passed 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 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 environmental assessment process will need to be fully funded by the fishery participants. It is estimated that the additional fees that would apply to industry to cover the costs of implementing this strategy (including the observer-based survey) will be between $500 and $800 per fishing business per year. 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 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 and an indication is given of likely further changes in charges. The FMS does not, in

itself, set the charges, or limit or otherwise 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.

Net registration

Net registration certificates can be issued at the local NSW Fisheries Office. The fee for registration of a net is $21 per application.

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 be annually adjusted in line 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. There is a charge of $150 for each of the first two fisheries in which a person is eligible to hold shares and $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.

Fisheries Research and Development Corporation (FRDC) levy

The annual fee of $115 collected upon commercial fishing licence renewal is paid directly to the FRDC to support funding of research programs. The FRDC support a number of research programs relating to the Estuary General Fishery in NSW. Further details on these programs can be found in the research section of this strategy.

This charge will be adjusted annually in accordance with inflation.

Catch monitoring

Fishers in the Estuary General 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 will allow 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 suspected omissions or errors are queried with fishers (by phone and/or written correspondence) and corrected if necessary
- Logical checks of data accuracy (range, consistency and validity checks) are performed automatically by computer during data-entry. Likely errors are queried with fishers (by phone and/or written correspondence) and corrected if necessary
- 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.

All existing and proposed procedures attempt to maximise data quality. 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 data. Consequently, the commercial catch

statistics supplied by fishers and maintained in the commercial catch records database is most accurately described as representing "reported landed catch".

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: www.lawlink.nsw.gov.au/

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 Management Advisory Committee

Share management and major 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.

At the time of preparation of this draft FMS, teh Fisheries Management Amendment Bill 2001 was before Parliament, and contained provisions extending the explicit role of the MAC to advise on the management strategy.

Table C17 details the current membership on the Estuary General 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 seven coastal regions in the fishery, although there are two representatives from region 4, to assist in addressing the diversity of issues that occur in that region. The members hold office for a term of 3

years, however the terms of office are staggered and the terms of half of the industry members expire every 18 months.

Table C17. Current membership on the Estuary General MAC.

Position	Northern boundary	Southern boundary
Independent chairperson	–	–
Region 1 (Upper north coast)	NSW-Queensland border	29°15'S Jerusalem Creek – south of Evans Head in the Bundjalung National Park
Region 2 (Clarence)	29°15'S	29°45'S Sandon River – south of Yamba in the Yuragir National Park
Region 3 (North coast)	29°45'S	31°44'S Diamond Head – south of Camden Haven in Crowdy Bay National Park
Region 4 (Central)	31°44'S	33°25'S Wamberal Point – the entrance to Wamberal Lagoon north of Terrigal
Region 4 (additional rep)	TBA	–
Region 5 (Metropolitan)	33°25'S	34°20'S Bulli Point at Bulli
Region 6 (Upper south coast)	34°20'S	35°25S Lagoon Head – Burrill Lake south of Ulladulla
Region 7 (Lower south coast)	35°25S	NSW-Victorian border
Recreational fishing	All areas	–
Indigenous fishing	All areas	–
Conservation	All areas	–
NSW Fisheries	All areas	–
Others determined by the Minister from time to time	–	–

The non-industry members on the MAC are appointed by the Minister for Fisheries and also hold terms of office of 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 General MAC. Consultation involves seeking to advice of the MAC on their views. The MAC generally meets at least twice a year - but many issues may require resolution ungently, 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 General MAC in this FMS may include the distribution of documents to individual MAC members with a request for comment from the individual members by a specific date. NSW Fisheries may then compile the comments received into a single document recording the views of

MAC members. This document may them be used a basis for further decision making by NSW Fisheries and/or the Minister for Fisheries.

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 General 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 MACs 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 Mnisterial advisory councils is determined by regulations under the FM Act, and may be altered from time to time.

Fisheries Resources 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.

