NSW GOVERNMENT | Department of Primary Industries

The NSW Marine fish stocking fishery management strategy

Published by the NSW Department of Primary Industries

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First published August 2014

ISBN 978 1 74256 651 1

More information

Recreational Fisheries Management

www.dpi.nsw.gov.au

Acknowledgments

Cardno Pty Ltd for their assistance with the EIS process.

INT14/62511

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1.1 Fish Stocking in NSW

NSW Department of Primary Industries (DPI) and other groups have been stocking native fish and salmonids for over 50 years to boost fish stocks in rivers and in recruitment limited impoundments to enhance recreational fishing opportunities for anglers.

Marine fish stocking is proposed to be delivered by DPI as a specific targeted service, referred to as Harvest Stocking. 'Harvest Stocking', is specifically defined as 'a DPI program of stocking NSW estuaries with native fish recognised as recruitment limited, to enhance both the stock and recreational fishing opportunities'.

This draft Fisheries Management Strategy (FMS), developed as part of the Marine Fish Stocking Environmental Impact Statement (EIS), will manage the activity of stocking native species into estuarine waters by DPI or authorised agents (such as cultural groups), through the Department's Harvest Stocking Program and other applications to stock under section 216 of the Fisheries Management Act 1994 (FM Act). Together the EIS and draft FMS will provide a framework for the assessment and authorisation of these activities.

Chapters B and C provided a comprehensive description of the proposed activity and included a risk assessment that examined the activity of fish stocking. This chapter, the draft FMS, sets out how the activity is proposed to be managed and conducted to mitigate the risks identified in that assessment process and/or during the development of this draft FMS.

1.2 Brief Description of the Activity

DPI proposes to implement Harvest Stocking into selected estuarine waters along the NSW coast to enhance stocks and recreational fishing opportunities.

Harvest Stocking will include up to seven native estuarine species: eastern king prawn, mulloway, blue swimmer crab, giant mud crab, yellowfin bream, dusky flathead and sand whiting, in up to 80 estuaries. DPI will develop a Harvest Stocking Plan each year prior to stocking, and estuaries and species will be selected primarily on a recruitment limited basis.

Over the last ten years there has been a range of stocking activities undertaken by various groups for specific purposes within estuarine waters, such as cultural and conservation groups, and fishing clubs. It is expected that DPI will continue to receive these proposals in the future. Where feasible, these stocking proposals will be incorporated into the DPI Harvest Stocking program. However, if this is not feasible and the proposed stocking is also inconsistent with the FMS, then the stocking proposal would be subject to a separate environmental assessment process consistent with the Environmental Planning and Assessment Act 1979 (EP&A Act).

The draft FMS does not cover stocking for conservation purposes however it is recognised that these stockings may need to be undertaken as part of future conservation activities (refer to Section E.2.1.3).

Marine fish stocking represents one initiative which is part of a broader DPI program to enhance and improve recreational fishing. Other existing recreational fisheries programs include:

- Deployment of artificial reefs in estuaries and inshore areas
- Habitat Action program
- Fish aggregating devices (FADs)
- Coastal fish habitat protection
- Fishcare Volunteers and Get Hooked…it's fun to fish

These programs complement current DPI fisheries management practices to ensure sustainable fisheries resources and to improve environmental performance of fishing practices.

1.3 The Role of the Fisheries Management Strategy

The draft FMS sets out the policies and administrative arrangements to guide the annual stocking events as part of the Harvest Stocking program. It demonstrates a commitment to environmentally responsible stocking in NSW estuarine waters. A policies and procedures manual will be prepared in response to management response 4.1(b) of the draft FMS, to provide an administrative framework for reviewing stocking events.

Pursuant to section 216 of the FM Act, a fish stocking permit is required for the release of live fish into waters. This includes the stocking of fish into the sea, into a river, creek or other naturally flowing stream of water or into a lake but does not apply to the immediate return of fish to waters from which they were taken (catch and release).

This draft FMS outlines the rules, regulations and programs that are designed to manage the activity of marine fish stocking. Impacts by related activities (such as recreational fishing and Aboriginal cultural fishing) or industry sectors (commercial fishing, aquaculture and the aquarium trade) are also considered in the draft FMS, although the rules applying to such sectors are dealt with under separate management or legislative arrangements. In particular, aquaculture has long been synonymous with fish stocking, but the risk assessment in the freshwater fish stocking EIS (2003) highlighted the need to de-couple these two forms of fish production. The same framework will be used for marine fish stocking. Issues related to the aquarium trade are addressed through legislation prohibiting the release of fish into natural waterways without a permit, listing of noxious or pest species, and the concurrent program of establishing a list of species permitted for importation into NSW for use in the aquarium trade.

A key priority for the draft FMS is the introduction of an appropriate management regime to minimise the environmental risks that were identified in Chapter D, which concluded that without sufficient management, many elements of the activity of fish stocking pose some threat to the environment and ecological sustainability, as well as potential social and economic impacts.

Strict hatchery protocols, general administration and information management elements of the activity that would be implemented through the draft FMS will mitigate many of the risks. It will also serve to make administration and compliance less complicated and allow for more targeted monitoring or research related to broodstock and their progeny. Developing and improving research and monitoring of the activity will also reduce much of the uncertainty identified by the risk assessment by assessing the actual rather than potential environmental impacts of fish stocking.

Stocking Review Guidelines (SRGs) have been developed to assess individual fish stocking events (Appendix E.1 & E.2). The guidelines provide a format for rigorous assessment to be undertaken before any stocking can take place by taking into account all matters likely to affect the environment and other relevant FMS issues and the concurrent program of establishing a list of species permitted for importation into NSW.

1.4 Overview of the Draft Fisheries Management Strategy

The draft FMS provides a framework for the management of fish stocking activities in estuarine waters in NSW by defining the parameters within which the annual stocking events by DPI (through the Harvest Stocking Program) will be reviewed and approved. The key elements of the draft FMS are described below.

The parameters will be updated as required to be consistent with broader State, National or multi-jurisdictional policies (e.g. National Policy for the Translocation of Live Aquatic Organisms, etc.).

1.4.1 Species that can be stocked

The draft FMS details the species that can be stocked in NSW. Any associated conditions of stocking these species, either based on species ranges or other identified risks, are detailed in Tables E.2 and E.3.

Any proposals to stock species into estuarine waters that are not covered by the draft FMS would require a separate environmental assessment process consistent with Divisions 1 and 3 of Part 5 of the EP&A Act.

It should be noted that this draft FMS does not cover the stocking of freshwater fish species. Any proposals to stock fish into waters not provided for by this draft FMS or addressed in the Freshwater FMS will require separate environmental assessment.

1.4.2 Waters assessed for stocking

The draft FMS lists a number of waters or sections of waters that have been assessed for stocking, some of these waters are closed to stocking.

1.4.2.1 Waters Permanently Closed to Stocking

This is a list of waters (Table E.4) where stocking will not be approved due to those waters comprising pristine or unique aquatic environments (e.g. Ramsar Wetlands). Proposals to stock into these waters will not be approved, even if the proponent supplies a separate environmental assessment on the proposal. The only exception to this is conservation stocking as part of a recovery activity.

1.4.2.2 Waters with Restrictions to Stocking

This is a list of waters or sections of waters (see Table E.5) where the stocking of some or all species is restricted following assessment of a range of ecological (e.g. threatened species, marine protected areas (MPAs), habitat condition), economic (e.g. local economic dependencies), social (e.g. history of stocking, alternative opportunities) or policy factors. The draft FMS includes a mechanism to review the list and to list or de-list waters based on changes in the factors over time.

1.4.2.3 Waters Suitable for Stocking

One hundred and fifty eight estuaries in NSW were assessed in Chapters B-D as to their suitability for marine fish stocking. Estuaries were assessed according to a range of ecological, social and economic criteria. There were 80 estuaries which were deemed suitable for stocking during the assessment process and these are listed below (Table 1) and in Section 1.1 Appendix 6.

Table 1. Waters suitable for stocking

Estuaries deemed suitable for marine stocking		
Northern	**Central**	**Southern**
Avoca Lake	Allans Creek	Back Lagoon
Bellinger River	Berrara Creek	Barragoot Lake
Boambee Creek	Botany Bay	Bega River
Bonville Creek	Brisbane Water	Bermagui River
Cakora Lagoon	Broken Bay	Bunga Lagoon
Camden Haven River	Burrill Lake	Curalo Lagoon
Clarence River	Cooks River	Cuttagee Lake
Cudgen Creek	Crooked River	Merimbula Lake

Estuaries deemed suitable for marine stocking		
Cudgera Creek	Georges River	Murrah Lake
Deep Creek	Hawkesbury River	Nelson Lake
Evans River	Killalea Lagoon	Nullica River
Hastings River	Lake Conjola	Pambula Lake
Hunter River	Lake Illawarra	Towamba River
Jerusalem Creek	Lake Wollumboola	Twofold Bay
Khappinghat Creek	Lane Cove River	Wallagoot Lake
Killick Creek	Meroo Lake	Wapengo Lake
Korogoro Creek	Middle Harbour Creek	Wonboyn River
Lake Innes/Lake Cathie	Minnamurra River	
Lake Macquarie	Narrabeen Lagoon	
Macleay River	Narrawallee Inlet	
Manning River	Parramatta River	
Mooball Creek	Pittwater	
Nambucca River	Port Hacking	
Oyster Creek	Port Jackson	
Richmond River	Shoalhaven River	
Saltwater Creek (Frederickton)	St Georges Basin	
South West Rocks Creek	Swan Lake	
Terrigal Lagoon	Tabourie Lake	
Tuggerah Lake	Termeil Lake	
Tweed River	Ulladulla	
Wallis Lake	Willinga Lake	
Wamberal Lagoon		

1.4.3 Ongoing Review of Stocking Events

Prior to any authorisation, each proposed stocking event will be subject to an explicit review by relevant officers of DPI to ensure that all matters raised within the draft FMS (including those within the local area) have been properly considered and, where relevant, strict conditions are imposed on the stocking event. SRGs for stocking events will guide this process (see Section E.2.6.1.3 and Appendix E.1).

1.4.4 Generalised Predatory Impact Model (GPIM)

The GPIM has been developed by Taylor and Suthers (2008) as a decision support tool to assist with the management of fish stocking activities and minimise ecological risk. The GPIM is being used in this draft FMS to determine appropriate stocking rates and to potentially reduce the risk of overstocking (see Appendix E.5). The model has been applied to the seven selected species proposed for stocking in the Harvest Stocking program, and this has been expressed as an estimated stocking rate (maximum number of individuals released per hectare of suitable habitat) and estimated harvest (total tonnes of stocked species to be harvested from the estuary)(Appendix E.5). The limitations of the modelling are acknowledged in Appendix E.5, and

the recommended stocking thresholds should be considered as a starting point that will be refined through the research and monitoring proposed in the draft FMS.

The GPIM represents a precautionary approach to minimise potentially negative ecological effects and lower the risk of overstocking by providing an upper threshold for stocking density based on the ecological characteristics of the target estuaries and selected species in conjunction with other policies and protocols that would be in place through the implementation of the draft FMS.

1.4.5 Management of Fish Hatcheries

The draft FMS incorporates plans to better manage the production of fish by the one Government and multiple private hatcheries currently licenced for stocking purposes. This includes the development of a quality assurance and accreditation scheme for hatcheries to increase the certainty that fish supplied for stocking have been produced using best practice techniques for broodstock collection and husbandry, management of disease, genetic resource management and stock identification. Policies and guidelines relating to each of these factors will be prepared and will be implemented along with the Hatchery Quality Assurance Scheme (HQAS) which is to be developed to include the seven proposed marine species.

1.4.6 Biosecurity

The draft FMS incorporates plans to better manage the production of fish by Government and private hatcheries for Harvest Stocking purposes. This includes the development of biosecurity protocols for fish supplied for stocking. Policies and guidelines relating to biosecurity protocols will be implemented along with the HQAS. Note: Biosecurity staff may at any time prohibit a fish stocking event occurring based on biosecurity risks, which have not been addressed in the EIS, import protocols or the HQAS.

Emergency disease responses will be managed in accordance with NSW DPI biosecurity policy.

Disease or potential disease outbreaks would be reported through any of the following hotlines Emergency animal disease hotline 1800 675 888, Aquatic pest hotline 02 4916 3877 or the Fishkill hotline 1800 043 536.

1.4.7 Information Management

A stocking database has been developed to record all information reported by accredited hatchery operators, from proponents who undertake the stocking activity and from the various research programs that produce information relevant to the review and assessment of individual stocking events. The database, built in a form that can be transposed to Geographic Information System (GIS) software, will allow for spatial management of the activity.

1.4.8 Research

A Research Plan has been prepared and is based on the outcomes of the risk assessment of the activity to ensure that the projects being undertaken are focussed on the areas of greatest environmental risk (Table E.7). Research and monitoring related to the survival of stocked fish within the receiving waters is also important to determine whether the stocking events being undertaken are providing good returns for the investment.

1.4.9 Compliance and Education

Improved education of stocking proponents and the community about the environmental risks associated with stocking is critical to promote responsible stocking. An education program will highlight the potential damage that can be caused by unauthorised releases. The education program will also include information provided to groups about best practice techniques for transporting and releasing fish at the stocking site.

1.4.10 Responsiveness

The controls within the draft FMS, including the detailed policy and guideline documents, are responsive to new information originating from research programs or the information management system. The strategy is also subject to reviews if the performance monitoring (incorporating performance indicators and trigger points) indicates that the management goals are not being met.

1.5 The legal and policy regime

A range of legislative and policy instruments apply to or have the potential to influence fish stocking activities in NSW, including:

1.5.1 The Fisheries Management Act 1994 (FM Act)

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

1) To conserve, develop and share the fishery resources of the State for the benefit of present and future generations.

2) In particular, the objects of the Act include:

   a) to conserve fish stocks and key fish habitats;

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

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

and, consistently with those objects:

   d) to promote viable commercial fishing and aquaculture industries;

   e) to promote quality recreational fishing opportunities;

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

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

   h) to recognise the spiritual, social and customary significance to Aboriginal persons of fisheries resources and to protect, and promote the continuation of, Aboriginal cultural fishing.

The activity of marine stocking is consistent with these objectives as outlined in the EIS. Fish stocking is also a designated fishing activity under Schedule 1A of the FM Act.

1.5.2 The Environmental Planning & Assessment Act (EP&A Act)

Fish stocking is a designated fishing activity under Schedule 1A of the FM Act. As such, DPI developed this draft FMS as a chapter in the EIS for marine fish stocking, consistent with the requirements of the EP&A Act.

The draft FMS includes a strategic framework and approach to the management of marine fish stocking practices. This provides greater control over factors such as translocation, genetic integrity of stocks and disease mitigation, and requires a demonstrated need for any proposed marine stockings to be conducted.

1.5.3 Threatened Species Legislation

There are two pieces of State legislation that incorporate provisions for the protection of threatened species, populations or ecological communities. They are the FM Act (Part 7A) and the Threatened Species Conservation Act 1995 (TSC Act). Aquatic species listed under these Acts could be affected by fish stocking and as such need to be considered during the development and implementation of the FMS for the activity. There is a third piece of legislation

addressing threatened species conservation, the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), discussed separately below.

In addition to listing species, populations or ecological communities that are presumed extinct, endangered or vulnerable, both of these Acts contain provisions for listing Key Threatening Processes (KTPs). A threatening process is eligible to be listed as a KTP if, in the opinion of the Scientific Committee (TSC Act) or Fisheries Scientific Committee (FM Act), it:

> Adversely affects threatened species, populations or ecological communities, or could cause species, populations or ecological communities that are not threatened to become threatened.

A Priority Action Statement (PAS) is a statutory instrument outlining the actions needed to reduce or eliminate the effects of a KTP on the long-term survival of threatened species, populations and ecological communities.

The TSC Act requires the Director General of the Office of Environment and Heritage (OEH) to prepare and adopt a PAS that:

- sets out the recovery and threat abatement strategies to be adopted for each threatened species;
- establishes relative priorities and actions to implement the above strategies;
- establishes performance indicators to report achievements in implementing recovery and threat abatement strategies and their effectiveness;
- contains a status report on each threatened species (where information is available);
- sets out clear timetables for recovery and threat abatement planning and achievement.

OEH has now prepared the PAS which can be found at www.environment.nsw.gov.au/threatenedspecies. This website is designed so stakeholders and community members can easily:

- retrieve recovery and threat abatement actions for each threatened species and KTP;
- identify similar recovery and KTP abatement strategies and actions that occur in each broad geographical area (OEH 2011).

1.5.4 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The Commonwealth EPBC Act commenced in 1999. It is administered by the Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC) and provides for the protection of certain matters of national environmental significance (NES) from the impact of new activities. Matters of NES relevant to fish stocking activities include: declared World Heritage areas (WHAs), declared Ramsar wetlands, listed threatened species and ecological communities, listed migratory species, Commonwealth marine environment and national heritage places.

In NSW sporadic marine fish stockings have been undertaken for over 10 years and this activity will now be managed under the draft FMS, subject to more stringent environmental controls. Following assessment of the NSW marine fish stocking program, the EIS determined that there was no significant impact on matters of NES (section G.2.1.2.6) and on the basis of this assessment the program has not been referred under Part 7 Section 67 of the EPBC Act as under the current assessment it is a non-controlled action and therefore does not require assessment under that Act (Chapter G, Section G.3.1.2 of the EIS). The draft FMS establishes a comprehensive framework for managing the impacts of stocking on threatened species and environmental heritage.

1.5.5 Ecologically Sustainable Development (ESD)

The EIS, and in particular this draft FMS, provide for the management of marine fish stocking consistent with the principles of ESD.

The National Strategy for Ecologically Sustainable Development, endorsed by all Australian jurisdictions at the Council of Australian Governments meeting in 1992, defines the goal of 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.'

According to the NSW Protection of the Environment Administration Act 1991, ESD requires the effective integration of economic and environmental considerations in decision-making processes. ESD can be achieved through the implementation of the following principles and programs:

a) the precautionary principle—namely, that 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.

In the application of the precautionary principle, public and private decisions should be guided by:

i. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment;

ii. an assessment of the risk-weighted consequences of various options;

b) inter-generational equity—namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations;

c) conservation of biological diversity and ecological integrity—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration;

d) improved valuation, pricing and incentive mechanisms—namely, that environmental factors should be included in the valuation of assets and services, such as:

i. polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement;

ii. the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste; and

iii. environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

All fisheries that use ecological risk assessment to assist in formulating their fishery management plans require a qualitative risk assessment method because data deficiency of one or more ecological components is a common feature of almost all fisheries. Therefore, qualitative methods, i.e. those that use attributes or properties of an ecological component rather than exact numerical measurements are needed to assess all major ecological components of data deficient fisheries (Astles et al. 2009).

