

# **Working Together: the National Fishing and Aquaculture RD&E Strategy 2010**

*A component of the  
National Primary Industries Research, Development  
and Extension Framework*

**31 March 2010**

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## Executive summary

This National Fishing and Aquaculture Research, Development and Extension (RD&E) Strategy establishes the future direction to improve the focus, efficiency and effectiveness of RD&E to support Australia's fishing and aquaculture industry over the next five years.

The strategy was developed at the request of the Australian Primary Industries Ministerial Council (PIMC), and is one component of the National Primary Industries Research, Development and Extension Framework. The Framework recognises that basic and strategic research can be provided from a distance; while adaptive development can be achieved regionally; and extension and adoption of research outcomes most often have a local focus. The concept of major, supporting, and linking (M-S-L) roles in RD&E has been incorporated in this strategy recognising that RD&E activities span a broad spectrum of research- from stock assessment research, through innovative broader aquatic research, and supply chain development. These M-S-L arrangements will aim to reduce duplication, improve efficiencies and maintain key national capabilities.

The fishing and aquaculture industry is characterised by its diversity of stakeholders and activities, geographic distribution, high number of species utilised, and by having both a natural resource management (NRM) and primary industries basis for management and development respectively. The fishing and aquaculture industry comprises three main sectors: commercial (comprising wild-catch, aquaculture and post-harvest); recreational; and indigenous customary<sup>1</sup>. These complexities have a significant bearing on RD&E priorities and investment processes.

It was recognised early on in the development of the strategy that the existing RD&E system was characterised by fragmented planning processes, and lack of focus on national issues. With no common forum for stakeholders to work together on RD&E, the system contributed to confusion, competition, inefficient investment and suboptimal adoption rates.

While this strategy has presented an opportunity to create a common industry vision, it was recognised early on that changes to RD&E structures and processes cannot be considered without understanding how those changes affect the management and regulation of fishing and aquaculture activities. Defining the differences in the RD&E supporting both innovation and regulation has been an important step in the development of the strategy, and in securing stakeholder support.

Given the inherent complexity and diversity, consultation has been critical. Mechanisms included establishing the strategy working group, a leadership group, and a broader stakeholder reference group. The latter group, consisting of over 50 members, met twice to provide input on RD&E drivers, current capability, priority research areas and changes to the RD&E structure. Input from grassroots fishers was ensured through regional workshops. The strategy evolved through numerous versions that were widely distributed for feedback.

In addition to wide consultation two comprehensive studies, *Overview of the Australian fishing and aquaculture industry: present and future*, and *RD&E capability audit and assessment for the Australian Fishing and Aquaculture Industry* supported the development of the strategy.

Change has now occurred that responds to the findings of these reports, and is consistent with the objectives for the National Primary Industries RD&E Framework. These changes include:

- agreement to establish a national priorities forum that brings together

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<sup>1</sup> Aboriginal and Torres Strait Islander people also participate in the commercial and recreational sectors.

government and industry leaders to lead the implementation of the strategy, including prioritisation of RD&E investment

- an agreed definition of RD&E that recognises that stock assessment research differs from innovative RD&E activities and needs to be managed accordingly (nevertheless, the strategy demonstrates the close linkage between RD&E and management of fisheries)
- development within the strategy of a national strategic RD&E plan, with defined outcomes, research themes and research topics
- a regional approach to RD&E planning, investment and delivery that encourages collaborative arrangements consistent with habitat, species distributions, and aquaculture activity
- recognition that extension needs to be included when considering research and development investment, and integrated within the national system
- key performance indicators have been defined which will measure achievement against the strategy's planned outcomes
- gaps in critical RD&E capability have been determined.

Importantly, the strategy provides a foundation for further change that will improve the outcomes for stakeholders from their RD&E investment. The most important elements that require further change are:

- addressing the identified gaps in capability (e.g. Aquatic animal health veterinarians)
- advancing the major-support-link (M-S-L) within a regional and national approach – the strategy has identified opportunities for research specialisation for particular sectors (e.g. Southern Rocklobster), and around specific research areas e.g. bio-security, recreational fishing, and climate change
- Progressing the first meetings of the research and extension networks
- Establishing mechanisms to better engage with all stakeholders, but in particular with Aboriginal and Torres Strait Islander groups
- Establishing mechanisms for monitoring, review and reporting on the strategy

When the strategy is fully implemented, the fishing and aquaculture industry will be strengthened by a national system in which end users of the research take a leading role in determining and reviewing strategic directions and priorities for RD&E. Although agencies will retain and build RD&E capability in fields strategically important to their jurisdictions and industry sectors, they will collaborate more effectively with others to improve the capability of the national system in priority areas. Coordination and sharing of expertise and research infrastructure will be important to this collaboration. To encourage rapid uptake of new technologies, research developed in one location will be available nationally for the whole industry. Through the strategy, higher returns on the substantial resources invested by government and industry in RD&E will be possible.

This strategy is a significant step for fishing and aquaculture, but it is only the beginning. Structural and collaborative arrangements, driven by strong leadership, will continually improve on the benefits the strategy can deliver.

# Context of the National Fishing and Aquaculture RD&E Strategy

This strategy is part of a new national research, development and extension framework for primary industries

Rural R&D corporations, and others, are jointly developing the *National Primary Industries Research, Development and Extension Framework* to encourage greater collaboration and to promote continual improvement in the investment of RD&E resources nationally. The Framework spans fourteen primary industry sectors and seven cross-industry sectors.

*Working Together: the National Fishing and Aquaculture RD&E Strategy* is a component of the framework that has resulted from a comprehensive examination of the emerging RD&E needs and opportunities of Australia's fishing and aquaculture industry, and the strategic research necessary to respond to them.

Information about the National Primary Industries Research Development and Extension Framework is available at:

<http://www.daff.gov.au/agriculture-food/innovation/national-primary-industries>

## The National Primary Industries Research, Development and Extension Framework

RD&E in primary industries is a key factor for increasing productivity and achieving sustainability. Australia has a very complex web of research providers and investors who are independent operators with strong interconnections. The 15 rural R&D corporations are part of this web, as are the federal, state and territory governments, CSIRO, universities and private RD&E providers.

Nationally, RD&E investment in primary industries, which exceeds \$1 billion annually, needs to be applied effectively, efficiently and collaboratively. To that end, in 2005 the Primary Industries Ministerial Council endorsed the concept of "National R with Regional D&E", which recognises that basic and strategic research (R) can be provided from a distance, with regional adaptive development (D) and local extension (E) being required to improve the uptake of innovation by industry.

Subsequently, the Ministerial Council agreed to a set of principles for further cooperation between agencies and industry to improve the efficiency and effectiveness of national primary industries RD&E. The principles emphasise cooperation, information sharing, maintaining funding, access to capability and reporting.

In 2007, the Ministerial Council agreed to develop a national RD&E framework to provide a more comprehensive, structured approach within an agreed timeframe. The framework was launched, together with an over-arching intergovernmental agreement in 2008, as the *National Primary Industries Research, Development and Extension Framework*.

In November 2009, the Ministerial Council endorsed the framework including an overarching *Statement of Intent* as a vehicle for commitment by the agencies coming within the ambit of

the Primary Industries Steering Committee, the rural R&D corporations and the Australian Council of Deans of Agriculture. The statement provided the structural arrangements and commitment of these parties to implement the framework.

The framework spans 14 primary industry sectors and seven cross-industry sectors. The primary industry sectors are beef, cotton, dairy, fishing and aquaculture, forests, grains, horticulture, pork, poultry, sheepmeat, sugar, wine, wool, and new and emerging industries.

The cross-industry sectors are: animal biosecurity, animal welfare, biofuels and bioenergy, climate change and variability, food and nutrition, plant biosecurity and water use in agriculture.

More information:

[http://www.daff.gov.au/\\_\\_data/assets/pdf\\_file/0020/1450631/rde-statement-intent.pdf](http://www.daff.gov.au/__data/assets/pdf_file/0020/1450631/rde-statement-intent.pdf)

## Important definitions

Developing this strategy has been useful in many ways, not least in developing accepted terminology among different stakeholder groups.

### The industry and its main sectors

The fishing and aquaculture industry includes any industry carried on in or from Australia in connection with the culturing, taking, preserving, storing, transporting, processing or marketing of fish or fish products.<sup>2</sup>

The fishing and aquaculture industry comprises three main sectors: commercial<sup>3</sup>, recreational, and indigenous customary.

The commercial sector undertakes activities directed to a financial return from the sale of seafood and non-edible aquatic products. Activities are commercial wild-catch, aquaculture and post-harvest (i.e., processing, handling and retailing).

The recreational sector undertakes activities that create personal enjoyment and recreation from fishing or non-extractive use of aquatic resources. It includes fish stocking activities and commercial enterprises associated with the sector such as fish tour operators, charter operators and fishing guides, and fish-out activities from public or private impoundments. Supporting the recreational sector are commercial enterprises such as tackle manufacturers and suppliers, industry magazine and DVD publishers, etc.

Customary fishing is undertaken by many Aboriginal and Torres Strait Islander communities to satisfy personal, communal, domestic, ceremonial and/or educational needs inherent to their cultural life. Many indigenous communities and individuals also participate in commercial and recreational fishing.

### Industry stakeholders

Stakeholders in the fishing and aquaculture industry include:

- members of the fishing and aquaculture industry (commercial wild-catch fishers, aquaculture producers and post-harvest enterprises; recreational fishers and associated commercial enterprises; and indigenous customary fishers)
- non-extractive users of aquatic resources

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<sup>2</sup> The definition is from the Fisheries Research and Development Corporation Regulations, Amendment 1992.

<sup>3</sup> Also called the “seafood industry”, although non-food items such as pearls are included among its products.

- the federal, state and territory governments (including their fisheries managers and other natural resource managers)
- research providers
- the people of Australia (on whose behalf aquatic resources are managed, and as consumers)

## Basic and strategic research

Basic research is work, of a general nature, conducted in order to acquire knowledge of the underlying foundations of phenomena and observable facts without any obvious practical application in view.<sup>4</sup> It is sometimes referred to as fundamental research.

Strategic research is mission-oriented and involves the application of established scientific knowledge and methods to broad social or economic objectives, often extending over a considerable period.<sup>5</sup>

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4 Cited in *The Language of Business Intelligence*, a glossary by Vernon Prior, at <http://www.markintell.com/b-intelligence-language/>

5 <http://www.markintell.com/s-intelligence-language/>

## The concept of national research, regional adaptive development and local extension

The Primary Industries Ministerial Council has endorsed the concept of “National R with Regional D&E”, recognising that basic and strategic research (*R*) can be provided from a distance, with regional adaptive development (*D*) and local extension (*E*) being required to improve the uptake of innovation by industry.

Only a small proportion of jurisdictionally based “research” activities currently undertaken for fisheries by fisheries management agencies is classified as basic or strategic research, *R*. About 80% of the “research” activities undertaken to support fisheries management involves regional and/or local monitoring and assessment, which would be classed as *D*; and provision of advice, which would be classed as *E*. For the purpose of this document, this 80% is defined as stock assessment research.

Basic or strategic *R*, in the context of fisheries management, is the development of new tools that could be applied in more than one location, such as new methods for:

- measurement of biological, social or economic attributes, assessment of stocks or ecosystems, oceanographic modelling systems, governance frameworks, harvest strategies, and sampling techniques
- fishing that improve the value, cost-effectiveness or environmental appropriateness of fishing operations, and which could apply across multiple fisheries.

Basic or strategic *R* for aquaculture is similar to other farming sectors. It may include new husbandry methods to improve cost efficiencies in production, development of new production systems, nutritional research and means to minimise environmental impacts, which can apply across multiple species.

Decisions about what to apply and at what scale can be determined at the regional or local level.

Regional adaptive development (*D*), in the context of the fishing and aquaculture industry, applies to adaptation of new tools, as outlined above, for use at regional or local scales. Examples of adaptive development include the use of an existing type of sampling program or stock model in a new location. Whether they are applied at a local or regional scale depends on the geographic extent of the stock and the management systems that operate. Decisions about what to apply and at what scale can be determined at the regional or local level.

Aquaculture *D* includes adaptation of previously developed production systems or production processes for a species into a new region where some of the parameters may be different. This can include examination of the cost effectiveness of any *R* completed for new locations, species etc.

Local Extension *E* facilitates empowerment through systematic and participatory transfer of knowledge and skills to bring about positive change in behaviours and/or attitudes. In the context of fishing and aquaculture, target groups include fisheries management, government agencies, catching sectors, aquaculture producers and the broader community.

# The fishing and aquaculture industry: present and future

A comprehensive study, *Overview of the Australian fishing and aquaculture industry: present and future*, was undertaken as part of the preparation of this strategy. It is available from the Fisheries Research and Development Corporation in hard copy and electronically from [www.frdc.com.au](http://www.frdc.com.au)

This section summarises the key issues and indicators for the Australian fishing and aquaculture industry, consistent with that study.

## Industry profile

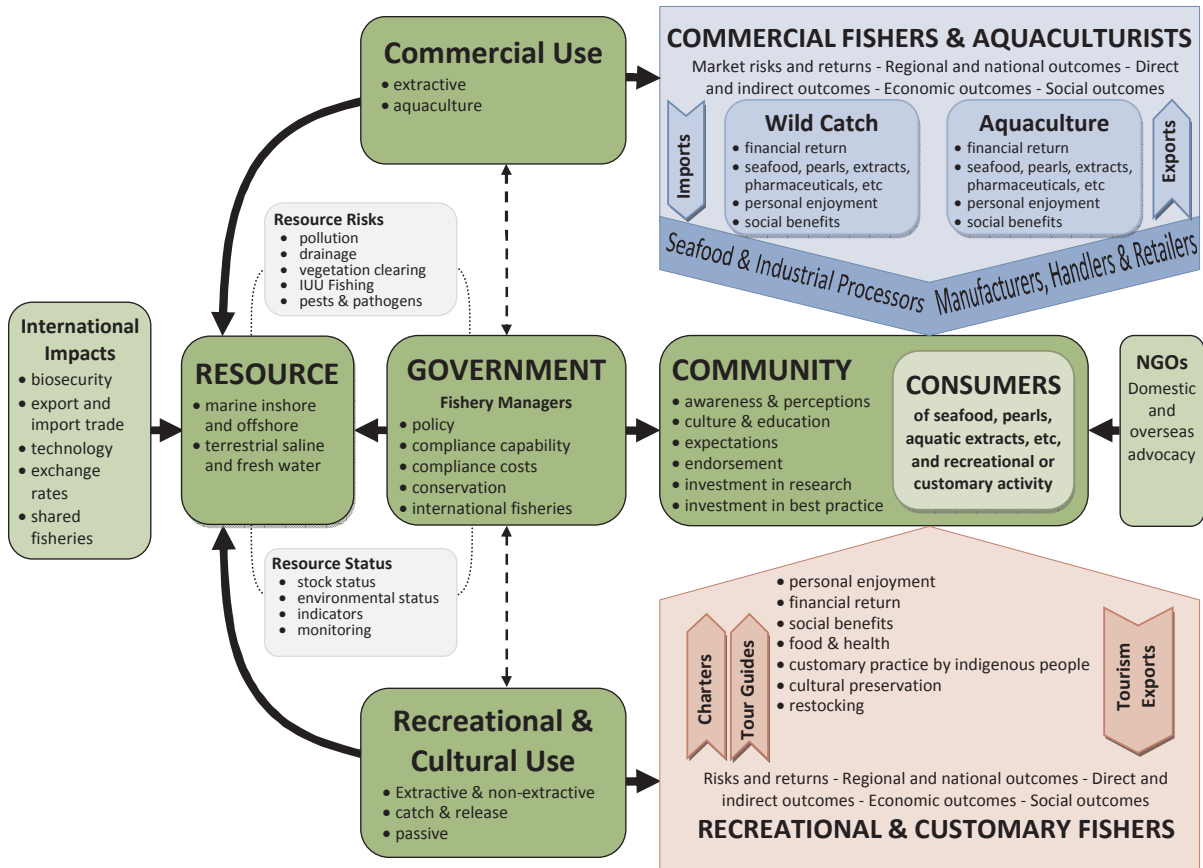
The fishing and aquaculture industry makes a large, unique contribution to the wellbeing and economy of Australians. The use and management of aquatic natural resources enable contributions in four areas as follows:

- Commercial wild-catch and aquaculture is Australia's sixth most valuable food-based primary industry. The combined gross value of production of commercial wild-catch and aquaculture for 2007–08 (landed/farmgate value) was \$2.19 billion. Exports earned \$1.3 billion.
- Increased seafood consumption is a global trend for modern, health-conscious consumers. Commercial fishers and aquaculturists provide fresh, high-quality products to meet this demand.
- Fishing is a recreational activity for about 3.4 million Australians each year, directly contributing an estimated additional \$2.5 billion to national and regional economies.
- Customary fishing by Aboriginal and Torres Strait Islander people contributes significantly to their cultural life, health, and social cohesion. Fishing and aquaculture activities also provide a context for economic development and for training.