FRCAC advises the Minister for Fisheries on the preparation and revision of fishery management strategies for fishing activities, including this strategy for the Estuary General 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 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 Ministerial Advisory Council on Commercial Fishing are consultative bodies that facilitate cross-sectoral and cross-fishery consultation, respectively.

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

Prawn Resource Forum & Total Allowable Catch Setting and Review Committee

A prawn resource forum will be formed in line with this strategy and will provide a process for cross fishery consultation regarding commonly shared prawn stocks. Other fisheries proposed to be represented in the forum include the estuary prawn trawl fishery, the ocean prawn trawl fishery and the recreational fishery.

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 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
- A person appointed by the Minister who is a natural resource economist not employed by the Government
- A person appointed by the Minister who is a fishery scientist not employed by the Government
- Persons appointed by the Minister who have appropriate fisheries management qualifications.

The composition and role of the TAC Committee is set by the FM Act and its regulations and decisions by the Minister. These arrangements may change from time to time.

j) Share management plan

A share management plan for the Estuary General 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. Further discussion on the relationship between a share management plan and this fishery management strategy is presented in section 1 of this draft FMS and information relating to the transition of the Estuary General Fishery to full share management is provided in section 6(a) of this draft FMS.

CHAPTER D. CONSIDERATION OF ALTERNATIVE MANAGEMENT REGIMES

1. Outline of Feasible Alternative Management Regime

a) The alternative management regime paradigm

The draft FMS contains seven goals, 34 objectives, 97 management responses and numerous performance indicators and trigger points. There are also at least 17 types of management tools that can be used to varying degrees, and different combinations of each may be used to control the impacts of fishing activities on fish stocks (see Table D1). With this large array of management responses and tools, there are an almost infinite number of alternative management options.

Many alternative management options were considered during the preparation of the draft FMS and were rejected in favour of those that appear in the draft FMS. This is due largely to the iterative process undertaken while preparing the numerous drafts of the FMS and undertaking draft environmental impact statements at each stage.

With the above in mind, alternatives to the proposed FMS can only meaningfully be considered at the higher policy level rather than the level of individual management responses and the like. Also, as the goals and objectives of the 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 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.

Table D1. Types of management tools available to control fishing activity

(Source: Adapted from DUAP, 2001).

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

b) Alternative regimes for ensuring stock sustainability

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 limits and maximum fishing effort levels. Other measures in the strategy include gathering further information on fish stocks and

stronger compliance programs. A more comprehensive discussion on these proposals can be found in Chapter C section 3.

Two feasible alternatives to the proposals in the strategy that may be used to achieve stock sustainability include;

1) Managing the fishery using output controls, specifically a total allowable catch, or

2) using a different suite of input controls to those proposed in the fishery management strategy

The first alternative to the proposals in the FMS is to use output controls to manage the fishery, predominantly a total allowable catch. To properly consider output controls as an alternative in the Estuary General Fishery, it is firstly important to understand the fundamental differences between input and output controls.

i) The difference between input and output controls

Input controls limit the amount of effort fishers are able to apply to take fish in the fishery, thereby indirectly controlling the catch. Input controls can be as broad as limited 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 & Munro (1999) as the ability, or power, of a vessel or a fleet (or in the case of the Estuary General Fishery, a person) to generate fishing effort per period of time.

Output controls on the other hand directly limit the amount of fish that can be harvested (usually of a particular species). Output control regimes can vary from setting a total allowable catch (TAC) for an entire fish stock with individually allocated and tradeable quotas, to setting a maximum daily limit on catches which applies equally to all operators in a fishery.

ii) Assessment of feasibility of a total allowable catch for a 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 General Fishery in relation to each factor.

Jurisdictional issues

Quota management of species managed by more than one jurisdiction often requires an arrangement to coordinate management, perhaps with an overarching TAC. While TAC's 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 United States of America 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.