Determining what contributes to an ecological component being at risk is based on two independent aspects – its biological, ecological and/or geological characteristics, and the activities of the fishery that act on that component; the process of conducting the qualitative ecological risk assessment clearly identifies issues that are contributing to the risk and hence

indicates the areas that require a management response to mitigate these risks and hence achieve the FMS goals (Astles et al. 2009).

1.5.6 Resource Ownership

It is recognised that marine fish stocking will take place in 'public waters' where members of the public have the right to take fish for their private use in accordance with NSW Fisheries Management regulations. Once released, fish that are stocked into NSW estuaries will therefore become a part of the common resource.

Fishing catch and effort both before and after stocking and in adjacent unstocked areas will be monitored in representative estuaries (as per Objective 2.3 (d) of the FMS). The results of these surveys will assist in determining relative increases in recreational catch that are attributable to marine stocking and will be taken into consideration when developing future resource sharing plans

2 Designated Stocking Activity

This draft FMS describes the Harvest Stocking program within NSW estuarine waters. The draft FMS also describes cultural and ceremonial fish stockings, in recognition of the spiritual, social and customary significance of fisheries resources stakeholders within the community including to Aboriginal people, in alignment with aims to protect and promote the continuation of Aboriginal cultural fishing (Table E.1). The Harvest Stocking program involves regular reviews of the species to be stocked and stocking areas, and final numbers are dependent upon the extent of recruitment limitation and the annual production of fish from government and private accredited hatcheries.

Table 2. Overview of the fish stocking programs for approved species under the Fisheries Management Strategy

Component of Designated Stocking Activity	Programs/events that make up the activity
Harvest Stocking	Stocking NSW estuaries with native fish recognised as recruitment limited, to enhance both the stock and recreational fishing opportunities.
Cultural Stocking	Stocking of native species into estuarine waters by cultural groups (including Aboriginal people) as part of recognised cultural or ceremonial events

2.1 Policies for Marine Fish Stocking

DPI proposes to undertake selected stocking of estuarine waters of NSW in recruitment limited situations to enhance fish stocks and recreational fishing opportunities and to meet the balance between appropriate environmental management and fishing interests, as outlined in the following sections.

2.1.1 Harvest Stocking Policy

1. Only the seven approved native species produced from accredited hatcheries may be stocked into specified estuarine waters in recruitment limited situations of NSW to enhance fish stocks and to provide quality recreational fishing and Aboriginal cultural fishing opportunities.

2. Native species will be stocked for harvesting purposes only: in suitable waters within their specified stocking range as outlined in E.3.2 and Appendix E.3.: at or below the recommended stocking rate (Appendix E.6); and in accordance with the genetic protocols outlined in Table E3 and Appendix E3.

3. DPI will produce stocks of native species for stocking at accredited government hatcheries. If a suitable alternative source is available from an accredited NSW hatchery (or interstate hatcheries using production methods of an equivalent standard to the satisfaction of

DPI), stock may be obtained from those sources. A combination of those sources may be used to meet stocking requirements.

4. Native species will only be stocked where all of the following conditions apply:

- pertinent environmental conditions are available for the welfare and optimal survival and health of the stock;
- the stocked waters offer reasonable access to fishers, and
- demand for stocking native species in a particular area is evident.

5. Native species will only be stocked where it can be determined to the satisfaction of DPI that either the species or location to be stocked meets one of the following recruitment limiting criteria. Criteria for the determination of a species or sites eligibility in relation to marine stocking:

Recruitment limiting criteria

1. Species based recruitment limitation

- If the NSW exploitation status, as determined by DPI, for the seven species outlined in this FMS is defined as either recruitment overfished or overfished.

2. Location based recruitment limitation

- If the proposed stocking location is acting as a barrier to recruitment. For example, ICOLLs and other physically restricted estuaries may inhibit recruitment of a species to the system.

6. A Harvest Stocking plan will be developed by DPI in consultation with stakeholders, relevant Government agencies and advisory bodies, e.g. the Advisory Council on Recreational Fishing (ACoRF) and the Aboriginal Fishing Advisory Council.

7. Research

Despite the above provisions, the stocking may take place for targeted research purposes to improve understanding in any of the following key areas;

- To increase knowledge of a species i.e. the species stock status, through demonstrating recruitment limitation by increasing the number of recruits within the system.
- To improve our understanding of the impacts of releasing fish into estuarine fisheries and ways to mitigate or minimise these impacts

It is expected that for a marine fish stocking event to be approved under the research criteria that it would form part of a formal research program.

2.1.2 Cultural Stocking Policy

1. Only the seven approved native species produced from accredited hatcheries may be stocked into specified estuarine waters in recruitment limited situations of NSW to maintain or enhance cultural opportunities.

2. DPI may produce the stock of native species for cultural programs from an accredited government hatchery. Where a suitable alternative source of stock is available from an accredited NSW hatchery (or interstate hatcheries using production methods of an equivalent standard to the satisfaction of DPI), stock may be obtained from those sources. A combination of these sources may be used to meet cultural stocking requirements.

3. Cultural stocking will be permitted where:

- the activity forms part of a recognised cultural activity
- pertinent environmental conditions are available for the welfare and optimal survival and health of the stock.

4. Cultural stockings will be included in the total harvest stocking rates. Once the stocking rate has been reached no further harvest or cultural stockings will be approved under this draft FMS.

5. Native species will be stocked where it can be determined to the satisfaction of DPI that either the species or location to be stocked meets one of the following recruitment limiting criteria. Criteria for the determination of a species or sites eligibility in relation to marine stocking:

Recruitment limiting criteria

1. Species based recruitment limitation

- If the NSW exploitation status, as determined by DPI, for the seven species outlined in this FMS is defined as either recruitment overfished or overfished.

2. Location based recruitment limitation

- If the proposed stocking location has a barrier to recruitment. For example the location is an ICOLL or is a similar restricted estuarine waterway, which has inhibited recruitment of a species to the system.

6. Despite any other limiting provision within the draft FMS, additional or other stocking may take place provided an appropriate environmental assessment has been undertaken in accordance with Divisions 1 to 3 of the EP&A Act, and approved by the relevant authority prior to the stocking event. In such events, DPI is likely to assist with both the preparation of guidelines for, and to approve those assessments

2.1.3 Other Stockings

This draft FMS only relates to Harvest Stocking for recreational and cultural purposes, however it is recognised that other stockings e.g. conservation stockings, may be needed from time to time. The impact of these activities will be assessed in accordance with Part 5 of the EP&A Act. Those types of stocking activities may be permitted where they can demonstrate they meet the following criteria as well as any requirements under the EP&A Act.

2.1.3.1 Conservation Stocking

1. Stocking of native species will be conducted for the purpose of supporting fisheries conservation management objectives at a State, National or International level.

2. DPI may produce the stock of native species for conservation programs from an accredited government hatchery. Where a suitable alternative source of stock is available from an accredited NSW hatchery (or interstate hatcheries using production methods of an equivalent standard to the satisfaction of DPI), stock may be obtained from those sources. A combination of these sources may be used to meet conservation stocking requirements.

3. Conservation stocking will be permitted where:

- the activity forms part of a threatened species recovery activity; or
- the activity is a recognised program relating to the conservation of a species.

4. Despite any other limiting provision within the draft FMS, additional or other stocking may take place provided an appropriate environmental assessment has been undertaken in accordance with Divisions 1 to 3 of the EP&A Act, and approved by the relevant authority prior to the stocking event. In such events, DPI is likely to assist with both the preparation of guidelines for, and to approve those assessments.

5. Priority

The priority arrangements for conservation stocking programs will vary from time to time but will be subject to consultation with the DPI or equivalent relevant authority.

2.1.3.2 Stocking of Adult Fish

Large or adult fish will not be stocked on a major scale due to the cost of production and concerns that larger fish can become domesticated and may not survive in the wild. However, the stocking of adult fish may be appropriate in a limited number of circumstances such as to assist with conservation or research programs. Accordingly, adult fish will only be stocked when one or more of the following criteria are met:

- the activity forms part of a conservation stocking activity or a research program that underpins a conservation initiative;
- relates to the return of brood fish to the wild providing genetics, translocation, food safety and health issues are addressed, or
- relates to the release for research purposes

Despite any other limiting provision within the draft FMS, additional or other stocking may take place provided an appropriate environmental assessment, in accordance with Divisions 1 to 3 of the EP&A Act, has been undertaken and duly considered prior to the stocking event. DPI will provide guidelines for these assessments.

'Adult fish' are defined as fish above the size at which 50 % of the stock are mature (i.e. in spawning condition), unless otherwise agreed for individual species by DPI.

2.1.3.3 Stocking of Other Native Species of Fish

Stocking of native species not considered within this draft FMS may occur despite any other limiting provision within the draft FMS, provided an appropriate environmental assessment has been undertaken in accordance with Divisions 1 to 3 of the EP&A Act, and approved by the relevant authority prior to the stocking event. In such events, DPI is likely to assist with both the preparation of guidelines for, and to approve those assessments.

2.2 Species to be stocked

Waters permitted to be stocked under the draft FMS include estuarine waters of NSW excluding ocean waters. To ensure that environmental impacts of Harvest Stocking are minimised and in some cases avoided altogether, the species and areas to be stocked, and conditions for stocking will be limited to those outlined in Tables E.2 and E.3, respectively.

With the exception of yellowfin bream, all species stocking ranges are identical to their natural ranges within NSW (Table E.2). The stocking range of yellowfin bream has been restricted to those estuaries north of and including the Manning River to avoid the potential for hybridisation with black bream (see Appendix E3 and D4.4).

Table 3. Species considered in this Fisheries Management Strategy

Species	Stocking Range
Mulloway (*Argyrosomus japonicus*)	Entire length of NSW coastline
Eastern king prawn (*Melicertus plebejus*)	Entire length of NSW coastline
Blue swimmer crabs (*Portunus pelagicus*)	Entire length of NSW coastline
Yellowfin bream (*Acanthopagrus australis*)	From the Queensland (QLD) border south to and including the Manning River
Sand whiting (*Sillago ciliata*)	Entire length of NSW coastline
Dusky flathead (*Platycephalus fuscus*)	Entire length of NSW coastline
Giant mud crabs (*Scylla serrata*)	From the QLD border south to and including Wallaga Lake

Any conditions associated with the stocking of a species are detailed in Table E.3. Stocking will not be permitted unless the conditions have been met.

Table 4. Species status and conditions

Species	Status and conditions
Eastern king prawn (*Melicertus plebejus)*	*Approved subject to genetic regions as detailed in Appendix E 3, prior to stocking, genetic samples are to be collected.*
Blue swimmer crab (*Portunus pelagicus)*	*Approved subject to genetic regions as detailed in Appendix E.3, prior to stocking, genetic samples are to be collected*
Mulloway (*Argyrosomus japonicus)* Yellowfin bream (*Acanthopagrus australis)* Sand whiting (*Sillago ciliata)* Dusky flathead (*Platycephalus fuscus)* Giant mud crab (*Scylla serrata)*	*Approved subject to the following conditions:* *1) Broodstock must be sourced from the estuary where the proposed stocking is to take place or* *2) Broodstock must be sourced from within the same genetic region as the estuary proposed to be stocked.* *NOTE: stocking using genetic regions allowed for in point 2 will only be approved following completion of a dedicated genetics research program to determine the level of genetic divergence within the NSW population*

Any proposal to stock fish species that do not comply with the above specifications in Table E.2 and E.3 will not be permitted to proceed under the draft FMS and would need to be subject to a separate environmental impact assessment process under Divisions 1 to 3 of the EP&A Act or an EIS. In such events, DPI is likely to assist with both the preparation of guidelines for, and to approve those assessments.

Any proposals to stock approved fish species would also be subject to best practice genetic management to ensure that the fish stocked into an estuary are of the same genetic makeup as the resident population within the estuary. Current knowledge about genetic zones in NSW as outlined in Appendix E3 and will also be included in the HQAS. As noted in Table E3, there is currently considerable uncertainty about the population structure for most species along the NSW coast, including those proposed to be stocked as part of this draft FMS. As a precautionary measure and until there is published information available about the population structure for a given species, all finfish and giant mud crabs must be stocked into the estuary from which their parent/broodstock originated. Stockings that do not comply with the best practice genetic management will not be permitted to proceed under the draft FMS.

If the effective size of the receiving population drops below 100, stocking should be halted or a revised genetic rescue stocking strategy shall be implemented to restore the genetic population.

2.3 Waters Permanently Closed to Stocking

Some waters within NSW are unique aquatic environments, where there are minimal anthropogenic influences. Such areas will be permanently closed to stocking to protect existing aquatic biodiversity (irrespective of the potential level of environmental impact). These waters permanently closed to stocking are listed in Table E.4. Apart from proposals to undertake conservation stocking in these areas as part of a recovery activity, no proposals to stock fish in these waters will be considered, even if an associated environmental impact assessment is completed and provided to DPI.

Table 5. Waters permanently closed to stocking

Feature	Waterway	Restriction
All waters within or directly adjacent* to declared Wilderness areas and declared World Heritage areas (as at December 2010)	Nadgee River, Nadgee Lake, Merrica River, Limeburners Creek* and Esk River* *These waterways are directly adjacent to declared wilderness areas.	No Stocking within those listed Wilderness areas and World Heritage areas
All waters within declared Ramsar wetlands (as at	Myall Lakes, Boolambayte Lake, Bombah Broadwater, Lower Myall River	No stocking within those waters declared as Ramsar wetlands

December 2010)		
All waters within the declared sanctuary zones in NSW Marine Park Areas	As described by the Marine park zoning plans.	No Stocking in sanctuary zones within those Marine Park Areas

2.4 Waters with Restrictions to Stocking

An outcome of Chapters B-D was that specific waters will be restricted from stocking, primarily in response to the risk assessment undertaken on the proposed activity as well as DPI stocking policies. Table E.5 contains a list of waters where stocking is subject to conditions. Conservation stocking as part of a recovery activity (as detailed in Section E.2.1.3.1) is exempt from these restrictions. Waters may be added to (or removed from) Table E.5 as detailed in Table E.6.

Table 6. Waters with restrictions to stocking

Issue	Feature	Restriction
Waters which 'Drain to Dry'	Cockrone Lake, Dee Why Lagoon, Curl Curl Lagoon	These waters are 'drain to dry' ICOLLs and as such are unsuitable for stocking
All waters designated as Commonwealth	No estuarine waters currently listed	No stocking within Commonwealth waters
All waters within the declared general use, habitat protection and special purpose zones in NSW Marine Protected Areas (as at December 2010)	As described by the NSW Marine Park zoning plans	No stocking in general use, habitat protection and special purpose zones in NSW Marine Protected Areas
All waters within Aquatic Reserves (as at December 2010)	Cook Island Aquatic Reserve, Bushrangers Bay Aquatic Reserve, Barrenjoey Head Aquatic Reserve, Boat Harbour Aquatic Reserve, Bronte-Coogee Aquatic Reserve, Cabbage Tree Bay Aquatic Reserve, Cape Banks Aquatic Reserve, Long Reef Aquatic Reserve, Narrabeen Head Aquatic Reserve, North (Sydney) Harbour Aquatic Reserve, Shiprock Aquatic Reserve, Towra Point Aquatic Reserve	No Stocking in Aquatic Reserves
Estuaries less than 10 hectares in area	Broken Head Creek, Darkum Creek, Dalhousie Creek, Middle Lake, Bournda Lagoon, Shadrachs Creek, Boydtown Creek, Fisheries Creek, Table Creek, Black Head Lagoon, Manly Lagoon, Towradgi Creek, Elliot Lake, Shellharbour Creek, Wrights Creek, Werri Lagoon, Wowly Gully, Flat Rock Creek, Nerrindilah Creek, Mollymook Creek, Kiola Lagoon, Durras Creek, Maloneys Creek, Bengello Creek	These waters are less than 10 hectares in size and as such have not been previously stocked and are generally considered an unsuitable environment for stocking based on level of habitat and carrying capacities of smaller estuaries
All estuarine waters declared as critical habitat	Any waters identified as critical Little Penguin habitat in the Little penguin Recovery Plan. No other estuarine waters currently listed	No Stocking within estuarine waters declared as critical habitat
Shorebird community occurring on the relict tidal delta sands at Taren Point	The Shorebird community occurring on the relict tidal delta sands at Taren Point (as described in the final determination of the Scientific Committee to list the ecological community)	No Stocking within waters declared as part of the Shore Bird Community at Taren Point

Table 7. Factors for listing (and de-listing) waters with restrictions to stocking.

Reason for restriction	Potential reasons for listing (and de-listing*)
Protection of listed threatened species, endangered ecological communities and critical habitat of threatened species	If recommended by the Director Aquaculture Conservation and Marine Parks (DPI) or after a declaration of threatened species, population, ecological community or critical habitat by notification in the Government Gazette, it is agreed by the Director, Recreational and Indigenous Fisheries (DPI) that the species, population or community could be detrimentally affected by stocking fish in that area. If recommended by another authorised environmental management agency or after a declaration of threatened species, population, ecological community or critical habitat by notification in the Government Gazette it is agreed by the Director, Recreational and Indigenous Fisheries (DPI) that the species, population or community could be detrimentally affected by stocking fish in that area
Protection of aquatic biodiversity	If, after declaration of a marine protected area and notification in the Government Gazette. or If recommended by the DPI (as approved by the Director, Recreational and Indigenous Fisheries and the Director Aquaculture Conservation and Marine Parks) and/or another authorised environmental management agency and agreed by DPI
Determined as 'unsuitable' by multi-criteria analysis (MCA) or through the stocking review framework	If the area is defined as unsuitable (e.g. temperature ranges, consistently poor returns). If a specific area of concern is identified through a stocking review with respect to an individual stocking event i.e. a culturally sensitive site. If drought or flood affected or affected by toxic agents, noxious aquatic flora or disease.
Places of cultural, historic or Aboriginal significance (must be based on Aboriginal group consultation results)	If such places are identified as requiring special management in consultation with relevant stakeholder groups. If the areas are protected from disturbance under legislation. If otherwise recommended, with sufficient justification, by an authorised agency.