The commercial, recreational and indigenous customary sectors of the Australian fishing and aquaculture industry experience common, national challenges. Within those sectors, there are many unique challenges that vary around Australia and give rise to specific research, development and extension needs. A few indicative examples are as follows:

- Some commercial wild-catch fisheries face declining stock recruitment (WA Rocklobster).
- Changes in predation patterns are occurring within ecosystems (Tasmanian Rocklobster).
- Seafood chain efficiency and viability are crucial in some fisheries (South East Australian scale fisheries).
- Some aquaculture sectors need to reconfigure their harvest of wild breeding stock (Southern Bluefin Tuna), address predation by seals and other marine mammals (Atlantic Salmon), and build the operational scale to enable efficient reinvestment in RD&E (Blue Mussels).
- Recreational fisheries continue to be hindered by a lack of up-to-date data to guide sector development and difficulties in defining and quantifying social and economic benefits.

- Indigenous customary fishing is geographically and culturally diverse, presenting challenges to coordination of planning for RD&E investments.



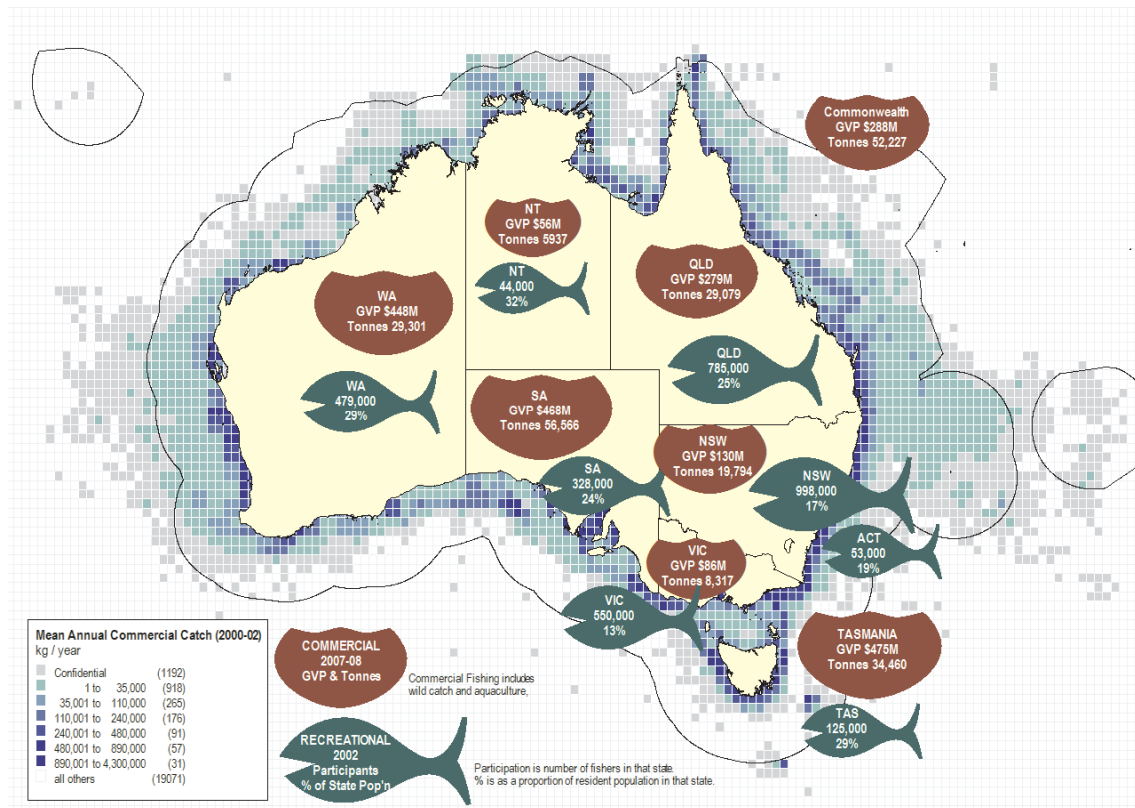
**Figure 1: Major components and relationships within Australia's fishing and aquaculture industry**

The fishing and aquaculture industry operates in a business environment made more complex due to its dependence on access to publicly managed natural resources. These resources are managed for the benefit of the community taking into account both the needs of the present generation of Australians and the interests of future generations.

The complexity of ecosystems, species, fisheries management arrangements, users and products along multiple tangible and intangible value chains (seafood, recreation, indigenous customary) creates a complex operating environment for the industry. This intricacy flows through to industry sectors, specific fisheries, enterprises and regulators. Access to the resource must be legally clear and commercially and socially attractive for industry to attract and make investment in infrastructure, time, licences, vessels and people. As the demography of Australian communities change, so too does the demand for access to aquatic resources and the products and services they create. In turn, management of the interests of fishery users requires constant attention. Re-balancing of these property rights needs to be undertaken optimally, in a publicly transparent way.

Likewise, the adaptive capacity of the fishing and aquaculture industry is closely linked to the degree of flexibility in fisheries and aquaculture management arrangements.

More than 200 centres around Australia contribute to one or more sectors of the fishing and aquaculture industry. The following map highlights commercial and recreational activity and effort. Customary activity is shown at Figure 6.



**Figure 2: Tonnage and value of commercial fishing and aquaculture; number of recreational fishers**

## Fishing and aquaculture resources

Australia's marine environment is generally low in nutrients and, as a consequence, is low in biological productivity. Little opportunity exists to increase the volume from wild-catch fisheries. However, the diversity of marine and freshwater habitats, from the tropics through to the Antarctic, provides a great variety of seafood products, potential for selected aquaculture development, and enjoyment of many recreational and cultural fishing experiences.

To service the complex needs of the private fishing and aquaculture industry and its use of a public resource, government must play a central role. Various federal, state and territory fisheries management agencies have multiple overlapping and discrete jurisdictional arrangements to permit access by resource users. They also manage harvesting of aquatic products and enjoyment of the aquatic environment. Fishery managers must balance the needs of the community today regarding seafood and recreational and cultural benefits with expectations about sustainability of the resources and their future uses. Public policy judgements must also be made about the competitive worth of non-fishing demands, such as maritime trade, oil and gas exploration, or marine exclusion zones. Added to this mix are uncertainties surrounding the effects of climate change and variability that managers and industry must consider in their decision-making. Accurate, up-to-date information and

scientific discovery are crucial to inform all these decisions by managers, fishery users and communities. The pre-eminent role of the broader public and their regional communities in decisions about the fishery and aquaculture resources brings with it demands for strong science and effective, comprehensive dialogue. Science and awareness are inextricably embedded in the management and governance of fisheries.

It is important that Australia's International treaties and fishery agreements provide the uniform framework for management of our fisheries and those of our neighbours and take account of the interests of various NGOs and interest groups.

## Drivers and opportunities

Many factors in the business environment of the fishing and aquaculture industry affect the industry's performance and the sustainability of the natural resources it uses. Many of these factors also affect global fisheries, but not in the same way as in Australia. Importantly, much of the factors are beyond the control of the industry.

As proposed in the *Overview of the Australian fishing and aquaculture industry: present and future*, the drivers of RD&E and the opportunities on which RD&E can capitalise can be grouped under the following five categories.

### Biosecurity and aquatic animal health

Pest organisms, including translocated species and pathogens, are an increasing threat to Australian fisheries and their ecosystems. They may adversely affect native species or farmed non-endemic species for food and habitat, by predation, or by introduction of disease. Borne by international trade in live aquatic animals, bait fish, aquaculture feeds and foodstuffs, and global logistic and human travel, the risk will continue to rise in concert with globalisation and climate change.

Chemical contamination from land-based industries and agricultural and urban development is also a factor in aquatic animal health.

Nationally, Australia is well prepared for biosecurity incursions in terrestrial industries. But it is less clear that we are able to identify the risks and are ready to defend the health and security of aquatic animal and plant species and their dependent communities and users.

### Ecologically sustainable development

Biological diversity in ecosystems and the interconnectedness of ecosystems is increasingly understood by the Australian community and considered to be important. All commercial fishers that export, and all Commonwealth fisheries, require assessment approval under the *Environment Protection and Biodiversity Conservation Act 1999*. This Act and other environmental instruments will play an increasing role in the regulation and management of Australian wild-catch fisheries.

To achieve ecologically sustainable development, fishers and aquaculturists need to:

- be aware of ecosystem needs and impacts (as with fishery managers and other natural resource managers)
- engage in planning and management processes that include all users (including land users and regulators onshore and upstream from fishing and aquaculture resources) and local communities
- achieve profitability in commercial fishery enterprise (wild-catch; aquaculture; services supporting recreational fishing, chartering and other non-extractive uses) and

satisfying experiences in non-commercial fishing activities

- engage in open and frequent dialogue between the industry as natural resource users and their communities.

The industry and governments have made good progress with the ecologically sustainable development agenda but continued effort and commitment by all stakeholders is essential if the crucial benefits are to be realised by the nation.

## Climate change and variability

Some impacts of increased climate change and variability are now evident in our fisheries. These and many anticipated direct and indirect impacts will change where and how the industry fishes and farms in the future. There will be gains and losses, and challenges and opportunities for fishers, aquaculturists, their communities and seafood businesses. Better understanding is needed about the biophysical implications of climate change; social and economic implications of change for sectors and related communities; market risks and opportunities ahead; and the needs of stakeholders. More adaptive capacity is needed within sectors. Climate change will impact the fishing and aquaculture industry on a number of levels such as fuel, and through gear, engine and vessel configuration changes.

## Consumers and markets

Consumers make the crucial choice on which the commercial sector depends: whether seafood or some other food at the retail point of sale meets their needs and desires. Consumers are paying more attention to the food they eat, the value they get from it, and what it does for them and for the world around them. The commercial sector must increase its knowledge of markets and supply chains and develop new products specifically for their target markets. Developing new niche export markets and demonstrating credence values (e.g. food safety, environmental sustainability, animal welfare) will become increasingly important. This is especially so in premium markets that can accommodate production costs much higher than in competing countries. Innovative processing and manufacturing within Australia is an opportunity to differentiate Australian product and add value to it and there is a need to improve the connectedness along the supply chain from harvest to the consumer. Enterprises and supply chains need to take the most environmentally sustainable pathway to manage the resource, operate efficient supply chains, and meet complex consumer needs.

## Global and demographic factors

To a large extent, global wild-catch fisheries are fully fished, with many struggling to recover from over-exploitation. Demand for seafood is predicted to grow strongly as population increases and Asian countries become more affluent. To meet this demand, global aquaculture will need to grow 70 per cent to 90 million tonnes by 2030. Implications for Australia industry include increased export sales of premium wild-catch seafoods at attractive margins, increased trade flows, growth in domestic aquaculture, increased biosecurity risks, increased opportunity to select and adopt global technologies, uncertainty regarding community perceptions of wild-catch fishing and therefore access to the resource for both passive (i.e., tourism) and active use. Increased disposable incomes in the developing economies will drive higher demand for recreation and ecotourism in unique environments such as those in Australia. The fishing tourism industry is likely to expand. These are complex matters and the Australian fishing and aquaculture industry can only respond and prosper if it has invested in the necessary human skills, community endorsement, technologies and financial capacity. One factor that will remain is the risk to commercial operators in the Australian fishing and aquaculture industry from a high, volatile exchange rate against the US dollar — a factor that is

completely outside industry influence.

Human migration patterns and changing demographics affect community attitudes and usage patterns of the aquatic resource. The composition and age of Australia's population is set to change substantially over the next 50 years, with significant variation across states and regions. Regional and metropolitan Australia is moving to a more diverse ethnicity and a higher average age. Policy responses and industry investments in RD&E need to be informed by these trends to ensure returns to the community are optimised.

## Business indicators for fishing and aquaculture

### Production

The total tonnage of commercial sector production (from Commonwealth, state and territory fisheries and from aquaculture) peaked at 279,000 tonnes in 2004–05 after several years of growth. Since then, tonnage, value and nominal prices have fallen.

Commercial wild-catch fisheries have a landed value of about \$1.3 billion annually. Three species comprise over 60% of the sector's gross value of production: Rocklobster, prawn and Abalone. The past decade has seen wild-catch sector tonnage rise and then fall 15% to retreat to levels at the start of the last decade. In real terms, the gross value of Australian commercial wild-catch has declined 22% since 2001–02.

Since 2000–01, landed aquaculture production has increased 40% and gross value of production has increased 19%. The sector generates about \$900 million in landed value per year — about 40% of commercial fishery revenues. Although growth is strong, in real terms it is just adequate to keep pace with inflation. The sector is dominated by five species that comprise 86% of the gross value of production of the sector: Atlantic Salmon, Southern Bluefin Tuna, pearls, edible oysters, and prawns. Aquaculture farm gate prices per kilogram fell 15% in the six years to 2008.

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
<b>TONNES</b>							
Total wild catch	192,398	207,031	223,138	231,085	191,640	183,423	173,178
Total aquaculture	44,746	45,943	43,475	48,014	54,539	60,142	62,503
Total commercial	237,144	252,974	266,613	279,099	246,179	243,565	235,681
<b>GVP \$'000</b>							
Total wild catch	1,698,514	1,570,607	1,447,778	1,451,770	1,424,092	1,405,070	1,318,494
Total aquaculture	731,163	734,470	731,811	634,082	742,346	805,690	868,355
Total commercial	2,429,677	2,305,077	2,179,589	2,085,852	2,166,438	2,210,760	2,186,849
<b>NOMINAL PRICES A\$/kg</b>							
Total wild catch	8.83	7.59	6.49	6.28	7.43	7.66	7.61
Total aquaculture	16.34	15.99	16.83	13.21	13.61	13.40	13.89
Total commercial	10.25	9.11	8.18	7.47	8.80	9.08	9.28

**Table 1: Seafood production, value and price per kg, 2001–02 to 2007–08**

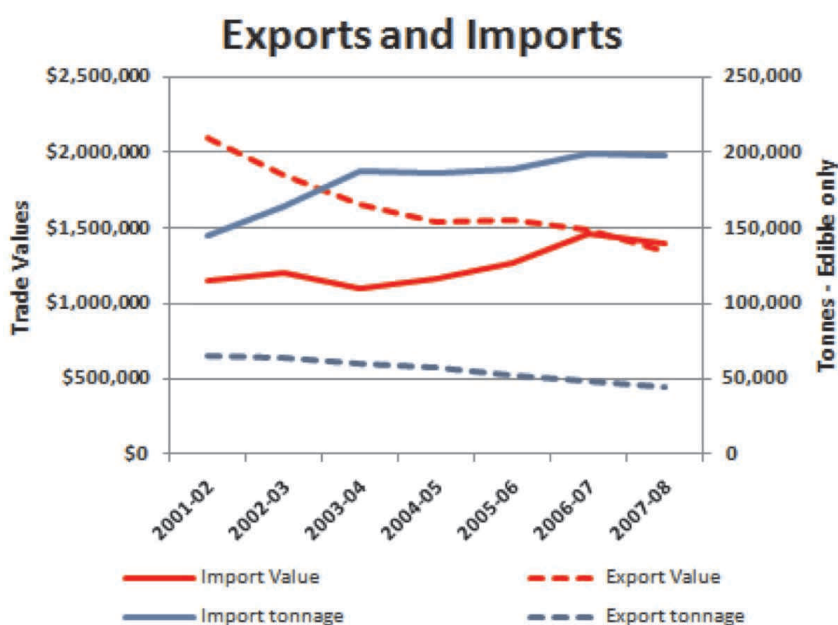
## Trade

Three key wild-catch sectors (Rocklobster, Southern Bluefin Tuna and Abalone) are highly export-focused; a fourth (prawns) exports about 25% of its catch. In the aquaculture sector, Southern Bluefin Tuna and Pearl Oysters, are export-dominant. Across both wild-catch and aquaculture, about half of Australia's seafood volumes are exported.