A number of the species caught in the Estuary General Fishery are caught in other NSW fisheries (eg. bream in ocean hauling fishery and snapper in the ocean trap and line fishery and both in

the recreational fishery) and in waters outside the jurisdiction of NSW (eg. mullet and mud crabs in Queensland). The application of a catch quota on such species would need serious consideration of the management arrangement in these other fisheries and other jurisdictions to ensure that the catch quotas were having the desired outcome on those resources. Additionally, if the value of the catch of a species differs substantially between areas, seasons and/or methods, the impact of a TAC would affect different fisheries to different extents.

Target species and gear types

Fisheries that target more than one species or use more than one gear type are generally more difficult to manage under a quota control system than fisheries with only one or few target species. If the methods used to target a species of fish also catch other species the harvest rate of the other species needs to be carefully monitored and controlled to ensure that they are not over-exploited.

Quota management regimes applied in multi-species fisheries can often lead to increased discarding of product, due to high-grading or over-quota catches. High-grading is the practice of discarding lower value fish of a particular species when a price premium is paid for higher grades (eg. different sizes) of that species. Over-quota catch is when fishers in multi-species fisheries will sometimes find themselves in a position where their quota for a particular species is exhausted. If the species in question is an incidental catch of other target species, the fisher, if intending to continue fishing, faces either having to purchase or lease additional quota or discard. 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).

Many of the species taken in the Estuary General Fishery are taken by more than one gear type as well as by endorsement holders in other fisheries and jurisdictions. Many of the primary species in the fishery are also caught by methods that take substantial quantities of other commercially valuable species. For example, hauling fishers targeting bream also rely on species such as whiting and silver biddies to supplement their income.

As suggested by Kaufmann *et al*. (1999), being part of a multi species fishery raises difficult questions under a quota management scheme. If there was a quota on, say, bream, and a fisher fills their individual quota before the end of the season, should they be required to stop hauling in estuaries for the rest of the season in order that they do not land any more bream? If not, trip limits may need to be introduced and set at a level to allow some level of bycatch but not encourage targeting.

Eels and most species taken by handgathering (eg. pipis and beachworms) are the most obvious species targeted that are taken with the least amount of bycatch.

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 involved.

The financial costs of quota management regimes vary 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 higher costs could be attributed to generally greater levels of catch reporting and administration needed in quota systems compared to input controls.

The key fish species taken by the Estuary General Fishery are relatively low value - high volume species. Bream, sand whiting, mulloway and eels are some finfish species with high values. Several of the shellfish species, including mud crabs and prawns, are also relatively high in value, however, these fisheries are also relatively low in volume. The costs involved in supporting quota management of any species in the Estuary General Fishery are likely to represent a significant proportion of the gross annual value of landings by all fishers for these species.

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. A small or easily definable recreational fishery is also desirable due to the extensive monitoring requirements and the need to factor recreational catches into the TAC setting process.

Currently, there are around 940 fishing businesses with endorsements to operate in the Estuary General Fishery. Even with the restructuring proposed by the FMS, the fishery is by far the largest commercial fishery in NSW in terms of the number of participants.

While there are no firm data on the number of people who fish on a recreational basis in NSW estuaries, preliminary data from the National Recreational and Indigenous Fishing Survey conducted in 2000/01 indicates that approximately 16% of the NSW population (approximately 1 million people) go recreational fishing at least once a year. This preliminary data also suggests that approximately 40% of these people fish in estuarine waters. The FMS contains a proposal to assess, as far as practicable, the size of the non-commercial harvest.

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. Estuary general fishers are permitted to operate in around 114 estuaries and on most ocean beaches along the NSW coast. The high number of locations that catches are landed and the subsequent potential for the quota management system to be subverted makes quotas in this fishery particularly difficult.

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. The general biology of the species also impacts on its suitability for quota management. For instance a slow growing long lived species may be more suited than a species where there is a high inter-annual variation in stock size or recruitment, such as prawns.