* De-listing generally applies if the reverse situation to a specified trigger occurs.

2.5 Waters Suitable for Stocking

One hundred and fifty eight estuaries in NSW were assessed as to their suitability for stocking. Estuaries were assessed according to a range of ecological, social and economic criteria. Estuaries which were deemed suitable for stocking during the MCA process are listed in Appendix E.6.

Chapters B-D also assessed and determined appropriate stocking rates for each species and estuary using the GPIM allocating up to 5 % of available habitat productivity to be utilised by the stocked fish. The results of the model will be used as a guide for fisheries managers so that overstocking and its associated impacts are prevented. The basic concept of the GPIM is outlined in Appendix E.5.

Although the MCA process identified 80 estuaries as suitable locations for marine stocking, DPI will only permit Harvest Stockings to take place if, following assessment, it is determined that the proposed stocking is in a recruitment limited situation.

2.6 Review of Proposed Stocking Events

To ensure that individual stocking events are properly reviewed before being carried out, a review framework will be used (Figure E.1). The framework ensures that all potential risks associated with the stocking are mitigated as per the EIS and FMS processes and allows for the identification of constraints early in the planning stage. Events that do not comply with the SRGs (in Appendix E.1 and E.2) and as a result fail to demonstrate compliance with the FMS will not be authorised.

Reviews of stocking events, supported by the SRGs (Appendix E.1 and E.2), will be carried out by appropriately qualified staff within DPI with the delegated power to approve stocking permits under Section 216 of the FM Act. The outcomes of each review will be counter-signed by appropriately qualified staff to advise on threatened species issues to ensure that threatened species, populations and ecological communities and biodiversity issues are addressed before the stocking event takes place.

2.6.1 Review Process

The review process is shown diagrammatically in Figure E.1.

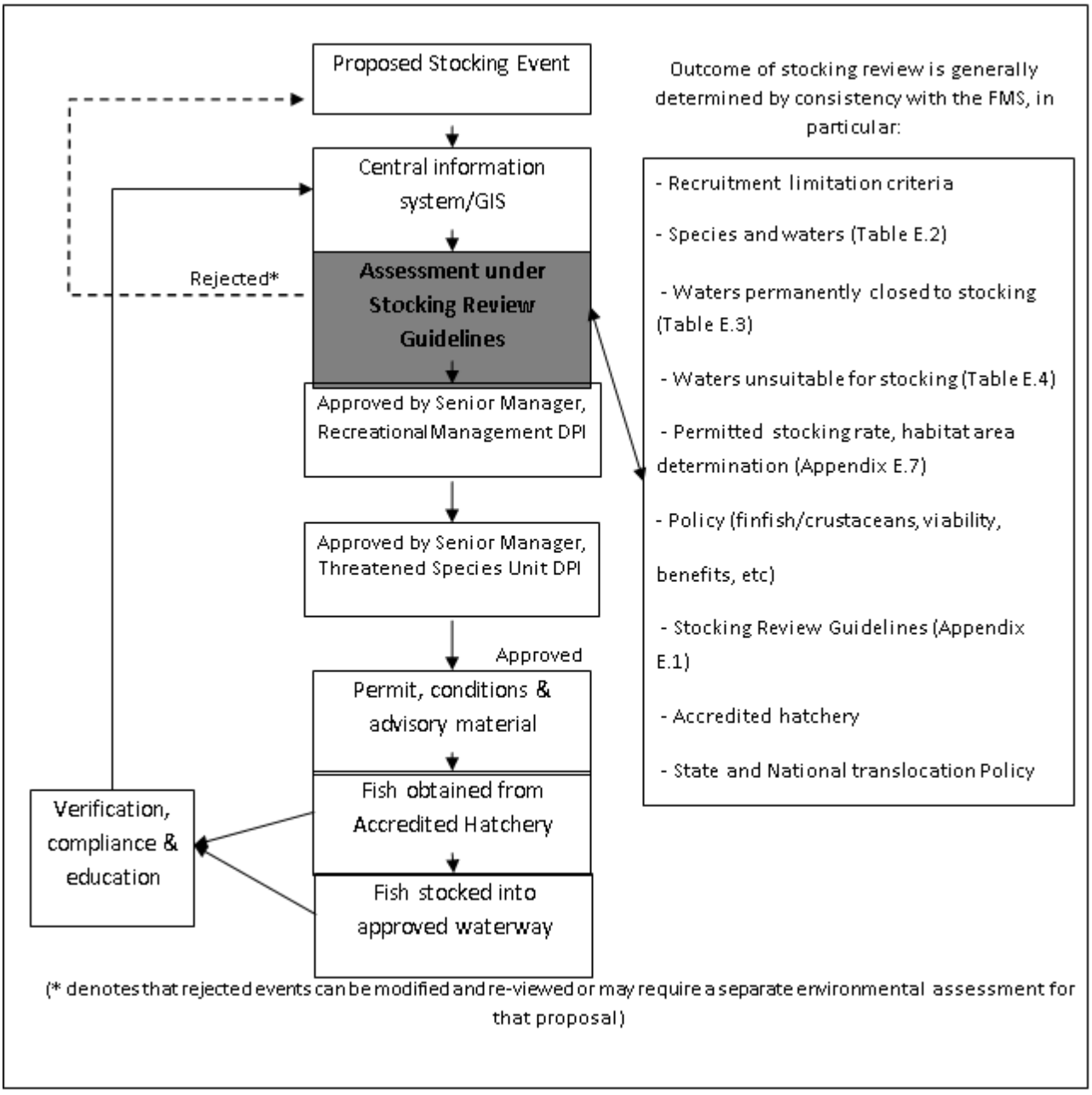

Figure 1. Diagram of the stocking review process

2.6.1.1 Policy and procedures manual

To ensure consistent application of the review process within DPI, a Fish Stocking Policy and Procedures Manual will be developed (see Management Response 4.1(b)). The manual will describe the relevant policy, procedures, assessment protocols and management arrangements that are to be observed when reviewing a stocking event in NSW. The manual will provide

consistency within the organisation and provide transparent review and permit systems to support the strategy.

2.6.1.2 Delegation of Power

The Senior Recreational Fisheries Manager and Senior Fisheries Manager (Threatened Species) are the delegated officers to exercise the Minister's authority to issue a stocking permit under Section 216 of the FM Act and pursuant to the FMS.

Reviews of stocking events will be carried out by approved DPI stocking management staff for approval by the delegated officers. The reviews will ensure that all aspects of the review process under the FMS as well as any issues relating to native title, threatened species, fishing access, habitat, water quality and biological diversity are considered in accordance with the FMS before the stocking event takes place.

2.6.1.3 Stocking Review Guidelines

Guidelines have been developed and will be used to assess individual fish stocking events. The guidelines provide a format for rigorous review to be undertaken before any activity can take place by taking into account all matters likely to affect the environment and other relevant FMS issues. The SRGs, incorporated into the Policy and Procedures Manual (see Section E.2.6.1.1), will ensure the consideration of matters such as the source and quality of the stock, translocation and disease risks, local environmental issues and potential conditions that should be applied to the event.

The SRGs will be adaptive to reflect the dynamic nature of the natural environment and may be amended by the Director-General, DPI at any time in light of new information, such as research outcomes or habitat conditions that could influence the decision about whether an individual stocking event should proceed.

The four parts of the guidelines are summarised below and detailed in Appendix E.1:

Part 1. The stocking activity - This part examines the source and quality of the stock, the appropriateness of the intended release site, the permitted stocking rates, the annual stocking cap and general compliance with the FMS.

Part 2. Translocation of live aquatic organisms - This part is based on the National Policy for the Translocation of Live Aquatic Organisms (stocking open waters) and examines the likelihood and consequences of inadvertent translocations of non-target species into the zone through the stocking activity. It identifies translocation risks, highlights mitigating actions that need to be taken to minimise risks and leads to further assessment, where necessary.

Part 3. Local environmental issues - This part considers any potentially significant impacts at a local level that may be caused by the activity. Using the best available information on the zone, the decision-maker can determine whether further assessment or action is required.

Part 4. Review of the stocking proposal and permit arrangements - This part provides a review of the entire proposal to ensure that all matters have been taken into account and that the proposal is permissible under the FMS. It ensures a transparent appraisal of the proposal and outlines the authorisation arrangements, including the application of special conditions where necessary to mitigate unacceptable impacts.

2.6.1.4 Application Forms

Forms will be designed for fish stocking events to procure the information required for the review of fish stocking or one-off stocking events in NSW. The forms will be designed to guide the proponents into planning events that comply with the provisions of the FMS.

The information provided in the forms will be considered during the review using the SRGs. Where a stocking event fails to comply with the FMS or has unacceptable environmental impacts, the activity will not proceed.

The forms for fish stocking events will be designed following approval of the draft FMS by the Minister for Primary Industries.

2.6.2 Authority to Stock Fish

Stocking permits under Section 216 of the FM Act are required for all stocking events undertaken. The permits authorise the activity and outline the conditions under which the event must be carried out.

A stocking event is deemed authorised if it is undertaken under any DPI fish stocking program and has been favourably reviewed under the FMS to ensure that local environmental issues are properly considered prior to the event. Any measures that are required for individual stocking events in order to manage potential environmental impacts must be complied with before the event progresses.

This draft FMS and the policies and management arrangements contained herein constitute the permit issued by the Minister (by virtue of Section 216 of the FM Act) to undertake stocking for authorised events by DPI staff, volunteers or agents of DPI. The authority is subject to any special conditions determined during the stocking review process.

2.7 Management of Hatcheries Producing Fish for Marine Stocking

To ensure the consistent production of quality stock to be used for marine stocking, DPI will develop the current HQAS to include the seven marine species nominated in this draft FMS.

2.7.1 Hatchery Quality Assurance Scheme

A first of its kind in Australia, the HQAS currently involves the production of freshwater native fish, namely golden perch, silver perch, Australian bass and Murray cod. Prepared by DPI scientists, hatchery managers and aquaculture managers the HQAS was developed in consultation with private hatchery operators and other relevant agencies. The scheme is designed to guide the production of these key native species in a manner that provides high quality and genetically sound stock. The seven marine species nominated in this draft FMS will be included within the current HQAS, and will consider all aspects of hatchery production through a hazard analysis critical control approach.

The HQAS will apply to any facility producing or growing out fish for stocking (including hatching eggs sourced from another hatchery). Marine hatcheries will be accredited based on their capacity to implement agreed standards under these programs and to maintain minimum requirements in the form of appropriate infrastructure, equipment, breeding techniques and relevant expertise. The department will support new hatcheries with extension advice while ongoing support and compliance checks will also form important components of the system.

During the development stage of the HQAS marine hatcheries may be allowed to stock if they indicate intentions to comply with the HQAS when implemented. This is to provide sufficient time to set up the necessary equipment and procedures. After the implementation, any hatcheries failing to comply with the HQAS will not be permitted to provide fish for stocking. Some of the key initiatives within the HQAS include a Ne of 50 for Harvest Stocking, and the supply of broodstock fin-clips and a sample of fish from larval rearing ponds can be requested by DPI for compliance and monitoring purposes at any stage.

2.7.2 Broodstock Collection Policy

The collection of wild fish for use as broodstock is a critically important component of the draft FMS supporting the production of quality fish for stock enhancement and conservation programs. Managed by DPI, a Broodstock Collection Policy has been developed to ensure this

component of the activity is managed in accordance with the draft FMS and the principles of Ecologically Sustainable Development.

2.8 Research

2.8.1 Overview

This Section describes research programs designed to support the draft FMS and provide information that will lead to continuous improvement in the way the stocking activity is undertaken.

2.8.2 Research Priorities and Timeframes

The research topics and components supporting the draft FMS (outlined in Table E.7), are categorised into two levels depending on the relevance to the risks identified in the EIS and information required to support the goals and objectives of the draft FMS, as follows:

Level 1 (initial research): Commencement scheduled for within one year of the approval of the draft FMS and reviewed within five years of commencement.

Level 2 (supportive research): Commencement scheduled for within three years of the approval of the draft FMS and reviewed within five years of commencement.

Table 8. Research Plan (Research Topics and components supporting the draft FMS)

Research Topic	Priority	Order of Components	Short description of research project and expected outcomes
1.1 Genetic distribution of native species and sub-populations	Level 1	1. Eastern king prawn 2. mulloway 3. dusky flathead 4. yellowfin bream 5. sand whiting 6. blue swimmer crab 7 giant mud crab	To research and map the genetic distribution of native species used in the activity with regard to identifying any population substructures within each species. Research outcomes will provide information upon which stocking locations and broodstock collection zones can be determined, thereby minimising negative impacts on genetic resources.
1.2 Impacts of native fish stocking on aquatic biodiversity	Level 1	1. Native species breeding programs 2. Broodstock management	To research the impacts of stocking activities on the biodiversity of native populations within stocking areas, having specific regard to areas of conservation significance and marine protected areas.
		1. Native species breeding programs 2. Broodstock management	To establish a monitoring program to look at impacts of stocking on non-stocked species at fish stocking locations and make recommendations to the FMS for future management arrangements as appropriate.
1.3 Genetic Resource Protocols	Level 1	1. Genetic Protocols	Review current literature and research the most appropriate genetic protocols under NSW conditions with regard to native species breeding programs and broodstock management arrangements.

Research Topic	Priority	Order of Components	Short description of research project and expected outcomes
	Level 1	2. Ryman-Laikre effect and effective population size	Research is needed on all species to determine the potential for a Ryman-Laikre effect. The objective of the research would be to determine the genetic effective population size of the target species population in each estuary where stocking is occurring. Importantly, samples from the target population must be collected prior to stocking commencing.
		3. Introgression	Introgression can be minimised by using pure-bred native individuals from the appropriate population as broodstock. Research is needed on all seven species to find genetic markers that can be applied to potential broodstock to test their ancestry.
1.4 Disease research	Level 1	1. Identify diseases which pose a translocation risk in NSW waters.	To determine the potential aquatic pathogen risks relevant to the target species in NSW waters, in particular where broodstock are to be sourced and where stocking is conducted (including all hatcheries) and subsequent disease mapping within stocking zones to support accurate stocking reviews to minimise translocation risks.

Research Topic	Priority	Order of Components	Short description of research project and expected outcomes
1.5 Disease Resistance	Level 2	1. Identify diseases which pose a genetic resistance risk in hatcheries.	Genetic resistance to disease may develop within hatcheries when disease control procedures are not stringent and when the effective population size of hatchery stock (i.e. brood stock and offspring) is low. Research should identify methods to include (a) use of sensitive disease detection protocols for application to hatchery and field samples, (b) stringent disease control mechanisms within hatcheries and (c) maintenance of high genetic effective population size in all life-stages within hatcheries. Genetically resistant stocked fish will have low levels of infection, thus disease testing procedures need to be particularly sensitive.
1.6 Disease management	Level 1	All species	Identify parasites and pathogens of all species for stocking in locations where broodstock are obtained and where fingerlings are released.
2.1 Movement of stocked fish	Level 2	All species	To determine the distance that stocked fish may travel from the point of release. Outcomes will provide data to support accurate reviews of stocking events where threatened species, aquatic biodiversity or ecological communities may be affected.
2.2 Impacts of native fish stocking on threatened species and areas of conservation significance	Level 1	1. Native Species	To determine interactions between stocked native fish species and threatened species and areas of conservation significance. The research outcomes may also support the development of appropriate stocking densities, buffer zones and ongoing reviews of waters listed as closed to stocking.
	Level 2	1. Native Species	To establish a monitoring program to look at incidence of injury/fatality from harmful marine debris and/or hooking and make recommendations to the FMS for future management arrangements as appropriate.

Research Topic	Priority	Order of Components	Short description of research project and expected outcomes
2.3 Food chain interactions	Level 2	1. Native species	To establish reliable data regarding food chain interactions between stocked fish and the aquatic environment. The project will also examine sites not stocked to establish relative changes in fish and invertebrate species assemblages. Research outcomes will also support the further development of appropriate stocking densities.
3.1 Cost effective marking techniques	Level 2	1. Native species	To research and implement the most cost effective and reliable marking techniques used to identify stocked individuals for monitoring.
3.2 Optimal stocking practices for NSW waters	Level 1	1. Optimisation of Harvest Stocking techniques	To assess and refine the generalised predatory impact modelling methods for release purposes and specifically to assess measurement approaches, appropriateness of 5 % productivity allocation and the long term monitoring of ecosystem components in both stocked and unstocked (control) systems
	Level 2	2. Optimisation of Harvest Stocking releases	To research the efficiency and effectiveness of current stocking methods for Harvest Stocking programs. Includes appropriate classes of stock, stocking survival/mortality rate, conditioning, timing, release techniques. Information will be used to evaluate success of the activity in achieving the stated goals in the FMS. Outcomes will also guide the development of optimal stocking practices under NSW conditions.

3 Vision and Goals for the Activity

3.1 Vision for the Activity

The long-term vision for the activity of marine fish stocking is:

An activity that provides effective enhancement of saltwater fish stocks and recreational and Aboriginal cultural fishing in NSW; that supports conservation outcomes for fish and fish habitat; and that is undertaken within a clear management framework and consistent with the principles of ecologically sustainable development and ecosystem management.

3.2 Goals for the Activity

The proposed goals that have been designed to achieve this vision for the activity are as follows:

1. to manage the activity in a manner that minimises impacts on ecological sustainability and aquatic biodiversity and improves the knowledge of the activity and ecosystems in which it operates.

2. to enhance fishing opportunities through cost-effective stocking programs which complement other existing DPI programs to ensure sustainable fisheries resources and that maximise social, economic, Aboriginal and other cultural benefits, consistent with achieving outcomes aligned with the priorities of the NSW State Plan.

3. to ensure the consistent production and release of appropriate quality stock.

4. to provide efficient administrative services, education and support services, information management and reporting systems.

This Section sets out the goals, objectives and management responses for the activity of marine fish stocking established under the FMS.