Australia imports about \$1.3 billion worth of aquatic products annually, both edible and inedible.

These trade flows are large relative to the commercial sector's size, and the financial impact on industry from exchange rate fluctuations is therefore also substantial. The value of the Australian dollar declined between 1998–99 and 2000–01 to a low of US 50 cents, then rose consistently on the back of the commodities boom through to more than US 90 cents in late 2009. Currency movements and production volatility have caused Australian imports to rise in both tonnage and value since 2001. Exports have declined in value by \$700,000 and in volume by 20,000 tonnes during that time.

Increasing use of trade instruments, including free trade agreements, biosecurity requirements and health standards will require Australian exporters to demonstrate that they can meet these changing conditions of international trade.

**Figure 3: Distribution, tonnage and value of seafood exports and imports**

The returns on capital achieved by the great bulk of wild-catch fishing enterprises are poor relative to other rural and food industries. Available evidence suggests returns to aquaculture are higher, but the large working capital loads of some aquaculture ventures have presented added difficulties during the 2007–2009 global financial crises.

## Consumption

Australian seafood consumption continues to rise on a long-term trend. In 2000, domestic consumption was 11.33 kg per person with a projection of between 14.7 to 17.25 kg per person by 2020 (Fish Futures 2020 modeling study 2003, FRDC project 1999/160). Research shows that Australian consumers believe seafood is better for them than other foods, and that

they want to eat more seafood. They prefer to eat local seafood, but are generally unaware that about two-thirds of seafood consumed in Australia is imported. Consumers are showing an increased preference to purchase their seafood from supermarkets.

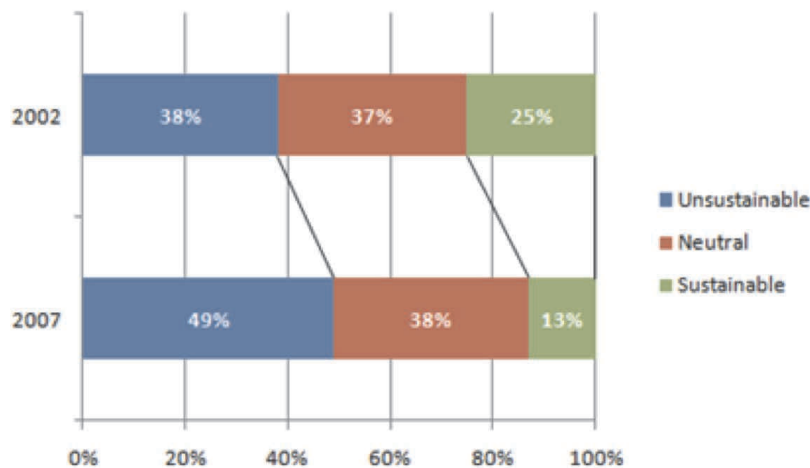
In terms of consumption of recreational fishing activity, industry experts believe the demand in Australia is relatively static, with participation dominated by 35-55 year old metropolitan males. Cheap access to technology provides an increasing array of alternative recreational options for all consumers.

## Public perceptions

Global fisheries experts and NGOs believe Australian wild-catch fisheries (commercial and recreational) are well managed and sustainable. However community research also confirms that Australians are increasingly concerned about the sustainability of wild-catch fishing.

Research has found that only 13% of the public believe that wild-catch fishing is sustainable in its current form. Apart from being a very low absolute figure, the number is only half the number of people who believed wild fisheries were sustainable in 2002. (A new data set to be released and incorporated early in 2010.)

With 38% of people in the recent survey being neutral, about half now believe wild-catch fishing is not sustainable compared with 38% in 2002.



**Figure 4: Australian public perceptions of the sustainability of wild-catch fishing, 2002 and 2007**

## Employment

ABARE's *Australian fisheries statistics 2008* (July 2009), page 27, cites Australian Bureau of Statistics (ABS) census data, August 2006, showing 6,108 people in various commercial wild-catch categories and 3,628 in aquaculture — totalling 9,736. A further 4,202 are cited as being employed in fish wholesaling and 2,001 in seafood processing, totalling 6,203. The grand total is 15,939.

However, significant obstacles stand in the way of unambiguously attributing employment to the fishing industry.

There is wide variability in the statistics from year to year. For example, ABS estimates from the Labour Force Survey (part of the Monthly Population Survey) indicated that commercial fishing employment in 2007–08 was 13,000 persons, more than 30 per cent higher than in 2006–07 but about 32 per cent lower than in 2000–01.

The Fisheries Research and Development Corporation has stated (in *Investing for tomorrow's fish: the FRDC's research and development plan, 2005 to 2010*, p.52) that "Data collected by the ABS is not broken down in sufficient detail to be very useful for planning or strategic purposes. The data also tends to under-report employees, including through attribution of some fishing industry activities to other industries such as transport and generalised food processing. For example, in 1998 the ABS recorded 22,400 people directly employed in "wild catch, aquaculture and processing" and during 2004 recorded 12,000 people in "commercial fishing" (comprising the same components). This data does not appear to be consistent and does not compare well with data collected in connection with the number of boats, fishing licences (e.g. 16,000 Australia-wide in 2004) and other forms of fishing regulation. Unfortunately, the latter sources are not sufficiently comprehensive to substitute for ABS data."

With respect to the aquaculture sector, the Aquaculture Industry Action Agenda in 2002 stated that the sector employs more than 7,000 people directly (ABS estimate: 5,050) and more than 20,000 people indirectly.

The break-down of the FRDC's conjectural estimate of direct-plus-indirect employment by sectors totalled: wild-catch 60,000; aquaculture 20,000; post-harvest 20,000–30,000.

For direct and indirect employment in the commercial sector beyond production and processing — i.e., in the transportation, storage, wholesaling and retailing sectors — the FRDC proposed a "conservative estimate" for 2005 of 20,000–30,000 people.

The resulting total was stated to be a "broad — but highly conjectural — estimate" of direct and indirect commercial sector employment between 100,000 and 120,000. This estimate included wild-catch, aquaculture and all post-harvest processes, including putative seafood components of transport, wholesaling, retailing and a small component of restaurant employment.

Consistent with the FRDC estimates, and taking into account reductions in the size of the wild-catch sector and expansion of the aquaculture sector since 2005, the estimates in table 2 — albeit highly conjectural, as for the FRDC figures, but broadly in line with industry estimates — are projected for 2010.

**Table 2: Estimates of direct and indirect employment by the commercial sector and related post-harvest activities**

	Wild-catch	Aquaculture	All post-harvest*	Total
Direct	20,000	10,000		
Indirect	30,000	20,000		
Total	50,000	30,000	20,000–30,000	100,000–110,000

\* Includes processing and putative transportation, storage, wholesaling, retailing and a component of restaurants

The employment generated in support of about 3.5 million Australians who participate in recreational and indigenous customary fishing is not known.

## Outlook for the industry

### Commercial wild-catch

A report to the FRDC Resource Working Group, *Evaluation the Performance of Australian Marine Capture Fisheries* (Ridge Partners 2009), estimated that under-performance in

Australian wild-catch fisheries (commercial and recreational) results in a loss to the Australian economy of about \$1 million per day. They have identified five action priorities to recover this loss:

- a more strategic approach to fisheries management
- clearer allocation of shares and rights to fishery users
- better collation and access to fishery data to inform the industry, managers and communities
- greater use of economics in decision-making by the industry and managers
- clearly defined harvest and management goals and strategies for each fishery.

Solutions to these challenges require:

- more collaboration among communities and their fishers to manage and monitor fishery use, allocation and performance
- support from management agencies in progressing fishery procedures from centralised and consultative approaches to collaborative and delegated approaches, including co-management
- uniform sustainability indicators and monitoring procedures across fisheries and jurisdictions
- more engagement by fishers with communities to plan and manage the resource, and for communities to see the significant benefits of well-managed commercial fisheries.

It is unlikely that the commercial wild-catch sector will be able to increase its catch in coming years. However, attractive development opportunities exist for wild-catch fisheries if fishers focus on efficiency and consumers. The focus for the sector must be on increasing harvest efficiency on the water, and on financial margins in the downstream seafood sector through market development and promotion.

## Aquaculture

In line with global trends, the aquaculture sector is expected to expand considerably unless constrained, especially by public policy. Growth will enable the operational margins and reinvestment needed for innovation and market development. However, as competition increases from imported aquaculture, Australian producers must have the operating scale, global technologies and human capacity to be internationally competitive — based on new differentiated products from Australia's growing environments. Producers also need to engage their communities to enable logical, sustainable growth to be planned and implemented. It is unlikely Australia will be able to compete on price alone. The aquaculture sector must:

- engage with local communities to increase awareness of aquaculture practices and demonstrate the sustainability, positive economic contribution and excellent products created by aquaculture — and in so doing secure endorsement to gain access to waters and natural resources
- align legislation across jurisdictions to motivate and promote efficient, sustainable investments by industry based on competitive advantages of regions and ecosystems
- continue to invest in innovation and closely monitor and adopt/adapt technologies available in advanced aquaculture operations worldwide
- jointly plan the development strategies for each species, and identify the key research areas that drive the strategic competitive advantages of that species.

Three-quarters of the value of Australian commercial fisheries is drawn from only seven key species. Other species will continue to emerge over the next decade. In the meantime, it is important that national investment in science, capacity development, biosecurity and information adequately safeguards these key species across their wild-catch, aquaculture, recreational and indigenous customary fishing domains.

## Recreational fishing

Australian communities continue to evolve economically and socially, in turn creating changes in the values and expectations of Australians, including their participation in recreational fishing. The recreational fishing sector's contribution to Australia is economically substantial (it directly contributes \$2.5 billion) and socially substantial (3.4 million Australians a year participate). However, it is reasonable to believe that the industry's contribution on both counts is undervalued because it is fragmented, often poorly described, and lacks the data and organisational capacity to demonstrate its substantial outputs and outcomes to the economy and the community.

Community demand for recreational fishing activity is broadly stable or slightly declining as competing recreational activities abound in Australian life. However, demand for some activities such as charter and tourism-related recreational fishing is growing. Lacking the mechanisms that can convert the large user base into organisational resources, the sector struggles to take up its full role in engaging communities, contributing to policy, and accessing and managing its share of the fisheries resource. This is crucial, as resource shares and access arrangements for recreational fishers will come under greater scrutiny.

Communities increasingly want to monitor fishing sector performance (both commercial and recreational) through quantifiable outcomes across environmental, demographic, economic and social indicators. Environmental indicators are in place for recreational fishing, and the demographic and economic data and tools exist but are yet to be organised and implemented. For example, there is still immaturity in tools to efficiently measure participation, catch and release by location and time, and economic activity for all parts of the direct and indirect recreational fishing supply chain.

Recent regional studies have made good progress in developing these tools and our understanding of the triple bottom line performance of Australia's fisheries. However, the social indicators that define tangible and intangible recreational outcomes from fishing are not well understood, and are the subject of much global research investment. Progress in this field must be monitored.

## Indigenous customary fishing

The indigenous customary fishing sector is now supported by legislation in all Australian jurisdictions. The development of harmonised language to describe and define the various activities of indigenous fishers (customary, commercial, aquacultural, recreational) has contributed to a more unified approach. The sector can now more efficiently move forward to establish the organisational frameworks, planning goals and investment priorities that will most effectively support the cultural and community values of Aboriginal and Torres Strait Islander people, including fishing. But the measures to indicate progress toward these goals must be more clearly defined.

A major constraint to implementing these goals is the lack of current comprehensive information about indigenous fishing communities, especially in northern Australia, and the relatively limited engagement on these issues with indigenous communities. Better engagement will bring greater trust and benefits for this sector.

The catch and main centres of this sector of the industry, as reported by the fisheries agencies of the states and Northern Territory, are shown in Figure 5.

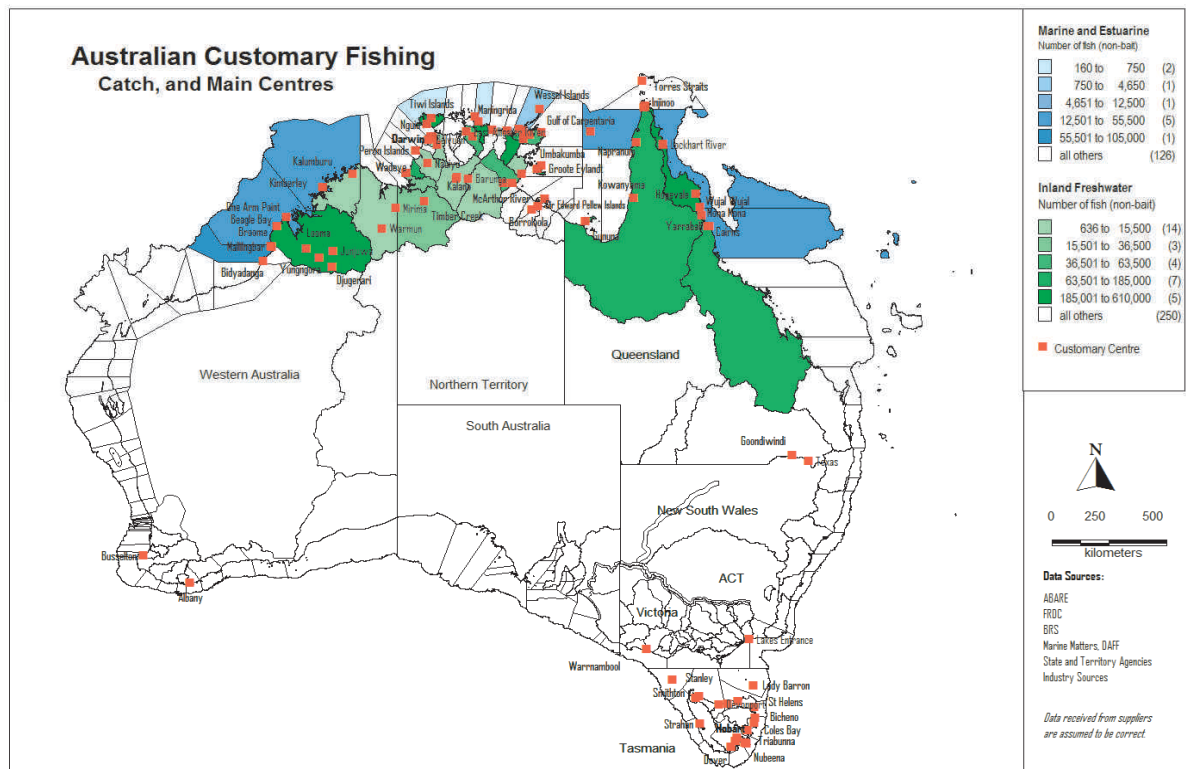


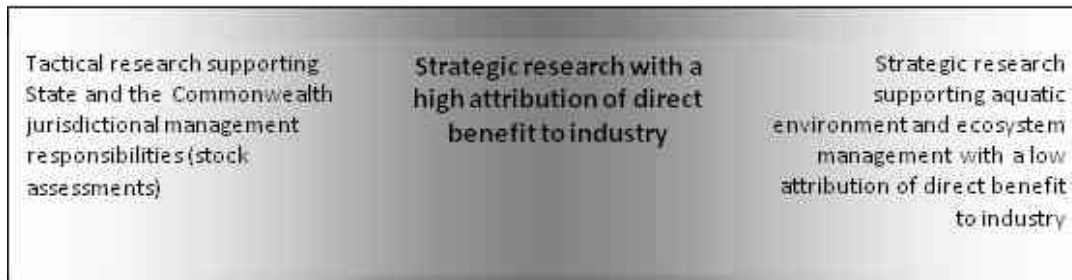
Figure 5: Indigenous customary fishing - catch and main locations .

