

# **Fisheries NSW**

## Strategic Research Plan 2014-2018



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**More information**

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (April 2014). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of the Department of Primary Industries or the user's independent adviser

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Fisheries NSW is a division within the NSW Department of Primary Industries. The vision of Fisheries NSW is for:

*Healthy aquatic ecosystems, productive fisheries and aquaculture*

The purpose of Fisheries NSW is to:

*Work with industries and communities to maintain the health of our aquatic ecosystems for the economic benefit and enjoyment of the people of NSW*

Fisheries Research is one of five branches within Fisheries NSW. Its role is to:

*Undertake and facilitate research and provide scientific advice to assist Fisheries NSW achieve its vision and purpose*

In doing this, the Fisheries Research branch informs the work done by Fisheries NSW in fulfilling legislative requirements under the *Fisheries Management Act 1994* and the *Marine Parks Act 1997*. The Fisheries Research branch works primarily with the Commercial Fishing, Recreational and Indigenous Fishing, and Aquaculture and Aquatic Environment branches but it also provides some specialist support to Fisheries Compliance, notably in association with the NSW Shark Meshing (Bather Protection) Program.

## What the Fisheries Research branch does

The Fisheries Research branch:

- undertakes innovative research, either on its own or with various partners, to
  - evaluate the effectiveness of fisheries management initiatives
  - underpin the sustainable development of aquaculture
  - ensure the sustainable harvest of fish
  - develop indicators of environmental condition
  - assess and reduce threats to the health of aquatic environments
  - develop and improve techniques to restore damaged aquatic ecosystems
  - develop and improve techniques for the enhancement of fisheries
- monitors the health of aquatic systems, either on its own or with various partners
- provides scientific advice about the sustainable use and management of aquatic environments
- recommends techniques for managing specific aquatic areas, ecosystems and threats.

In carrying out these activities, the Fisheries Research branch strives to:

- engage and support world-class researchers
- use best scientific practices
- ensure that fisheries research in NSW is well coordinated and cost-effective
- collaborate effectively with other Fisheries NSW branches, other DPI divisions and relevant local, state and commonwealth agencies
- develop and nurture productive and mutually beneficial research partnerships with universities and other research providers consistent with our vision
- work with local communities to collect scientific data and implement research activities
- publish the findings of its research in leading scientific journals and in refereed technical reports
- extend the results of research to relevant fisheries managers and stakeholders
- communicate research findings to the broader scientific community, stakeholders and the general public.

## How the Fisheries Research branch is organised

The branch is led by the Director of Fisheries Research and has four administrative units:

- Fisheries Resource Assessment
- Marine Ecosystems
- Freshwater Ecosystems
- Aquaculture Research

Each unit has scientists and technicians with specialist expertise and skills appropriate to these four broad areas of research. However, the skills and experience of many staff have broader applicability across the branch as a whole. The branch is headquartered at the Port Stephens Fisheries Institute in the Hunter region, with staff also located in four other NSW regions – at Narrandera in the lower Murray-Darling Basin, at Mosman and Wollongong in the Greater Sydney area, at Batemans Bay/Jervis Bay on the south coast and at Coffs Harbour/Grafton on the north coast. Each unit is led by a Research Leader who is responsible for managing the physical and human resources within their unit across all of NSW.

## What are the priorities for Fisheries Research

The Fisheries NSW Strategic Plan 2012–2015 identifies four Key Result Areas (KRAs). Key Result Area 2, ‘Aquatic ecosystems and resources sustainably managed and shared’ contains outcomes and strategies that are particularly relevant to the Fisheries Research branch. To help deliver the outcomes identified under this, and the other three KRAs where applicable, almost all fisheries research and monitoring activities are organised into seven priority programs:

- Threats to fishery resources
- Sustainable fish harvest
- Ecosystem assessment
- Aquatic biodiversity
- Sustainable aquaculture
- Fishery enhancement
- Fish habitat improvement

Some programs fit primarily within a single administrative unit but most cut across several units, underscoring the cross-disciplinary nature of most fisheries research. The relationships between the four units and the seven priority programs are shown in Table 1. This table also shows how the programs are related to the major stakeholder groups, relevant management partners and key funding agencies.

Each priority program may encompass several research themes that are relevant to Fisheries NSW (Table 2). Themes are not formal subdivisions within programs, but rather serve as a convenient basis for grouping individual research projects. Projects, as commonly understood in research parlance, will continue to be the basic units for delivering research outcomes for Fisheries NSW. A short description of each priority program is given in the appendix to this plan.