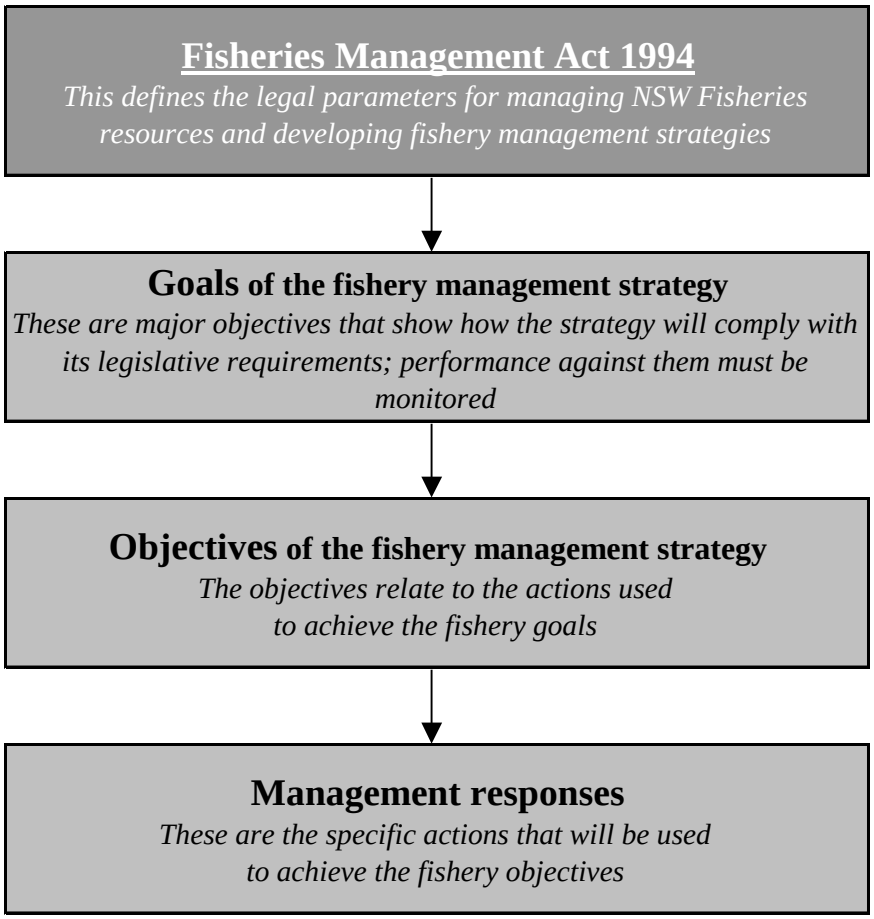

Figure 2. A model of the framework for a fishery management strategy

The draft FMS contains broad goals, operational objectives and specific management responses (see Figure E.2). The link between the goals, objectives and management responses is not as simple as that portrayed in this figure. The reality is that most management responses assist in achieving more than one goal, and as such cannot be presented in a simplistic issue, goal, objective and response format (see Figure E.3).

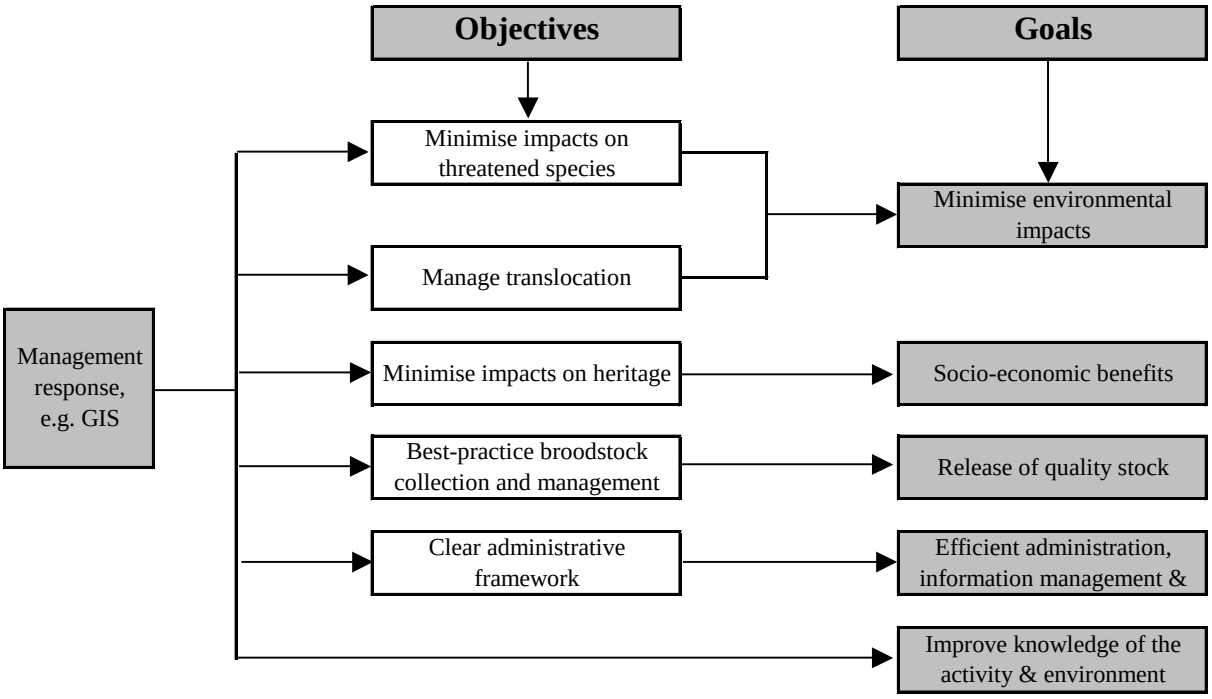

Figure 3. Example of how a single management response from the FMS affects multiple goals and objectives within the activity of marine fish stocking

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 associated with each management response to the goals that the response assists in achieving (Appendix E.4).

Information relating to the implementation of management responses is provided in a table located in Appendix E.4. The implementation table outlines the scheduled periods within which each management response is to be implemented, as well as information relating to the head of power for implementation and the group who has the lead responsibility for carrying out the actions.

3.3 GOAL 1.

To manage the activity in a manner that minimises impacts on ecological sustainability and aquatic biodiversity and improves the knowledge of the activity and ecosystems in which it operates

3.3.1 Objective 1.1 To develop and maintain a framework to guide appropriate assessment of stocking activities

3.3.1.1 (a) Use reliable and current information resources to support the stocking review framework

Background: The Stocking Review Guidelines will draw on a set of reliable information sources to assist decision-makers to review stocking events. Information sources used in the review will include the most reliable base-line data available from the Primary Industries Aquatic Ecosystems Unit on estuarine habitat mapping and will also utilise data from the "NSW Atlas of wildlife" information resource (a computer-networked information resource of current natural resource information that draws on a number of data sets including spatial information on threatened species locations, ecological communities and other relevant data supplied by the Australian Museum, the OEH and Royal Botanic Gardens).

3.3.1.2 (b) Continually update the list of estuaries where stocking can and cannot occur based on the evaluation of social, economic and ecological factors:

The table of waters suitable and unsuitable for stocking will be reviewed and updated in light of new information or decisions and having regard to a range of ecological (e.g. suitable habitat area, threatened species listings, water condition, frequency and magnitude of stocking), economic (e.g. local economic dependencies) and social (history of stocking, alternative opportunities) factors.

3.3.1.3 (c) Map the activity in a Geographic Information System (GIS) to:

- accurately depict the historic stocking activity
- record the ongoing activity to the best available standard
- regularly update the assessment resources
- allow accurate reviews of stocking events in relation to environmental considerations
- plot the presence of disease, pest species, noxious species (including aquatic weeds and algae), and
- contribute to other spatial data sets held by the Government or other authorised agencies as required.

Background: An important component of the FMS is the development of accurate mapping of the activity. The historic and ongoing stocking activity in NSW will be recorded on a series of (GIS-based) maps. This will provide accurate spatial and temporal information in a format that can be considered alongside other similar natural resource data also on GIS platforms. This information will be made accessible to interested stakeholders, recreational fishers and Aboriginal communities.

3.3.1.4 (d) Continually update the Stocking Review Guidelines and assessment resources to accurately review potential impacts from the activity

Background: The SRGs established under the FMS are designed to be continually improved and updated. As new information or review procedures are developed they will be readily transposed into the review framework. The document will be assigned version numbers to ensure that only the latest version is in circulation.

This process of modifying the guidelines as new information is developed will equally apply to the other policy and procedures prepared under this draft FMS, such as the Genetic Resource

Management Guidelines and guidelines developed under the Hatchery Quality Assurance Scheme.

3.3.2 Objective 1.2 To minimise and/or eliminate any negative impact from the activity on threatened species, populations, ecological communities (including mammals, birds, reptiles, amphibians, fish, invertebrates and vegetation) and critical habitat, and where possible promote their recovery

3.3.2.1 (a) Appropriately manage stocking in areas where the activity may adversely affect a threatened species

Background: By drawing on the resources provided by the NSW Atlas of Wildlife and in light of the stocking review framework, any stocking event that has the potential to affect a threatened species will be thoroughly reviewed with a view to preventing or minimising any potential impacts. The event may be modified, ceased or allowed to proceed subject to stringent conditions in order to mitigate any potential threats.

3.3.2.2 (b) To record and monitor sightings and incidences involving threatened and protected species within stocked estuaries.

Background: By drawing on the resources provided by the NSW wildlife atlas, DPI sightings and incidences of threatened species and targeted campaigns in each stocked estuary, these will be linked to the fish stocking database and allow for the monitoring of any potential increases in interaction in order to manage any potential conflicts.

3.3.2.3 (c) Apply empirical methods to determine optimum stocking density rates (in terms of efficacy and effectiveness) to minimise potential for overstocking.

Background: To promote efficiency in stocking rates, empirical methods will be used to determine appropriate stocking densities. In the longer term, it may be possible to further develop and refine stocking density formulae based on fixed factors such as the surface area, shoreline length and water volume of the receiving waterway, and variable factors such as the type and class of stock, existing stock, frequency of past stocking, harvesting pressure and availability of food and habitat values.

3.3.2.4 (d) To educate stakeholders regarding threatened species including reporting sightings and incidences involving threatened and protected species within stocked estuaries.

Background: Educational material will continue to be provided through the current methods by DPI. Current methods include signage, pamphlets, media, mail outs, radio as well as a sightings program to allow the angling public to report incidences with threatened species. These sightings may be reported through the internet, phone, email or post. DPI will continually work to improve understanding and awareness in regard to threatened and protected species through all suitable medium with special attention in areas where stocking may take place.

3.3.3 Objective 1.3 To provide reliable genetic resource management in the activity

3.3.3.1 (a) Develop and implement genetic resource management guidelines for marine fish stocking in NSW

Background: These guidelines will underpin the critically important use of, and potential effects on, genetic material as it relates to all fish stocking programs in NSW. Designed to be representative of current scientific literature and understanding on the subject, the guidelines will include the DPI policy on the use of aquatic genetic material and will provide precise standards for private hatcheries (stocking) and all NSW Government hatcheries. In essence, the guidelines will address the critically important feature of any ecologically sound stocking management system, namely adherence to genetic, evolutionary, and ecological principles (Miller & Kapuscinski, 2003).

There are four major components of hatchery production and each component represents a genetic risk: (1) Broodstock collection; (2) Breeding Programs; (3) Rearing Progeny; and (4) Stocking Techniques (Miller & Kapuscinski, 2003). How these factors are managed is representative of the level of genetic risks posed under the activity. Each component will be addressed by the guidelines, either outright or in conjunction with the FMS goals and management responses briefly described below.

1. **Broodstock collection:** The Broodstock Collection Policy (Management Response 3.3a) will address the point of capture techniques required to mitigate any sampling bias and provide direction on other broodstock collection issues. This will result in high quality broodstock extraction providing a solid basis for good breeding programs.
2. **Breeding programs:** The Genetic Resource Management Guidelines (Management Response 1.3a) will address breeding programs through literal standards resulting in an appropriate mix of suitable progeny for harvest and conservation programs by defining the required amount of parent stock and necessary breeding crosses required to establish an effective population size (relevant to the stocking type). For the FMS, the genetic standard for Harvest Stockings will require hatcheries to use an effective population size (Ne) of 50. Principally, the breeding programs established under the guidelines will be designed to minimise or eliminate genetic drift and inbreeding, outbreeding depression and gene pool swamping by considering and mitigating the factors resulting in these problems including population subdivisions and Evolutionarily Significant Units. Knowledge in these areas will be improved by conducting research as outlined in the research plan, in particular the research into distribution of populations (see Section 2.8 - Research Topic 1.1).
3. **Rearing Progeny:** This area will be managed under the Hatchery Quality Assurance Scheme (Management Response 3.1a). These systems (each of which draw on the genetic resource management guidelines) will provide direction and guidance on how progeny are to be reared for release into the wild.
4. **Stocking Techniques:** Management of this area is improved through the mandatory observance of the Stocking Code of Practice (Management Response 3.4a) that will provide direction for the appropriate release techniques to be used for hatchery progeny under the FMS.

Where the FMS and/or the above requirements generate significant changes to the way the activity is conducted, these will be progressively implemented to minimise any negative impacts on hatcheries.

3.3.3.2 (b) Develop and implement species specific stocking guidelines directly relevant to species ranges in NSW

Background: DPI will review species information and where necessary develop detailed and species specific stocking guidelines to improve the management and operation of the stocking program. Appendix E.3 of the FMS outlines some of the specific stocking regions for species. More specific guidelines for species may be established following further research.

3.3.4 Objective 1.4 To implement the FMS in a manner consistent with related Commonwealth and State endorsed programs designed to protect aquatic environments and biodiversity

3.3.4.1 (a) Manage the activity having regard to cross-jurisdictional management arrangements

Background: This draft FMS operates alongside other programs relating to the protection and management of aquatic resources. Consultation with other jurisdictions, such as interstate fisheries agencies and other management authorities such as the NSW Marine Parks Authority and the OEH will occur to ensure compatibility between programs and matters of environmental concern. Information relating to cross-jurisdictional management issues will be considered

during the stocking review process. Where terrestrial threatened species are of concern the relevant managing agency will be consulted.

3.3.4.2 (b) Manage and conduct the activity having regard to other DPI fisheries management arrangements

Background: This draft FMS operates alongside other programs conducted by DPI to improve recreational fishing and ensure fisheries resource sustainability. Consultation with other programs and units within DPI will occur to ensure compatibility between programs and matters of environmental concern. An example of this would be increased advisory campaigns in stocked areas in regard to habitat sensitivities.

3.3.5 Objective 1.5 To appropriately manage the risks associated with translocation of live aquatic organisms during stocking activities

3.3.5.1 (a) Manage the activity consistently with State and National policies governing the translocation of live aquatic organisms

Background: Translocation of live aquatic organisms (translocation) has been identified as an area that has the potential to impact on the sustainability of the activity. Translocation issues such as disease transfer and pest/non-target species introductions are immediate threats that are addressed by the FMS. To guide the management of this issue the policies that will be relied upon are the “Introduction and Translocation Policy (1994)” and the “National Policy for the Translocation of Live Aquatic Organisms (1999)” as amended from time to time. These policies will be factored into the stocking review framework and considered in all stocking assessments, while at the same time best practice techniques designed to minimise or eliminate translocations will be incorporated into the Hatchery Quality Assurance Scheme.

In the case of any direct inconsistencies or conflicts between the FMS and the translocation policies, the situation will be reviewed by DPI and the activity or the FMS may be modified as a result.

3.3.6 Objective 1.6 To initiate research relating to the activity

3.3.6.1 (a) Facilitate research programs to fill information gaps identified in the risk assessment of the existing activity, as provided for in the Research Plan

Background: This draft FMS will draw on existing research programs that are relevant to the activity while actively developing the most appropriate direction of future research. A Research Plan has been developed and included in the FMS and is based on filling identified information gaps and addressing areas of highest environmental risk as identified in the EIS. The research proposed in the plan will be considered in order of priority and, subject to available resources, will be carried out according to the timetable set out in the plan (see Section E.2.8).

3.3.7 Objective 1.7 To minimise any competitive advantage of the stocked species over wild conspecifics

3.3.7.1 (a) Facilitate stock releases in timing with the selected species lifecycles and natural recruitment patterns

Background: In order to help reduce the impact of releasing juvenile fish, stocking events will be timed as closely as possible to coincide with natural fish spawning events to ensure cohorts of stocked fish are released at the optimal time for survival and that no advantage is created for stocked fish over wild juveniles.

3.4 GOAL 2.

To enhance fishing opportunities through cost-effective stocking programs which complement other existing DPI programs to ensure sustainable fisheries resources and that maximise social, economic, Aboriginal and other cultural benefits, consistent with achieving outcomes aligned with the priorities of the NSW State Plan

3.4.1 Objective 2.1 To provide quality stock to enhance recreational fisheries

3.4.1.1 (a) Commence provision for the stocking of approved fish species at appropriate densities to provide or enhance quality recreational fishing opportunities in estuarine waters

Background: I &I NSW will undertake the release of up to seven marine species in recruitment limited situations consistent with a stocking program plan, which will be developed in consultation with stakeholder groups. The program aims to enhance recreational fisheries and to provide for economic and social benefits arising from them, and will operate within the context of controls on stocking described in the FMS to reduce the environmental risks of stocking fish into estuarine waterways. Stocking activities will need to take account of other measures to restore native fish populations, such as ecosystem restoration and protection.

3.4.2 Objective 2.2 To minimise any negative impacts of the activity on cultural heritage values and provide opportunities for Aboriginal communities to participate in stocking activities and to support cultural fishing practices

3.4.2.1 (a) Provide for the stocking of native fish for Aboriginal cultural fishing and moiety purposes as requested in alignment with the FMS

Background: Stocking events of the approved species for Aboriginal cultural fishing and/or moiety purposes will take account of a number of a number of factors, including the findings of research relating to the identification of culturally important species and areas fished by Aboriginal people as well as alternative means of re-establishing native fish populations.

3.4.2.2 (b) Ensure that new information about areas or objects of cultural significance is taken into account in the stocking review framework

Background: The management regime must be able to respond appropriately to new information about items or locations of cultural significance. For example, stocking waterways near of sites of cultural significance may cause increased disturbance in the area, or, where the local Aboriginal community considers a species of cultural significance, the activity needs to minimise or prevent any impacts on that species, or class of species. Recognition of cultural sites has been incorporated into the SRGs. The OEH is responsible for management of cultural heritage within National Parks and Wildlife Service (NPWS) estate and the protection of all Aboriginal objects on all lands, and their input will help ensure protection of such sites.

3.4.2.3 (c) Consult with relevant Aboriginal groups in the assessment of any new sites proposed to be stocked

Background: Stocking has the potential to impact on Aboriginal values and beliefs and as such the relevant Aboriginal groups within the vicinity of any new stocking locations should be consulted prior to the stocking event proceeding.