# Analysis of fishing and aquaculture RD&E capability

## The 2010 RD&E capability audit

A comprehensive audit of current RD&E capability — human, infrastructure and investment — relating to the fishing and aquaculture industry was undertaken to support the development of this strategy, and has been published as a companion document. The scope for the audit included capability in research fields as broad as production systems, engineering and technology, social sciences, economics, post-harvest, environment and ecosystems as applied to fishing and aquaculture, and associated aquatic ecology and biodiversity. Major and specialist infrastructure was included.

**The RD&E capabilities supporting the Australian fishing and aquaculture industry cover probably the broadest range of any of Australia’s primary industries. This wide spectrum is represented in Figure 6.**

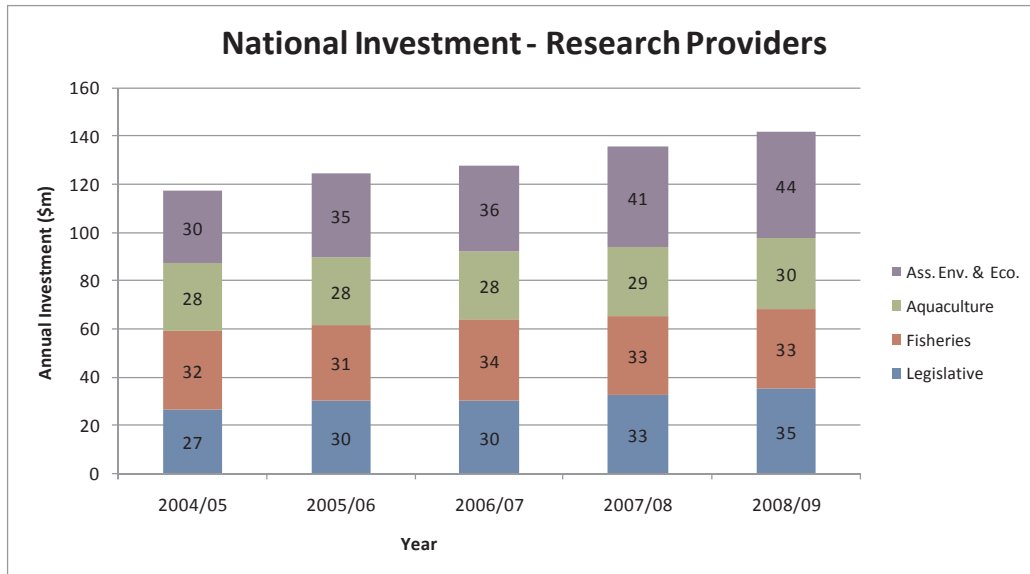


**Figure 6: Spectrum of RD&E capabilities supporting the fishing and aquaculture industry**

While the full spectrum of research is recognised and included in the capability survey, the main focus for this strategy is on the centre grouping: the strategic activities with a high attribution of direct benefit to the Australian fishing and aquaculture industry, acknowledging that the boundaries between these areas are not easy to define.

## RD&E investment

Key national research organisations (research providers) reported an average national annual investment of \$129 million for the five financial years 2004-05 to 2008-09 against the full spectrum of research. During this period investment increased in each year from \$117m in 2004/05 to \$142m in 2008/09. In each of the years reported, investment increased in stock assessments, and environmental and ecosystem research areas, with investment in Fisheries and aquaculture being relatively static.



**Figure 7: National RD&E investment (aquaculture, fisheries, legislated activities, associated environment and ecosystems)**

When investment attributed to associated environment and ecosystems is excluded, key national research providers reported an average annual investment of \$92m over these years. During this period, total investment increased each year from \$87m in 2004/05 to \$98m in 2008/09. This represents an increase of about 13%, matching the corresponding Consumer Price Index (CPI) increase over the same period.

The trend for rising investment in RD&E supporting stock assessment is worth highlighting, as it indicates increased management costs during a time when participation in wild fisheries has declined. This trend supports the need to deliver more efficient governance and regulatory systems, which is one of the strategy's research themes.

## Research infrastructure

Twenty eight research organisations provided information on infrastructure and capital items valued at more than \$100,000 per item, plus all research vessels, (table 3). An indication of available usage (latent capacity) was also provided. Reported infrastructure investment totalled in the order of \$323 million. Infrastructure is reported as largely fully utilised under current conditions.

As this strategy proposes a regional approach to implementation, it is useful to indicate where infrastructure is located in relation to these proposed regions (Figure 14). Infrastructure and capital items with a reported value of \$138m is located in the Northern region of Australia, \$52m in the Southwestern region and \$133m in the Southeastern region.

Item	Northern region				Southwestern region <sup>6</sup>				Southeastern region			
	Value <sup>a</sup>	No. <sup>b</sup>	Available (%) <sup>c</sup>		Value <sup>a</sup>	No. <sup>b</sup>	Available (%) <sup>c</sup>		Value <sup>a</sup>	No. <sup>b</sup>	Available (%) <sup>c</sup>	
			Min.	Max.			Min.	Max.			Min.	Max.
Accommodation	0.8	2	0	0								
Aquaculture equipment	0.3	1	0	0					0.2	1	100	100
Aquaculture ponds	11.4	5	2	100								
Aquarium facility	40.7	11	15	100	5.5	2	40	50	23.2	11	0	50
Biocontainment facility									7.6	2	0	10
Boatshed	0.2	1	0	0								
Education equipment									0.3	1	10	10
Hatchery	9.7	4	10	80	15.0	1	30	30	17.7	8	10	50
Laboratory	28.0	18	2	100	11.6	3	25	40	32.4	13	0	100
Laboratory equipment					0.3	2	20	20	1.3	3	0	90
Library									3.0	1	0	0
Microalgal biofuels									4.6	1	10	10
Photobioreactor									5.0	1	0	0
Recirculation system	4.5	3	20	20								
Research facility	16.4	3	15	15					2.5	1		
Research farm					1.0	1	0	0	5.0	2	30	60
Scientific equip. (field)	9.3	8	20	30	1.3	3	10	100	11.4	9	0	70
Supercomputer <sup>7</sup>											0	0
Vessels (< 5 metres)	0.3	17	5	50	0.1	4	0	0	1.7	49	0	80
Vessels (5 - 10 metres)	2.1	25	0	30	0.9	12	10	50	3.2	33	10	100
Vessels (10 - 20 metres)	1.0	1	20	20					2.4	3	20	95
Vessels (20 - 50 metres)	6.7	2	25	25	16.7	2	20	20	11.5	2	20	20
Vessels (> 50 metres) <sup>8</sup>										1	0	0
Weather Stations	0.2	7	0	0								
Wharf	1.9	1	0	0								
Workshop	4.1	4	0	0								
Total reported value	138				52				133			

Key: a – Estimated capital value (\$ m); b – Number of Items; c – Estimated available capacity

<sup>6</sup> SARDI, is included in the Southeastern region

<sup>7</sup> No value was provided for this item

<sup>8</sup> The capital value for the vessel *Aurora Australis*, which is chartered by the Australian Antarctic Division, is not included in this list

**Table 3: RD&E infrastructure and capital items >\$100,000, plus all research vessels**

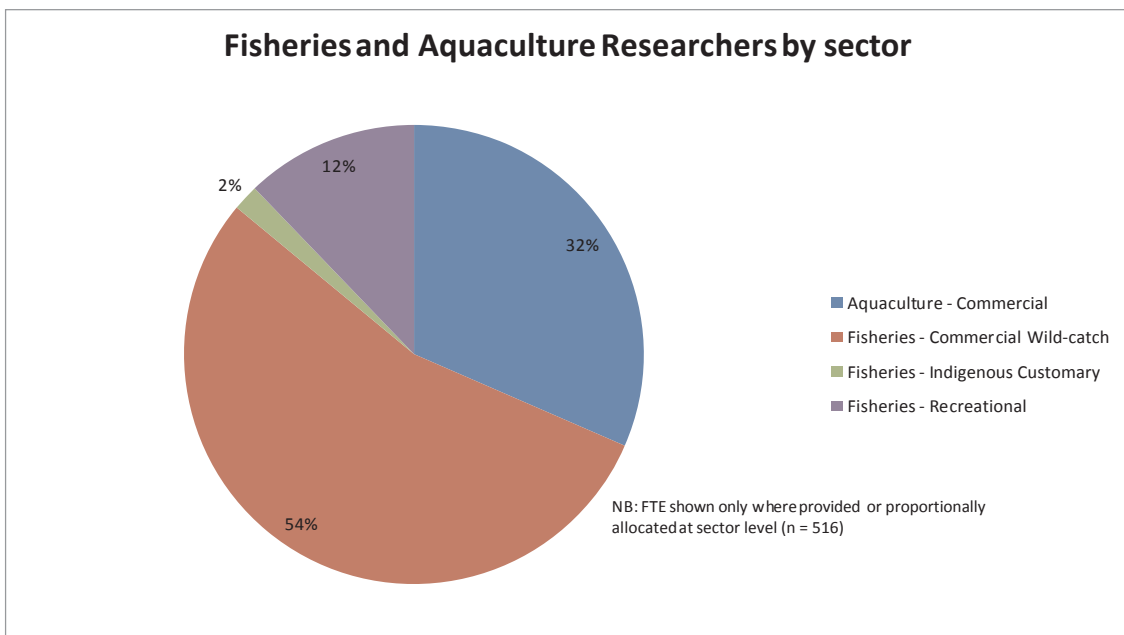
## Researcher capability

The number of full-time equivalent (FTE) researchers undertaking strategic research with a high attribution of benefit to the fishing and aquaculture industry are reported as 539. The number of FTE extension professionals was 68, of which:

- about 32 % working in aquaculture-focused disciplines
- 68% working in fisheries, further broken down as:
  - 54% of fisheries researchers are apportioned to commercial wild-catch sector
  - 12% for recreational sector
  - 2% for the indigenous customary sector.

When associated environment and ecosystems fields of research are included the number of FTE researchers and extension professionals is reported at 884 nationally.

Appendix 1 maps FTEs against the strategy's research themes.

**Figure 8: Fishing and aquaculture researchers by sector**

## Researcher capability at regional level

Figure 8 shows how the 607 FTE research and extension professionals (excluding those working in associated environment and ecosystem fields) are spread across the states and territories. As CSIRO staff are located nationally, a split of 70% Tasmania, 25% Queensland and 5% Western Australia is assumed.

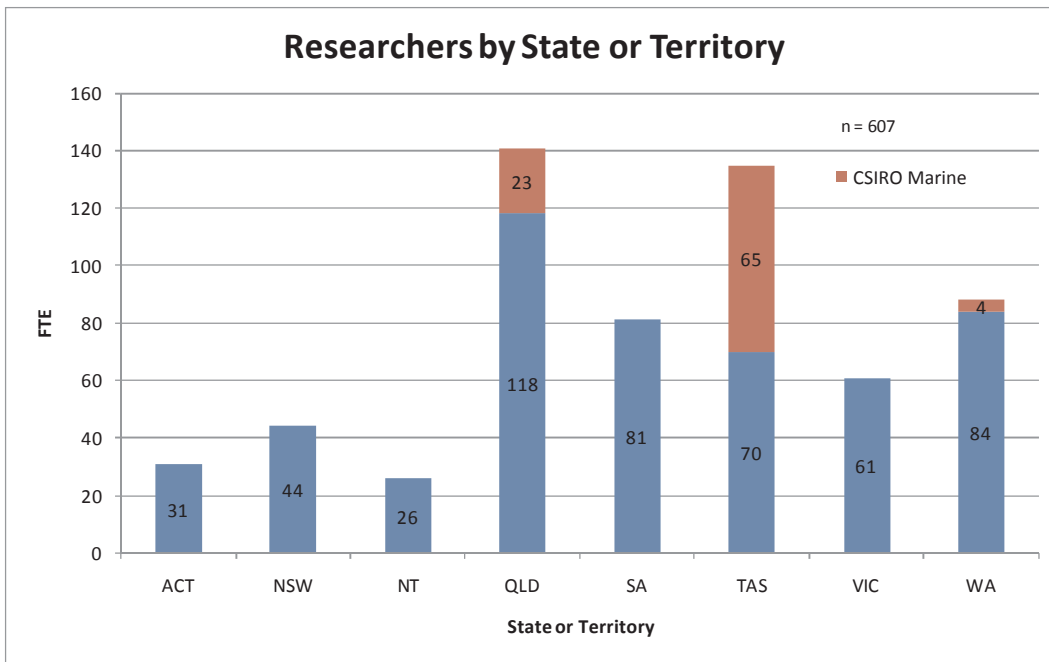


Figure 9: Research capability by state and territory

### Researcher capability by major institution type

Commonwealth research agencies, state governments and universities are all significant providers of research capability for the fishing and aquaculture industry. Of the 884 researchers reported across the research spectrum, 531 FTE research and extension professionals are employed by major institutions (those with ≥5 reported FTEs). (Figure 10).

Twenty-seven small (≤ 5 FTE) RD&E providers responded to a call for submissions to the audit. Many of these were small, private consultancies headed by specialist personnel. This sector is becoming increasingly important in provision of smaller RD&E projects with a specialist focus and a low reliance on infrastructure.

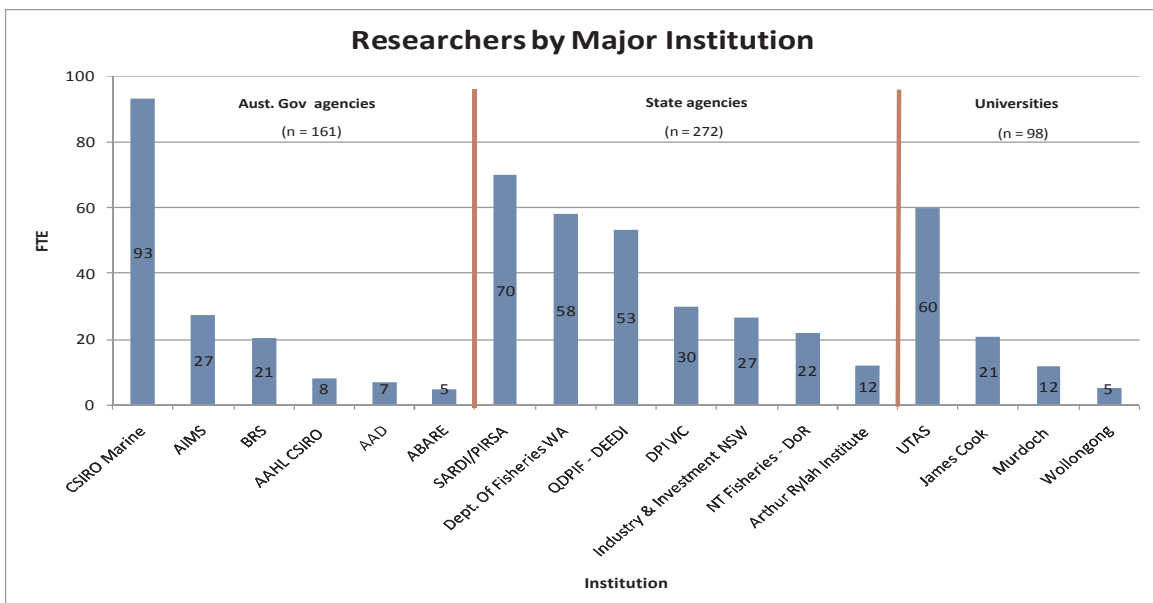


Figure 10: Research capability by major institution type

# National fishing and aquaculture RD&E needs

## Planned outcomes of the National Fishing and Aquaculture RD&E Strategy

Although investment in RD&E has been shown to provide significant benefits for fishing and aquaculture, stakeholders have traditionally undertaken planning and priority-setting on a sector or jurisdictional basis. Although there will always be specific important issues at these levels, significant alignment exists on national, strategic issues. This strategy moves fishing and aquaculture toward integrated planning particularly for national, market-driven, whole-of-value-chain priorities.