Table 1. Priority programs within Fisheries Research

	Fisheries Research Programs						
Research Unit	Threats to fishery resources	Sustainable fish harvest	Ecosystem assessment	Aquatic biodiversity	Sustainable aquaculture	Fishery enhancement	Fish habitat improvement
Fish Resource Assessment	Minor involvement	Significant involvement				Significant involvement	Minor involvement
Marine Ecosystems	Significant involvement		Significant involvement	Minor involvement			Minor involvement
Freshwater Ecosystems	Minor involvement		Minor involvement	Significant involvement		Minor involvement	Significant involvement
Aquaculture	Minor involvement				Significant involvement	Minor involvement	
<b>Stakeholders</b>							
Recreational fishers	X	X	X			X	X
Commercial fishers	X	X	X				X
Indigenous and cultural users	X	X	X	X			X
Aquaculture businesses	X				X	X	
Conservation NGOs	X	X	X	X			X
<b>Management Partners</b>							
Marine Estate Management Authority	X	X	X	X			X
Office of Environment and Heritage	X		X	X			
NSW Office of Water	X		X	X			X
Coastal Local Land Services	X		X	X	X	X	X
Inland Local Land Services	X		X	X		X	X
<b>Funding Partners</b>							
Commercial Fishing Trust		X					
Recreational Fishing Trusts	X	X				X	X
ACIAR					X		X
FRDC	X	X	X		X	X	X
CRCs	X (Invasive animals)				X (Seafood)		

**Table 2. Examples of Fisheries Research themes that may nest within the priority programs**

<b>Priority program</b>	<b>Fisheries Research theme</b>
Threats to fishery resources	<ul style="list-style-type: none"> <li>• Unaccounted fishing mortality</li> <li>• Land-derived impacts</li> <li>• Climate change</li> <li>• Water resource management</li> </ul>
Sustainable fish harvest	<ul style="list-style-type: none"> <li>• Quota managed species</li> <li>• Harvested invertebrates</li> <li>• Harvested fish and sharks</li> <li>• Recovery of over-fished species</li> </ul>
Ecosystem assessment	<ul style="list-style-type: none"> <li>• Marine estate condition monitoring and evaluation</li> <li>• Freshwater condition monitoring and evaluation</li> <li>• Ecological connectivity</li> <li>• Ecosystem resilience</li> </ul>
Aquatic biodiversity	<ul style="list-style-type: none"> <li>• Marine or freshwater threatened species</li> <li>• Biology of key native species</li> <li>• Pests and disease</li> <li>• Habitat and biodiversity mapping</li> </ul>
Sustainable aquaculture	<ul style="list-style-type: none"> <li>• Mollusc production</li> <li>• Finfish production</li> <li>• Aquaculture nutrition</li> </ul>
Fishery enhancement	<ul style="list-style-type: none"> <li>• Freshwater stocking</li> <li>• Marine stocking</li> <li>• Artificial structures</li> </ul>
Fish habitat improvement	<ul style="list-style-type: none"> <li>• Environmental flows</li> <li>• Fish passage</li> <li>• Fish-friendly infrastructure</li> <li>• Restoring damaged habitats</li> </ul>

## Fisheries Research planning and coordination

Each priority program is supported by at least one scientific expert with considerable experience and credibility in that area. Their role is to help guide the development of a cohesive research plan for the program and to work with the Director of Fisheries Research and the relevant Research Leaders to implement the program plan. The plan for sustainable aquaculture already exists, having been developed by the Aquaculture Research Advisory Committee in 2011. Other program plans will be progressively developed during 2014.

Priority program plans will also be informed by input from relevant fisheries managers and the key stakeholder groups and funding partners identified in Table 1. Once finalised, these plans will identify priority projects for subsequent development by Fisheries NSW and in collaboration with research and funding partners where appropriate. Periodic workshops may be held to review the program plans in light of any relevant new developments. It is also recognised that

not all research done by Fisheries NSW is strategic in nature – issues can arise that require immediate research input to meet specific tactical needs of the division. The Fisheries Research branch will continue to retain capacity and flexibility to meet such needs.