Irrespective of whether input or output controls or a combination of both are used to manage a fishery, the intention is to control harvesting at a level that will support the fishery into the future. To be able to confidently estimate a biological sustainable yield for any fishery, a good knowledge of the biology and population dynamics of the species is required. Where little is known about the biology and population dynamics of a stock, it is generally safer to apply input controls. This is especially true with stocks that may vary significantly in stock size from year to year.

Using a quota to manage the harvest of a species that may vary in population size significantly without a robust indication of the biological sustainable yield for that species may result in two negative outcomes. Firstly, where stock levels are believed to be low for a given year, the use of a

quota may result in an inappropriate level of fishing pressure being applied to that stock during that time. Conversely, if there was a good availability of a species in a given year when compared to a previous year, which is often the case with prawns, the use of a quota may have negative effects on the possible economic return able to be made from that stock during that time.

The level of scientific knowledge of fish harvested in the Estuary General Fishery varies depending on the species but is generally poor. None of the major species have accurate estimates of the level of spawning biomass or a maximum sustainable yield that could be taken from the stock. Many of the species are also comparatively short lived and, despite long term catch levels being relatively stable, there is high inter-annual variability in catches. The FMS proposes the development of a system to conduct formal stock assessments within five years and to promote research that will contribute to more robust and reliable fish stock assessments.

Enforcement issues

Enforcement of quota systems generally relies less on fieldwork and more on paper work. These types of enforcement schemes generally include specified landing locations, complex weighing requirements, tagging, logbook schemes and regular compliance audits.

For input control schemes, more on-water enforcement or vessel monitoring systems are likely to be required as limitations on gear and vessel restrictions are introduced. Enforcement of input controls involves a high level of fieldwork and requires sufficient resources to ensure the mobility and safety of Fisheries Officers. In theory, enforcement of quota schemes reduces the level of fieldwork required by providing a paper trail to monitor catches, and through other measures such as the pre-notification of time and place of landings.

As the majority of compliance training and day to day duties in this fishery presently involves the enforcement of input controls, it would be necessary to re-focus training on the development of new skills to enforce catch controls in any new quota managed fisheries.

Management issues

Management and administration of quota systems involves significantly more effort than input controls. In particular, there is a need to maintain accurate and auditable records of quota transactions, 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 rock lobster fishery. The administration and resourcing of the TAC Committee, which is tasked with recommending the level of the TAC for the commercial sector for species under quota management, is another specific cost.

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 General Fishery in unknown, but it unlikely to differ substantially from the recommendation of the Estuary General MAC in April 1998, made in accordance with the 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.

iii) Alternative input controls

An alternative way of ensuring sustainability of target and bycatch stocks with input controls is to significantly reduce the number of participants and the area able to be used in the fishery through fishing closures. This alternative is similar to the approach being adopted in the declaration 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.

Benefits to stock sustainability from a reduction in fisher numbers and a decrease in the area of the fishery would only become apparent if they were complimented by measures to prevent the stocks remaining from simply being caught by other users of the resource. The benefits of such a change however, need to be weighed against the likely economic and social costs.

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. As the number of estuary general fishers reduces from current levels, it is expected that the potential for increased individual fishing business profitability would initially expand because of the available fish stocks becoming accessible to a smaller number of fishers. In other words, there is some level of competition for fishing grounds and fish resources between commercial fishers, and this is evidenced by the need for the current management arrangements which define the rules of priority between commercial fishers operating on the same fishing ground.

However, the relationship between the number of fishers and catchability is not likely to be linear. Due to the range of controls on the gear used and the area and time able to be fished, 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. After 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 fish to the community.

Stock sustainability benefits from closures would vary on a species by species basis depending on biology, movements and population dynamics of a species. To achieve a specific outcome for a species, some closures may include a combination of elements by restricting the use of certain gear types in parts of estuaries during certain times of the year. Increasing or broadening the effect of that type of closure may not enhance the outcome any further. An example of this would be the restrictions placed on the use of mesh nets to protect Australian bass whilst spawning in the upper reaches of estuaries in winter. Increasing that closure to include other times of the year or to be applicable in other parts of estuaries is unlikely to have any significant stock sustainability benefits for Australian bass.