The primary outcome from the National Fishing and Aquaculture RD&E Strategy will be that:

the Australian community derives optimal economic, environmental and social benefits from its fishing and aquaculture resources.

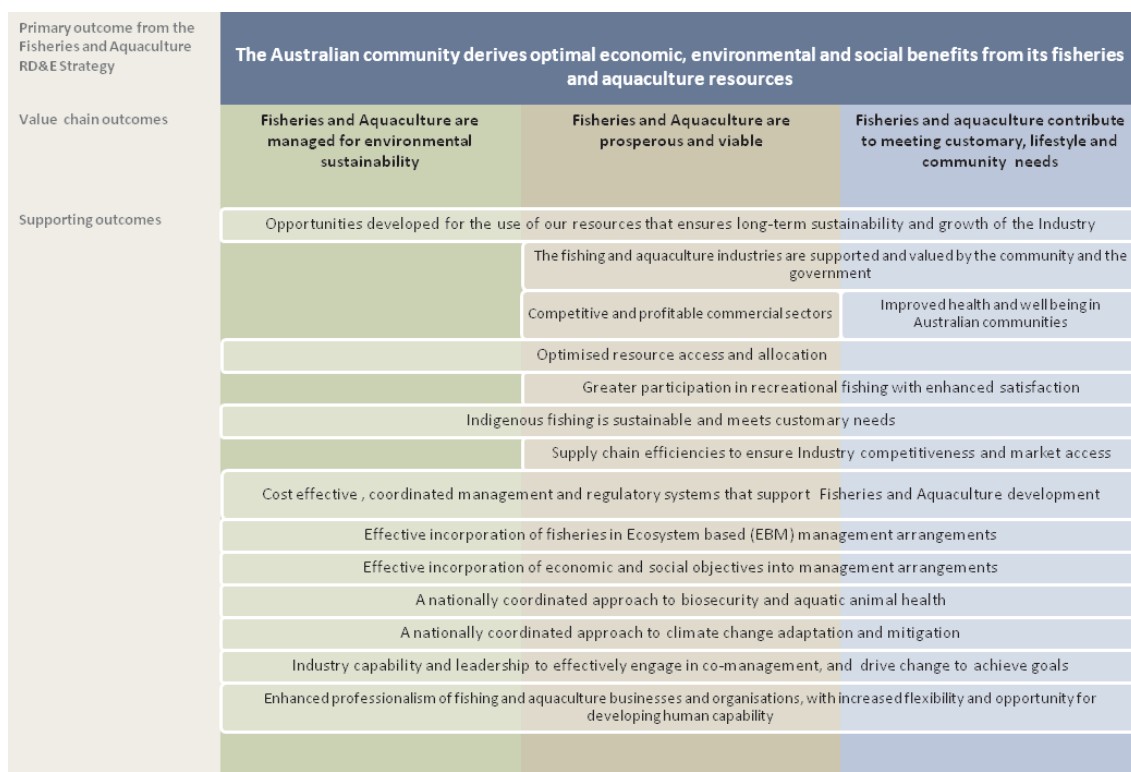
To achieve this outcome the following three “value chain” outcomes must be addressed by the Strategy:

Fishing and aquaculture is managed for environmental sustainability.

Fishing and aquaculture is prosperous and viable.

Fishing and aquaculture contributes to meeting recreational, indigenous customary, and community needs.

Within each area, “supporting outcomes” have been identified. They form the scaffold for determining the national research themes and priority research topics that complete the national RD&E planning structure and provide for performance measures to be set.



**Figure 11: Primary outcome, value chain outcomes and supporting outcomes from the National Fishing and Aquaculture RD&E Strategy**

## Strategic research themes and research topics

National strategic research themes are identified against the three value chain outcomes, and under each theme priority research topics as identified by stakeholders are detailed (figure 12). These themes are further expanded pages 26–34.

Although there is contextual variation across sectors, there is an enormous amount of commonality in stakeholder goals and RD&E needs. Similarly, there is considerable cross-over of themes between the three value outcome areas: for example, aquatic animal health is crucial to the viability and prosperity of the industry.

Although seven cross-sectoral strategies will be developed in the National Primary Industries RD&E Framework for Australian primary industries, this National Fishing and Aquaculture RD&E Strategy identifies the cross-sectoral issues that are critical to the fishing and aquaculture industry — namely biosecurity, animal welfare, biofuels and energy, and climate change and variability. This strategy provides detail on the key research topics identified as high-priority, noting that a significant task for implementation of this strategy will be to ensure alignment of those priorities with cross-sectoral plans.

Primary outcome	Value chain outcomes	Strategic research themes	Sector alignment				Cross value chain enabling strategies: Extension and adoption People development
			AQUACULTURE	COMMERCIAL FISHING	RECREATIONAL FISHING	CUSTOMARY FISHING	
<b>The Australian community derives optimal economic, environmental and social benefits from its fishery and aquaculture resources</b>	Fisheries and Aquaculture are managed for environmental sustainability	Biosecurity and aquatic animal health	✓	✓	✓	✓	
		Habitat and ecosystem protection	✓	✓	✓	✓	
		Climate change	✓	✓	✓	✓	
		Ecologically sustainable development	✓	✓	✓	✓	
		Governance and regulatory systems	✓	✓	✓	✓	
	Fisheries and Aquaculture are prosperous and viable	Resource access and allocation	✓	✓	✓	✓	
		Growth and profitability	✓	✓	✓		
		Maximising value from aquatic resources	✓	✓	✓	✓	
		Consumers and markets	✓	✓			
	Fisheries and aquaculture contribute to meeting customary, recreational and community needs	Community support for the industry	✓	✓	✓	✓	
		Community resilience and development	✓	✓	✓	✓	

**Figure 12: Snapshot of strategic research themes and research topics, and the priorities for each sector of the industry**

### Value chain outcome 1: Fishing and aquaculture are managed for environmental sustainability

**Strategic research theme:**

***Biosecurity and aquatic animal health – To develop methods and processes to protect fisheries, aquaculture sites and ecosystems from pests and diseases***

Pest organisms, including translocated species and pathogens, are an increasing threat to Australian fishing and aquaculture sectors and ecosystems. Conveyed by movement of live animals to, and within, Australia, interactions between cultured and wild stocks, increased global goods transportation and human travel, this risk will continue to rise in concert with globalisation. It is also predicted that climate change will increase the risk of pest and pathogen movement.

Australia’s fishing and aquaculture sectors need to develop the capability, systems, knowledge and technologies to prevent and reduce the incidence and impact of pests and disease on ecosystems, profitability and viability.

Priority areas for RD&E:

- enhancing knowledge of pests and diseases of commercial consequence  
Understanding attitudes and responses of industry (fishing, goods transportation and tourism etc.) to translocation threats.
- reducing pest and disease impacts on fishing and aquaculture businesses and the

environment

- developing capability, technology and processes to detect, prevent and respond to aquatic animal health pathogens and minimise risks through translocation
- R&D to support improved access to fit for purpose chemicals (AquaVet Chemicals) for the Australian aquaculture industry.

***Strategic research theme:***

***Habitat and ecosystem protection – To increase and apply knowledge of the effects of fishing, aquaculture, pollution, habitat destruction, and land based activities on fish and their aquatic habitats***

Changes in the broader environment directly affect the sustainability of regional habitats and ecosystems for aquatic species. Habitat integrity is a primary driver for the productivity of fisheries, the health of the catch and food safety. Habitat degradation and destruction, pollution, sediment run-off and urban development affect aquatic ecosystems and the fishing and aquaculture operations they support.

Globally, changing community values have placed the environmental performance of fisheries under scrutiny. There is a need to better understand the effects of fishing, aquaculture and other human activities on fish, aquatic habitats and ecosystems with the goal of minimising their impacts.

Priority areas for RD&E:

- understanding key food webs that support fisheries production and resilient aquatic ecosystems
- mitigating impacts of fishing and aquaculture on threatened, endangered and protected species, and on ecosystems
- reducing bycatch and discards, and better utilising previously discarded catch
- Understanding current responses and identifying behaviour modification options (where necessary) for industry and community in regard to ecosystem protection.
- replacing and optimising the use of fish meal in aquaculture diets
- designing improved and standardised environmental monitoring and management systems and technologies
- mitigating human catchment and coastal activities on aquatic habitats that support fishing and aquaculture activities, including improved land management practices and mitigation of chemical pollution.

***Strategic research theme:***

***Climate change – To develop knowledge, systems and processes to adapt to and mitigate the effects of climate change and variability***

A changing climate poses both challenges and opportunities for Australia's commercial wild-catch, aquaculture, recreational and indigenous customary sectors, and the communities in which they are based. Many indirect and as yet unforeseen impacts will change where and how people fish and farm in the future.

Priority areas for RD&E:

- understanding risk, opportunities and impacts of climate change on fishing and

aquaculture

- understanding the sensitivity and impacts of climate change on ecosystems, fish stocks and fishing and aquaculture communities
- understanding the adaptive capacity of stakeholders – both management and industry, and options to assist adaptation
- developing tools to assist fishing and aquaculture businesses and management to adapt to climate change
- understanding the effects of climate change policies such as an emissions trading scheme on the industry
- understanding and reducing the carbon foot print of industry.

***Strategic research theme:***

***Ecologically sustainable development – To develop knowledge, tools and processes to support responsible use and management of aquatic resources***

The harvesting of wild fisheries resources and development of aquaculture is conditional on management and production processes that minimise ecosystem impacts, and ensures maximum value for the community from use of the aquatic resource. The community's focus has changed from single-issue measures, to taking into account broader environmental and community interactions, and being cognisant of other users of the resource.

Priority areas for RD&E:

- developing technologies and models to underpin harvest strategy development, delivery and evaluation; including for data poor fisheries
- integrating social, environmental and economic considerations into fisheries management strategies

Identifying and understanding community aquatic values and how these can be integrated into fisheries management.

- developing performance indicators, including social, ecological and economic
- understanding the influence of oceanographic and ecological factors on fisheries — e.g., recruitment of fish stocks
- developing and adapting technologies and processes to better understand the impacts of aquaculture systems and to quantify carrying capacity
- developing practical tools for EBFM, and incorporating them into fisheries management plans
- implementation of environmental management systems, eco-labels and other schemes to foster user-stewardship of the resource.

***Strategic research theme:***

***Governance and regulatory systems – To deliver good public policy outcomes with reduced complexity and cost***

Good governance is recognised by stakeholders as essential to sustainable, profitable seafood industries and the fishing and aquaculture industry generally.

Regulatory systems need to be further developed to meet changing industry and community

aspirations and to be more flexible to adapt quickly to changing conditions.

A key driver is to look at innovative, cost-effective means of fisheries management that will also build cooperation and trust between regulators and fishers, and therefore confidence for investors and the community. For the wild-catch sectors this may include providing greater clarity in management objectives, more efficient data collection systems for reporting purposes (e.g. e-monitoring and log books), and research to support co-management, reduced complexity, cost-effective survey techniques, and indigenous customary fishing arrangements.

Priority areas for RD&E:

- developing governance models for better accountability, increased delegation of management functions to industry, and co-management
- developing and implementing tools and processes for data collection and monitoring to support flexible, adaptive, more responsive fisheries management
- integrating monitoring and reporting systems so as to reduce costs and complexity
- developing efficient multi-fishery and multi-sector management arrangements in Australia's bio-regions
- involving communities in fisheries management at the local and regional level (e.g. clarification of community and stakeholder expectations, monitoring, decision-making and implementation)
- developing and implementing cost-effective compliance systems, including targeting and performance assessment (technologies, incentives, disincentives and education).

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## **Value chain outcome 2: Fishing and aquaculture are prosperous and viable**

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***Strategic research theme:***

***Resource access and allocation – To optimise resource access and allocation opportunities for each sector of the fishing and aquaculture industry within a rights-based framework***

There is increasing competition for access to, and allocation of, aquatic resources. As society's values and activities change, there may be a need to adjust access and allocation of aquatic resources.

A significant part of the management challenge is to develop adjustment mechanisms that adjust allocation access shares between sectors, including access by non-extractive users.

Mechanisms to establish the economic, environmental and social value of activities, and processes to clearly establish the access rights of users have been shown to improve management outcomes and reduce conflict.

Priority areas for RD&E:

- developing and implementing methods for defining access rights and allocating shares
- developing and applying methods for valuing the resource (economically, socially and environmentally) for all sectors
- developing and applying adjustment and re-allocation mechanisms between sectors.

***Strategic research theme:******Growth and Profitability – To improve economic value and efficiency***

Growth and profitability of the commercial wild-catch and aquaculture sectors depends on innovation and implementation of technologies and processes to build efficiencies along the supply chain.

Aquaculture has strong growth prospects and will focus on domestication and breeding genetics for disease resistance and growth. The wild-catch sector has opportunities to improve operational efficiencies and add value to the catch, including through more efficient use of untargeted retained catch.

Opportunities may exist for boutique or heritage fishing operators in regional and urban areas, and some sections of the recreational and indigenous customary sectors seek to generate growth and become profitable from tapping into other markets such as regional tourism.

Priority areas for RD&E:

- developing new technologies and innovative processes
- developing improved business models and building business modelling skills
- developing new business opportunities and new products, including non-seafood products such as bio-actives and bio-fuels
- utilising domestication technologies for aquaculture species, particularly breeding genetics for disease resistance and growth, climate change and market attributes
- supporting operational efficiencies through improvements such as fuel efficiency, hull and gear technologies, and cost-effective technologies associated with compliance
- in the recreational sector, developing improved technology and knowledge to participate in recreational fishing activities.

***Strategic research theme:******Maximising value from aquatic resources – To enhance the social and personal value from fishing and aquaculture resources***

Value means different things to different sectors and it is important that all sectors of the fishing and aquaculture industry look for ways to maximise and improve the value of their resources, both for themselves and the general public.

In addition to the opportunities for increasing the economic value of the raw resources described under growth and profitability, there are also opportunities to improve the cultural, societal, spiritual, ceremonial and personal value enjoyed from the aquatic environment by recreational and indigenous customary fishers and by the broader community.

Value may also be enhanced through developing new methods to improve the productivity of the natural systems, replenishing the resource, or creating new resources that can be accessed and used.

Priority areas for RD&E:

- identifying and understanding community values of the resource and building this into management strategies
- enhancing fisheries through improved productivity of natural systems
- understanding the environmental interactions of stock enhancement technologies

- enhancing the recreational fishing experience through stock enhancement and the application of structures to enhance recruitment, including artificial reefs and snags
- understanding and enhancing indigenous customary fishing activities in Aboriginal and Torres Strait Islander communities.