## Working with others

Fisheries NSW obviously cannot provide the scientific research required to address all knowledge gaps about aquatic environments or fisheries resources. Effective collaborations with other research groups within state agencies, research institutions, universities and the community are essential in building the knowledge base for sound management. The program plans will provide a guide to the research and monitoring collaborations that Fisheries NSW and its partner agencies will continue to build. Two key existing partnerships arise out of the location of Fisheries NSW researchers within university research institutes:

- At Coffs Harbour with the National Marine Science Centre (NMSC) run by Southern Cross University
- At Chowder Bay, Sydney with the Sydney Institute of Marine Science (SIMS), a facility jointly operated by four major universities in Sydney

These two partnerships will be further strengthened during 2014-2018, partly as a response to the adoption by the NSW Government of a new approach to managing the NSW Marine Estate which will be a driver for new research activities.

Many other collaborative arrangements currently exist with state, national and international partners at the level of individual projects. The Fisheries Research branch will proactively pursue additional collaborations that will help deliver the priority Fisheries Research programs. Particular importance will be given to establishing effective research partnerships with neighbouring jurisdictions where an aquatic resource is shared across boundaries between NSW and that jurisdiction.

## Communication of Fisheries Research activities

It is important for the sustainable management of the marine and freshwater environments of NSW that all research effort be captured and results made available to other researchers, managers, policy makers and the wider community. Reporting on the findings from research and monitoring will vary in type and timing, depending on project requirements, but may include:

- reporting on divisional and departmental strategic plans
- milestone reporting on individual research projects
- publication of non-technical summaries on completion of research projects
- timely publication of key results in scientific journals
- regular extension of research results to fisheries managers and policy makers
- frequent updates on research findings to stakeholders, committees and relevant agencies
- presentation of research results at relevant scientific conferences and public seminars
- review and update of the *Fisheries NSW Strategic Research Plan* every five years.
- periodic reviews of research plans for the seven priority programs
- publication of web-based information

## Appendix - Fisheries Research programs (not in priority order).

### Program 1 - Threats to fishery resources

#### Relevant KRA, outcomes, and strategies in the Fisheries NSW Strategic Plan – 2.1.1, 2.1.3, 2.2.1

Threats to fishery resources include all human activities that impact significantly on the diversity and abundance of aquatic animals and plants, as well as the habitats and ecosystems they live in. Threats to these resources can be divided into several broad categories which inform the Fisheries Research themes noted within this Plan.

A better understanding of unaccounted fishing mortality allows more reliable stock assessments. In addition, impacts from fishing activity can have unintended consequences for non-target species or fish habitats. Reducing these impacts can take the form of by-catch avoidance, gear selectivity, more environmentally friendly fishing gear or improved survival of released catch. Fisheries NSW is a world leader in this field and ongoing research to identify sources of fishing mortality and reduce impacts will continue to be an important component of ensuring the future sustainable use of the state's fishery resources.

Land-based impacts exert strong pressure on aquatic ecosystems due to increased inputs of contaminants, sediments, nutrients and debris. The impacts of land degradation and of diffuse or point source pollution need further research. Fisheries NSW has limited research capacity for this theme, so close coordination with other state agencies will be important.

Climate change is predicted to alter such parameters as ocean temperatures and chemistry, sea level, storm frequency and severity, the amount of freshwater entering aquatic systems and patterns of regional oceanography. These changes may directly or indirectly affect aquatic habitats and species, but the rates of change, their consequences and the resilient capacity of aquatic biodiversity all require research and monitoring. Fisheries NSW has limited research capacity under this theme, so close collaboration with other research providers is expected.

In freshwater systems, the extraction of water for human consumption, industry or agriculture has altered natural flow regimes in many different ways in most NSW rivers. In turn, this has affected native fish and their habitats. Understanding these impacts is a key to their mitigation.

### Program 2 - Sustainable fish harvest

#### Relevant KRA, outcomes, and strategies in the Fisheries NSW Strategic Plan – 2.1.2, 2.1.3, 2.3.2

Fish stocks are influenced by many natural factors and by various human activities, the most direct of which is fishing. Sustainable management is achieved via an integrated approach in which fisheries-based information is used to assess the way in which a fishery operates. A primary responsibility of the Fisheries Research branch is to monitor levels of catch and fishing effort and assess risks to the continued sustainability of the state's fisheries resources. This information is then used to inform management decisions about such things as limits on catch or fishing effort.

Fisheries NSW has an established and well-regarded resource assessment process which provides the framework for regular examination of the exploitation status of marine fish, shark and invertebrate species harvested in NSW. The status provided for each species reflects its biology, the level of importance of that species to the various harvesting sectors and its past catch history. Commitments made in existing fisheries management strategies and issues of risk identified in the environmental impact statements are also considered. Several monitoring programs underpin this process, including regular data collection on commercial catch and effort, observer programs and periodic estimates of recreational catch obtained from fishery independent surveys, game-fish tournaments and charter-boat logbooks.