The use of a species specific closure such as that to protect Australian bass is appropriate for that species, as it is protected from commercial fishing and therefore not able to be taken in the Estuary General Fishery. The scenario would become far more complex if similar species based

closures were implemented for a large number of the retained species in the fishery. The result would be a wide range of closures, with some potentially in contradiction of each other and the end result may possibly be that no fishing could be carried out in a specific area. This could be an unnecessarily high cost when the initial intention was only to place marginal controls on a range of species. Other programs, such as marine protected areas are used, in part, to provide protection of this nature and indirectly assist in achieving stock sustainability.

With respect to management actions designed to assist in the recovery of species that have been determined as 'overfished', a combined plan of action considering the impact of all harvest sectors is required. The recovery plan may consist of recomendations and actions across a range of harvest groups, or focussed upon a single harvest group. There are no feasible alternatives to the development of recovery plans as proposed in the draft FMS.

c) Alternative regimes for promoting ecosystem management

Ecosystem management in a fisheries context involves recognition of the interactions between the various components of the environment and being able to modify fishing activities (and indeed other anthropogenic activities) to respond appropriately to environmental needs. Ideally this would involve having a good understanding about ecological relationships and actively monitoring aspects of the environment. These aspects range from the abundance of all target, non-target and bycatch species, biodiversity, water quality, air quality and habitats. Ecosystem management also involves having an adaptive management framework so that an activity can be modified or stopped if there were unacceptable changes to the ecosystem.

Unfortunately though, the Estuary General Fishery does not provide a significant economic rent and as such the financial resources available for species research and monitoring associated with the fishery are limited. Indeed, the bulk of the funding for research and monitoring associated with the Estuary General Fishery has historically been focussed toward the primary species upon which the fishing pressure is greatest.

Given that the approach proposed in the draft FMS is consistent with the approach developed and recommended at the national level, there are no feasible alternatives to that proposed in the draft FMS.

d) Alternative regimes for improving economic viability

Whilst the *Fisheries Management Act 1994* aims to promote the economic viability of commercial fishing, the objectives of conserving fish stocks and promoting ecological sustainable development come first. Accordingly, any alternative methods proposed to improve the economic viability of the Estuary General Fishery must not compromise the conservation of fish stocks and ecological sustainability.

Increasing the efficiency of fishing by decreasing the effect of the current suite of input controls is not a feasible alternative to increase economic viability, as this will probably have a negative effect on the conservation of fish stocks. This is a common fisheries management conundrum, because restrictions and regulations limiting the capacity of fishers are short-term restrictions on market competition.

The economic viability of fishers in the Estuary General Fishery is currently assisted by a subsidy provided by the state government to cover the costs of management. The Independent Pricing

and Regulatory Tribunal (1999) found that in the 1996/97 financial year estuary general fishers contributed an estimated $455,000 worth of revenue against an overall expenditure attributed to the fishery of $1,883,000; a subsidy of 76%. This does not include subsidies like tax concessions that are provided to primary producers by the federal government.

The international literature on fisheries and subsidies suggests there is evidence that subsidies encourage and aggravate problems of over-capitalisation and over-capacity, probably on a massive scale (Greboval and Munro, 1999; Ibsen, 1999). Porter (1998) suggests that subsidies to the fishing industry contribute to over-capacity in three ways. Firstly, by reducing costs and increasing profits per unit of effort, subsidies have attracted more entrants into the fishing industry. Secondly, by reducing the cost of adopting new technologies than would have been the case in an undistorted market. Thirdly, subsidies have encouraged producers who would have disinvested partially or completely to remain in the industry, in spite of serious financial difficulties. Porter (1998) further suggests that subsidies to the fishing sector have prevented the market signals from influencing the fishing industry to stop investing in already over-capitalised fisheries. While it is unlikely that the Estuary General Fishery could be considered 'over-capitalised', this theory would equally apply to over-capacity.