***Strategic research theme:***

***Consumers and markets – To increase consumer satisfaction and build markets***

Consumers are important stakeholders of the fishing and aquaculture industry. For the commercial sector this means creating a consistent high-quality product, in a desirable form, that has good shelf life and is delivered via cost-effective, reliable mechanisms that deliver on consumers' requirements and expectations. In addition, consumers, particularly in OECD economies, are paying more attention to the food they eat, the value they get from it, and what it does for them and for the world around them. This means that the commercial sector must increase its knowledge of markets and supply chains, and look to develop new products specifically for their target market. Exploring and developing new niche export markets and demonstrating quality and credence values (e.g. food safety, environmental sustainability, animal welfare) will become increasingly important.

Priority areas for RD&E:

- maximising trade and market access opportunities
- understanding and responding to consumer trends and needs, including credence values, chain of custody and food safety
- understanding and disseminating the health benefits of seafood
- improving supply chain efficiencies and connectedness to the point of sale
- introducing consumers to new products.

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**Value chain outcome 3: Fishing and aquaculture contribute to meeting recreational, indigenous customary, and community needs**

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***Strategic research theme:***

***Community support – To increase support for the benefits of the three main sectors of the fishing and aquaculture industry***

The Australian community has a long-established relationship with the commercial sector and the natural resources on which it relies. However, the key drivers and motivations for the community can be very different from those of the sector because of joint use of and interest in these resources. Most people have some understanding of the health benefits of seafood; but this is only one small aspect of the industry. This theme provides the community with the information for a better understanding of the broader benefits of the industry.

Priority areas for RD&E:

- understanding community perceptions, the reasons for them, relation to reality, and the information needed to influence them
- understanding the value of Australian commercial fishing to the general public
- responding to community concerns about public health issues associated with seafood
- communicating the benefits and value of fishers and fishing (commercial, recreational)

and indigenous customary) to the community.

***Strategic research theme:***

***Community resilience and development – To build strong supporting communities***

Regional and rural communities are home to most of Australia’s primary industries. The long-term prosperity of many communities is interwoven with that of the fishing and aquaculture industry — and not only the commercial sector. Developing a better understanding of the interactions between users, community and the resource, and how they affect each other, is necessary before developing new strategies and approaches to minimise impacts and maximise social, environmental and economic benefits.

Priority areas for RD&E:

- developing a better understanding of the interactions between fishers and aquaculturists and the community
- understanding the social impacts of change within the industry’s business environments
- developing pathways to regional employment and community development (relevant to the commercial, recreational and indigenous customary sectors)
- valuing, communicating and developing opportunities based on the cultural and heritage value of fishing
- understanding the capacity of society to accept and incorporate higher levels of fishing and aquaculture activity, and how to assess and increase this carrying capacity
- understanding the nature and resilience of industry (social, demographic, economic and attitudinal) and identifying methods to increase resilience and adaptability
- understanding and predicting behavioural responses to management approaches
- building social capital between industry, management and the community.

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**Cross value-chain enabling strategy: People development - To develop the capabilities of the people to whom the industry entrusts its future**

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The fishing and aquaculture industry is geographically dispersed and fragmented, with a history of limited uptake of formalised training. Workforce profiles and dynamics are poorly understood, and there is a decline in vocational and post-secondary students entering related educational programs.. These factors limit the industry’s ability to meet the future need for technical, managerial, scientific, professional and semi-skilled people. The industry will need to learn from other industries that have embraced a knowledge and innovation culture, and develop skills that will directly improve business profitability and sustainability. Strategic approaches to attracting people to the fishing and aquaculture industry are required, and business managers need the management skills necessary to retain and optimise the workforce.

There is also a need to develop the skills and networks of leaders within all sectors to better understand the processes for decision-making and implementing change, and having the capacity to contribute to these processes.

Supporting the ability of all stakeholders to adapt to new circumstances and adopt innovations, technologies, and business frameworks will be critical to maximising investment

in research and development through adoption and extension activities.

Priority areas for RD&E:

- understanding and identifying opportunities to meet regional workforce needs, including attraction and retention of required technical, managerial, professional, semi-skilled and scientific capability
- identifying and understanding success drivers and factors in comparable industry and resultant opportunities for fisheries
- improving workplace health and safety
- developing the leadership skills across all stakeholder groups
- understanding and developing strategies to enhance, decision making and adoption practices
- developing business and business modelling capability
- building stakeholder capacity to move toward co-management of fisheries
- identifying and understanding factors that drive responsiveness or adoption of new practices and innovation and how these can be influenced
- building skills and networks that support knowledge transfer and R&D adoption
- building understanding, and commonality of objectives, between stakeholders, including researchers, managers, fishers and NGOs

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### **Cross value-chain enabling strategy: Extension and adoption – To create positive practice and attitudinal change through information transfer**

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This enabling strategy is especially concerned with bringing about positive change through extension and adoption of research outputs. Importantly, people involved in the change — the end-users of RD&E outputs — will be engaged in the processes for extension design and delivery. The theme is closely linked with people development.

The value of research and development from domestic and international sources can be greatly enhanced through effective management and delivery of adoption strategies. The main focus of the extension and adoption program is to ensure the timely delivery of accessible and accurate information to all stakeholders, including governments, managers, industry, the research community and the broader public.

Extension and adoption of research outputs also extends to the community. An example of public attitudes that are of concern to the industry is the public perception of the fishing and aquaculture industry's environmental sustainability. It is declining, despite significant improvements in environmental performance of Australian fisheries. This message presents considerable challenges for all wild fishers. Public perception and lack of trust also extends to aquaculture, affecting the sector's ability to gain access to new sites. The science and knowledge underpinning fishing and aquaculture decision-making needs to be clarified and communicated well to policy makers, industry, the community and special interest groups.

Priority areas for RD&E:

- identifying and understanding existing perceptions of fishing activity and management
- developing the methods to communicate key information about the fishing and aquaculture industry to the community

- capturing and transferring knowledge from domestic and international sources to industry and managers
- demonstrating the value and link between RD&E and profitability and sustainability
- understanding and designing appropriate communication and adoption and engagement systems for all sectors
- developing industry capacity to undertake adoption and extension
- evaluating the impacts and value of adoption and extension to continually improve performance.

## Key performance indicators

The success of the strategy will be measured by how well it is being adopted, as evidenced by:

- number of research themes being addressed
- number of collaborative arrangements for the provision of fishing and aquaculture RD&E that enhance the planned outcomes
- trends in sharing of RD&E capabilities, and trends toward specialisation in fishing and aquaculture RD&E
- progress against implementation milestones
- satisfaction in delivery of services and outcomes
- trends in engagement of Aboriginal and Torres Strait Islander people in customary, commercial and recreational fishing and aquaculture RD&E activities
- how well RD&E that is directly attributable to the strategy, delivers on trends in:
  - the unit value for seafood products
  - community perceptions of the acceptability of fishing in Australian waters.
  - participation in recreational fishing
  - engagement of Aboriginal and Torres Strait Islander people in cultural, commercial and recreational fishing and aquaculture RD&E activities
  - numbers of fisheries assessed as environmentally sustainable
  - aquaculture production

# Assessment of capability to meet RD&E needs

Full-time equivalent (FTE) staff working in each of the strategy's identified strategic research themes were calculated by mapping areas of expertise, as assessed using the survey matrix (see appendix 1).

In summary, the following trends are evident:

## Capability is currently adequate

### Habitat and ecosystem protection

Current capability is adequate, with no significant need for increased capability in the near term.

### Climate change

Current capability is adequate, with no significant need for increased capability in the near term. However, there are gaps in capacity for adaptation and reduction of carbon footprint. These capabilities are relevant to the people development program.

### Ecologically sustainable development

Current capability is adequate, with no significant need for increased capability in the near term.

### Governance and regulatory systems

Current capability is adequate, but with a near-term need to increase capability, especially in increasing cost-effectiveness of compliance with the increasingly complex ecosystem-focused, multi-fishery, multi-sector regulatory environment.

## Capability is currently inadequate

### Biosecurity and aquatic animal health

Current capability is inadequate, with a near term need to increase capability especially in the area of fish veterinary and pathology R&D.

### Resource access and allocation

Current capability is inadequate, with a near term need to increase capability especially in the area of social research to determine cross-sector issues, including non-extractive user expectations and the economic contribution of recreational and non-extractive user activity.

### Growth and profitability

Current capability is inadequate, with a near term need to increase capability in the area of increasing input efficiency of wild capture fisheries and post-harvest value adding is indicated.

### Maximising value from aquatic resources

Current capability is inadequate with a near term need to increase capability especially in the areas of understanding how value is perceived by non-commercial users and how this value can be increased

### **Consumers and markets**

Current capability is inadequate, with a near term need to increase capability especially in the areas of consumer trends and needs and promoting to those needs.

### **Community support**

Current capability is inadequate, with a near term need to increase capability especially in the areas of understanding and promoting the health benefits of seafood, and the behaviours, motivations and expectations of all users of living marine resources.

### **Community resilience and development**

Current capability is inadequate, with a near term need to increase capability especially in the areas of understanding community needs and drivers and how the building of true and sustainable social capital can be supported by the fisheries and aquaculture sectors.

### **People development**

Current capability is inadequate, with a near term need to increase capability especially in the area of understanding regional workforce drivers and needs, building capacity to adapt and innovate, and understanding the leadership gaps and drivers for the aquaculture and fisheries sectors.

### **Extension and adoption**

Current capability is inadequate, with a near term need to increase local and regional capability especially in the area of community understanding of and support for the aquaculture and commercial fishery sectors and an increased industry capacity to identify, commission and take up relevant outputs from R&D.

## **Addressing capability gaps**

For the Australian fishing and aquaculture industry to meet the challenges of the coming years increased RD&E capability will be required in several key areas. Some of this increased capability could be met through increased delivery efficiency (e.g. consolidation and/or centralisation of expertise), or accessing capability currently working in other sectors. This however, will not be enough.

Additional targeted, strategic investment will be required, particularly to encourage young, keen, skilled RD&E practitioners into the discipline areas that support the industry. Tertiary education is essential for the future of growth in primary industry, but entry into these fields is in decline. According to the Corish Report<sup>9</sup>, the rate of decline of students entering agricultural science fields is 9 percent in the 5 years to 2000 and a further 6 percent in the 4 years to 2004. It should be noted that that this trend appears consistent with the decline in enrolments in fisheries and aquaculture discipline areas.

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<sup>9</sup> Corish, P. (2006), *Creating our Future: Agriculture and Food Policy for the Next Generation*, Department of Agriculture Fisheries and Forestry

# Implementation structure and system

An effective structure, agreed to by stakeholders, with appropriate supporting systems, is imperative to the successful implementation and monitoring of the National Fishing and Aquaculture RD&E Strategy. This section describes the structures and process by which the fishing and aquaculture industry will:

- monitor and review long-term strategic RD&E needs and priorities
- promote and facilitate collaboration
- maximise sharing of capabilities and specialisation in RD&E
- monitor national RD&E capability
- improve extension capability
- monitor, evaluate and review the implementation of the strategy, and report to government and industry.

(It should be noted that the national fishing and aquaculture RD&E strategy creates the environment to allow further change to happen, but does not postulate the entirety of those changes.)

## Sharing of capabilities and specialisation in RD&E

A major driver for the National Primary Industries Research, Development and Extension Framework is that RD&E resources are finite and there is a need to rationalise delivery to make RD&E more efficient. The framework proposes that careful alignment of RD&E delivery will ensure that gaps in capability do not affect strategic areas of need.

For jurisdictions with significant capability in a particular R&D field and major industry, it may be determined that they will take a major role and specialise in that field of R&D. For another jurisdiction with lesser capability but with strategic interest, it may be determined that it will take a supporting role in the provision of RD&E in that particular field. Jurisdictions without R&D capability in a particular R&D field but still requiring R&D in that field will link up, deriving their R&D needs from jurisdictions with major capability.

When Primary Industries Standing Committee state and territory members were asked, during the development of this strategy, to nominate who would “major, support or link (M-S-L)” in the provision of RD&E for fishing and aquaculture, all parties nominated a major role, including CSIRO. This is not surprising given the strong link between fisheries science and the provision of advice to jurisdictional ministers on wild capture fisheries management. Nevertheless, there was recognition that within the intention to take a major role, this related to specific areas of the fishing and aquaculture industry. Some jurisdictions indicated major support for their regions (northern, south-west or south-east), or for activity (recreational, indigenous, finfish aquaculture, and specific large fisheries e.g. Abalone).

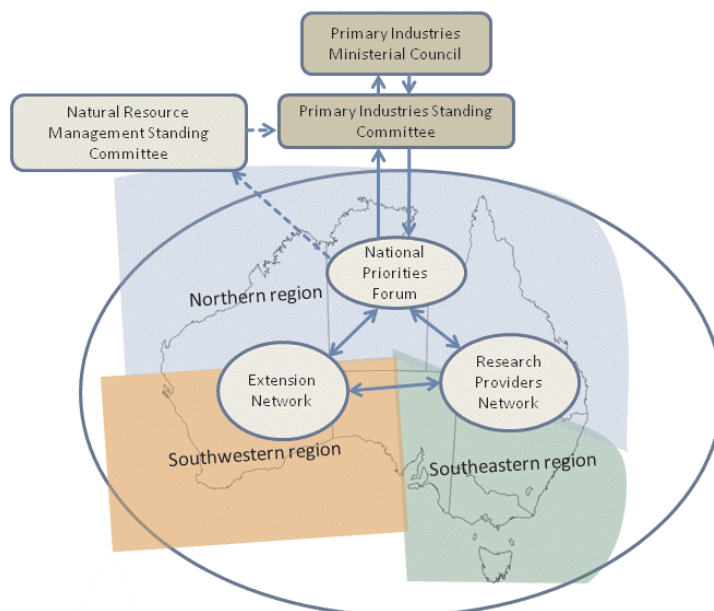
The strategy also recognises that there is a need to differentiate the particular needs of the various sectors, commercial, recreational and indigenous where they have no common overlap. For example, the seafood supply chain is particular only to the commercial fishing and aquaculture industry.

## Linking the national and the regional

To progress the implementation of M-S-L the stakeholders have indicated two mechanisms they would support. The two mechanisms are:

1. Establish a regional approach that is consistent with the environmental distribution of major fisheries. This is diagrammatically shown in Figure 13. The diagram shows 3 regions, northern, south-west and south-east. The lines are for demonstration only and would not reflect the pragmatic approach to regional RD&E. For example Southern Rocklobster has a distribution beyond the western border of the south-east region.
2. Establish national areas of expertise that are based more on scientific disciplines or functional approaches. Stakeholders have nominated that the intention is that species specific specialisation will occur at the regional level, and that at the national level specialisation will occur around areas such as bio-security, ecosystem fisheries models (e.g. Atlantis) and seafood product development.

The Fisheries Research and Development Corporation has agreed that it will adopt the above two mechanisms in its RD&E investment policy. This will mean that there will be a financial incentive for organisations to develop research around either regional or national collaborations. FRDC's policy will also support agreed areas of specialisation, for example FRDC has been working with South Australia, Tasmania and Victoria to develop a single specialised approach to Southern Rocklobster RD&E. FRDC supports jurisdictional Fisheries Research Advisory Bodies (FRABs) that will continue under the new strategy. The operating instructions for FRABs will be changed to encourage them to develop planning and evaluation process that have a regional and national basis where appropriate. Further, FRABs will be encouraged to support specialised research organisations.



**Figure 13: Key structures to deliver and monitor the National Fishing and Aquaculture RD&E Strategy**

## Strengthening partnerships, building networks

The implementation structure and system to deliver and monitor the National Fishing and Aquaculture RD&E Strategy enhances government and industry relationships. The structure has a new emphasis on networking of research and extension providers, which has been a significant gap to date. In addition to a national priorities forum, the structure includes a new extension network and research network. These structures are described below.