3.4.3 Objective 2.3 Maximise economic benefits and provide social equity from the activity

3.4.3.1 (a) Provide opportunities for religious and ceremonial stocking of approved species and increase awareness of the legislative and policy requirements with the groups involved

Background: Applications are received by DPI to stock approved fish for religious or ceremonial purposes - e.g. Buddhist communities often seek to release a small number of fish into

waterways as part of particular religious festivals. In the past DPI has provided such groups with a permit to stock species endemic to the waters proposed to be stocked and observed the stocking event. Provided that the review of these stocking events demonstrates they are appropriate within the context of the FMS, such applications will be supported and advisory material provided to the stockists to educate them about stocking issues.

3.4.3.2 (b) Provide opportunities for other stockings of non-approved species and increase awareness of the legislative and policy requirements with the groups involved

Background: Applications are occasionally received by DPI to stock non-approved fish for conservation or research purposes - e.g. Public display aquariums often seek to release a small number of excess fish into waterways. In the past DPI has provided such groups with a permit to stock species endemic to the waters proposed to be stocked and observed the stocking event. Provided that the review of these stocking events has been conducted in accordance with divisions 1 to 3 of the EP&A Act which demonstrates that they are appropriate, such applications will be supported and advisory material provided to the stockists to educate them about stocking issues.

3.4.3.3 (c) Monitor the level of socio-economic benefit from fish stocking using surveys undertaken on an episodic basis

Background: Past economic surveys have confirmed the importance of the freshwater fish stocking program in areas such as the Snowy Mountains region. These will be of use to recreational fishers, fisheries managers, Aboriginal communities and the other people in regional communities who are also concerned with maintaining and increasing the value of the enhanced fisheries to the local community.

Further socio-economic surveys will be conducted in stocked areas to measure the benefits of the activity to the economy and societies and/or cultures. This will enable an assessment of the benefits of the activity compared to the expenditure of funds for stocking.

3.4.3.4 (d) Monitor the level of fishing effort and changes in effort associated with marine fish stocking

Background: Monitoring of fishing catch and effort both before and after stocking and in adjacent unstocked areas will provide valuable information for assessing the success of the fish stocking program. Previous catch and effort surveys have highlighted the importance of fishing in metropolitan and regional areas. The results of these surveys will be used by fisheries managers, recreational fishers, Aboriginal communities and the other stakeholders involved in monitoring the activity. Catch and effort surveys will be conducted in stocked and unstocked areas to measure the benefits of marine fish stocking.

3.5 GOAL 3.

To ensure the consistent production and release of appropriate quality stock

3.5.1 Objective 3.1 Ensure stock is of the highest standard in terms of fish health

3.5.1.1 (a) Develop and implement quality assurance standards and an accreditation system for hatcheries supplying fish for stocking:

- to ensure consistent production of genetically sound, quality, disease-free stock
- to eliminate non-target species/parasite releases and other translocation risks
- to provide continual improvement in stock production through progressive implementation of best practice techniques
- to ensure new entrants (hatchery permits) are aware of accreditation standards at the application stage, and

- to provide recognition for hatcheries achieving accreditation under the system

Background: Hatcheries are required to comply with the aquaculture permit system established under Part 6 of the FM Act. The conditions placed on hatcheries under this system require compliance with all facets of responsible hatchery management and operation, however, these standards are set for the aquaculture industry only and do not take into account the more robust standards required of hatcheries to produce quality fish for stocking.

All hatcheries (including Government hatcheries) will be required to meet and demonstrate compliance with new quality assurance and accreditation standards that are considered vital to achieving key objectives of the FMS while providing a reliable quality of stock. For instance, hatcheries will be required to comply with the Genetic Resource Management Guidelines as provided for under Management Response 1.3a. By making accreditation mandatory under the HQAS for hatcheries wishing to partake in stocking programs and managing the progressive implementation of the requirements, all hatcheries involved in the activity will need to reach a satisfactory level of accreditation over a three year period.

3.5.1.2 (b) Ensure that any fish, fish eggs or larvae procured from interstate hatcheries for import into NSW for the activity of marine fish stocking meets quality assurance standards

Background: Hatcheries can be a vector for disease, release of non-target and pest species (e.g. banded grunter), chemicals and stock of unsuitable genetic background. These are all significant potential impacts that threaten the ecology of the receiving environment. Fish produced for some stocking events in NSW are supplied through hatcheries that operate in other jurisdictions (e.g. QLD). Presently there are no consistent accreditation schemes governing these facilities. The implementation of hatchery standards through accreditation/quality control is the most appropriate way of ensuring consistency in quality assurance. The establishment of a nationally accredited HQAS will eventually address these issues. In the meantime, however, any stock produced by interstate hatcheries for import into NSW will be subject to rigorous review to ensure that standards equivalent to those applied in NSW are met.

3.5.1.3 (c) Ensure that any disease risks associated with fish, fish eggs or larvae procured from hatcheries for the purposes of marine fish stocking are mitigated

Background: Hatcheries can be a vector for disease, and the release of disease into waters through fish stocking represents a significant potential impact that could threaten the ecology of the receiving environment.

The implementation of hatchery standards through accreditation/quality control is the most appropriate way of ensuring consistency in quality assurance. All hatcheries (including Government hatcheries) will be required to meet and demonstrate compliance with disease testing regimes developed for hatcheries producing fish for stocking.

3.5.2 Objective 3.2 To promote the use of appropriate technology for genetic resource management in all hatcheries involved in the activity

3.5.2.1 (a) Ensure the use of appropriate technology in genetic resource management

Background: The genetic resource management guidelines, as developed under Management Response 1.3a will provide genetic resource management for fish produced for stocking. Appropriate technology to assist broodstock identification includes the use of the Passive Integrated Transponder-tag system (PIT-tags, i.e. microchip identifiers) for stock identification and husbandry, where considered necessary.

DPI will provide leadership and extension services for the implementation of the technology across all hatcheries involved in the activity resulting in the appropriate identification of broodstock used under the HQAS.

3.5.3 Objective 3.3 Implement best practice in broodstock collection and management

3.5.3.1 (a) Develop a broodstock collection policy that addresses collection, husbandry and management arrangements for hatcheries engaged in the activity:

Background: Broodstock collection and management is essential to the sustainability of the activity and the aquaculture industry generally. Currently, broodstock collection is authorised by permit issued under Section 37 of the FM Act and managed under the 'Broodstock Collection Policy (1994)' (currently under review). Under the FMS, broodstock collection will attract a greater focus to ensure the level of demand for the resource and ongoing management of broodstock is ecologically sustainable, while ensuring appropriate genetic material is used in stocking programs. Broodstock management will be aligned with genetic resource management arrangements and used to guide the ongoing review of the stocking events. Areas where certain fish populations are of conservation concern or recovering through a recognised management plan will be protected from broodstock collection.

The development of the broodstock collection policy will provide hatcheries involved in fish stocking with vital information regarding critical aspects of broodstock collection operations and further information on maintenance and husbandry and record keeping that are specific to the activity.

3.5.3.2 (b) Integrate broodstock collection database

Background: To support the genetic resource management and broodstock management initiatives within the FMS, broodstock collection information will be collated with the aquaculture information system. The purpose of this measure is to ensure that all fish taken from the wild can be monitored by DPI to allow managers to track the numbers of broodstock removed from the natural population. The information will be used in compliance audits to ensure that all hatcheries comply with the broodstock collection policy, especially with regard to recognised genetic zones.

3.5.3.3 (c) Continue to provide for the issue of permits under Section 37 of the FM Act for broodstock collection purposes consistent with the vision and goals of the FMS

Background: Permits are used to manage the taking of species by methods or by persons not normally permitted to do so under the Fisheries Management (General) Regulation 2010. The current management of this aspect of the activity includes relevant advisory material to promote best practice techniques and clearly indicate the permit holder's obligations including the specific locations from which the broodstock may be taken. The permits will be subject to conditions to ensure that the broodstock collection techniques are appropriate and that the number of fish collected does not lead to overfishing of the target species.

3.5.4 Objective 3.4 To promote best practice techniques for marine fish stocking

3.5.4.1 (a) Develop a stocking Code of Practice that defines and promotes best practice in stocking techniques and release locations, transport medium management, ethical treatment and care of stock, stocking verification procedures, and the assessment of disease and fish health at the point of release.

Background: The provision of a comprehensive Code of Practice to guide the carrying out of the activity at the point of release is seen as an important management tool to ensure a consistently high level of best practice at the stage between fish leaving the hatchery and the eventual point of release. DPI will develop the Code of Practice by drawing on the expertise of hatchery managers and stocking participants.

Once developed, a copy of the Code of Practice will be issued to each stockist before a stocking event can proceed. The Code of Practice will be a comprehensive information resource to guide the activity at point of release.

3.6 GOAL 4.

To provide efficient administrative services, education and support services, information management and reporting systems

3.6.1 Objective 4.1 To provide a clear and efficient administrative framework for reviewing stocking events

3.6.1.1 (a) Develop stocking application forms in plain English

Background: To streamline the process, stocking application forms will be developed in plain English and will procure sufficient information about the event in order to allow a stocking review to be conducted. The forms should not seek information that has already been gathered and reviewed. The forms will be accompanied by relevant advisory material to assist stockists to complete the form and supply the information necessary to undertake the prerequisite review of the stocking event.

3.6.1.2 (b) Develop a specific marine stocking policy and procedures manual for DPI staff

Background: To provide a consistent framework for review, management and administration of the activity by DPI, a Policy and Procedures Manual for Marine Fish Stocking will be developed for the relevant DPI staff. The manual will help to collate and preserve corporate memory and promote consistent management of the activity into the future.

3.6.2 Objective 4.2 To maintain and report accurate information relating to the activity

3.6.2.1 (a) Maintain records of all stocking events centrally

Background: The review of the freshwater stocking activity in 2005 highlighted that record keeping of stocking activity is fragmented and could be improved by centralising the records. Under the FMS, all records pertaining to stocking events will be held centrally so they can be kept in a consistent format and reported on accurately when required to do so.

For each individual stocking event, records will be kept about the stocking data recorded will include:

1.	site ID	16.	site description
2.	stocking program	17.	closest town to the site
3	date of release	18.	postcode
4.	duration	19.	exact GPS coordinates
5.	stocking event completion date	20.	water type
6.	species	21.	source of funding
7.	size of the released fish	22.	compliance officer district
8.	number	23.	local government area
9.	hatchery of origin	24.	whether or not the fish are marked
10.	stocking group which released them	25.	stocking review guideline number
11.	genetic zone of the fish	26.	permit number
12.	catchment	27.	threatened species incidences
13.	sub catchment	28.	status of the stocking
14.	river system	29.	comments in regard to the stocking are recorded (this may include habitat condition, incidences to other species and stakeholder comments).
15.	the name of the site		

An appropriate level of monitoring would be maintained during each stocking event so that any incidences to threatened (see MR 1.2(b)) or other species or social conflict that may have arisen as a consequence of the stocking event are recorded. Where incidences have arisen, the potential cause (e.g. accidental release of disease, increased fishing effort) will be investigated. At the end of the stocking event, record will be made as to the 'success'.

3.6.2.2 (b) Periodically report on the activity:

Background: Reporting procedures provide an opportunity to convey information to those engaged in fish stocking as well as those involved in managing the activity including fisheries units, internal and external clients, Ministerial Advisory bodies, the Indigenous Fisheries stakeholders, other natural resource agencies, and angling media. Reporting will take several forms under the FMS including data generated from the performance indicators, results of research, production reporting (aquaculture production), DPI Annual Report, scientific reports, via the Internet, and through submissions to advisory councils and other groups. An efficient way to meet these reporting requirements and avoid duplications is to produce a single report to report on all aspects of the activity.

Information on stocking figures and advances in management will be provided to recreational fishers and Aboriginal stakeholders through appropriate media in a culturally appropriate manner.

3.6.3 Objective 4.3 To improve community understanding and public perception of the activity through an education strategy

3.6.3.1 (a) Develop and implement a culturally appropriate educational (communication) plan

Background: To ensure the education component of the FMS is carried out with optimum benefit a culturally appropriate education plan will be developed. It will be designed to develop appropriate educational material in the form of advisory notes, web-based information and specific publications to meet the needs of people involved in the activity or that would like to become involved. In particular, educational and promotional information will be prepared and delivered in a form that considers the expectations of recreational fishers, Aboriginal

communities and other people with an interest in fish stocking. The educational material will also include information on responsible fishing practices. Access to information will be improved through the use of the Internet, through all DPI offices, Fishcare Volunteer programs, through NSW 'Natural Resource Service Centres'. Educational material will be provided to all stockists prior to stocking events proceeding and whenever other opportunities arise (such as field days and in the angling media).

3.6.4 Objective 4.4 To develop and deliver an effective compliance program

3.6.4.1 (a) Require persons involved in stocking to verify stocking events when complete

Background: It is important to be able to verify that the species and quantity of fish examined under the stocking review framework were actually stocked in the nominated areas. Accurate and timely data is necessary for the ongoing management and reporting of stocking, particularly for disease management and the ability to trace sources of outbreaks. A failure to comply with stocking verification procedures would attract a penalty that is dealt with under the Self Enforcing Infringement Notice System (SEINS) and could result, in extreme cases, in the rejection of future stocking events by that stocking person or group.

4 Performance Monitoring and Review

4.1 Performance Monitoring

The complex nature of fish stocking 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 this draft FMS against the four goals (i.e. the major objectives). A regular report will, however, be prepared (as outlined later in this Section) detailing the progress made in implementing the management responses.

4.1.1 Performance Indicators

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 Tables E.9 to E.12.

With the implementation of the new research and information management programs for the activity outlined in Goal 1, a broader information base relating to the activity and its impacts will enable more precise performance indicators to be developed over time.

4.1.1.1 Data Requirements and Availability

The data requirements and availability for each performance indicator in Tables E.9 to E.12 relate to the collection of information used to measure the performance indicators and the data that are available.

4.1.1.2 Robustness

The robustness ratings applied to each performance indicator in Tables E.9 to E.12 have been selected using the definitions established by the Standing Committee on Fisheries and Aquaculture (2000), as outlined in Table E.8:

Table 9. Robustness ratings applied to each performance indicator

Level	Description
High	The indicator is a direct measure of the goal, or if indirect, is known to closely reflect changes in the issue of interest
Medium	The indicator is suspected to be reasonably accurate measure against the goal, or the known error is in the conservative direction
Low	The degree to which the indicator measures against the objective is largely unknown, or known to be low. Often this will involve surrogate indicators

4.1.2 Trigger Points

Trigger points specify when a performance indicator has reached a level that suggests there is a problem with the activity and a review is required. Tables E.9 to E.12 establish the performance indicators and trigger points that will be used to measure whether each of the management goals described in Section E.3 of are being attained.

4.1.3 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 current performance indicators. If new information becomes available as a result of research programs, more appropriate performance indicators and trigger points can be developed and the Minister for Primary Industries may amend the FMS accordingly.

A review of the appropriateness of all performance indicators and trigger points will occur not more than five years from the commencement of this draft FMS.

4.1.4 Reporting on the Performance of the FMS

There are two types of reports to be prepared under this management strategy. One is a performance report that reports generally on the performance of the fishery with respect to the management strategy. The other type of report is a review report, which is to be prepared if a performance indicator for the fishery is breached. Both types of reports are discussed in further detail below.

4.1.5 Performance Report

A performance assessment examining each performance indicator will be undertaken annually and a report on the performance indicators will be submitted to the Minister for Primary Industries within two years of the commencement of the FMS, and biennially thereafter. The annual performance review is the formal mechanism for reporting on performance indicators and trigger points, and the report will be made publicly available. This report will also include a review of progress made in implementing each of the management responses.

The vast majority of management responses in the management strategy are linked to specific 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. 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 for Primary Industries. The fishery will continue to be regarded as being managed within the terms of the management strategy whilst any remedial measures associated with breaches in timeframes or triggering of performance indicators are being considered through the review process and/or by the Minister for Primary Industries.

4.1.6 Review Report in Response to Trigger Points

If the trigger point for a performance indicator is breached, a review is to be undertaken of the likely causes for the breach. While the biennial performance report will report on whether any trigger points have been exceeded, this does not prevent a review from being conducted at any other time should it become apparent that a performance indicator has breached a trigger point, especially during the annual performance assessment process.

Where the data or information indicates that a trigger point has been breached, details will be provided to the relevant Ministerial advisory bodies and advice sought on the suspected reasons for the breach.

Reviews arising from activities exceeding trigger points should consider (but not be limited to) the following factors:

- changes in the relative production levels or other factors among hatcheries (including those beyond NSW jurisdiction)
- new biological or stock information, and
- changes in the activities or effectiveness of technology producing the species.

A review report is to be provided to the Minister for Primary Industries within six months of the trigger point being breached, and must include the likely reasons for the breach (where known), and any recommendations for remedial actions.

A review report should include whether the suspected reasons for the trigger point being breached are the result of an effect of the activity or an influence external to the activity, or both.

If a review concludes that the reasons for the trigger point being breached are due to the operation of the activity, or if the FMS objectives are compromised if the activity continued to operate unchanged, management action must be taken with the aim to return the performance indicator to an acceptable range within a specified time period. The nature of any remedial action proposed would vary depending on the circumstances that have been identified as responsible for the trigger point being breached.

There may be circumstances where no change to management arrangements or the management strategy is deemed necessary following the review. For example, a review might be triggered because the number of hatcheries producing a species for stocking declines. However, there would be little cause for concern over the performance of the FMS if the decline in production of a species was clearly caused by changing market prices. Price fluctuations can result in hatcheries adjusting their activities.

If a review considers that the management objectives or the performance monitoring provisions are inappropriate and need to be modified, the management strategy itself may be amended by the Minister for Primary Industries. 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.

All review reports will be publicly available.

4.1.6.1 External Drivers

External drivers are factors that are known to potentially impact on the performance of the fishery but which are outside of the control of DPI or the hatchery industry (e.g. environmental conditions, social changes etc.). Any external influences that may contribute to a trigger being breached will be identified during the review and, if necessary, referred to any relevant managing agency for action.

4.2 Contingency Plans for Unpredictable Events

In addition to the circumstances outlined above, the Minister for Primary Industries may order a review and/or make a modification to the activity or to the FMS in circumstances declared by the Minister as requiring contingency action, or upon the recommendation of a Ministerial advisory body on recreational fishing, conservation or Aboriginal issues. In the case of the former, the Minister must consult the relevant advisory body on the proposed modification or review.