The branch's resource assessment process will be further refined and strengthened during the life of this research plan, and ways of including indigenous and customary take will be considered.

### Program 3 - Ecosystem assessment

#### Relevant KRA, outcomes, and strategies in the Fisheries NSW Strategic Plan – 2.1.1, 2.1.2, 2.1.3, 2.2.3

NSW has had a Monitoring, Evaluation and Reporting (MER) program since 2006. Under this program, data were collected on several natural resource themes including marine ecosystems, coastal lakes and estuaries, riverine ecosystems, wetlands, threatened species and invasive species. These data provide baseline and trend information that allows assessments of the condition of aquatic resources and the pressures on them. Fisheries NSW had important lead or supporting roles under that program.

With the establishment of the Marine Estate Management Authority (MEMA) in 2013, Fisheries NSW has been given several new tasks which will require ongoing monitoring of the marine estate and new research to address specific management issues. A new MER process, which will integrate ecological, economic and social indicators across marine and estuarine ecosystems, will be developed and implemented, and the Fisheries Research branch will play a lead role in the ecologic aspects of this.

In freshwater systems, the cessation in 2013 of the Sustainable Rivers Audit within the Murray Darling Basin left a considerable gap in the state's previous MER program. During the life of this research plan, the Fisheries Research branch will work with the Commonwealth and other NSW agencies, particularly the Office of Environment and Heritage (OEH) and NSW Office of Water (NOW), to develop and implement suitable state-wide freshwater monitoring activities for the Murray Darling Basin. Similar initiatives will be progressed with other water authorities in inland and coastal catchments.

The future wise management of NSW's aquatic resources will be informed by sound assessments of the resilience of aquatic biodiversity to a range of threats. One key theme will be identifying the ecological systems to be assessed and the stressors impacting on them, and then evaluating how they are likely to respond. Another important theme will be connectivity among geographically distinct components of these systems. Research may be done at several levels including genetics, larval dispersal or adult migration.

### Program 4 - Aquatic biodiversity

#### Relevant KRA, outcome, and strategy in the Fisheries NSW Strategic Plan – 2.1.3

Aquatic biodiversity is defined as the variability within and among all living aquatic organisms. In addition to species diversity, it also includes genetic diversity (within species), habitat diversity and ecosystem diversity. It has intrinsic values and is vital to the ongoing supply of goods and services such as fresh local seafood, recreation and tourism.

Mapping and assessing aquatic biodiversity in NSW is important for understanding the distribution and structure of aquatic ecological assets. Considerable research has focussed on assessing algal beds, seagrasses, mangroves and saltmarshes, but additional tools and predictive modelling techniques are now available to map a broader range of aquatic habitats and assemblages. Such new and emerging methods will be the focus of research under this program, much of which will likely be done in collaboration with partner organisations because of limited research capacity within Fisheries NSW. The development of decision support tools to assist managers will be an important new focus, especially within the marine estate.

This program also includes detailed research into the threats to listed threatened species, as well as to protected and key endemic species. A number of projects have examined such issues over recent years, and Fisheries NSW is an acknowledged research leader in this field in both

marine and freshwater ecosystems. Additional research to improve the state's capacity to breed and restock threatened freshwater fish species is envisaged. Advising on strategies to extend the distribution and improve the conservation status of threatened species remains a core function for the Fisheries Research branch.

Pests and disease threaten many local populations and communities, either directly through fatal infection, predation or competition for resources or indirectly by altering habitats or increasing susceptibility to other stressors. Research is needed to understand and manage existing pests and to assess risks from new pest incursions or disease outbreaks. Fisheries NSW has a strong record of research on carp and will continue to play a key leadership role within the freshwater program of the Invasive Animal CRC during the life of this research plan. However, other elements of this theme, especially in relation to disease, will rely on collaborative engagement with other research providers.

## **Program 5 - Sustainable aquaculture**

### **Relevant KRAs, outcomes, and strategies in the Fisheries NSW Strategic Plan – 1.2.1, 1.2.5, 2.1.3**

Production from wild harvest fisheries in NSW is unlikely to increase sufficiently to meet expanding demand for local seafood. Currently, the state's most economically valuable seafood industry is based on aquaculture (i.e. oysters), and it is recognised that aquaculture has significant potential for growth as a future provider of seafood.