This strategy recognises that many major collaborative arrangements already operate within and across regions. As examples, the Department of Fisheries WA lists 7 state-wide and 43 regionally based collaborative research projects; and the Department of Employment, Economic Development and Innovation Queensland lists about 60 collaborations at the project level with other agencies (CSIRO, inter-state jurisdictions, universities), mostly within Australia but also internationally. The South Australian Research and Development Institute has built strong collaborative partnerships with other state fisheries agencies, including DPI Victoria, NT Department of Resources, Innovation and Investment NSW, and with national agencies such as CSIRO Marine and Atmospheric Research.

In progressing implementation, where existing arrangements are in place, and operating effectively, these will be supported. Appendix 2 highlights examples of major cross-jurisdictional collaborative agreements.

## Key structures

### ***National Priorities Forum***

FOCUS	National RD&E strategy and issues  Foster an operating climate that encourages national and regional RD&E coordination and collaboration
ROLES	A high level stakeholder partnership to:  Set and review national RD&E priorities to ensure the strategy remains relevant to stakeholders  Seek alignment / intersection of priorities among stakeholders  Negotiate and consult on agreed Major-Support-Link positions for each jurisdiction  Negotiate on capacity and RD&E investment decisions to deliver on national RD&E plan  Foster existing and encourage new alliances and partnerships (national and regional)  Support national and regional collaborative processes for planning, consultation, funding and delivery of RD&E  Drive research concepts to address National RD&E plan themes
REPORTING	Primary Industries Standing Committee / Primary Industries Ministerial Council

MEMBERSHIP	<p>Aboriginal or Torres Strait Islander delegate</p> <p>Senior Officers of Commonwealth, State and Territory fisheries agencies (or their senior delegate)*</p> <p>Commonwealth Fisheries Association</p> <p>Fisheries Research and Development Corporation</p> <p>National Aquaculture Council</p> <p>National Seafood Industry Alliance nominee</p> <p>Recfish Australia</p> <p>Chair of Researcher Providers' Network**</p> <p>Notes</p> <p>* Jurisdictions may choose whether or not to participate directly, subject to there being at least one lead agency member from each of the 3 regions (Fig. 13). Those jurisdictions that choose not to be a forum member may participate as an observer at forum meetings (i.e. to keep abreast of any emerging proposals), but are otherwise expected to build and maintain a close working relationship with the relevant regional representatives. (NB. Each jurisdiction retains sovereign authority to endorse, or otherwise, the forum's recommendations).</p> <p>** In the first year of implementation CSIRO will Chair the Researcher Providers' network</p> <p>Forum meetings are open to other interested parties, at own cost.</p> <p>Membership will be reviewed after first year of implementation</p> <p>Membership may be adjusted to achieve Forum's roles, and this may include broadening membership</p>
CHAIR	<p>Independent Chair, to be nominated by the Strategy Working Group</p> <p>Independent Chair role will be reviewed after first year of implementation</p>
FUNDING / SUPPORT	<p>FRDC to provide administrative and financial support to facilitate implementation and ongoing services to the strategy, and industry attendance at meetings</p>
MEETS	<p>Two to four times in the first year, then twice annually in conjunction with AFMF meetings where possible</p>

FIRST YEAR ACTIONS	<p>Development of possible national and regional processes, governance arrangements for collaboration, including funding of activities</p> <p>Negotiate and consult to confirm Major-Support-Link relationships</p> <p>Align fisheries and aquaculture priorities, and actions to address, with relevant cross-sectoral plans</p> <p>Develop reporting framework</p> <p>Develop refinements to RD&amp;E funding model to encourage national and regional consolidation and/or specialisation</p> <p>Organise National Fishing and Aquaculture Extension Network Forum</p> <p>Organise National Fishing and Aquaculture Research Provider Network Forum</p> <p>Develop strategy for improved representation and engagement with all sectors, and in particular indigenous stakeholders</p> <p>Oversee communications for strategy implementation</p> <p>Report to PISC, communicate with NRMSC</p>
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### ***Research Providers Network***

FOCUS	Encourage and foster existing and new regional RD&E coordination and collaboration, and optimise RD&E resource sharing
ROLES	<p>Negotiate on capacity and infrastructure investment decisions to deliver on national RD&amp;E plan</p> <p>Establish international linkages</p> <p>Determine the research needed and develop research concepts to address themes of the national RD&amp;E plan</p> <p>Seek opportunities to improve extension and adoption of research outcomes</p>
REPORTING	Reports to National Priorities Forum
MEMBERSHIP	<p>Research heads of state agencies, CSIRO, BRS, AIMS, universities, FRDC, Extension Network representative, Chair AFMF SSR, private providers, other research organisations, DAFF, NCARF, CERF; nominee of NSIA</p> <p>(Membership may be adjusted to achieve the network's roles)</p>
RESPONSIBILITY	<p>National Priorities Forum, members</p> <p>Nominated chair (In the first year of implementation CSIRO will Chair the network)</p>
FUNDING / SUPPORT	FRDC support for industry attendance in the first year
MEETS	<p>Annually</p> <p>Scope to meet regionally or on the basis of common interest in a particular research theme</p>

Note: in the implementation, a more collective approach will be taken to working with universities; the Excellence in Research for Australia (ERA) Initiative may drive change; and

RD&E investment will also encourage change.

### **Extension Network**

FOCUS	Enhance adoption and extension of R&D outcomes
ROLE	<p>Scan current and completed research and collaborate with FRDC and research providers to develop high-impact extension and adoption strategies</p> <p>Deliver funded strategies</p> <p>Identify opportunities to develop network capacity and skills of extension professionals</p> <p>Provide advice and guidance to the FRDC People Development Program on development programs to support adoption outcomes</p>
REPORTING	<p>Reports to National Priorities Forum</p> <p>Advises regional forums, FRDC</p>
MEMBERSHIP	State agencies, FRDC, SeaNet, SSA, universities and vocational training providers, discovery centres, Research Network representative, AFMF communicators, NAC, CFA, RA, NSIA representatives
RESPONSIBILITY	<p>National Priorities Forum and members</p> <p>Rotating nominated chair</p>
FUNDING / SUPPORT	FRDC support for industry attendance in the first year
MEETS	Annually

# Consultation and approvals

## Key stakeholders

Key stakeholders in the National Fishing and Aquaculture RD&E Strategy are:

- Australian Fisheries Management Authority
- Australian Government Department of Agriculture, Fisheries and Forestry
- Commonwealth Fisheries Association
- Commonwealth Scientific and Industrial Research Organisation
- Department of Employment, Economic Development and Innovation, Queensland
- Department of Fisheries, WA
- Department of Primary Industries, Victoria
- Department of Primary Industries, Parks, Water and Environment, Tasmania
- Department of Resources NT
- Fisheries Research and Development Corporation
- Industry and Investment NSW
- National Aquaculture Council
- National Seafood Industry Alliance
- Primary Industries and Resources SA
- Recfish Australia

## Communication

Key stakeholders will be responsible for securing endorsement of the strategy from their respective organisations.

## Agreement

The key stakeholders agree to work collaboratively and cooperatively to develop and implement the National Fishing and Aquaculture RD&E Strategy by:

- freely sharing the knowledge generated by publicly funded RD&E effort and minimising barriers to RD&E effort created by intellectual property protection
- providing timely and ready access to knowledge and information to facilitate extension and adoption of research to all potential end-users
- working collaboratively to improve access to national research capability (people and infrastructure) by industry and R&D partners across Australia
- working cooperatively to improve the administrative processes and effectiveness of information sharing and management
- encouraging, and wherever possible supporting, engagement by all stakeholder groups in the implementation of the strategy
- working collaboratively with stakeholders and other RD&E providers and jurisdictions to address stakeholder RD&E priorities, and retain and build national capability to

address future needs

- building on existing RD&E evaluation frameworks to develop monitoring and evaluation criteria to review the performance of the strategy
- encouraging and fostering regional RD&E coordination and collaboration
- contributing to an annual report on progress toward achieving the outcomes sought from the strategy and identifying solutions to overcoming identified blockages or delays to achieving them
- within three years from commencement, contributing to an independent review of the strategy, including the effectiveness in achieving its stated outcomes.

## Implementation steps

The next steps in the implementation of the strategy are as follows.

Planned delivery date	Action	Responsible parties/working groups
1 April 2010	Strategy approved by PIMC.	Strategy working group to table
3 May 2010	First meeting of National Fishing and Aquaculture RD&E Priorities Forum Key initial tasks (to be delivered subsequently): <ul style="list-style-type: none"> <li>☐ Alignment of strategy and jurisdictional research priorities, and actions to address, with relevant cross-sectoral plans</li> <li>☐ Develop reporting framework</li> <li>☐ Develop refinements to funding model to reinforce regional collaboration, consolidation and specialisation</li> <li>☐ Organise National Fishing and Aquaculture Extension Network Forum</li> <li>☐ Organise National Fishing and Aquaculture Research Provider Network Forum</li> <li>☐ Oversight of sectoral communications about strategy implementation</li> <li>☐ Confirm reporting requirements and timelines</li> </ul>	National Priorities Forum
30 June 2010	<ul style="list-style-type: none"> <li>☐ Develop criteria and transitional arrangements for RD&amp;E consolidation and specialisation by providers</li> <li>☐ Develop regional case studies (Southern Rocklobster for south-east, Bight Redfish for south-west / Commonwealth, pearls for northern region)</li> </ul>	National Priorities Forum
1 August 2010	Centre of Excellence for Indigenous Fishing scoped and funded	FRDC / Department of resources NT
1 September 2010	First meeting of Research Provider Forum	Nominated network chair / FRDC
1 November 2010	First meeting of Fishing and Aquaculture Extension Forum	FRDC / SeaNet / nominated industry council

1 July 2011	Progress Report to PISC and others	National Priorities Forum
1 July 2011	<p>Agreement on which organisations will specialise in which research areas in each region</p> <ul style="list-style-type: none"> <li>☐ Set criteria for specialisation</li> <li>☐ Develop process/contractual agreements for services to be provided.</li> <li>☐ Possible areas for specialisation are nutrition, genetics, aquatic animal health and gear research. These are areas of research that have clear lead agencies and that are achievable early.</li> </ul>	National Priorities Forum, and involving research providers and stakeholders in each region
1 July 2011	FRDC funding model adjusted to encourage and support collaboration aligned with the strategy	FRDC

## Appendix 1: Current and future fishing and aquaculture capability to address strategic research themes

Data collected in the capability survey was mapped against the findings of the related Ridge Partners study – Overview of the Australian Fishing and Aquaculture Industry: present and Future (2010) as a means of assessing whether current RD&E capability against each of the Fishing and Aquaculture RD&E Strategy research theme is currently “Adequate” or “Inadequate”, and whether an increase in RD&E capacity will be required in the short (1-5yr) or medium (5-10yr) term. The resulting analysis was further tested by agency heads and approximately twenty other nominated experts.

Strategic Research Theme (SRT)	Current FTE	Trends & future sector requirements and priority research topics <small>(based on data from capability audit, the related Ridge Partners Sector Overview &amp; draft Fisheries &amp; Aquaculture RD &amp; E Strategy)</small>	Capability assessment		
			Now	1 - 5 y	5 – 10 y
Biosecurity and aquatic animal health	30.0	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> <li>▪ Taxonomy; Fisheries Biology / Ecology; Aquatic Animal Health.</li> </ul> <p>Priority research topics**</p> <ul style="list-style-type: none"> <li>• Enhancing our knowledge of pests and diseases of commercial consequence [Aqua, Com]</li> <li>• R&amp;D to support changes to Biosecurity Australia policies and processes that improve market access and protect Australian industries from disease incursions [Aqua, Com]</li> <li>• Reducing pest and disease impacts on fishing and aquaculture businesses and the environment [Aqua, Com]</li> <li>• Developing capability, technology and processes to detect, prevent and respond to aquatic animal health pathogens and minimise risks through translocation [ALL]</li> <li>• R&amp;D to support changes to APVMA policies and processes that provide for improved access to fit for purpose chemicals [Aqua, Com]</li> </ul>	Inadequate	↑	→

<p>Habitat and ecosystem protection</p>	<p>112.0</p>	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> <li>▪ Taxonomy; Fisheries Biology / Ecology; Data Management / Programming; Stakeholder Surveys / Logbooks; Fish Surveys; Biometrics / Statistics; Fisheries Modelling; Aquatic Animal Health; Environmental impacts (incl bycatch); Oceanography; Hydrology; Chemistry / Biogeochemistry; Habitat Mapping; Benthic Ecology; Freshwater Ecology; Ecosystem Modelling; Gear Technology; Observational Technology.</li> </ul> <p>Priority research topics</p> <ul style="list-style-type: none"> <li>• Understanding key food webs that support fisheries production and resilient aquatic ecosystems [ALL sectors]</li> <li>• Mitigating impacts of fishing on threatened, endangered and protected species [Com]</li> <li>• Reducing by-catch and discards, and better utilisation of previously discarded catch [Com]</li> <li>• Replacing /optimising the use of fish meal in aquaculture diets [Aqua]</li> <li>• Designing improved and standardised environmental monitoring and management systems and technologies [Aqua]</li> <li>• Mitigating human catchment and coastal activities on aquatic habitats, including habitat rehabilitation and improved land management practices [ALL sectors]</li> </ul>	<p>Adequate</p>	<p>→</p>	<p>→</p>
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Climate change	102.1	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> <li>▪ Taxonomy; Fisheries Biology / Ecology; Data Management / Programming; Stakeholder Surveys / Logbooks; Fish Surveys; Biometrics / Statistics; Fisheries Modelling; Aquatic Animal Health; Biosecurity; Environmental impacts (incl bycatch); Oceanography; Hydrology; Chemistry / Biogeochemistry; Habitat Mapping; Benthic Ecology; Freshwater Ecology; Ecosystem Modelling; Social Impact and Assessment; Observational Technology.</li> </ul> <p>Priority research topics</p> <ul style="list-style-type: none"> <li>• Understanding risk, opportunities and impacts of climate change on fisheries and aquaculture [ALL sectors]</li> <li>• Understanding the sensitivity and impacts of climate change on ecosystems, fish stocks and fishing communities [ALL sectors]</li> <li>• Understanding the adaptive capacity of stakeholders – both management and industry [ALL sectors]</li> <li>• Developing tools to assist fisheries and aquaculture businesses and management to adapt to climate change [Aqua, Com]</li> <li>• Understanding and reducing the carbon foot print of industry [Aqua, Com]</li> </ul>	<b>Adequate</b>	→	→
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<p>Ecologically Sustainable Development</p>	<p>220.0</p>	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> <li>▪ Taxonomy; Fisheries Biology / Ecology; Data Management / Programming; Stakeholder Surveys / Logbooks; Fish Surveys; Biometrics / Statistics; Fisheries Modelling; Environmental impacts (incl bycatch); Oceanography; Hydrology; Chemistry / Biogeochemistry; Habitat Mapping; Benthic Ecology; Freshwater Ecology; Ecosystem Modelling; Observational Technology; Economic Surveying; Economic Assessment; Social Assessment; Economic Modelling.</li> </ul> <p>Priority research topics</p> <ul style="list-style-type: none"> <li>▪ Developing and implementing efficient and effective data collection and monitoring processes (e.g. electronic log books, fishery dependent data, remote observation systems) [Com]</li> <li>▪ Developing technologies and models to underpin harvest strategy development, delivery and evaluation; including for data poor fisheries [Com]</li> <li>▪ Integrating social, environmental and economic considerations into fisheries management strategies [ALL sectors]</li> <li>▪ Developing performance indicators - including social, ecological and economic [ALL sectors]</li> <li>▪ Understanding the influence of oceanographic and ecological factors on fisheries e.g. recruitment of fish stocks [Com, Rec, Cust]</li> <li>▪ Developing technologies and processes to better understand the impacts of aquaculture systems and to quantify carrying capacity [Aqua]</li> <li>▪ Developing practical tools for EBFM, and incorporating them into fisheries management plans [Com, Rec, Cust]</li> <li>▪ Implementation of environmental management systems, eco-labels and other schemes to foster user-stewardship of the resource [Aqua, Com]</li> </ul>	<p>Adequate</p>	<p>→</p>	<p>→</p>
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<p><b>Governance &amp; regulatory systems</b></p>	<p>54.0</p>	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> <li>▪ Fisheries Assessment; Ecosystem Modelling; Economic Surveying; Economic Assessment; Social Surveying and Assessments; Economic Modelling; Governance and Management; Fisheries Law; International Governance and Management.</li> </ul> <p>Priority research topics</p> <ul style="list-style-type: none"> <li>• Developing delegation and accountability governance models [ALL sectors]</li> <li>• Developing tools and techniques to support flexible, adaptive and more responsive fisheries management [Com]</li> <li>• R&amp;D to support the development of formal arrangements for responding to disasters and biosecurity emergencies [ALL sectors]</li> <li>• Integrating monitoring and reporting systems so as to reduce costs and complexity [Aqua, Com]</li> <li>• Developing efficient multi-fishery and multi-sector management arrangements in Australia’s bioregions [Com, Rec, Cust]</li> <li>• Involving communities in fisheries management at the local and regional level (e.g. monitoring, decision making and implementation) [Com, Rec, Cust]</li> <li>• Developing and implementing cost effective compliance systems, including targeting and performance assessment (incentives/disincentives and education) [ALL sectors]</li> </ul>	<p>Adequate</p>	<p>↑</p>	<p>→</p>