These circumstances may include (but are not limited to) food safety events, environmental events, and results of research programs or unpredictable changes in stocking activity over time. Notwithstanding the above, the Minister for Primary Industries may also make amendments to the FMS that the Minister considers to be minor in nature at any time.

4.3 Performance Indicators and Trigger Points for the Activity of Marine Fish Stocking

Tables E.9 to E.12 outline the performance indicators and associated trigger points to measure the performance of the FMS in relation to the four goals of the FMS.

Note: Performance indicators apply to goals and not individual management responses

Table 10. Performance indicators and trigger points for Goal 1 of the Fishery Management Strategy

GOAL 1: To manage the activity in a manner that minimises impacts on aquatic biodiversity and improves the knowledge of the activity and the ecosystems in which it operates			
Performance indicator (1)	Trigger point	Justification/comments	
Response of the activity to a threatened species recovery plans or threat abatement plans	Threatened species recovery plans or threat abatement plans require a modification to the activity which the Director-General, DPI, considers is not adequately provided for elsewhere in the FMS	There is no single indicator available to monitor the impact of the activity on biodiversity and, as such, surrogate indicators must be used. DPI and other government agencies monitor sightings of threatened species and develop threatened species recovery plans when required to do so	
Data required	Availability/monitoring programs	Robustness	External drivers
Status of implementation of threatened species recovery plans or threat abatement plans	Readily available from DPI and other government agencies (e.g. OEH)	Medium	Nil
Performance indicator (2)	Trigger point	Justification/comments	
Response of the activity to increased incidences with threatened species or key non threatened species or habitat	Threatened species or key non threatened species or habitat incidences within stocked estuaries increases by an amount deemed ‘of concern’ by the threatened species unit of DPI	Increased incidences on threatened species or key non threatened species or habitat within a stocked estuary may indicate a change in species interactions within that estuary. This may require a modification of the stocking activity.	
Data required	Availability/monitoring programs	Robustness	External drivers
Incidences of threatened species within stocked estuaries	Readily available from DPI and other government agencies (e.g. OEH) and through the fish stocking database	Medium	Nil
Performance indicator (3)	Trigger point	Justification/comments	
Response of the activity to strategies, management plans or legislation (State or national) developed to protect aquatic biodiversity	The Director-General, DPI, considers the FMS does not adequately comply with relevant strategies, management plans or legislation concerning protection of aquatic biodiversity	A number of State and National strategies, management plans and environmental protection laws are in force at present that require compliance by activities (such as fish stocking) that may compromise their effectiveness	

GOAL 1: To manage the activity in a manner that minimises impacts on aquatic biodiversity and improves the knowledge of the activity and the ecosystems in which it operates			
Data required	Availability/monitoring programs	Robustness	External drivers
Status of relevant management plans/strategies (e.g. national/State translocation policies, MPA Zoning plans and other relevant documents)	Readily available from DPI and other government agencies (e.g. OEH)	Medium	Nil
Performance indicator (4)	Trigger point	Justification/comments	
Implementation of research plan in accordance with priorities determined through the environmental assessment process	Research plan not implemented in accordance with priorities identified in the marine fish stocking Environmental Impact Statement	A lack of knowledge about the impact of fish stocking on various environmental factors has resulted in the environmental assessment determining areas of high risk. A research plan developed under the FMS will prioritise research programs based on the areas identified as high risk	
Data required	Availability/monitoring programs	Robustness	External drivers
Research plan available and the research priorities identified	Research plan will be publicly available and progress in implementing the plan will be outlined in the biennial performance report	Medium	Access to government or external funding sources
Performance indicator (5)	Trigger point	Justification/comments	
Identify and respond to potential risks to the environment from an increase in recreational fishing effort as a result of the program	Identified elements of the natural environment (including threatened species, habitats and areas of conservation significance) that have been impacted by an increase in recreational fishing effort.	This relates to the need to have an assessment of the impact of the potential increase in recreational fishing effort derived from stocking to help guide the management of future stocking events	
Data required	Availability/monitoring programs	Robustness	External drivers
Changes in recreational fishing effort as a result of stocking	Data collection on recreational fishing effort forms part of the FMS research plan.	Medium	Nil

Table 11. Performance indicators and trigger points for Goal 2 of the Fisheries Management Strategy

GOAL 2: To enhance fishing opportunities through cost-effective stocking programs that maximise economic benefits and provide social equity from the activity for recreational fishing and Aboriginal cultural fishing purposes, in alignment with the priorities of the NSW State Plan			
Performance indicator (1)	Trigger point	Justification/comments	
Estimates available to show effectiveness of harvest stocking programs	Estimates not available after four years of approval of the FMS	This relates to the need to have an assessment of the benefits derived from stocking to help guide future stocking events	
Data required	Availability/monitoring programs	Robustness	External drivers
Estimates should be available through research and other programs designed to define and examine the effectiveness of stocking	Results will become available as trials are completed	High	Environmental conditions
Performance indicator (2)	Trigger point	Justification/comments	
Response to Aboriginal or other cultural heritage issues	The Director-General, DPI considers that the FMS does not adequately meet the needs of Aboriginal or other cultural heritage issues	This relates to the need for this FMS to operate in harmony with Aboriginal or other cultural heritage issues	

GOAL 2: To enhance fishing opportunities through cost-effective stocking programs that maximise economic benefits and provide social equity from the activity for recreational fishing and Aboriginal cultural fishing purposes, in alignment with the priorities of the NSW State Plan			
Data required	Availability/monitoring programs	Robustness	External drivers
Involvement of Aboriginal fishers in stocking activities	Consultation with stakeholders	Medium	Nil

Table 12. Performance indicators and trigger points for Goal 3 of the Fisheries Management Strategy

GOAL 3: To ensure the consistent production and release of appropriate quality stock			
Performance indicator (1)	Trigger point	Justification/comments	
Response of the activity to a disease or pest species incursion	The Director-General, DPI certifies that the activity has not responded appropriately to a disease or pest species management program and recommends that the FMS be modified or an incidence of a novel disease of pest within an estuary involved in the fish stocking program	Pests and diseases can pose significant risks to the production of fish and the receiving waters. This indicator ensures that the activity is appropriately responding to pest and disease issues, particularly the translocation of live aquatic organisms and disease control in all hatcheries engaged in the activity	
Data required	Availability/monitoring programs	Robustness	External drivers
Ongoing monitoring of pests and diseases and records of responses to pest or disease incursions	Disease notification procedures (in line with DAFF) and AQUAVETPLAN, including cessation of the stocking program in contact with the notification pending advice from DPI Biosecurity	Medium	Introduction of pests and diseases through other aquatic or land based activities
Performance indicator (2)	Trigger point	Justification/comments	
Reliability of consistent production and appropriate quality fish stocks	More than 10 % of hatcheries fail to meet permit requirements within the HQAS If more than two hatcheries record a “critical defect” in HQAS standards	Hatcheries involved with the program should aim to produce quality fish stocks, compliance with the HQAS aims to ensure this occurs within each stocking year	
Data required	Availability/monitoring programs	Robustness	External drivers
Records of hatchery permits, audits and compliance	Data will be available through the information management system maintained by DPI	Medium	Nil

Table 13. Performance indicators and trigger points for Goal 4 of the Fisheries Management Strategy

GOAL 4: To provide efficient administrative services, education and support services, information management and reporting systems, in alignment with the priorities of the NSW State Plan			
Performance indicator (1)	Trigger point	Justification/comments	
Reliability of production reporting by hatcheries engaged in fish stocking	More than 20 % of hatcheries fail to submit production reports by the required time	Hatcheries (Government and Private) must provide prompt reports on the production of stock for fish stocking and other matters such as presence of pests and diseases, mortalities and trends	
Data required	Availability/monitoring programs	Robustness	External drivers
Record of receipt of hatchery production reports compared to due dates	Data will be available through the information management system maintained by DPI	High	Nil
Performance indicator (2)	Trigger point	Justification/comments	
Publication of stocking information in line with	Publications requirements missed or incomplete on two sequential	This relates to the need to accurately report on the components of the FMS to a range of	

GOAL 4: To provide efficient administrative services, education and support services, information management and reporting systems, in alignment with the priorities of the NSW State Plan			
education, and research plans	occasions	internal and external stakeholders, and ensuring that the FMS is taking account of new and updated information	
Data required	Availability/monitoring programs	Robustness	External drivers
Details of stocking figures, research outputs and compliance outcomes	Data will be available through the information management system maintained by DPI and the annual performance assessments	Medium	Nil
Performance indicator (3)	Trigger point	Justification/comments	
Overall rate of compliance by persons engaged in the activity	Overall rate of compliance with the strategy falls below 80 %	The compliance rate associated with the current operation of the activity is not easily measured. As the compliance strategy for the activity is implemented, the reporting of compliance outcomes is expected to be readily available and accurate	
Data required	Availability/monitoring programs	Robustness	External drivers
Outcomes of compliance operations	Data will be recorded by DPI as part of the compliance plan developed under the FMS	High	Nil

5 Appendices

5.1 Appendix 1 Marine Stocking Review Guidelines Form

Program: _____

Agent: _____

Stocking Summary

No. of stocking Sites: _____

Species:

Dusky Flathead		Eastern King Prawn		Yellowfin Bream	
Sand Whiting		Blue Swimmer Crab		Mulloway	
Giant Mud Crab					

Site Locations:

_____

_____

Excel File Reference: _____

Shapefile Reference: _____

Ecological restrictions:

System: _____

Estuary Type: _____

Threatened Species: _____

Size of Stocking Area: _____

Stocking Density: _____

Stocking Review Guideline Number (SRGN): _____

APPROVAL for Review Guideline Number #########

Name of delegated Authorising Officer: _____
Position of Authorising Officer: _____
Signature of Authorising Officer: _____
Date: ____ / ____ / ____

Name of delegated Conservation Officer:_____
Position of Conservation Officer: _____
Signature of Conservation Officer: _____
Date: ____ / ____ / ____

If approved, forward papers to Permits Officer
Date received by Permits Officer: ____ / ____ / ____

If answer is within an * box, stocking must not continue SRGN ######

Issue		Yes	No
1.1	Is the species approved for stocking in this zone?		*
1.2	Is the proposed release site approved for stocking in the zone?		*
1.3	Does the event form part of a DPI stocking program?		
1.4	Is the stock to be sourced from a HQAS accredited hatchery or equivalent?		*
1.5	Is the stock required to be marked with a marking agent or technique?		
1.6	Will monitoring of the stock be conducted after the release?		
1.7	Is the stocking level below the permitted stocking rate?		*
1.8	Has the stocking cap for the financial year been reached?	*	
1.9	Is the proposed release site an ICOLL? If yes is the timing optimal?		
2.1	Will the consignments be declared as disease free under the Hatchery Quality Assurance Scheme?		*
2.2	Will the consignment be declared as free of undesirable and non-target species under the Hatchery Quality Assurance Scheme?		*
3.1	Is the nominated site subject to any local management plan or action that would preclude stocking?	*	
3.2	Is the nominated site part of the NSW Monitoring, Evaluation and Reporting (MER) program? Has the nominated scientist approved the stocking?		
3.3	Are any threatened species (terrestrial or aquatic) recovery plans in force in the area?		
3.4	Are any endangered or vulnerable species listed under the TSC Act or FM Act known to be present at the release site?		
3.5	Is the recovery of a threatened species likely to be adversely impacted by the stocking event?	*	
3.6	Will the activity negatively impact on adjoining land use?	*	
3.7	Is a loss of the cultural, recreational or other environmental quality of the locality likely?	*	
3.8	Does the nominated site provide suitable access to anglers?		*
3.9	Is the area subject to and compliant with a NPWS Plan of Management		*
3.10	Are there active oyster leases in the nominated estuary? If ‘yes’, then POAG should be consulted. Stocking may then proceed following consultation with POAG		
3.11	Are there any long-term ecological monitoring programs at the nominated site? If yes the operators must be notified of the stocking		
4.1	Taking into account information under Part 1 and Part 2 of this review, is the event consistent with the marine fish stocking FMS?		
4.2	Taking into account information under Part 3 of this review and proposed permit conditions, is the event likely to have unacceptable impacts on the local environment given the expected benefits to the angling public?		
4.3	Does the event require further review? (e.g. an seven part test for threatened species) If yes, provide details and course of action in the ‘Conditions’ box below		
4.4	Having weighed up all the factors, in the delegated officer’s opinion should the stocking event proceed?		
4.5	Are special conditions required to mitigate any potential negative impacts and ensure the event satisfies the requirements of FMS? If yes, provide necessary conditions		

Conditions required:

_____

_____

5.2 Appendix 2 Stocking Zones

5.2.1 Estuary Management Regions

For the purposes of geographical equity, the Multi Criteria Assessment (MCA) (refer to Chapter B) was done separately for three regions that contained approximately the same number of estuaries. These were:

- Northern: Tweed River to Avoca Lake (55 estuaries)
- Central: Cockrone Lake to Cullendulla Creek (54 estuaries)
- Southern: Clyde River to Nadgee Lake (46 estuaries)

The locations of the boundaries between these management regions are shown in Figure E.4.

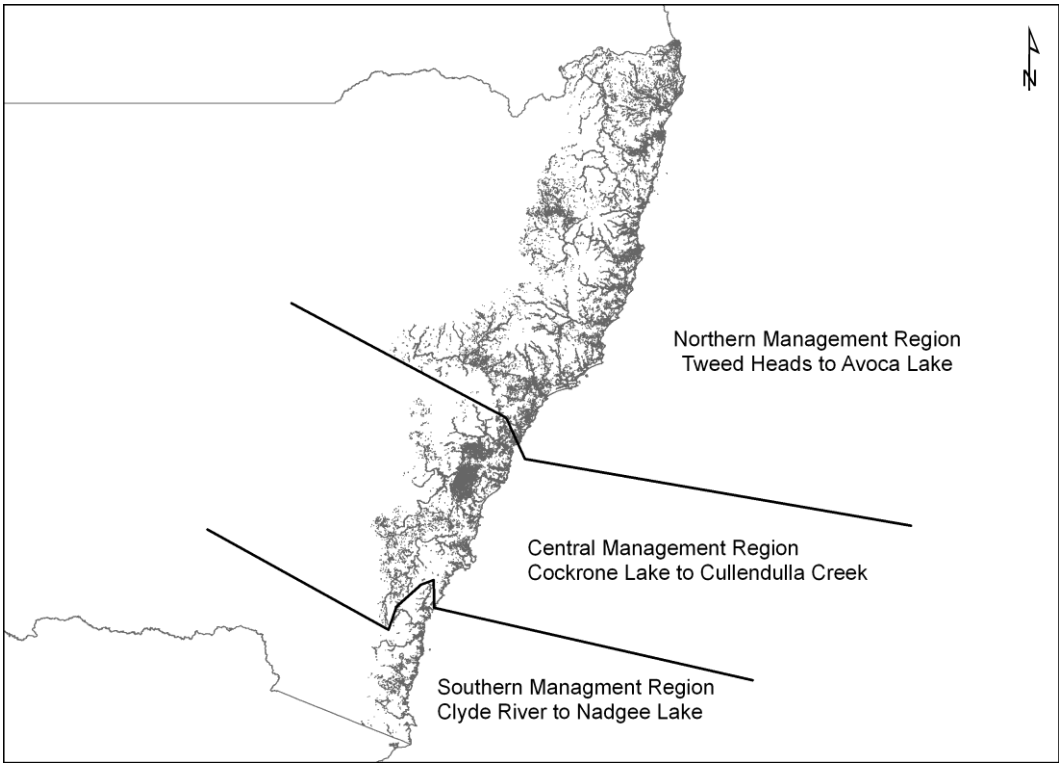

Figure 4. Estuary Management Regions

5.2.2 Species Ranges

Introduction of non-indigenous fish and marine vegetation to the coastal waters of NSW has been listed as a key threatening process as it has the potential to cause species, populations or ecological communities that are not threatened to become threatened. As such some restrictions have been placed on giant mud crab and yellowfin bream stocking in NSW waters.

5.2.2.1 Giant Mud Crabs

Giant mud crabs (Scylla serrata) are primarily a northern NSW species although are sometimes found in all estuaries of NSW. As releasing fish outside of their natural range is a KTP under the FM Act, as a precautionary measure a 50 km buffer zone has been implemented beyond the extent of the range of giant mud crabs and as such, the crabs will not be permitted to be stocked south of and including Wallaga Lake (see Figure E.5).

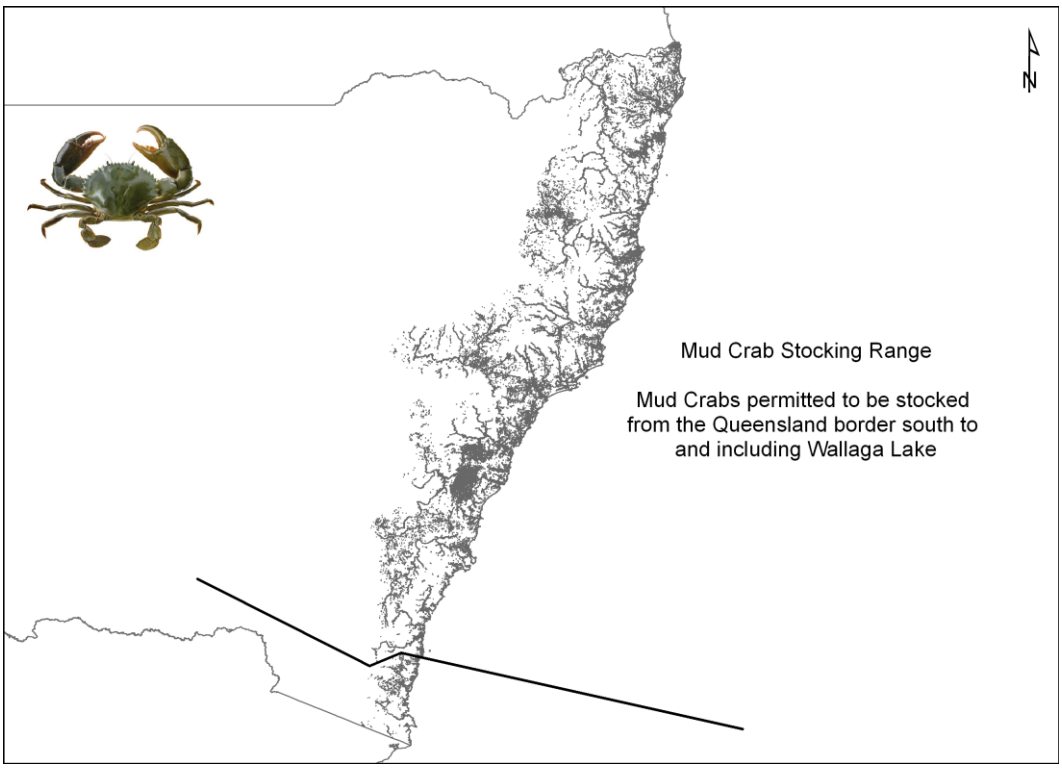

Figure 5. Range permitted for giant mud crab stocking

5.2.2.2 Yellowfin bream

Yellowfin bream (Acanthopagrus australis) have the ability to hybridise with black bream (Acanthopagrus butcheri) and as such, are not permitted under this draft FMS to be stocked within the range of black bream to minimise the risks associated with genetic swamping. As a precautionary measure a 50 km buffer zone has been implemented beyond the extent of the range of black bream. Yellowfin bream are not permitted to be stocked south of and including the Manning River (see Figure E.6).