The cost recovery policy outlined in the draft FMS, as it relates to all category 2 share management fisheries, is that the Government will not increase the total amount of revenue collected from industry for existing services until at least year 2005. From 2005 to 2008 (a period the start of which falls within the term of the proposed FMS), full cost recovery will be phased in. This means that a few years into the term of the FMS, the management cost subsidy available to estuary general fishers will decline, potentially reducing the viability of the participants at that time. As mentioned in the start of this discussion, the FMS proposes a number of measures to plan for this change, including a restructuring program based on minimum shareholdings, such that the fishers remaining are operating in an economically viable environment and can afford to pay higher management fees.

An alternative to this approach would be for the government to continue subsidising the management costs in the fishery for the full term of the plan. Such a policy however, would not promote the restructure of the fishery necessary to reduce latent effort and improve the economic viability, and as suggested by Porter (1998) would encourage marginal fishers to continue in, or new entrants to enter the fishery.

e) Alternative regimes for reducing bycatch

An alternative to using a combination of fishing closures and gear changes to reduce bycatch is to restrict the fishing gear able to be used in the fishery to highly selective gear types which are unlikely to catch species other than those which the gear is being used to target. Although the fishery does use a number of selective gear types, (including crab traps, fish traps, eel traps and some of the prawn and garfish nets), a significant percentage of the overall catch in the fishery comes from relatively non-selective gear types such as fish hauling and meshing nets. The majority of sea mullet (85%), dusky flathead (82%), luderick (70%) and bream (57%) that were landed in NSW (all fisheries) during 1997/98 were taken using fish hauling and meshing nets.

Highly selective gear and methods are used in the fishery where the use of those methods is practical, for example the traps and prawn and garfish nets mentioned above. The fishery also uses the method of handgathering, which is arguably the most selective fishing method available, for the taking of pipis, beachworms and cockles. Whilst selective fishing gear is the preferable option in most cases,

it is unlikely to prevent the capture of juveniles of the target species which sometimes constitute a significant proportion of bycatch.

Limiting the species that can be taken in the fishery to a shorter or more defined list as an alternative method to managing bycatch would be unlikely to succeed, or be an effective measure to reduce bycatch. Limiting the species in this fishery where a number of relatively non-selective fishing methods are used would probably only increase the rate of discards from catch.

The draft FMS proposes a scientific observer program to assist in quantifying bycatch and the use of best handling techniques when handling discarded organisms. Even so, when considering the range of species taken in the Estuary General Fishery, little is known on the effects of discarding these species after they have been caught in or impacted upon by fishing gear.

Another alternative to those proposed in the draft FMS may be to focus solely on a substantial increase in the use of fishing closures to reduce levels of bycatch. With the diverse range and distribution of species within estuaries, the additional closures required would most likely incur significant economic and social costs to the fishery. The effectiveness of these closures would also rely on corresponding closures to other fisheries (including recreational and the estuary prawn trawl).

f) Alternative regimes for protecting key habitat

Alternatives for the fishery to protect key areas of habitat to those proposed in the draft FMS include to either substantially increase the scope of spatial fishing closures in isolation of other management tools, or provide alternative habitats to those impacted upon by the fishery.

Increasing the range and affect of fishing closures to achieve a suitable level of protection for key habitat (without complimenting those fishing closures with parallel restrictions on fishing gear used in those areas) would require a substantial increase in the number or area of closures. As discussed above, the economic and social costs of increasing fishing closures to this level limit the practicality of this alternative.