<p>Resource access and allocation</p>	<p>23.3</p>	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> <li>▪ Stakeholder Surveys / Logbooks; Biometrics / Statistics; Fisheries Assessment; Resources Allocation; Economic Surveying; Economic Assessment; Economic Modelling; Social Surveying/assessment and modelling.</li> </ul> <p>Priority research topics</p> <ul style="list-style-type: none"> <li>▪ Developing and implementing methods for defining access rights and allocating shares [ALL sectors]</li> <li>▪ Identifying competing values and negotiating acceptable outcomes [ALL sectors]</li> <li>▪ Developing systems and models to underpin aquaculture planning and development, including for data poor environments and systems and where interactions with fisheries are likely to occur [ALL sectors]</li> <li>▪ Developing and applying methods for valuing the resource for all sectors [ALL sectors]</li> <li>▪ Developing and applying adjustment and re-allocation mechanisms between sectors [ALL sectors]</li> </ul>	<p>Inadequate</p>	<p>↑↑</p>	<p>→</p>
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<p>Growth and profitability</p>	<p>143.4</p>	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> <li>▪ Hatchery / Nursery; Growout / Production; Broodstock Management; Feed and Nutrition; Genetics and Genomics; Aquaculture Systems and Polyculture; Gear Technology; Aquatic Engineering; Economic Surveying; Economic Assessment; Economic Modelling; Social (Impact) Assessments; Social Surveying; Commercialisation; Seafood Processing; Seafood Safety.</li> </ul> <p>Priority research topics</p> <ul style="list-style-type: none"> <li>▪ Developing improved business models, and building business modelling skills [Aqua, Com]</li> <li>▪ Identifying supportive communities/environments for new business endeavours [Aqua, Com]</li> <li>▪ Developing new business opportunities and new products, including non-seafood products such as bio-actives and bio-fuels [Aqua, Com]</li> <li>▪ Domestication technologies for aquaculture species, particularly breeding genetics for disease resistance and growth, climate change and market attributes [Aqua]</li> <li>▪ Supporting operational efficiencies [Aqua, Com]             <ul style="list-style-type: none"> <li>o Fuel efficiency</li> <li>o Hull design</li> <li>o Anti-foulant technologies</li> <li>o Reducing fresh water use in the processing sector</li> <li>o Gear technologies to reduce costs</li> <li>o Technological development for cost-effective compliance</li> </ul> </li> </ul>	<p>Inadequate</p>	<p>↑</p>	<p>→</p>
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<p>Maximising value from aquatic resources</p>	<p>3.6</p>	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> <li>▪ Indigenous Studies; Sociology; Economic Surveying; Economic Assessment; Economic Modelling.</li> </ul> <p>Priority research topics</p> <ul style="list-style-type: none"> <li>▪ Enhancing fisheries through improved productivity of natural systems [Com, Rec, Cust]</li> <li>▪ Enhancing the recreational fishing experience through stock enhancement and the application of structures to enhance recruitment, including artificial reefs and snags [Rec]</li> <li>▪ Understanding the environmental interactions of stock enhancement technologies [All sectors]</li> <li>▪ Understanding and enhancing personal, domestic and non-commercial communal (including social, cultural, religious, spiritual and ceremonial purposes) fishing activities in Aboriginal and Torres Strait Islander communities [Cust]</li> </ul>	<p>Inadequate</p>	<p>↑↑</p>	<p>→</p>
<p>Consumers and markets</p>	<p>8.5</p>	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> <li>▪ Productivity and Market Analysis; Market Access and Trade; Seafood Processing; Seafood Safety.</li> </ul> <p>Priority research topics</p> <ul style="list-style-type: none"> <li>▪ Developing knowledge of consumer trends and needs [Aqua, Com]</li> <li>▪ Maximising trade and market access opportunities [Aqua, Com]</li> <li>▪ Understanding and responding to the needs of the consumer, including credence values, chain of custody and food safety [Aqua, Com]</li> <li>▪ Improving supply chain efficiencies [Aqua, Com]</li> <li>▪ Introducing consumers to new products [Aqua, Com, Cust]</li> </ul>	<p>Inadequate</p>	<p>↑↑</p>	<p>→</p>

<p>Community support</p>	<p>2.4</p>	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> <li>▪ Anthropology; Indigenous Studies; Sociology; Seafood Safety.</li> </ul> <p>Priority research topics</p> <ul style="list-style-type: none"> <li>• Understanding and promoting health benefits of seafood [Aqua, Com]</li> <li>• Understanding and responding to consumers beliefs regarding the sustainability of the Australian fisheries resource [Aqua, Com]</li> <li>• Responding to community concerns regarding public health associated with seafood [Aqua, Com]</li> <li>• Understanding and communicating the interactions between recreational and customary fishing and biosecurity, the environment and other aquatic environment users and managing those effects where necessary [All sectors]</li> <li>• Understanding the behaviours, motivations and expectations of fishers and aquaculturalists [All sectors]</li> <li>• Understanding and communicating the benefits and value of recreational and customary fishing lifestyles to the community [Rec, Cust]</li> <li>• To understand and communicate the benefits and value of fishers and fishing (commercial, recreational and customary) in the community, family and at the individual levels [Com, Rec, Cust]</li> </ul>	<p>Inadequate</p>	<p>↑↑</p>	<p>→</p>
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<p>Community resilience and development</p>	<p>1.3</p>	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> <li>▪ Anthropology; Demography; Indigenous Studies; Sociology.</li> </ul> <p>Priority research topics</p> <ul style="list-style-type: none"> <li>• Developing pathways to regional employment and community development (this is relevant to all of Recreation, Wild Catch, and Indigenous sectors) [Com, Rec, Cust]</li> <li>• To value, communicate and develop opportunities based around fishing heritage and emerging technologies and industries[Com, Rec, Cust]</li> <li>• R&amp;D to support planning for recovery from biosecurity emergencies, natural disasters or other emergencies [ALL sectors]</li> <li>• Understanding the capacity of society to accept and incorporate greater levels of fishing and aquaculture activity, and how to assess and increase this carrying capacity [ALL sectors]</li> <li>• Understanding the nature and resilience of industry (social, demographic, economic and attitudinal) [Aqua, Com]</li> <li>• Understanding and predicting behavioural responses to management approaches [All sectors]</li> <li>• Building social capital between industry and community [ALL sectors]</li> </ul>	<p>Inadequate</p>	<p>↑↑</p>	<p>→</p>
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<p>People development<sup>10</sup></p>	<p>2.2</p>	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> <li>▪ Anthropology; Educational Research; Demography; Indigenous Studies; Sociology.</li> </ul> <p>Priority research topics</p> <ul style="list-style-type: none"> <li>• Understanding and meeting regional workforce needs, including attraction and retention of required technical, managerial, professional, semi-skilled and scientific capability [Aqua, Com]</li> <li>• Improving workplace health and safety [Aqua, Com]</li> <li>• Developing the leadership skills across all stakeholder groups [All sectors]</li> <li>• Developing business and business modelling capability [Aqua, Com]</li> <li>• Building stakeholder capacity to move toward co-management of fisheries [Com, Rec, Cust]</li> <li>• Building skills and networks that support knowledge transfer and R&amp;D adoption [All sectors]</li> <li>• Building understanding between stakeholders, including researchers, managers, fishers and NGOs [All sectors]</li> <li>• Identifying and understanding factors that drive responsiveness or adoption of new practices and innovation and how these can be influenced [Aqua, Com]</li> </ul>	<p>Inadequate</p>	<p>↑↑</p>	<p>→</p>
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<sup>10</sup> Education and Training Providers were not included in this RD&E survey

<p>Extension and adoption</p>	<p>60.1</p>	<p>Core expertise to support this SRT is provided through the following areas:</p> <ul style="list-style-type: none"> <li>▪ Educational Research; Demography; Indigenous Studies; Sociology; Communication / Extension.</li> </ul> <p>Priority research topics</p> <ul style="list-style-type: none"> <li>▪ Identify perceived value of Research and new technology to industry sectors [ALL sectors]</li> <li>▪ Communicating accessible key messages about the fishing and aquaculture industry to the community [ALL sectors]</li> <li>▪ Capture and transfer knowledge from domestic and international sources to industry and managers [ALL sectors]</li> <li>▪ Demonstrate the value and link between R&amp;D and profitability and sustainability [ALL sectors]</li> <li>▪ Understand and design appropriate communication and adoption and engagement systems for all sectors [ALL sectors]</li> <li>▪ Develop industry capacity to undertake adoption and extension [Aqua, Com]</li> <li>▪ Evaluate the impacts and value of the adoption and extension program to continually improve performance [Aqua, Com]</li> </ul>	<p>Inadequate</p>	<p>↑</p>	<p>→</p>
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## Appendix 2: Current and emerging collaborative arrangements

Collaborative agreement	Principal partners	Intent, description, features
DPI Victoria/SARDI Alliance Contractual agreement signed by State Ministers 7 November 2008	Department of Primary Industries Victoria South Australian Research and Development Institute (Aquatic Sciences)	<p>To provide a more effective and efficient delivery of aquatic sciences through:</p> <ul style="list-style-type: none"> <li>Consolidating and building specialised capability in selected areas of aquatic science by one alliance partner</li> <li>Fostering collaboration between the agencies,</li> <li>Delivering R&amp;D services to each other,</li> <li>Facilitating the efficient development of new capabilities in aquatic scientific research,</li> <li>Enhancing the performance of the aquatic science non-business functions of SARDI and DPI Victoria through the coordination of activities, and</li> <li>Providing enhanced investment attraction by a consolidated and coordinated service offer.</li> </ul>

Collaborative agreement	Principal partners	Intent, description, features
Marine Innovation South Australia (MISA)	<p>MISA is an initiative of the South Australian government representing a partnership between:</p> <p>South Australian Research and Development Institute (SARDI)</p> <p>Flinders University (FU)</p> <p>University of Adelaide</p> <p>South Australian Museum</p> <p>South Australian Seafood Industry</p> <p>Regional communities</p>	<p>To provide the best outcome for South Australia's seafood industry and marine environment.</p> <p>Implemented in 2005.</p> <p>SA Government contributed \$13.7M, FU \$2M to infrastructure and salaries.</p> <p>\$23M project funds, &gt;30 staff, &gt;80 projects.</p> <p>Brings together and enhances the capabilities of South Australia's aquatic research and development sector in the areas of:</p> <ul style="list-style-type: none"> <li>• Product Quality and Value Adding</li> <li>• Aquaculture Innovation</li> <li>• Ecosystems Services</li> <li>• Biosecurity</li> </ul> <p>Builds collaborative partnerships with the seafood industry.</p> <p>Delivers outcomes for the sustainable development of the seafood industry.</p>

Collaborative agreement	Principal partners	Intent, description, features
Tasmanian Aquaculture and Fisheries Institute (TAFI) Joint Venture Agreement	University of Tasmania Tasmanian State Government	<p>To foster strong collaborative linkages and partnerships with similar agencies around the globe to balance the economic, social and environmental factors for the long term prosperity of the Tasmanian and broader Australian community.</p> <p>Established in 1998, it combined the complementary resources and facilities of both institutions into a single entity to promote:</p> <ul style="list-style-type: none"> <li>• coordination of research effort with shared goals and priorities</li> <li>• improved focus and quality in Research and Development activities</li> <li>• an enhanced role for industry in directing and committing research resources, and</li> <li>• increased access to Commonwealth funds for Research and Development.</li> </ul> <p>TAFI is a stand-alone Institute within the University of Tasmania’s Faculty of Science, Engineering and Technology combining areas of aquatic and marine research from the Department of Primary Industries, Parks, Water and Environment (DPIPWE) and the University of Tasmania. These are:</p> <ul style="list-style-type: none"> <li>• DPIPWE Marine Research Laboratories at Taroona</li> <li>• Fish Health Unit at the DPIPWE Mount Pleasant Animal Laboratories, Launceston,</li> <li>• School of Zoology, on the University’s Hobart campus</li> </ul> <p>TAFI has strong collaborative partnerships with national partners such as the CSIRO Marine and Atmospheric Research and a number of State fisheries agencies such as PIRVic and SARDI. It also has international partnerships with IFREMER in France and the Virginia Institute of Marine Science in the USA.</p>

Collaborative agreement	Principal partners	Intent, description, features
El Nemo Climate Change Program	15 State and Commonwealth government, academic and private partners.	<p>Dedicated to understanding the marine environment and resources, and to contribute to policy and management decisions on the future use of oceans.</p> <p>WAMSI's strategic projects address social and economic effects of changes to marine resource management, ecosystem-based management, change and marine ecosystems and ecosystems and food-webs.</p> <p>WA State Government provided a \$21 million five-year investment with a \$60 million co-investment by member partners. Its headquarters are at the University of Western Australia</p>
Aquaculture Research Strategy	CSIRO, Department of Employment, Economic Development & Innovation (DEEDI)	Co-location of /15 CSIRO aquaculture research staff at the DEEDI Bribie Island Research Centre (BIRC) from May 2011, with CSIRO constructing a \$5M nutrition research facility at BIRC. This agreement will support multidisciplinary research and collaboration on projects of national/international significance.

## Abbreviations and acronyms

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
AFMA	Australian Fisheries Management Authority
AFMF	Australian Fisheries Management Forum
AFMF SSR	Australian Fisheries Management Forum – Subcommittee for Science and research
AIMS	Australian Institute of Marine Science
APVMA	Australian Pesticides and Veterinary Medicines Authority
CERF	Commonwealth Environment Research Facilities
CFA	Commonwealth Fisheries Association
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture Fisheries and Forestry
EPBC	Environment Protection and Biodiversity Conservation Act 1999
FRAB	Fisheries Research Advisory Body
FRDC	Fisheries Research and Development Corporation
FTE	Full Time Equivalent
NAC	National Aquaculture Council
NCARF	National Climate Change Adaptation Research Facility
NGO	Non-government organisation
NRMSC	Natural Resource Management Standing Committee
NSIA	National Seafood Industry Alliance
OECD	Organisation for Economic Co-operation and Development
PIMC	Primary Industries Ministerial Council
PISC	Primary Industries Standing Committee
R&D	Research and development
RA	Recfish Australia
RD&E	Research, development and extension