The priorities for aquaculture research are largely driven by the need to overcome constraints to profitable culture. These are assessed on the basis of the estimated potential for environmentally-sustainable growth of the industry relative to the costs and benefits involved. The key species that should be studied need to be identified and the most important aspects of their hatchery production, grow-out technology or post-harvest treatment need to be researched.

The Sustainable Aquaculture program will continue to concentrate on the three major themes identified in the current Aquaculture Research RD&E Strategic Plan

(<http://www.dpi.nsw.gov.au/fisheries/aquaculture/publications/industry-development/arac-strategic-plan-2012-2017>)

- Mollusc research will focus on developing and improving hatchery and nursery techniques for shellfish species, particularly oysters. Fisheries NSW is a recognised leader of research into genetic improvement of Sydney Rock Oysters (for disease resistance, faster growth and improved marketability), and this work will continue. Additional research will examine the impacts of human activities and climate change on oysters.
- The fish production and enhancement theme has concentrated on improving methods for hatchery production of Mulloway, Australian Bass, Yellowtail Kingfish and Southern Bluefin Tuna, while also producing Australian Bass and Mulloway for stock enhancement.
- Work in the aquaculture nutrition theme will seek to improve artificial diets for cultured fish and prawns, with an emphasis on Mulloway and Yellowtail Kingfish. Two key priorities have been replacing fishmeal with Australian agricultural ingredients and producing cost-effective, environmentally friendly feeds.

## **Program 6 - Fishery enhancement**

### **Relevant KRAs, outcomes, and strategies in the Fisheries NSW Strategic Plan – 2.1.3, 3.1.3**

Fisheries NSW has an established strategy of deploying artificial structures in the marine environment (fish aggregation devices and reefs) to increase fish productivity and hence provide greater opportunities for all sectors of the recreational fishery. The focus of research around this strategy has been to understand how the design, configuration and location of the artificial

structures influence fish communities and how these deployments affect usage patterns by anglers. This research has led to a better understanding of how artificial structures can best contribute to the broader framework for the sustainable management of the state's fisheries resources. Monitoring the performance of offshore artificial reefs as they are progressively deployed in NSW remains a core function for the Fisheries Research branch.

Historically, fish stocking in NSW has focussed on key angling species in freshwater systems (e.g. trout, Australian Bass, Murray Cod, and Golden Perch). However, knowledge gaps in the fish stocking program remain. Ongoing research will seek to fill some of these gaps, especially for native species in inland waterways. More recently, pilot programs have identified the potential for stocking a variety of species in selected estuaries along the NSW coast in situations where natural recruitment appears to be limited. For both the established freshwater stocking and the proposed new estuarine stocking, research addressing key knowledge gaps, as outlined in the fisheries management strategies for stocking will improve practices.

## Program 7 - Fish habitat improvement

### Relevant KRAs, outcomes, and strategies in the Fisheries NSW Strategic Plan – 2.1.3, 2.2.4, 3.1.3

Fisheries NSW has an established program for improving degraded fish habitats in local freshwater and estuarine systems. Research associated with this program has sought to:

- identify habitats that contribute most to the survival, growth and productivity of key species
- determine the status of these habitats and identify the processes limiting their extent or threatening their ongoing value
- develop and refine appropriate management techniques to mitigate any risks.

Understanding the complex interactions between fish and aquatic invertebrates and their different habitats is required for most species in freshwater, estuarine and marine habitats. For most exploited species, the functions that habitats play in supporting populations is also poorly understood. As a result, the role that habitat degradation and rehabilitation play in the productivity of fisheries, or the recovery of threatened species or ecological communities, requires further work.

Much work has been done in NSW to rehabilitate degraded habitats. Examples include repairing the riparian zone, re-snagging river reaches, improving water quality and the creation of artificial refuges. These rehabilitation activities need to be evaluated to ensure that they achieve stated objectives in a cost-effective manner. In recent years research done by Fisheries NSW has improved our understanding of fish responses to river rehabilitation activities such as fish passage remediation, re-snagging and floodgate management, but many more activities need to be assessed in NSW.

In freshwater ecosystems, it is critical that river infrastructure is managed in a way that supports the continued sustainability of native fish. NSW has invested heavily in infrastructure such as weirs, regulators, dams, levees, culverts, floodgates, hydropower, irrigation canals and pumps, all of which can affect native species. Fisheries NSW is a world leader in researching ways to mitigate these impacts and further research will remain an important component of ensuring ongoing sustainability of freshwater ecosystems in NSW.