The other feasible alternative to not providing adequate protection to key habitat areas where the fishery occurs 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 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 the 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 an 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.

g) Alternative regimes for conserving threatened species

Although this draft FMS proposes a scientific observer program and catch reporting which will obtain information on interactions on threatened species at the fishery level, conservation of threatened species, populations and ecological communities is most appropriately managed at the species level. This species management is achieved through the use of threatened species recovery plans and threat abatement plans.

An alternative is to implement actions in the fishery independently of other users of the areas where the threatened species, populations or ecological communities may occur. This type of uncoordinated approach runs the risk of the fishery 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.

h) Alternative regimes for information needed for management regimes

The alternative to the types of 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 likely to be 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, information about sizes of individuals in a population, species composition and abundances of species, may be biased if taken from fishery dependent surveys.

The need for fishery independent research to be conducted to collect the information needed for the assessment of fish stocks is a widely held view. Whether to rely upon observer-based surveys to collect this information or to do 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 or observer-based surveys provide the same opportunity for this material.

Continuing to rely upon fishery dependent data is not considered a feasible alternative.

i) Alternative regimes for interactions with other resource users

An alternative to managing the interactions with other resource users in a manner that appropriately shares the resource between users is to allocate the entire resource exclusively to one sector. That would not be a feasible alternative due to the high economic and social costs that would be borne by the sectors that were denied access, unless appropriate compensation was made available.

Another alternative is to deny access to all sectors so interactions were not an issue that required management. This alternative is not considered feasible as it would only serve to deny a broad range of stakeholders access to a valuable and renewable community resource.

2. Assessing the Effectiveness of Alternative Management Strategies

As presented in the previous discussions in this chapter, the most significant and high level policy alternative to the suite of input controls is the use of output controls, specifically total allowable catches. Table D2 below presents the merits of using an output control regime (total allowable catch) against the proposals in the draft FMS, with both considered against a range of sustainability considerations.

The comparison shows that 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 bycatch or protecting key habitat.

Table D2. Effectiveness of alternate management regimes in addressing sustainability considerations.

Sustainability consideration	Alternative: output controls	Proposed FMS
Maintenance of ecologically viable stock levels	Very effective for specific species	Effective, with some exceptions for certain high risk species
Rebuild stocks to viable levels within nominated timeframes where overfished	Very effective for specific species	Effective, with specific proposals for recovery plans for overfished species, 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	Ineffective without further controls	Very effective, with proposals for monitoring bycatch and threatened species and changes to fishing in sensitive habitat areas
Protection of the ecosystem in particular key habitat areas	Ineffective without further controls	Very effective, particularly the proposals to protect seagrass areas
Fishing operations not being a threatening process to bycatch species	Ineffective without further controls	Very effective, through proposed changes to gear and monitoring regimes
Responsible stewardship in the management and harvesting of fishing resources, including the accountable management of latent effort and bycatch reduction	Promotes stewardship and addresses latent effort on specific species, although does not address bycatch reduction without further controls	Shares should promote stewardship, and FMS effectively addressing effort levels and bycatch issues

3. Justification of the Preferred High Level Option in the Draft FMS

There are some key species taken in the Estuary General Fishery, such as eels, pipis and beachworms, which lend themselves to quota management more than others. This is because they can be more readily targeted, and the methods by which they are taken do not involve significant catches of other species. However, the relatively low value of these species makes the fishery unlikely to be able to absorb the increased management costs that would be associated with the introduction of a quota system.

Given the comparison in Table D2 and the characteristics of the Estuary General Fishery considered under each of the factors discussed above, it is apparent that it is not practicable to implement the suggested alternative management regimes.

This conclusion is consistent with the outcome of a statutory review in 1997/98 that examined the question of whether each NSW commercial restricted fishery should be managed by input controls or output controls. The review was conducted under the *Fisheries Management (General) Amendment (Restricted Fisheries Termination) Regulation 1997* which commenced on 2 May 1997 and was repealed on 26 June 1998.

Volume 2

Chapters E – J

This is the second of four volumes in the second draft of the Estuary General Fishery Environmental Impact Statement