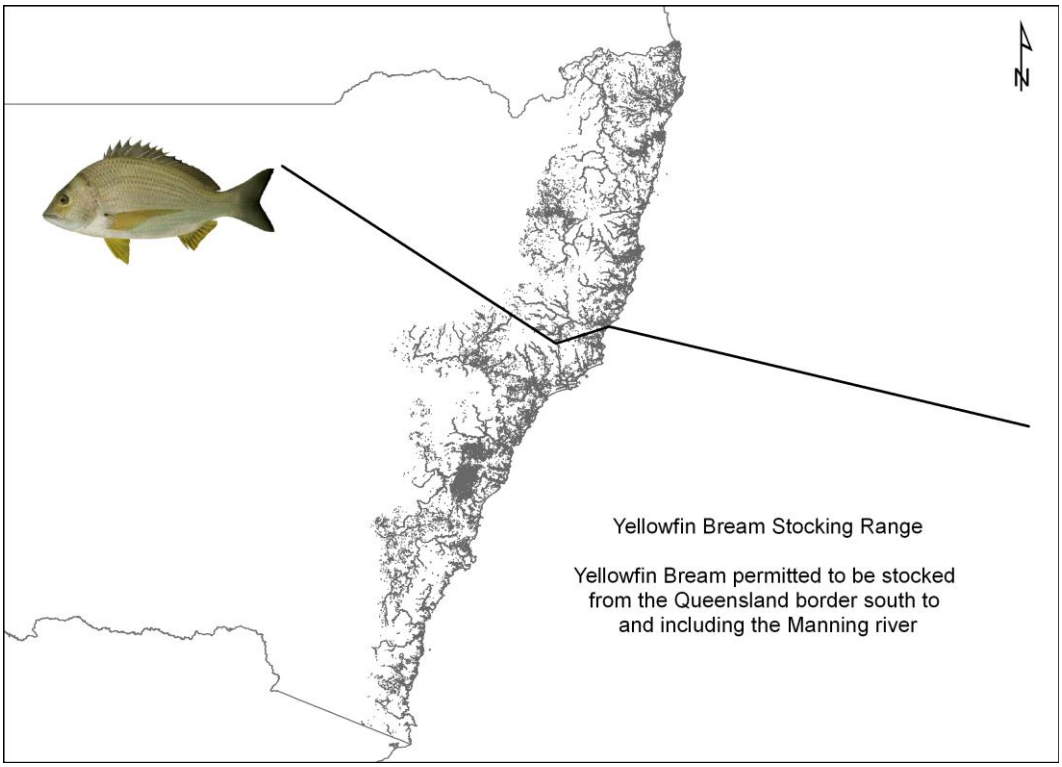

Figure 6. Stocking range for yellowfin bream

5.2.3 Broodstock Genetic Regions

The FMS will maintain genetic integrity of natural populations by sourcing broodstock from local fish/invertebrate stock. For five of the species in the proposal, it is unclear whether separate stocks occur in some estuaries or whether stocks range over wider areas or are panmictic in NSW. Until more information on species genetic stock structure is available and under the precautionary principle, broodstock for the program would be sourced from the estuaries into which juveniles would be stocked. These conditions specifically apply to dusky flathead, mulloway, sand whiting, yellowfin bream and giant mud crabs and arise from the lack of genetic information available for each of the species. For the other two species (eastern king prawns and blue swimmer crabs), more information is available that allows conclusions to be made about their stock structure. As such two separate genetic regions have been established for eastern king prawns and blue swimmer crabs see Figures E.7 and E.8.

If the effective size of the receiving population drops below 100, stocking should be halted or a revised genetic rescue stocking strategy shall be implemented to restore the genetic population.

5.2.3.1 Eastern King Prawns:

A large spawning stock of eastern king prawns exists off northern NSW and SE QLD that may contribute larvae to estuaries further south. As such, two stocking regions have been established.

1. Southern stocking region - broodstock for any stockings in this region must be collected from offshore waters in northern NSW. The southern stocking region covers all estuaries south of and including the Hastings River to the Victorian border.
2. Northern stocking region - As the potential exists for local spawning and recruitment to northern NSW estuaries, broodstock for stocking in the northern stocking region must be sourced from the estuary that is to be stocked. The northern stocking region covers all estuaries north of and including Killick Creek to the QLD border.

These requirements will be maintained in the FMS until genetic studies provide further information about local recruitment to these estuaries.

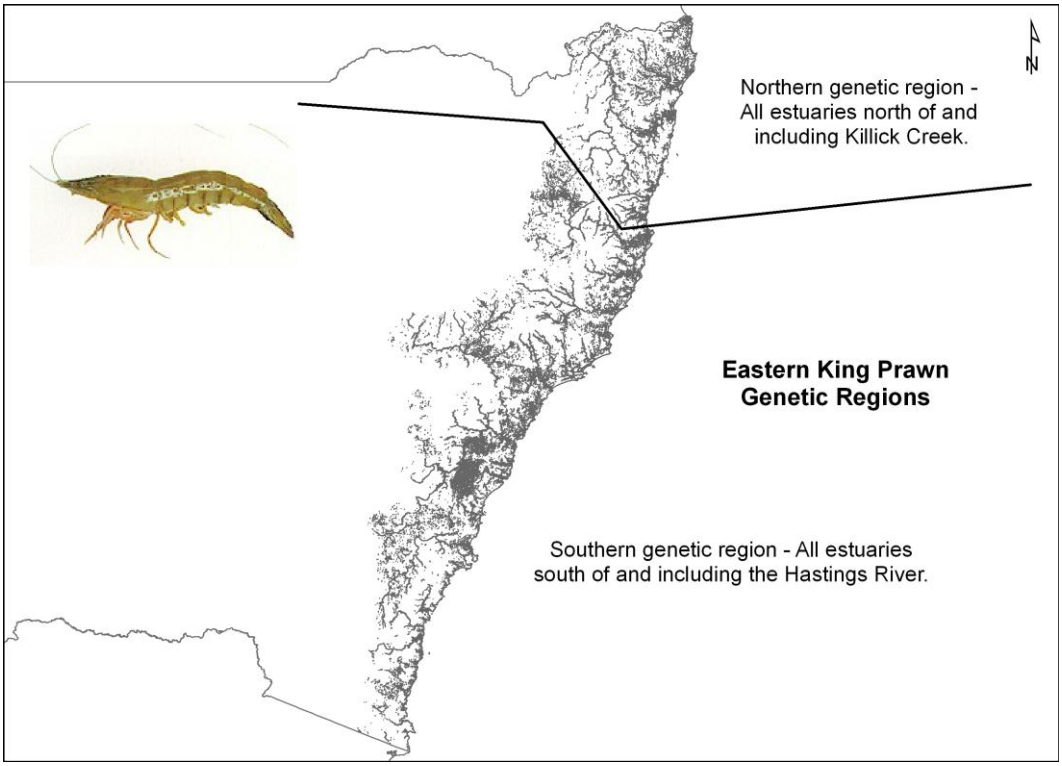

Figure 7. Genetic regions for eastern king prawns

5.2.3.2 Blue Swimmer Crabs:

Populations of blue swimmer crabs in NSW occurring north of Port Stephens are regarded as a single stock, however, little is known about the stock structure south of this. As such, two stocking regions have been established.

1. Northern stocking region - broodstock for any stockings in this region must be collected from within this region. The northern stocking region covers all estuaries north of and including Port Stephens to the QLD border.
2. Southern stocking region - as little information was available about the genetics of natural populations of blue swimmer crabs occurring south of Port Stephens; a southern stocking region has also been established. Broodstock for the marine stocking program in this region must be sourced from the estuary that is to be stocked. The southern stocking region covers all estuaries south of and including the Hunter River to the Victorian border.

This requirement will be maintained in the FMS until genetic studies provide further information.

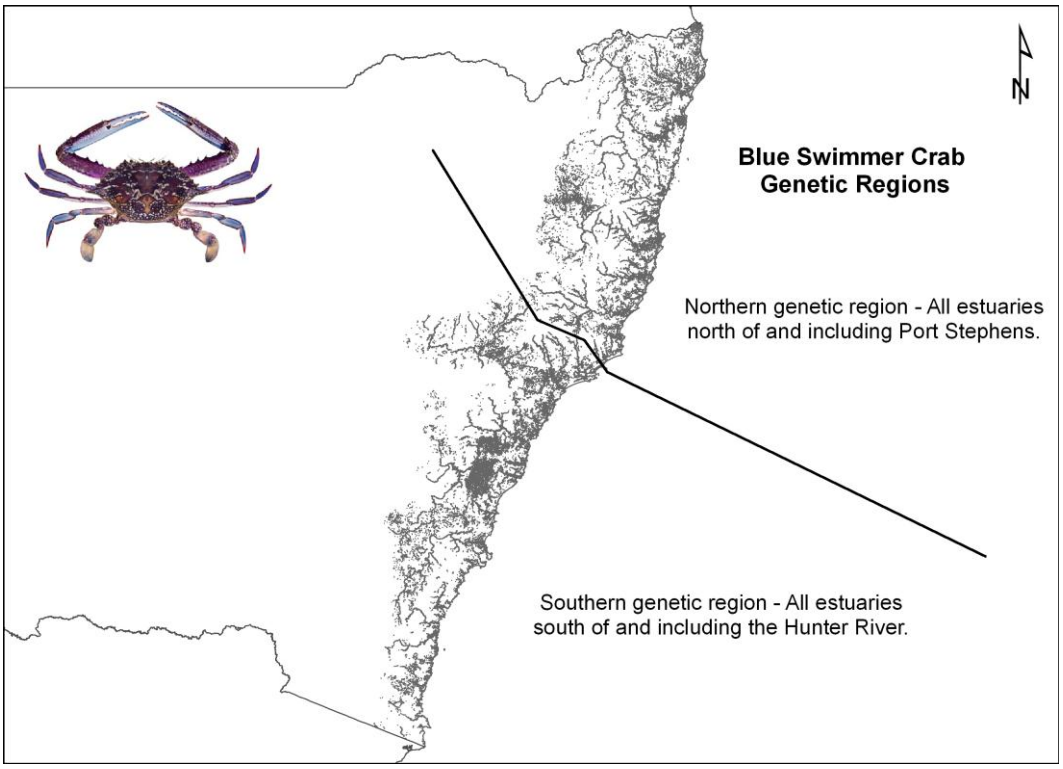

Figure 8. Genetic regions for blue swimmer crabs

5.3 Appendix 3 Implementation of Management Responses

The following tables outline the time periods within which each management response is to be implemented. The table also provides information relating to the head of power for implementation and who has the lead responsibility for carrying out the action(s). A general description of the terms used in the table with respect to timeframes is given in Table E.13 below:

Table 14. Implementation time periods

Term	Description
Immediate	Upon the date of approval of the strategy
Short term	Within one year of the date of approval of the strategy
Medium term	Within three years of the date of approval of the strategy
Long term	In excess of three years of the date of approval of the strategy
As required	Whenever the circumstances warrant action
Ongoing	Continuing into the future

Where an implementation date (e.g. a particular month) has been included for a management response instead of the terms above, the date represents a specific target time within which the management response is to be implemented.

Goal 1. To manage the activity in a manner that minimises impacts on aquatic biodiversity and improves the knowledge of the activity and ecosystems in which it operates						
OBJECTIVES	MANAGEMENT RESPONSES	CONTRIBUTE TO GOALS	TIMEFRAME	RESPONSIBILITY	AUTHORITY	PAGE
1.1 To develop and maintain a framework to guide appropriate review of stocking activities	a) Use reliable and current information resources to support the stocking review framework	2,3,4	Ongoing	DPI	Policy	32
	b) Continually update the list of estuaries where stocking can and cannot occur based on the evaluation of social, economic and ecological factors	2,3,4	As required	DPI		32
	c) Map the activity in a Geographic Information System (GIS)	2,3,4	Ongoing	DPI	-	32
	d) Continually update the Stocking Review Guidelines and assessment resources to accurately review potential impacts from the activity	2,3,4	As required	DPI		33
1.2 To minimise and/or eliminate any negative impact from the activity on threatened species, populations, ecological communities (including mammals, birds, reptiles, amphibians, fish, invertebrates and vegetation) and critical habitat, and where possible promote their recovery	a) Appropriately manage stocking in areas where the activity may adversely affect a threatened species	2,3	Ongoing	DPI	Policy	33
	b) To record and monitor sightings and incidences involving threatened and protected species within stocked estuaries.	2,3	Ongoing	DPI		33
	c) Apply empirical methods to determine optimum stocking density rates (in terms of efficacy and effectiveness) to minimise potential for overstocking.	2,3,4	Long term	DPI		33
	d) To educate stakeholders regarding threatened species including reporting sightings and incidences involving threatened and protected species within stocked estuaries	2,3	Ongoing	DPI	-	33
1.3 To provide reliable genetic resource management in the activity	a) Develop and implement genetic resource management guidelines for marine fish stocking in NSW	2,3,4	Short term	DPI Fish hatcheries	Policy	34
	b) Develop and implement species specific stocking guidelines directly relevant to species ranges in NSW	2,3,4	Short Term	DPI	-	34
1.4 To implement the FMS in a manner consistent with related Commonwealth and State endorsed programs designed to protect aquatic environments and biodiversity	a) Manage the activity having regard to cross-jurisdictional management arrangements	2,4	Ongoing	DPI	-	35
	b) Manage and conduct the activity having regard to other DPI fisheries management arrangements	2,4	Ongoing	DPI		35
1.5 To appropriately manage the risks associated with translocation of live aquatic organisms during stocking activities	a) Manage the activity consistently with State and National policies governing the translocation of live aquatic organisms	2,3,4	Ongoing	DPI	Policy	35

Goal 1. To manage the activity in a manner that minimises impacts on aquatic biodiversity and improves the knowledge of the activity and ecosystems in which it operates						
1.6 To initiate research relating to the activity	a) Facilitate research programs to fill information gaps identified in the risk assessment of the existing activity, as provided for in the Research Plan	2,3,4	As Required	DPI	-	35
1.7 To minimise any competitive advantage of the stocked species over wild conspecifics.	a) Facilitate stock releases in timing with the selected species lifecycles and recruitment patterns	2,3,4	Ongoing	DPI		35

Goal 2. To enhance fishing opportunities through cost-effective stocking programs that maximise social and economic benefits and provide equity from the activity for recreational fishing and Aboriginal cultural fishing purposes, in alignment of with the priorities of the NSW State Plan						
OBJECTIVES	MANAGEMENT RESPONSES	CONTRIBUTE TO GOALS	TIMEFRAME	RESPONSIBILITY	AUTHORITY	PAGE
2.1 To provide quality stock to enhance recreational fisheries	a) Commence provision for the stocking of approved fish species at appropriate densities to provide or enhance quality recreational fishing opportunities in estuarine waters	1,3,4	Ongoing	DPI	-	37
2.2 To minimise any negative impacts of the activity on cultural heritage values and provide opportunities for Aboriginal communities to participate in stocking activities and to support cultural fishing practices	a) Provide for the stocking of native fish for Aboriginal cultural fishing and moiety purposes as requested in alignment with the FMS	1,4	Ongoing	DPI, stockists	Policy	37
	b) Ensure that new information about areas or objects of cultural significance is taken into account in the stocking review framework	1,4	Ongoing	DPI	Policy	37
	c) Consult with relevant Aboriginal groups in the assessment of any new sites proposed to be stocked	1,4	Ongoing	DPI	Policy	38
2.3 Maximise economic benefits and provide social equity from the activity	a) Provide opportunities for religious and ceremonial stocking and increase awareness of the legislative and policy requirements with the groups involved	1,3,4	Ongoing	DPI	Policy	38
	b) Provide opportunities for other stockings of non-approved species and increase awareness of the legislative and policy requirements with the groups involved	1,3,4	As required	DPI		38
	c) Monitor the level of socio-economic benefit from fish stocking using surveys undertaken on an episodic basis	4	As required	DPI		38
	d) Monitor the level of fishing effort and changes in effort associated with fish stocking	4	As required	DPI		38

Goal 3. To ensure the consistent production and release of appropriate quality stock						
OBJECTIVES	MANAGEMENT RESPONSES	CONTRIBUTE TO GOALS	TIMEFRAME	RESPONSIBILITY	AUTHORITY	PAGE
3.1 Ensure stock is of the highest standard in terms of fish health	a) Develop and implement quality assurance standards and an accreditation system for hatcheries supplying fish for stocking	1,2,4	Medium term	DPI	Regulatory	39
	b) Ensure that any fish, fish eggs or larvae procured from interstate hatcheries for import into NSW for the activity of fish stocking meets quality assurance standards	1,2,4	Ongoing	DPI	Regulatory	39
	c) Ensure that any disease risks associated with fish, fish eggs or larvae procured from hatcheries for the purposes of fish stocking are mitigated	1,4	Ongoing	DPI		40
3.2 To promote the use of appropriate technology for genetic resource management in all hatcheries involved in the activity	a) Ensure the use of appropriate technology in genetic resource management	1,4	Short term	DPI	-	40
3.3 Implement best practice in broodstock collection and management	a) Develop a broodstock policy and guidelines that address collection, husbandry and management arrangements for hatcheries engaged in the activity	1,4	Medium term	DPI	Policy	40
	b) Integrate broodstock collection database	1,4	Short term	DPI	-	41
	c) Continue to provide for the issue of permits under Section 37 of the *Fisheries Management Act 1994* for broodstock collection purposes consistent with the vision and goals of the FMS	1,4	Ongoing	DPI	Regulatory	41
3.4 To promote best practice techniques for fish stocking	a) Develop a stocking Code of Practice that defines and promotes best practice in stocking techniques, transport medium management, ethical treatment and care of stock, stocking verification procedures, and the assessment of disease and fish health at the point of release	1,4	Short term	DPI	Various	41

Goal 4. To provide efficient administrative services, education and support services, information management and reporting systems, in alignment with the priorities of the NSW State Plan						
OBJECTIVES	MANAGEMENT RESPONSES	CONTRIBUTE TO GOALS	TIMEFRAME	RESPONSIBILITY	AUTHORITY	PAGE
4.1 To provide a clear administrative framework for reviewing stocking events	a) Develop stocking application forms in plain English	1,3	Short term	DPI	-	42
	b) Develop a specific marine stocking policy and procedures manual for DPI staff	1,2	Short term	DPI	Policy	42
4.2 To maintain and report accurate information relating to the activity	a) Maintain records of all stocking events centrally	1,2,3	Short term – ongoing	DPI	-	42
	b) Periodically report on the activity	1,2,3	Short term – ongoing	DPI		42
4.3 To improve community understanding and public perception of the activity through an education strategy	a) Develop and implement a culturally appropriate educational (communication) plan	1,2,3	Medium term	DPI	Policy	42
4.4 To develop and deliver an effective compliance program	a) Require persons involved in stocking to verify stocking events when complete	1,2,3	Short term - ongoing	DPI	Regulatory	43

5.4 Appendix 4 Generalised Predatory Impact Model

5.4.1 Introduction

The Generalised predatory impact model (GPIM) has been applied to the seven selected species proposed for stocking in the marine fish stocking program to obtain estimated stocking rates (maximum number of individuals released per hectare of suitable habitat) and estimated harvest (total tonnes of stocked species to be harvested from the estuary).

The GPIM will be a guide for fisheries managers so that overstocking and its associated impacts are prevented. Stocking rates are given as the maximum number of fish that may be stocked per hectare over the duration of a stocking event. As a precautionary measure, estimates for the number of fish to be stocked were allocated a maximum of 5 % of the total productivity within an estuary, which is considered to have minimal impact on the receiving ecosystem but that yields a worthwhile return in terms of predicted harvest and catch rates.

5.4.1.1 Key habitat

Table 15. Size classes for which the generalised predatory impact model has been calculated

Size Classes	Species	Key Juvenile Habitat
3.4 mm	Eastern king prawn	Seagrass, unvegetated soft sediment
10 mm, 25 mm, 50 mm	Giant mud crab	Seagrass, mangrove
10 mm, 25 mm, 50 mm	Blue swimmer crab	Seagrass, unvegetated soft sediment
25 mm, 50 mm, 75 mm	Yellowfin bream	Seagrass, mangrove
25 mm, 50 mm, 75 mm	Dusky flathead	Seagrass, mangrove
25 mm, 50 mm, 75 mm	Sand whiting	Seagrass, mangrove, unvegetated soft sediment
50 mm, 75 mm, 100 mm	Mulloway	Deep holes (>5 m depth)

5.4.1.2 Stocking Rates

Table 16. Stocking rates (per ha-1 of key habitat) for each species for each estuary type

Species	Size Class	Estuary Type			
		Coastal Lagoon		Riverine Estuary	
		Low Productivity	High Productivity	Low Productivity	High Productivity
Eastern king prawn	3.4 mm	1203	1782	1069	2053
Giant mud crab	10 mm	83	122	74	141
	25 mm	60	87	52	99
	50 mm	43	65	39	75
Blue Swimmer	10 mm	213	317	189	366
crab	25 mm	100	149	89	170
	50 mm	54	80	48	92
Yellowfin bream	25 mm	274	407	244	464
	50 mm	210	309	185	357
	75 mm	176	263	157	300
Dusky flathead	25 mm	307	457	272	517
	50 mm	253	373	225	432
	75 mm	222	328	200	381
Sand whiting	25 mm	631	944	562	1075
	50 mm	459	675	404	776
	75 mm	369	541	329	629
Mulloway	50 mm	140	208	123	238
	75 mm	106	155	94	180
	100 mm	83	123	74	141

Stocking rates are not provided for some species in some estuaries (refer Appendix 5). No stocking rates are given for giant mud crabs in the southern region as this is beyond the usual range of this species and for yellowfin bream south of the Manning River to prevent the risk of hybridisation with black bream. Stocking rates are given for sand whiting and blue swimmer crabs in all of the 80 estuaries. These species have the least specific juvenile habitat requirements and their key juvenile habitats can be found in all the estuaries (Table E.14). Juvenile mulloway have the most specific habitat requirement i.e. deep holes. Deep holes (> 5 m depth) only occur in 33 estuaries, and in only one estuary in the southern region (Merimbula Lake).

5.4.1.3 Harvest Rates

The predicted harvest from a given stocking event for an estuary is dependent on the productivity of the estuary, fishing mortality and predator and prey abundance but more particularly on the amount of juvenile habitat in that estuary.

Table 17. Predicted harvest (kg) per ha-1 for each species in each estuary type as determined from outputs from the Generalised Predatory Impact Model

Species	Size Class	Estuary Type			
		Riverine Estuary		Coastal Lagoon	
		Low Productivity	High Productivity	Low Productivity	High Productivity
Eastern King Prawn	3.4 mm	6.1	11.9	7.0	10.4
Giant mud Crab	10 mm	9.9	18.8	11.1	16.3
	25 mm	9.8	18.8	11.2	16.4
	50 mm	9.9	18.8	11.0	16.4
Blue Swimmer Crab	10 mm	11.7	22.5	13.2	19.5
	25 mm	11.7	22.4	13.1	19.4
	50 mm	11.7	22.4	13.2	19.6
Yellowfin Bream	25 mm	34.5	65.9	38.6	57.3
	50 mm	34.3	65.7	38.6	57.1
	75 mm	34.4	65.6	38.7	57.4
Dusky Flathead	25 mm	36.0	69.0	40.6	60.1
	50 mm	36.1	69.0	40.5	59.9
	75 mm	36.1	68.5	40.2	59.6
Sand Whiting	25 mm	10.9	20.8	12.3	18.2
	50 mm	10.9	20.8	12.3	18.2
	75 mm	10.9	20.8	12.2	18.1
Mulloway	50 mm	15.6	30.0	17.7	26.2
	75 mm	15.8	30.3	17.7	26.7
	100 mm	15.8	30.1	17.7	26.4

5.4.1.4 Duration of a stocking event

A single stocking event is defined as

'Single or multiple releases of a species in a particular estuary and includes the time it takes for all released post-larvae or juveniles to reach a harvestable size'

Table 18. Durations of a 'stocking event' for each species proposed for stocking

Species	Minimum Harvestable Size (mm)	Ave. Age at Minimum Harvestable Size	Approximate Duration of Stocking 'Event' ^
Yellowfin bream	250 TL	3 yrs.*	min 4 years
Mulloway	450 TL	2 yrs. (Silberschneider and Gray 2005)*	min 3 years
Dusky flathead	360 TL	1.5 yrs. (m) 1.0 yrs. (f) (Gray and Barnes 2007)*	min 2 years
Sand whiting	270 TL	2 yrs., 5 months*	min 3 years
Eastern king prawn	N/A	N/A (but are known to reach adulthood and remain in estuaries for up to a year)	min 1 year
Giant mud crab	85 CL	Approx. 5-6 months	min 1 year
Blue swimmer crab	60 CL	10 months (Johnson 2007)*	min 1 year

(*) indicates references for growth curve tables within Rowling et al. 2010. (TL)=Total Length, (CL) =Carapace Length. (FL)=Fork Length, (m) =male, (f) =female ^. The period would need to be extended in the event that an ICOLL closed after an initial stocking event or was closed at the time of stocking.

Stocking events can be achieved through a single release or several releases. This is because constraints in hatchery production may limit the numbers of juveniles that can be supplied at any one time and therefore a stocking event may need to be staggered over a number of years. If several releases are undertaken as part of a stocking event, the stocking event duration will commence from the date of the final release.

Stockings of multiple species will be permitted to occur only if the combined stockings do not exceed the 5 % of allocated estuarine productivity. For example a stocking event could take place where 2.5 % of the estuary's productivity is allocated to mulloway and 2.5 % is allocated to yellowfin bream. Stocking event durations for combined stockings must also be maintained (i.e. four years in this example as yellowfin bream has the longer stocking event duration).

The formula used when generating the number of individuals to be released into any estuary is as follows:

Suitable habitat within estuary (ha)	x	Individuals per hectare (Table E.15)	=	Permitted stocking rate per stocking event

It is also recognised that hatcheries may produce batches of juvenile fish or crustaceans that do not consistently correspond with one of the sizes for which stocking rates are modelled. In practice, fisheries (and hatchery) managers should match the average size of juveniles in a batch to the nearest stocking size for which an appropriate stocking rate has been given.

5.5 Appendix 5 Estuaries Suitable for Stocking and Stocking Rates

NB. Stocking rates are not given for species in estuaries where suitable juvenile habitat is not available, where there are genetic concerns associated with stocked yellowfin bream interbreeding with black bream, or where there would potentially be adverse interactions with threatened species.

Table 19. Appropriate stocking rates (per ha) for each species in each estuary as determined from outputs from the Generalised Predatory Impact Model

Estuary	Type	Yellowfin Bream			Mulloway			Dusky Flathead			Sand Whiting			Eastern King Prawn	Giant mud Crab			Blue Swimmer Crab		
		Stocking Size (mm)																		
		25	50	75	50	75	100	25	50	75	25	50	75	3.4	10	25	50	10	25	50
Northern																				
Tweed River*	Riv Low	244	185	157	123	94	74	272	225	200	562	404	329	1069	74	52	39	189	89	48
Cudgen Creek	Riv High	464	357	300	239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Cudgera Creek	Riv Low	244	185	157				272	225	200	562	404	329	1069	74	52	39	189	89	48
Mooball Creek	Riv High	464	357	300				517	433	381	1075	776	630	2053	141	99	75	366	170	92
Richmond River*	Riv Low	244	185	157	123	94	74	272	225	200	562	404	329	1069	74	52	39	189	89	48
Evans River	Riv High	464	357	300	239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Jerusalem Creek	Co Lg High										944	675	541	1782				317	149	80
Clarence River*[E]	Riv High	464	357	300	239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Cakora Lagoon	Co Lg High	407	309	263				457	373	328	944	675	541	1782	122	87	65	317	149	80
Boambee Creek	Riv High	464	357	300				517	433	381	1075	776	630	2053	141	99	75	366	170	92
Bonville Creek	Riv Low	244	185	157	123	94	74	272	225	200	562	404	329	1069	74	52	39	189	89	48
Bellinger River*	Riv High	464	357	300	239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Oyster Creek	Co Lg High	407	309	263				457	373	328	944	675	541	1782				317	149	80

Estuary	Type	Yellowfin Bream			Mulloway			Dusky Flathead			Sand Whiting			Eastern King Prawn	Giant mud Crab			Blue Swimmer Crab		
Deep Creek*	Riv High	464	357	300				517	433	381	1075	776	630	2053	141	99	75	366	170	92
Nambucca River	Riv High	464	357	300	239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Macleay River	Riv Low	244	185	157	123	94	74	272	225	200	562	404	329	1069	74	52	39	189	89	48
South West Rocks Creek	Riv High	464	357	300				517	433	381	1075	776	630	2053	141	99	75	366	170	92
Saltwater Creek (Frederickton)	Riv High										1075	776	630	2053				366	170	92
Korogoro Creek	Riv High	464	357	300				517	433	381	1075	776	630	2053	141	99	75	366	170	92
Killick Creek	Co Lg High	407	309	263				457	373	328	944	675	541	1782	122	87	65	317	149	80
Hastings River* [L]	Riv High	464	357	300	239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Lake Innes/Lake Cathie	Co Lg Low										631	459	369	1203				213	100	54
Camden Haven River*	Riv Low	244	185	157	123	94	74	272	225	200	562	404	329	1069	74	52	39	189	89	48
Manning River*	Riv Low	244	185	157	123	94	74	272	225	200	562	404	329	1069	74	52	39	189	89	48
Khappinghat Creek	Riv High	Stocking not permitted			239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Wallis Lake	Co Lg Low				141	106	83	307	253	222	631	459	369	1203	83	60	43	213	100	54
Hunter River	Riv High				239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Lake Macquarie*	Co Lg High				209	155	123	457	373	328	944	675	541	1782	122	87	65	317	149	80
Tuggerah Lake	Co Lg Low				141	106	83				631	459	369	1203				213	100	54
Wamberal Lagoon	Co Lg Low							307	253	222	631	459	369	1203	83	60	43	213	100	54
Terrigal Lagoon	Co Lg Low							307	253	222	631	459	369	1203	83	60	43	213	100	54
Avoca Lake	Co Lg Low										631	459	369	1203				213	100	54

Estuary	Type	Yellowfin Bream	Mulloway			Dusky Flathead			Sand Whiting			Eastern King Prawn	Giant mud Crab			Blue Swimmer Crab		
Central																		
Brisbane Water	Riv High	Stocking not permitted	239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Broken Bay	Riv High		239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Hawkesbury River	Riv Low		123	94	74	272	225	200	562	404	329	1069	74	52	39	189	89	48
Pittwater	Co Lg High		209	155	123	457	373	328	944	675	541	1782	122	87	65	317	149	80
Narrabeen Lagoon	Co Lg Low		141	106	83	307	253	222	631	459	369	1203	83	60	43	213	100	54
Middle Harbour Creek	Riv Low					272	225	200	562	404	329	1069	74	52	39	189	89	48
Port Jackson	Riv High		239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Lane Cove River	Riv High		239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Parramatta River	Riv Low		123	94	74	272	225	200	562	404	329	1069	74	52	39	189	89	48
Cooks River	Riv High		239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Botany Bay*	Riv High		239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Georges River	Riv Low		123	94	74	272	225	200	562	404	329	1069	74	52	39	189	89	48
Port Hacking	Riv Low		123	94	74	272	225	200	562	404	329	1069	74	52	39	189	89	48
Allans Creek	Riv Low					272	225	200	562	404	329	1069	74	52	39	189	89	48
Lake Illawarra	Co Lg Low					307	253	222	631	459	369	1203	83	60	43	213	100	54
Killalea Lagoon	Co Lg High								944	675	541	1782				317	149	80
Minnamurra River	Riv Low					272	225	200	562	404	329	1069	74	52	39	189	89	48
Crooked River	Riv High					517	433	381	1075	776	630	2053	141	99	75	366	170	92
Shoalhaven River	Riv High		239	180	141	517	433	381	1075	776	630	2053	141	99	75	366	170	92
Lake Wollumboola	Co Lg High					457	373	328	944	675	541	1782	122	87	65	317	149	80

Estuary	Type	Yellowfin Bream	Mulloway			Dusky Flathead			Sand Whiting			Eastern King Prawn	Giant mud Crab			Blue Swimmer Crab		
St Georges Basin*	Co Lg High	Stocking not permitted	209	155	123	457	373	328	944	675	541	1782	122	87	65	317	149	80
Swan Lake	Co Lg High					457	373	328	944	675	541	1782	122	87	65	317	149	80
Berrara Creek	Riv Low					272	225	200	562	404	329	1069	74	52	39	189	89	48
Lake Conjola*	Co Lg Low		141	106	83	307	253	222	631	459	369	1203	83	60	43	213	100	54
Narrawallee Inlet*	Co Lg High					457	373	328	944	675	541	1782	122	87	65	317	149	80
Ulladulla	Riv Low		123	94	74				562	404	329	1069				189	89	48
Burrill Lake*	Co Lg High					457	373	328	944	675	541	1782	122	87	65	317	149	80
Toubouree Lake*	Co Lg High								944	675	541	1782				317	149	80
Termeil Lake	Riv Low					272	225	200	562	404	329	1069	74	52	39	189	89	48
Meroo Lake*	Co Lg Low					307	253	222	631	459	369	1203	83	60	43	213	100	54
Willinga Lake	Riv High					1317	1098	972	1075	776	630	2053	141	99	75	366	170	92
Southern																		
Bermagui River*	Co Lg Low	Stocking not permitted				307	253	222	631	459	369	1203	Stocking not permitted			213	100	54
Barragoot Lake	Co Lg High					457	373	328	944	675	541	1782				317	149	80
Cuttagee Lake	Co Lg High					457	373	328	944	675	541	1782				317	149	80
Murrah Lake	Co Lg High					457	373	328	944	675	541	1782				317	149	80
Bunga	Co Lg High					457	373	328	944	675	541	1782				317	149	80
Wapengo Lake	Co Lg High					457	373	328	944	675	541	1782				317	149	80
Nelson Lake*	Co Lg High					457	373	328	944	675	541	1782				317	149	80
Bega River*	Riv High					1317	1098	972	1075	776	630	2053				366	170	92
Wallagoot Lake	Co Lg High					457	373	328	944	675	541	1782				317	149	80
Back Lagoon*	Co Lg High					457	373	328	944	675	541	1782				317	149	80

Estuary	Type	Yellowfin Bream	Mulloway			Dusky Flathead			Sand Whiting			Eastern King Prawn	Giant mud Crab	Blue Swimmer Crab		
Merimbula Lake	Co Lg High		209	155	123	457	373	328	944	675	541	1782		317	149	80
Pambula Lake	Riv Low					272	225	200	562	404	329	1069		189	89	48
Curalo Lagoon	Riv Low					272	225	200	562	404	329	1069		189	89	48
Twofold Bay	Co Lg Low		141	106	83	307	253	222	631	459	369	1203	Stocking not permitted	213	100	54
Nullica River*	Riv Low					272	225	200	562	404	329	1069		189	89	48
Towamba River*	Riv Low					272	225	200	562	404	329	1069		189	89	48
Wonboyn River*	Riv High					517	433	381	1075	776	630	2053		366	170	92

(*) = Recreational Fishing Haven

E = Excluding the Esk River (within a Wilderness area)

L = Excluding Limeburners Creek (within a Wilderness area)

Riv High (Riverine estuary with high productivity)

Riv Low (Riverine estuary with low productivity),

Co Lg High (Coastal lagoon with high productivity)

Co Lg Low (Coastal lagoon with low productivity)